THE STANDARD CYCLOPEDIA *of* HORTICULTURE

L. H. BAILEY

The Standard Cyclopedia of Horticulture

Edited by L. H. BAILEY
Author of "Hortus Second" (*with* ETHEL ZOE BAILEY)

IN THREE VOLUMES

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THE STANDARD CYCLOPEDIA OF HORTICULTURE

THE MACMILLAN COMPANY
NEW YORK • CHICAGO
DALLAS • ATLANTA • SAN FRANCISCO
LONDON • MANILA
IN CANADA
BRETT-MACMILLAN LTD.
GALT, ONTARIO

XL. Formal gardening, with veronica and phlox in the foreground

THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY
L. H. BAILEY

Illustrated with Colored Plates, Four Thousand Engravings in the Text, and Ninety-six Full-page Cuts

IN THREE VOLUMES
VOL. II—F–O
PAGES 1201-2422. FIGS. 1471-2693
Being Vols. III and IV of Original Edition

New York
THE MACMILLAN COMPANY

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REWRITTEN, ENLARGED AND RESET

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Nineteenth Printing, 1961

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FULL-PAGE PLATES

Facing page

XL. Formal gardening, with veronica and phlox in the foreground (in color) *Frontispiece*

XLI. A good fern in southern California.—*Alsophila australis* 1217

XLII. A young Celeste fig tree, as grown in Georgia 1234

XLIII. Floriculture.—A house of begonias, with a row of ferns 1242

XLIV. Forcing of grapes.—Muscat of Alexandria 1263

XLV. Ferns in a public garden, with springtime bloom (in color) 1307

XLVI. Type of an old-time formal garden.—Washington's garden at Mt. Vernon . 1315

XLVII. Fringed gentian. *Gentiana crinita* 1327

XLVIII. The garden gladiolus, variety "Peace" (in color) 1343

XLIX. The Niagara grape (in color) 1380

L. The grapefruit. About one-third natural size 1391

LI. A home greenhouse 1410

LII. Heliotrope, an old-time favorite 1452

LIII. Good use of spring flowers.—*Mertensia virginica* 1470

LIV. Herbs and shrubs employed about a pond 1481

LV. Hollyhock 1497

LVI. Roman hyacinth.—One of the forms of *Hyacinthus orientalis* 1614

LVII. A night-blooming cactus.—*Hylocereus tricostatus* in Hawaii. Hedge planted by Sibyl Moseley Bingham between 1831 and 1840 1625

LVIII. One of the many beautiful garden irises.—Probably one of the hybrid or derivative forms of the germanica group 1657

LIX. Japanese irises.—*Iris lævigata* 1675

LX. The black walnut.—*Juglans nigra* 1717

LXI. Landscape in southern California.—Bougainvillea, Banksian rose, *Phœnix canariensis* (in color) 1761

LXII. Example of the large rural park. View in Prospect Park, Brooklyn . . 1781

LXIII. View in a landscape cemetery 1812

LXIV. A good field of lettuce 1846

LXV. *Lilium speciosum* in an attractive setting (in color) 1866

LXVI. The tulip tree.—*Liriodendron Tulipifera* 1891

LXVII. *Magnolia Soulangeana*, the commonest hybrid magnolia in the North . . 1965

LXVIII. A Paheri mango tree in fruit.—Florida 1989

Facing page
LXIX. Muskmelon of the Hackensack type (in color) 2026
LXX. *Narcissus poeticus.*—The poet's narcissus; hardy and good 2108
LXXI. North American horticulture.—A commercial cabbage field in New Jersey . 2169
LXXII. North American horticulture.—A peach orchard in eastern Maryland . 2211
LXXIII. North American horticulture.—An orange grove in Florida . . . 2230
LXXIV. North American horticulture.—Foothill orchards in California . . . 2284
LXXV. Nut-culture.—The original (native) tree of the Butterick pecan, in Illinois; a commercial pecan plantation in Georgia 2296
LXXVI. *Odontoglossum crispum,* with *Asparagus Sprengeri* decoration . . . 2320
LXXVII. Onion.—The Prizetaker, a handsome pale yellow popular variety . . 2347
LXXVIII. A cluster of oranges, the Pineapple variety (in color) 2369
LXXIX. An orchid fancier's house.—Cypripediums, Selenipediums, Miltonias, Lælias, Oncidiums 2379
LXXX. *Osmunda cinnamomea,* the cinnamon fern, in its native place . . . 2414

F

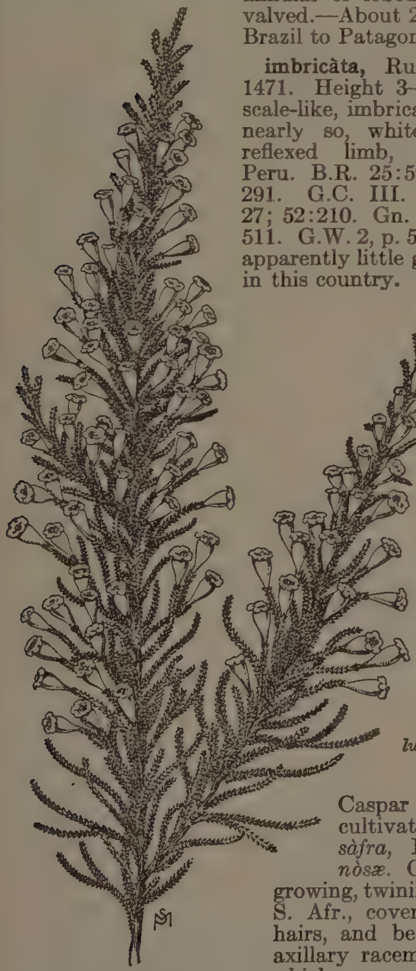
FÀBA (*phago*, to eat; yields edible seeds). *Leguminòsæ.* A genus established by Tournefort for certain plants now referred to Vicia. *Faba vulgaris*, Moench, is the horse bean, broad bean or Windsor bean, now accepted as *Vicia Faba.* From other groups in Vicia, it differs mostly in its stiff erect habit and the very large fleshy seeds and pods. The name *Fabaceæ* is sometimes used instead of *Leguminosæ*, and sometimes for the papilionaceous leguminosæ.

FABIÀNA (after Francisco Fabiano, Spanish botanist, Valencia). *Solanàceæ.* Small heath-like shrubs; one is sometimes grown in cool greenhouses and in mild climates for its bloom.

Erect and branching plants, sometimes viscid: lvs. small and crowded: fls. usually many, terminal or opposite the lvs., small; corolla long-tubular, dilated or ventricose above, often contracted at the throat; stamens 5, attached on the corolla-tube; disk fleshy, annular or lobed: caps. oblong, 2-valved.—About 20 species, Bolivia, Brazil to Patagonia.

imbricàta, Ruiz & Pav. Fig. 1471. Height 3–8 ft.: lvs. ovate, scale-like, imbricated: fls. sessile or nearly so, white, with a short reflexed limb, borne profusely. Peru. B.R. 25:59. R.H. 1903, p. 291. G.C. III. 32: suppl. Sept. 27; 52:210. Gn. 60, p. 430; 72, p. 511. G.W. 2, p. 511.—This plant is apparently little grown under glass in this country. It is a rather common shrub in S. Calif., where it blooms at different seasons. In England, it is said to thrive best near the sea. Good bushes produce a wealth of well-lasting bloom in late spring. It prop. without difficulty from potted cuttings in Aug.

L. H. B.



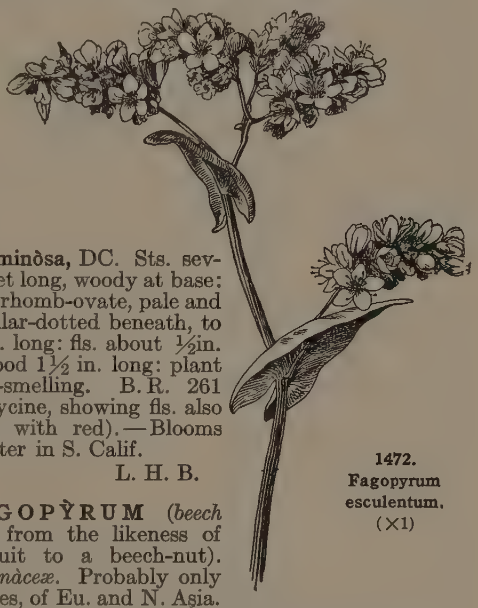
1471. Fabiana imbricata. (×½)

FAGÀRA: *Xanthoxylum.*

FAGÈLIA (after Caspar Fagelius, plant cultivator). Syn. *Bolusàfra*, Kuntze. *Leguminòsæ.* One species, a fast-growing, twining sub-shrub from S. Afr., covered with clammy hairs, and bearing all summer axillary racemes of pea-like fls. which are yellow, the keel tipped violet; standard reflexed; keel obtuse, exceeding the wings; stamens diadelphous: pod about 6-seeded, turgid. Cult. outdoors in S. Calif. and abroad under glass. The plant is allied to Cajanus, but its seeds are strophioled, pod swollen, not flattened, and the 2 upper calyx-lobes nearly distinct. The Fagelia of Schwenke (1774) is Calceolaria.

bituminòsa, DC. Sts. several feet long, woody at base: lfts. 3, rhomb-ovate, pale and glandular-dotted beneath, to 1½ in. long: fls. about ½in. long: pod 1½ in. long: plant strong-smelling. B.R. 261 (as Glycine, showing fls. also veined with red).—Blooms in winter in S. Calif.

L. H. B.



1472. Fagopyrum esculentum. (×1)

FAGOPỲRUM (*beech wheat*, from the likeness of the fruit to a beech-nut). *Polygonàceæ.* Probably only 2 species, of Eu. and N. Asia. Quick-growing annuals, with alternate deltoid or hastate lvs., small whitish fls. in racemes or panicles, 5-parted calyx, 8 stamens, 1-loculed ovary ripening into a floury 3-angled achene.—Both species are grown for the grain, from which flour is made; and in horticulture sometimes used as a catch-crop or green-crop in orchards and elsewhere for the good effect on the land.

esculéntum, Moench (*Polýgonum Fagopýrum*, Linn.). BUCKWHEAT (which see). Fig. 1472. Lvs. large and broad, long-petioled: fls. white, fragrant, in panicled or corymbose racemes: achene or grain with regular angles.

tatáricum, Gaertn. (*Polýgonum tatáricum*, Linn.). INDIA-WHEAT. DUCKWHEAT. Fig. 1473. More slender: lvs. smaller and hastate or arrow-shaped, shorter-petioled: fls. greenish or yellowish, in small mostly simple racemes from the lf.-axils: achene with wavy or notched angles, smaller than in buckwheat.—Useful in short-season climates and on poorer lands. The Fig. 1473 is made from Linnæus' original specimens of his *Polygonum tataricum*, now deposited in the Linnæan herbarium, London.

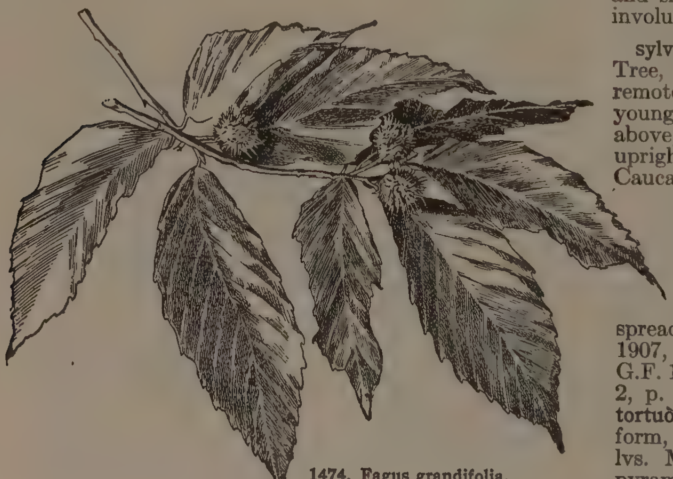
L. H. B.

FÀGUS (ancient Latin name). *Fagàceæ.* BEECH. Ornamental trees, chiefly grown for their handsome foliage, good habit and the conspicuous color of the bark; also valuable timber trees. There are marked horticultural forms.

Deciduous: winter-buds conspicuous, elongated, acute: lvs. alternate, distichous, dentate or nearly entire, with caducous small stipules: fls. monœcious, with the lvs.; staminate in slender-peduncled pendulous heads, appearing at the base of the young shoots; perianth 5–7-lobed; stamens 8–13; pistillate with 3 styles, usually 2 in an axillary peduncled involucre: fr. a brown, ovate, triangled nut, 1 or 2 in a prickly, dehiscent involucre.—Eight species occur in the cooler regions of the northern hemisphere. The species of the southern hemisphere, often included under Fagus (as *F. betuloides* and others), form the genus Nothofagus, which see.

The beeches are tall deciduous hardy trees, of noble, symmetrical habit, with smooth light gray bark and clean dark green foliage, which is rarely attacked by insects or fungi. They are among the most ornamental and beautiful trees for park planting, and attractive at every season, especially in spring, with the young foliage of a tender delicate green, and the graceful, drooping heads of the staminate flowers. All of the eight species known, save one, are in cultivation and differ comparatively little from each other. The American and the European species are especially much alike, but the first has the bark of a lighter color, the head is broader and more roundish, and the leaves less shining, turning clear yellow in fall, while the latter has a more ovate head and shining foliage, which turns reddish brown in fall and remains on the branches almost through the whole winter. It is sometimes used for tall hedges. In Europe, the beech is a very important forest tree, and the hard and very close-grained wood is largely used in the manufacture of different articles and for fuel; but it is not very durable in the soil. The sweet nuts are edible, and in Europe an oil is pressed from them, used for cooking and other purposes.

1473. Fagopyrum tataricum.

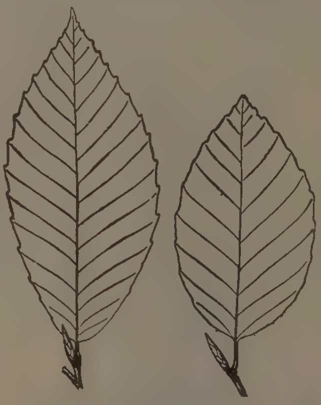


1474. Fagus grandifolia. (×⅓)

The beech prefers dryish situations, and grows best in sandy loam and in limestone soil. Propagated by seeds sown in fall where there is no danger of their being eaten by mice, or dried after gathering and kept mixed with dry sand until spring. The young plants should be transplanted every second or third year; otherwise they make long tap-roots, and cannot always be transplanted successfully. The varieties are grafted on seedling stock, usually in the greenhouse in early spring; grafting in the open usually gives not very satisfactory results.

Both in Europe and the eastern United States the beech forms extensive forests. It is today the common hardwood tree of central Europe, particularly in Denmark and Germany, raised as pure growth or mixture. It requires a loamy, preferably calcareous soil, shuns poor sand and swamp, ascends to 3,500 feet in the Alps; prefers north and east exposures, endures much shade, protects and improves the soil, and produces large amounts of wood to the acre. The wood is heavy (specific gravity 0.65 to 0.75) hard, straight-grained, of close texture, not durable. Beech is not used as building lumber, but is extensively used for ordinary wooden ware, furniture, wheelwright and cooperage stock. (F. Roth.)

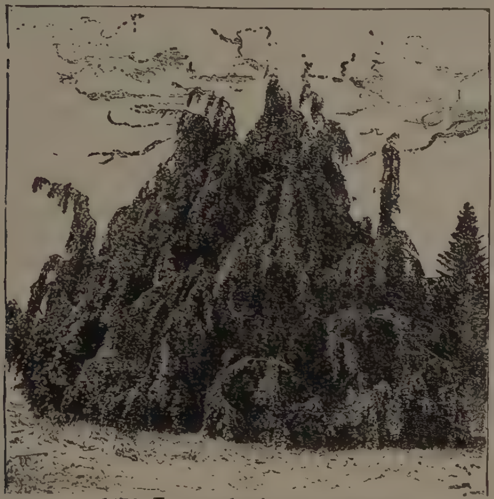
grandifòlia, Ehrh. (*F. ferrugínea*, Ait. *F. americàna*, Sweet. *F. atropunícea*, Sudw.). AMERICAN BEECH. Figs. 1474, 1475. Tree, to 80 ft., rarely 120 ft.: lvs. ovate-oblong, acuminate, coarsely serrate, silky beneath when young, with 9–14 pairs of veins, dark bluish green above, light yellowish green beneath, 2½–5 in. long: involucre covered with slender, straight or recurved prickles, ¾in. high. E. N. Amer., west to Wis. and Texas. S.S. 9:444. Em. 182. G.F. 8:125. A.G. 12:711. F.E. 20:586. Var. **pubéscens,** Fern. & Rehd. Lvs. soft-pubescent below, sometimes only slightly so. Var. **caroliniàna,** Fern. & Rehd. (*F. ferrugínea* var. *caroliniàna*, Loud. *F. rotundifòlia*, Raf.). Lvs. broader, of firmer texture, darker above: involucre rufous-tomentose, with fewer and shorter prickles: nut smaller, not exceeding the involucre. From N. J. and S. Ill. to Fla. and Texas.



1475. Fagus grandifolia (left), and F. sylvatica. (×⅓)

sylvática, Linn. EUROPEAN BEECH. Fig. 1475. Tree, to 80 ft., or rarely 100 ft.: lvs. ovate or elliptic, remotely denticulate, silky beneath and ciliate when young, with 5–9 pairs of veins, dark green and glossy above, pale beneath, 2–4 in. long: involucre with mostly upright prickles, about 1 in. high. Cent. and S. Eu. to Caucasus. M.D.G. 1902:579–582. H.W. 2:20, pp. 42, 43. F.E. 33:615. Fig. 1475 contrasts the lvs. of the American and European species. A great number of varieties are in cult., of which the following are the most remarkable: Var. **péndula,** Lodd. Fig. 1476. With long, pendulous branches, the larger limbs mostly horizontally spreading. G.C. III. 51:114. G.W. 15, p. 662. B.H. 1907, p. 393. Gn. 42, p. 65; 55, p. 267; 64, p. 167. G.F. 1:32 (adapted in Fig. 1476). Gng. 6:258. G.W. 2, p. 15; 9, p. 510; 15, p. 663. G.M. 52:807. Var. **tortuòsa,** Dipp. (var. *suenteliénsis*, Hort.). Dwarf form, with twisted and contorted branches and small lvs. M.D.G. 1912:110. Var. **pyramidàlis,** Kirchn. Of pyramidal habit. Var. **purpùrea,** Ait. (var. *atropurpùrea*, Hort.). Fig. 1477. Lvs. purple. M.D.G. 1901:

163; 1908:499. G.C. III. 24:305. F.E. 13:472; 14: 874. A.G. 18:837. G.W. 2, p. 539. A form with very dark purple lvs. and of compact habit is var. **Ríversii,** Hort. There are other forms, differing in the shade of purple, as var. *cuprèa,* Hort., and also some with rosy pink variegated lvs. Var. **purpùrea péndula,** Hort., has purple lvs. and pendulous branches, but is of slow growth. Var. **Zlàtia,** Spaeth, has yellow foliage. Var. **heterophýlla,** Loud. (var. *asplenifòlia,* Lodd.). Lvs. deeply cut, often almost to the midrib, into narrow lobes. A very graceful variety, forming a dense and low, shrubby tree. Mn. 1, p. 61. F.E. 18:314. P.G. 3:163. Less important varieties, but sometimes grown, are the following: Var. **cristàta,** Lodd., with deeply toothed, curled, small and clustered lvs.: of slow growth. Var. **incìsa,** Hort. Similar to var. *heterophylla,* but lvs. less deeply cut. Var. **macrophýlla,** Hort. Lvs. large, to 5 in. long. Var. **quercifòlia,** Schelle (var. *quercoìdes,* Hort.). With deeply toothed and sinuate, rather narrow lvs. Var. **quercoìdes,** Pers., often confused with var. *quercifolia,* is a form with dark and rough, oak-like bark. M.D.G. 1909:509.



1476. Fagus sylvatica var. pendula.

F. asiática, Winkl.=F. orientalis.—*F. Engleriàna,* Seemen. Tree, about 50 ft. tall: lvs. obovate or oval-obovate, glabrous below: stalk of fr. 2–3 in. long, glabrous. Cent. China.—*F. japónica,* Maxim. Lvs. small, elliptic, crenate: involucre small, slender-peduncled, half as long as the nuts. Japan. S.I.F. 1:35.—*F. orientàlis,* Lipsky (F. asiatica, Winkl.). Pyramidal tree: lvs. elliptic to oblong-obovate, nearly entire: lower prickles of the involucre changed into linear-oblong lobes. Asia Minor to N. Persia.—*F. Sièboldii,* Endl. Lvs. ovate, shortly acuminate, crenate, with 9–14 pairs of veins: lower prickles of the involucre changing into slender linear or obovate-oblong lobes. Japan. S.I.F. 1:35.—*F. sinénsis,* Oliver (F. sylvatica var. longipes, Oliver). Tree, about 50 ft. tall: lvs. ovate or rhombic-oval, finely pubescent below: stalks of fr. 1½–2 in. long, pubescent above. Cent. China.

Alfred Rehder.

FALLÙGIA (after Virgilio Fallugi or Falugi, an Italian botanical writer, end of the seventeenth century). *Rosàceæ.* Ornamental woody plant sometimes cultivated for its handsome white flowers and the attractive heads of feathery tailed fruits.

Deciduous shrub: lvs. alternate, small, 3–7-lobed at the apex, stipulate: fls. 1–3, terminal on elongated branchlets, perfect or polygamous, with 5 narrow bracts inserted between the calyx-lobes; calyx-tube cupular; sepals 5, imbricate; petals 5, suborbicular, yellowish white; stamens numerous in 3 rows; pistils many, on a conical torus, pubescent; style slender: achenes with long persistent plumose styles.—One species in S. W. N. Amer.

This plant is a low divaricate shrub with slender spreading branches, and conspicuous white flowers at the tips of slender branchlets, followed by dense heads of feathery tailed fruits. Hardy as far north as Massachusetts; demands well-drained soil and a sunny warm position; likes limestone soil; stagnant moisture, particularly during the winter, is fatal to it. Its best place is in a rockery of southern aspect. Propagation is by seeds, which are freely produced.

paradóxa, Endl. Shrub, to 3 ft.: lvs. cuneate with 3–7 narrow-oblong lobes decurrent into the linear petiole, revolute at the margin and whitish tomentose below, ⅓–½in. long: fls. 1–3, 1–1½ in. across, white: achenes with feathery tails 1–1½ in. long. June–Aug.; fr. Aug.–Oct. Calif., Nev. and Utah south to Mex. B.M. 6660. M.D.G. 1900:207.

Alfred Rehder.

FARADÀYA (Michael Faraday, famous chemist, 1794–1867). *Verbenàceæ.* Climbing shrubs, allied to Clerodendron, with opposite simple lvs., and fls. in terminal or nodular panicles; corolla tubular, widened upward, with a 4-lobed limb of which one lobe is larger; stamens 4, paired, exserted; ovary 4-lobed and 4-celled: fr. a drupe. There are about a half-dozen species in Austral. and S. Pacific islands. They appear not to be in the trade. *F. spléndida,* Muell., of Austral., may occur in choice collections: it is a tall glabrous climber with ovate, acuminate coriaceous lvs. 6–12 in. long, and large white fls. in terminal panicles.

FARFÙGIUM: *Ligularia.*

FÁTSIA (from a Japanese name). *Araliàceæ.* Half-hardy shrubs or small trees, used for subtropical foliage effects in the North, and planted permanently far South.

Fatsia has 2 species, belonging to the Panax series, in which the petals are valvate, while in the Aralia series they are more or less overlapping, but the sides affixed at the base. Within the Panax series, Polyscias has the pedicel articulated under the fl., while in Fatsia and Acanthopanax the pedicel is continuous with the fl. Fatsia is distinguished from the hardier and less familiar but worthy Acanthopanax by the greater length and distinctness of the styles. This genus is doubly interesting as producing the famous rice paper of the Chinese, and two rivals of the castor-oil plant in bold subtropical effects, made by large lvs., the lobes of which spread out like fingers.

1477. Good specimen of purple beech.—Fagus sylvatica var. purpurea.

While fatsias require more care in the North than the hardy aralias, their massive subtropical appearance is highly distinct. A perfect specimen is figured in Gardening 5:133, where W. R. Smith says of *F. papyrifera:* "This plant produces the beautiful substance known as rice paper; it grows to 10 ft. high, with a st. 4 in. diam., full of white pith like the elder; in a full-grown specimen the pith is about 1 in. diam. It is divided into pieces 3 in. long, and by the aid of a sharp instrument is unrolled, forming the thin, narrow sheets known as rice paper, greatly used by the Chinese for drawing figures of plants and animals, and also for making artificial fls. Until about 1850 the source of this substance was unknown to scientists. The Chinese, on inquiry, gave very fanciful figures and descriptions of it. . . . It is destined to be a people's plant, as ½in. of the root will grow and form a good plant the first season. It has survived most winters for the past 5 years in Washington, D. C."

As associates in groups of bold-habited plants, F. W. Burbidge (Gn. 45, p. 321) suggests *Polygonum sachalinense, Chamærops Fortunei* and *Rodgersia podophylla.* For contrast with feathery and cut-leaved foliage, he suggests bamboos, aucubas, cut-leaved maples and various ivies. Fatsia may be grown in the temperate house in the North, outdoors southward. It is easily grown and propagated. The species are unarmed; the very spiny plant sometimes referred to this genus as *F. horrida,* is treated under Echinopanax, which see. Siebert and Voss declare that most of the plants sold as *Fatsia japonica* are *Aralia spinosa.* These plants like shade. Full sunlight for an hour or two in early morning is enough. They should have a shelter-spot, where the wind will not whip their foliage.

1478. Fatsia japonica.

papyrífera, Benth. & Hook. (*Aràlia papyrífera,* Hook. *Tetrapànax papyríferum,* Koch.). Height 5–7 ft. (according to Franceschi, 20 ft. in the open ground in S. Calif.): branches and young lvs. covered with stellate, more or less deciduous down: mature lvs. reaching 1 ft. long, cordate, 5–7-lobed; lobes acute, serrate; sinus very deep: fls. inconspicuous, white, in sessile, globose clusters. Formosa. B.M. 4897. A.F. 7:385. Gng. 5:133. Gn. 45, p. 321.

japónica, Decne. & Planch. (*Aràlia japónica,* Thunb., not Hort.? *A. Sièboldii,* Hort.). Fig. 1478. Lvs. downy at first, finally shining green: fls. in umbels. Japan, China.—Abroad are cult. forms with white or golden margins and a form reticulated with gold markings. Var. **Mòseri,** Hort., is regarded as an improved, more compact-growing variety which originated with Moser of Fontainebleau. Intro. into Amer. by Montarioso Nurseries, Santa Barbara, Calif.

WILHELM MILLER.
N. TAYLOR.†

FÈDIA (application doubtful). *Valerianàceæ.* One glabrous branching annual of the Medit. region, sometimes grown as an ornamental and also as a salad plant. Lvs. entire or dentate: fls. red, small, in more or less dense terminal cymes; peduncles thick and fistular; corolla with an elongated tube and a 2-lipped limb, irregular at the base; stamens 2; style entire or 2–3-fid. *F. Cornucòpiæ,* DC. (*Valeriàna Cornucòpiæ,* Linn.), a variable species, usually with purplish sts., grows 10–16 in. high: lvs. nearly all radical, oval-oblong, shining green. It is sometimes known as African valerian. The lvs. are eaten as salad, being related to corn-salad. The plant seems not to be in the American trade.

FEIJÒA. The FEIJOA, or PINEAPPLE GUAVA (*Feijòa Sellowiàna,* Berg, family *Myrtàceæ*) is indigenous to western Paraguay, southern Brazil, Uruguay, and parts of Argentina, where it is common in the forests, and the fruit is highly esteemed by the natives though not cultivated. It was introduced to southern Europe in 1890, and is grown along the Riviera, both in France and Italy. From the former country it was introduced to the United States about 1900, and is becoming widely planted in California. Its distribution in other countries is very limited.

Feijoa is of 2 species. It is the Orthostemon of Berg, not of Robert Brown. *F. obovàta,* Berg (*O. obovàtus,* Berg), is considered by Niedenzu to be a variety of *F. Sellowiana.* It is a white-tomentose shrub, with bisexual showy fls.; petals 4, spreading; stamens numerous, in many series, colored; ovary 4-celled, bearing a thickish style; pedicels 1-fld., at the ends of the branches or becoming lateral. The other species is *F. Schenckiàna,* Kiaersk., of Brazil, described first in 1891. The genus is closely allied to Psidium, but is distinguished by the albuminous seeds and stamens suberect in the bud.

The plant grows to an ultimate height of 15 feet. Its leaves are similar in form and appearance to those of the olive, but larger, the upper surface glossy green, and lower surface silvery gray, forming a contrast that makes the shrub effectively ornamental. This effect is much heightened by its flowers which are produced in late spring and are 1½ inches in diameter, composed of four cupped petals, white outside and purplish crimson within, surmounted by a tuft of crimson stamens 1 inch long. The oval or oblong fruits, 2 inches in length and 1½ inches in thickness, ripen in autumn and early winter. The skin is dull green, with sometimes a touch of crimson on the cheek; it incloses a layer of whitish, granular flesh, which surrounds a quantity of translucent, melting pulp, containing twenty to thirty seeds. The flavor bears a pronounced resemblance to that of the pineapple, this being enhanced by the fact that the seeds are so small that they cannot be felt in the mouth. While commonly eaten fresh, the fruit may be cooked in several ways, crystallized, or made into jam or jelly.

The feijoa does not seem to thrive under strictly tropical conditions, preferring a climate such as that of southern California or the Riviera, free from excessive humidity, and cool at least part of the year. In France, the plants have passed uninjured through temperatures of 12° F. A good loam, rich in humus, is the ideal soil for the feijoa. It has been successfully grown on heavy clay, by working in a quantity of light material, but it does not do well on light or sandy soils. The situation seems to be of little importance, provided the land is well drained. While the plant is notably drought-resistant, for best results in growth and fruiting a liberal supply of water is necessary. During the dry season, irrigations should be as frequent as for citrous trees. Fertilizers must be applied with caution, or they will stimulate growth at the expense of fruit. A small quantity of bone-meal, or other fertilizer not too rich in nitrogen, may be advantageously applied each year, while well-rotted manure will supply the much-needed humus, if it is lacking in the soil. The plants should be set 15 or 18 feet apart, and require very little pruning. Seedlings usually come into bearing at three to five years; grafted or layered plants will sometimes bear the second year.

In some instances, seedling feijoas fruit sparingly or not at all, either through the failure of the flowers to be properly fertilized or because of unfavorable soil or surroundings. Although isolated plants are often productive, it has been suggested that the feijoa is sometimes self-sterile, and two or more bushes should be planted together to permit of cross-pollination. The difficulty can probably be obviated, in a measure at least, by propagating asexually from strains of known productiveness.

The fruits fall when mature, and must be laid in a cool place until they are in condition for eating, which can be detected by a slight softening, and also by the odor,—a fragrance most delightful. If picked before fully mature and ready to fall, the fruits lack much of the delicate flavor of a perfectly ripened specimen. Very little care is required in packing, and the fruits can be shipped long distances without difficulty. They spoil quickly in a hot, humid atmosphere, but if stored in a cool place they can be kept for a month or more in perfect condition.

The shrub is attacked by a very few insects, the only one noted in either California or southern Europe being the black scale (*Saissetia oleæ*), which rarely requires combative measures. No fungous diseases have been observed on mature plants.

Propagation is usually by seed, but some vegetative means must be used to perpetuate named varieties. Fruits for seed should be selected with a view to desirability in every character, as in precocity of bearing and productiveness of the parent. While the feijoa does not come absolutely true from seed, fairly good results are usually secured from selected seeds.

One of the best mediums for germinating the seeds is a mixture of silver-sand and well-rotted redwood sawdust. This gives an almost sterile medium, in which there is little danger of damping-off, to which fungus the young plants are very susceptible. With care in watering, however, any light porous soil, not too rich in humus, may be used. Sow the seeds in pans or flats, covering them to the depth of ¼ inch. Germination will usually take place within three weeks. A glasshouse is not necessary, but the flats containing the seeds should be kept in a frame with lath or slat covering to provide partial shade. The seeds will retain their vitality a year or more, if kept dry. As soon as the young plants have made their second leaves they should be pricked off into 2-inch pots; after attaining a height of 4 inches they should be shifted into 3-inch pots, from which they can later on be transplanted into the open ground.

Cuttings can be successfully rooted under glass. They should be of young wood from the ends of branches, and about 4 inches in length. Inserted in clear sand over bottom heat they will strike roots in a month or two; without bottom heat they root very slowly. It is sometimes advised to keep them covered with bell-jars until they have formed roots.

Layering is used in France to perpetuate choice forms. It is somewhat tedious, but more certain than any other vegetative means of propagation. Those branches which are closest to the ground are bent down and covered with soil for the space of 3 to 6 inches. They require no care except to keep the soil fairly moist, and they will root in six months.

Whip-grafting and veneer-grafting are successfully practised under glass, using as stocks seedling feijoas of the diameter of a lead pencil. The cions should be of about the same diameter and of young but firm wood.

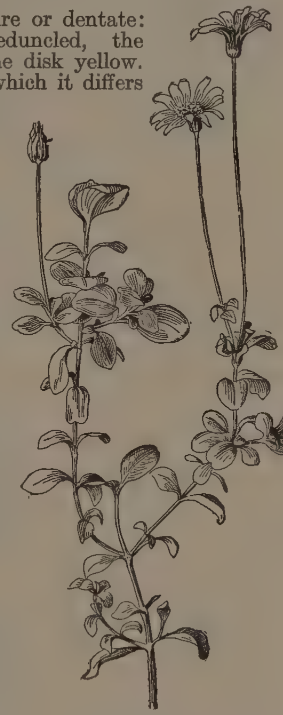
Several named varieties have been established, of which the most prominent are André and Besson.

F. W. Popenoe.

FELÍCIA (for Herr Felix, a German official). *Compósitæ.* Herbs or sub-shrubs, grown under glass or as pot specimens.

Leaves alternate, entire or dentate: heads usually long-peduncled, the corolla blue or white, the disk yellow. Much like Aster, from which it differs in having pappus bristles in one series, and in other technical characters.—Forty to 50 species in Afr.

amelloìdes, Voss, not Schlechter 1898 (*Cinerària amelloìdes*, Linn. *Áster rotundifòlius*, Thunb. *A. capénsis*, Less. *Agathæa cœléstis*, Cass. *A. rotundifòlia*, Nees. *A. amelloìdes*, DC.). Blue Daisy. Blue Marguerite. Fig. 1479. An old greenhouse plant, 1–2 ft., with roundish ovate opposite lvs. and large, solitary heads of an exquisite sky-blue. S. Afr. B.M. 249. A.F. 13:657. F.R. 1:674. Gng. 6:149.—There is a variegated-lvd. variety (I.H. 8:296). Grown easily from cuttings. Handled like a cineraria; or, if grown from spring cuttings for winter bloom, like a chrysanthemum, but with more heat in the fall. An elegant pot-plant, and useful for bedding in a protected place. Var. **monstròsa**, Hort. Fls. double the size of the type.



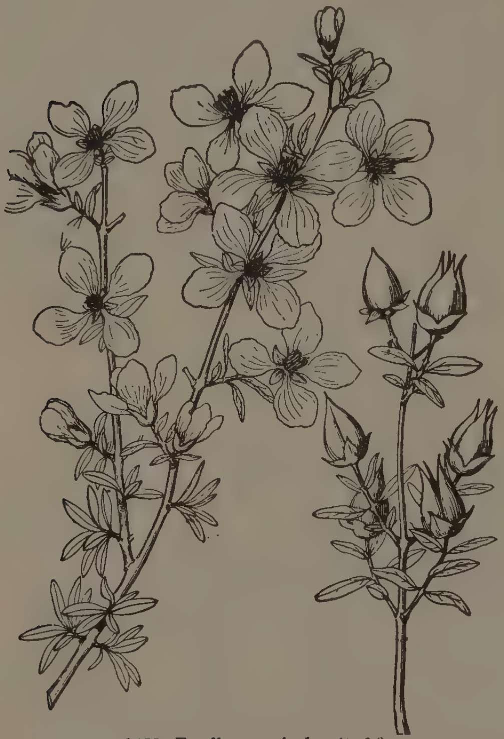
1479. Blue daisy.—Felicia amelloides. (×⅛)

petiolàta, N.E. Br. (*Áster petiolàtus*, Harvey). An undershrub more or less prostrate and useful for hanging-baskets: lvs. obovate or lanceolate, wedge-shaped at the base, rather papery: fls. at first rose-colored, gradually changing to aster-blue. S. Afr. B.M. 8370. F.E. 33:503. G.C. III. 42:82.—Intro. in S. Calif. in 1912.

N. Taylor.†

FENDLÈRA (after Augustus Fendler, a German naturalist, botanical explorer of New Mexico). *Saxifragàceæ.* Ornamental woody plant grown for its handsome white flowers.

Deciduous shrub: lvs. opposite, short-petioled, entire, 3-nerved: fls. solitary or rarely 2–3 at the end of short lateral branchlets; calyx-lobes and petals 4; stamens 8: ovary almost superior: fr. a 4-celled, dehiscent caps., with flat, oblong seeds.—Two species from Texas to Mex. Allied to Philadelphus, but differing in its 8 stamens and superior ovary. They are graceful ornamental shrubs with small, grayish foliage, covered in June along the slender, arching branches with graceful white fls., resembling in shape a Maltese cross. Hardy in New England, and growing best in a well-drained, sandy or peaty soil and sunny position. A very handsome and graceful plant for sunny rockeries or rocky slopes. Prop. by seeds or by greenwood cuttings under glass.



1480. Fendlera rupicola. (×⅔)

rupícola, Engelm. & Gray. Fig. 1480. To 4 ft.: lvs. linear-lanceolate or linear-oblong, 3-nerved, revolute at the margin, grayish tomentose beneath, ½–1 in. long: fls. milky white, 1 in. across; petals rhombic-ovate, with distinct claw, spreading; stamens erect. June. G.F. 2:113 (adapted in Fig. 1480). G.C. III. 36:410. B.M. 7924. R.H. 1891, p. 42; 1899, p. 129. M.D.G. 1899:231. G. 28:601. Alfred Rehder.

FENNEL. Species of *Fœniculum* (Umbelliferæ), annuals or treated as such, used as salad or condimental herbs. Native of southern Europe. The common fennel (*F. officinàle*, Linn.) is grown mostly for its young leaves, which are used in flavoring, and also for its aromatic seeds. Leaves sometimes eaten raw. Sow seeds in late fall to ensure early germination in spring, or sow in early spring. In any good soil, the plant comes to maturity quickly. This plant has become in California one of the most widely naturalized European weeds. It is a pest in pastures, said at times to attain 12 or 15 feet.

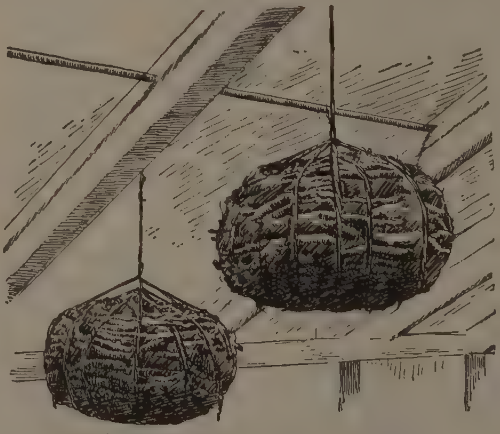
The Florence or sweet fennel is *F. dulce*, DC. The bases of the crowded leaf-stalks are much thickened, making a bulb-like enlargement above the ground. This thickened base has an oval form in cross-section. Earthing-up blanches these thickened leaf-bases, and after boiling they are fit for eating. A good fennel bottom may be 3 or 4 inches high. This is an Italian vegetable, but is in the American trade. Easily cultivated annual; matures quickly. Sow in spring, and later for succession.

Giant fennel is cultivated for ornament, and is described under *Ferula*. Fennel-flower is a name of Nigella. L. H. B.

FENUGREEK (*Trigonella Fœnum-Græcum*, literally Greek hay). An annual legume indigenous to western Asia, cultivated for human food, forage, and for medicinal qualities; widely naturalized in Mediterranean countries; little grown in America.

Fenugreek is an erect little-branched plant with 3-foliolate leaves. The seeds are 1 or 2 lines long, brownish yellow and marked with an oblique furrow half their length. They emit a peculiar odor, and contain starch, mucilage, a bitter extractive, a yellow coloring matter, and 6 per cent of fixed and volatile oils. As human food they are used in Egypt, mixed with wheat flour, to make bread; in India, with other condiments, to make curry powder; in Greece, either boiled or raw, as an addition to honey; in many oriental countries, to give plumpness to the female human form. The plant is used as an esculent in Hindostan; as an early fodder in Egypt, Algiers, France, and other countries bordering the Mediterranean. Formerly the seed was valued in medicine; now it is employed only in the preparation of emollient cataplasms, enemata, ointments and plasters, never internally. In veterinary practice it is still esteemed for poultices, condition powders, as a vehicle for drugs, and to diminish the nauseating and griping effects of purgatives. It is commonly used by hostlers to produce glossy coats upon their horses and to give a temporary fire and vigor; by stockmen to excite thirst and digestion in fattening animals; by manufacturers of patent stock foods as a flavoring ingredient.

Fenugreek does not succeed on clays, sands, wet or sour soils. It yields most seed upon well-drained loams of medium texture and of moderate fertility; most fodder upon rich lands. For seed-production, potash and phosphoric acid should be applied; for forage, nitrogenous manures. Deep plowing and thorough harrowing are essential. Ten to twenty pounds of seed should be used broadcast, or seven to ten pounds in drills 18 inches apart. Thinning when the plants are 2 or 3 inches tall, and clean culture throughout the season until blossoming time, are necessary for a seed crop. The crop may be mown, dried and threshed four or five months after seeding. An average yield should be about 950 pounds an acre. As a green manure, fenugreek is inferior to the clovers, vetches and other popular green manures of this country. It possesses



1481. Fern-balls as received from the dealer.

the power of obtaining nitrogen from the air by means of root-tubercles.—For description of the plant, see *Trigonella*.
M. G. Kains.

FÉNZLIA: *Gilia.*

FERDINÁNDA: *Podachænium.*

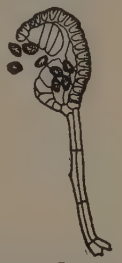
FERN-BALLS (Fig. 1481) are the dried rhizomes of ferns, imported from Japan. Dealers often start them into growth, and sell them when the mass is well covered with its delicate vegetation. To start them into growth, the balls are drenched in a tub of water and then hung in a warmhouse, not in direct sunlight. When the plants are well started, gradually expose them to more light and to a cooler air. Give liquid manure if they do not grow satisfactorily. The species are mostly Davallias, apparently *D. bullata* and *D. Mariesii*.

Fern-balls (*Davallia bullata*) are of Japanese origin. They are natives of deep mossy forests (the mosses on trees as well as on the ground), with abundant humidity in the air, as in Kiso or some parts of Fukushima districts. Toward the end of every winter, an expert goes into these forests and gathers the vines of such ferns. They should be carefully kept in the bamboo baskets in which a large quantity of mosses are contained, which must be sprinkled with water on the way to the metropolis. The people outside of large towns or cities do not care much for this plant. When the plants arrive in the cities or towns, they fall into the hands of gardeners who make many shapes with the vines (Fig. 1482). This is done before any leaves appear. Then the balls or other shaped articles are hung from the ceiling beam quite near to its end but not exposed to rain or hot sunshine. The ferns should not be subjected to pouring rain or showers, although they like dew. They should have some sprinkling of cool water once every day after sunset. The plant dislikes dust or warm impure water. The best fertilizer is the extract of fish-meal or cake ("abura-kasunazumi"). Prices run from 20 cents to 50 cents United States money according to the shape of balls and general excellence. (Issa Tanimura.)

1482. Ferns in formal shapes.

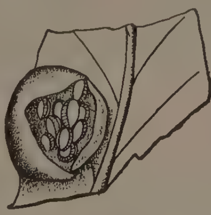
FERNÈLIA (Jean François Fernel, 1497–1558, physician to Henry II of France). *Rubiàceæ.* Four small evergreen trees or shrubs of the Mascarene Isls., rarely grown in choice warmhouse collections. Lvs. small, opposite, coriaceous, short-stalked, ovate-oblong or nearly orbicular: fls. small, solitary or in 2's, provided with a 4-toothed calyx-like involucre; corolla short-tubed, salver-shaped, with 4 spreading lobes; stamens 2, affixed in the corolla-throat; disk annular; ovary 1-celled below and 2-celled above: fr. a small berry. *F. buxifòlia*, Comm., is the species likely to be in cult. It is a much-branched shrub 4–5 ft. high, with obovate or oblong lvs. ½in. or less long, and many whitish fls. in the axils of the lvs.: berry dry, size of a pea, red, borne inside the involucre. Mauritius.
L. H. B.

FERNS. The plants included under this name comprise an entire order, made up of several distinct families. They include plants varying in size from a hair-like creeping stem bearing a few simple, moss-like leaves, to tall trees 80 or more feet in height, with a stem or trunk nearly a foot in diameter. Singularly enough, the extremes in size are both found in tropical regions, in which most of the species abound. Most of the ordinary native species, as well as the larger part of those in cultivation, consist of an erect underground stem or rootstock with leaves, often called fronds, clustered in dense crowns, or in the cases of creeping stems with scattered leaves. In gardening parlance, other plants are sometimes called ferns, as species of lycopodium and selaginella, as well as *Asparagus plumosus.*

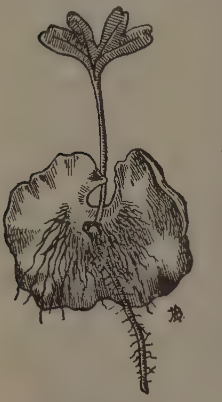

1483. Sporangium or spore-case of a fern.

In the life of an individual fern plant, two distinct phases occur, represented by two separate and unlike plants. The ordinary fern plant represents the asexual phase of growth (*sporophyte*), producing its spores normally in spore-cases (*sporangia*, Fig. 1483), which are borne in masses (*sori*, Fig. 1484) on the back or margin of the leaf, or in a few cases are grouped in spikes or panicles, or in rare cases spread in a layer over the entire under surface of the leaf. The sexual stage (*gametophyte*) develops from the germinating spore, and consists of a tiny usually scale-like green heart-shaped prothallus (Fig. 1485), which bears the sex-organs (*archegonia*, female, and *antheridia*, male) on the under surface. After fertilization in the archegonium, the egg develops directly into a young fern plant (Fig. 1485). Many ferns also propagate vegetatively by runners or offsets, by bulblet-like buds, and in certain species the tips of the leaves bend over and take root, as in our common walking-leaf (Camptosorus, which see).

Ferns frequently hybridize. The crossing takes place naturally in the prothallium stage. They are not crossed by hand, as are the seed-plants, but from the accidental mixing when prothallia of allied species are growing together. Fig. 1486 (G.F. 9: 445) is a hybrid between two native species; it has been found in the wild in several parts of New England.


1484. A sorus or fruit-dot of a fern.

Great diversity has existed in the matter of the separation of the ferns into genera. Hooker, relying mainly on artificial characters drawn largely from the sorus, recognized about seventy genera only, many of them heterogeneous groups of plants with little resemblance in structure, habit or natural affinities. John Smith, relying on stem characters, Presl on variation in venation and habit, Fée, Moore, and others, have recognized a much greater number of genera, ranging from 150 to 250, or even more. In the very unequal treatment by Diels in Die Natürlichen Pflanzenfamilien (Engler & Prantl), some 120 genera are recognized. A somewhat similar difference prevails in regard to the number of species. The Synopsis Filicum of Hooker and Baker (1874), supplemented by Baker's New Ferns (1892), recognizes some 2,700 species. It is the too prevailing tendency in this work (1) to fail to recognize many valid species which have been described by German and French botanists, and (2) to mass under one name very diverse groups of species from distant quarters of the world—from 8 to 10 species not infrequently appearing as a single so-called "variable species." The most recent book dealing with the whole order of ferns, the Index Filicium by Carl Christensen, recognizes approximately 150 genera and 6,000 species, and this number is continually increased as the result of further tropical exploration and more careful study. New forms are constantly coming in from the less-explored parts of the world, and within the last few years several new species have been described from the United States, including some from the better-known parts. Of this number some 200 species are in occasional cultivation in America, but the species that form the bulk of the fern trade do not exceed two dozen. In Europe several hundred species have long been in cultivation. Most of the species thrive best in the mountain regions of the tropics, the mountains of Jamaica and Java having nearly 600 species each, and the Andes also a large number. About 165 species are native in the temperate United States, representing some thirty-five genera; our native species are so widely distributed that usually not more than twenty-five to fifty will be found within the limits of one state, and the common species of the best locality do not number more than twenty. Recent explorations in southern Florida have discovered in that state the presence of a considerable number of West Indian species not found elsewhere in the United States.



1485. Prothallus of a fern, with a young leaf arising.

The ferns are commonly classified as part of a group of spore-bearing plants, with vascular (woody) tissue in stem and leaves; this group is technically known as the Pteridophytes, and is ordinarily divided into three orders; viz., the **Equisetales,** including the horsetails and scouring rushes; the **Lycopodiales,** including the selaginellas and the club mosses, or ground pines; and the **Filicales,** including the true ferns and their nearer allies (see pp. 7–9, Vol. I). The Lycopodiales and Equisetales are really not as closely related to ferns as this grouping would indicate.

It should be noted that neither the family nor the generic limitations are in a settled condition. The researches of Bower, Lang, Jeffrey, and others have resulted in some changes of classification which are not included below because they are not complete enough. Their conclusions are undoubtedly correct but are not at present usable.

The families of the order **Filicales** may be distinguished as follows:

A. *Spores of one sort. (Isosporous.)*

B. *Sporangia fleshy, with no ring, rising from the interior tissues of the lf. (Eusporangiate ferns.)*

1. **Ophioglossàceæ.** ADDER'S-TONGUE FERNS. Herbaceous small ferns with the sporangia borne in spikes or panicles on highly modified divisions of the large fleshy foliage lvs.; prothallium tuberous, subterranean, without chlorophyll.

2. **Marattiàceæ.** Coarse ferns with large fleshy sporangia on the under surface of the lf., arranged in circular or boat-shaped receptacles; prothallium above ground, green.

BB. *Sporangia rising from an epidermal cell, with an elastic ring of peculiar cells, which assist in scattering the spores by rupturing. (Leptosporangiate ferns).*

C. *Lvs. filmy, usually only 1 cell thick between the veins.*

3. **Hymenophyllàceæ.** FILMY FERNS. Sporangia attached to a thread-like receptacle arising in a cup at the end of the lf.: ring complete, horizontal or oblique.

CC. *Lvs. herbaceous or leathery.*

D. *Ring incomplete or rudimentary: sporangia in panicles.*

4. **Osmundàceæ.** FLOWERING FERNS. Coarse swamp ferns developing copious green spores early in the season: sporangia in panicles at the apex or middle of the lf. or on separate lvs.

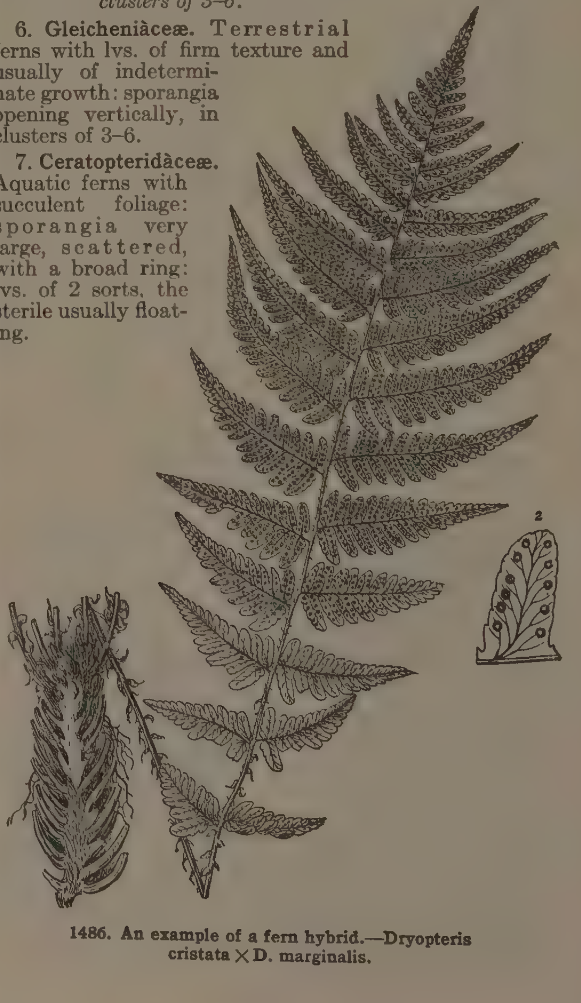
DD. *Ring apical: sporangia usually single under a scale, or in panicles.*

5. **Schizæàceæ.** Upright or climbing ferns with ovate sporangia, which open vertically.

DDD. *Sporangia sessile, either single or in clusters of 3–6.*

6. **Gleicheniàceæ.** Terrestrial ferns with lvs. of firm texture and usually of indeterminate growth: sporangia opening vertically, in clusters of 3–6.

7. **Ceratopteridàceæ.** Aquatic ferns with succulent foliage: sporangia very large, scattered, with a broad ring: lvs. of 2 sorts, the sterile usually floating.



1486. An example of a fern hybrid.—Dryopteris cristata × D. marginalis.

DDDD. *Sporangia numerous, collected in definite clusters (sori).*

8. **Cyatheàceæ.** Mostly tree ferns with sessile or short-stalked sporangia in conspicuous receptacles, opening obliquely (Fig. 1179, Vol. II).

9. **Polypodiàceæ.** Ferns with stalked sporangia (Fig. 1483), which burst transversely: sori covered with a membranous indusium or sometimes naked. This family contains three-fourths of all the ferns.

AA. *Spores of two sorts: minute microspores and conspicuous macrospores. (Heterosporous.) These spores develop into two sorts of prothalli, those from the microspores developing only antheridia, and those from the macrospores only archegonia.*

10. **Marsiliàceæ.** Small plants rooting in mud, the lvs. either quadrifoliate or reduced to mere filamentous petioles: sporangia borne in oval conceptacles on the leaf-stalks. Often aquatic, with the leaves floating on the surface of water in pools or lakes.

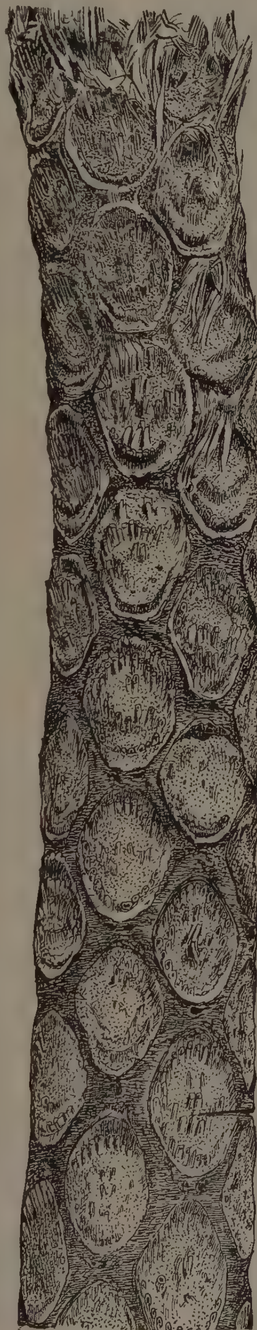
11. **Salviniàceæ.** Small or minute plants with the aspect of liverworts, floating on the surface of pools: sporangia in mostly spherical conceptacles.

The literature on the ferns is very extensive, since they have ever been attractive plants in cultivation. Many of the species have been illustrated in elaborate treatises by Schkuhr, Kunze, Hooker, Greville, Blume, Fée, Mettenius, Moore, and others. Our native species have been illustrated in the two quarto volumes of D. C. Eaton, "The Ferns of North America." A valuable summary of the more common fern species is found in Dr. Christ's "Die Farnkräuter der Erde" (1897), and a recent structural and morphological treatment is by Sadebeck, in Engler & Prantl: "Die Natürlichen Pflanzenfamilien." Schneider's "Book of Choice Ferns" is the most complete treatise on the species under cultivation. A useful American horticultural manual is Robinson's "Ferns in Their Homes and Ours." An excellent little handbook for the wild species of this country is Underwood's "Native Ferns and Their Allies."

L. M. UNDERWOOD.
R. C. BENEDICT.†

Tree ferns.

The term "tree fern" is applied commonly to ferns of the family Cyatheaceæ, to distinguish them from species of other families of ferns which, for the most part, are not at all arborescent. A comparatively small number of Cyatheaceæ, it is true, have the trunk short, and oblique or decumbent; but in most species the trunk is erect and greatly elongate (commonly 3 to 40 feet high) and the whole plant so unmistakably tree-like in size and proportion, that the name "tree fern" is a most appropriate one for the family. The leaves are usually large and are borne in a radiating palm-like crown at the apex of the trunk, or caudex, as it is often called. The trunk itself, in the case of an ordinary mature individual, is marked by numerous close-set leaf-scars (Fig. 1487); these serve to indicate not only the relatively great age of the plant but its slow rate of continuous development, as well.



1487. The trunk of a tree fern.—Cyathea arborea.

Tree ferns are primarily forest dwellers and occur either as component parts of the dominant forest growth or, more commonly, as a sort of thicket or "under-forest" association in moist partial shade beneath the crowns of the higher forest trees. They are nearly confined to wet tropical mountain slopes which are not subject to drought or pronounced seasonal change; they reach therefore, their best development, both as to species and number of individuals, upon lofty mountains and upon the seaward side of ranges which are drenched constantly by cool moisture-laden winds from the ocean.

The successful cultivation of tree ferns under glass is predicated upon these facts, although not all the species here mentioned are horticulturally known in this country. It is found that most species should be grown at a temperature of about 60° F. and in a rather shallow soil; that a continuously wet but well-drained substratum is essential; and that in general a tolerably high atmospheric humidity also is requisite for best growth. Very bright sunlight must be guarded against in all but a few species, among these being the common tropical American *Cyathea arborea,* which grows naturally in rather open places, and *C. furfuracea,* a native of Cuba and Jamaica which assumes a not unattractive form in drier open situations. As in other groups of ferns, there are certain species which demand unusual care and minor variations of treatment, such as wrapping the trunk in sphagnum as a safeguard against drying out. These special requirements can be determined only by experience.

The Cyatheaceæ are divided technically into three tribes: Thyrsopterideæ, Dicksonieæ, and Cyatheæ. The first mentioned consists of a single species, *Thyrsopteris elegans,* Kunze, from Juan Fernández. The two latter tribes may be distinguished as follows:

Sori terminal upon the veins, at or near the margin of the segments; indusia at least bilobed, the outer lip formed of the more or less modified lobule of the leaf..... **Dicksonieæ.**
Sori borne upon the back of the veins; indusium (if present) not formed of the leaf-margin in any part **Cyatheæ.**

The Dicksonieæ consist of three genera: Culcita (often known as Balantium), with about six species, all of small stature and nearly devoid of trunk; Dicksonia, with five tropical American species and several hardy Australasian species, the latter not uncommon in cultivation and capable of enduring unusually great extremes of cold; and Cibotium, with four North American species and several which occur in Asia and the islands of the Pacific. (See under *Cibotium* and *Dicksonia.*)

It is in the Cyatheæ, however, that the greatest variety and extremes of leaf form are noted, and consequently the species of this tribe are most highly esteemed in cultivation. They are commonly associated under three genera: Cyathea, Alsophila, and Hemitelia, distinguished mainly by characters of the indusia. One of the most graceful species of all is *Cyathea arborea*, introduced into England from the West Indies by Admiral Bligh in 1793. There are numerous species almost equally fine, many of which are not in general cultivation. The species with clean trunks, from which the leaves are freely deciduous after maturity, are the most pleasing; and among those which deserve especial notice are the following: *Cyathea minor*, a very slender Cuban plant with trunk 6 to 12 feet high and 1 to 1½ inches thick, its several slender bipinnate leaves borne in a spreading crown; *C. portoricensis*, a tall Porto Rican species with large nearly tripinnate leaves, its rachises dark, lustrous, purplish brown; *C. elegans*, of Jamaica, a close ally of *C. arborea*, often attaining a wide spread of leaf at an unusually early age; *C. Werckleana*, *C. hemiotis*, and *C. hastulata*, of Costa Rica, a peculiar subgroup characterized by having the leaves fully tripinnate, the ultimate rachises discontinuously alate; *C. divergens*, extending in one form or another from the Andes to Costa Rica, its huge fronds exceedingly lax and sometimes even in large plants recurved nearly to the ground; *C. insignis* of the Greater Antilles, in technical characters allied to the well-known *C. princeps* of Mexico; *C. suprastrigosa* and *C. conspersa* of Costa Rica and Panama, delicate graceful tripinnatifid plants of the high mountains; *C. punctifera* of Nicaragua and Costa Rica, a plant of lower range, its huge tripinnatifid fronds remarkably beautiful from the strong contrast afforded by the slender rich brown rachises and the unusually vivid green leaf-segments; *C. aureonitens* of Costa Rica and Panama, a lofty plant with leaf-scars in distant zones, having the unusual habit also of shedding piecemeal all its large tripinnatifid fronds, seasonally.

Of Alsophila, the two best-known species in cultivation are doubtless *A. australis* and *A. aspera*, the latter a common West Indian plant. *A. myosuroides*, of Cuba, Mexico, and Central America, has lately been reintroduced to cultivation. It is a remarkably handsome plant, its rather harsh, heavy, gray-green, tripinnatifid leaves borne from a copious mass of slender, glossy brown scales. Another beautiful species, *A. Salvinii*, from Mexico and Guatemala, has very large tripinnate fronds, with woody castaneous rachises in striking contrast. A favorite species in cultivation also is *A. quadripinnata* (*A. pruinata*), native in the West Indies and from Mexico to Chile, its short trunk bearing huge four-pinnate fronds, bluish or silvery white beneath.

The genus Hemitelia includes not only plants of the above sort, with tripinnatifid fronds (as, for example, the well-known *H. capensis*), but also plants of a distinctly different type known as the subgenus Cnemidaria. These are *H. horrida*, of the West Indies, and numerous related species of the American tropics, many of which have long been cultivated in European conservatories. They are characterized mainly by short trunks and large, leafy, simply pinnate or bipinnatifid fronds, and make a beautiful display in cultivation. Among them may be mentioned *H. speciosa*, *H. bella*, *H. grandifolia*, (*H. insignis*), *H. spectabilis*, and *H. subincisa*. Their characters have recently been discussed at some length. (See Contr. U. S. Nat. Herb. 16:25–49, 1912.)

Considering the wealth of material available in the American tropics and the comparative ease with which it may be secured, it is remarkable that so little attention has been given to the introduction of recently described species. The novelty and beauty of many of these render an effort to this end exceedingly desirable and advantageous from a horticultural point of view. Costa Rica in particular has yielded many interesting new species within late years. This region, which has been called the richest in the world, will doubtless be equaled by certain parts of the Andes of South America, when that immense territory shall have been adequately explored. William R. Maxon.

Cultivation of tender ferns.

To grow commercial varieties of ferns profitably, the first care should be to secure the necessary number of properly built and equipped houses, with a conveniently arranged workshop. The house which gives the most general satisfaction runs north and south, has an even-span roof, and with a fall to roof of 6 inches to the foot. Its benches should be arranged to be about 7 feet wide, with a 24-inch path on either side. In an 18-foot house this will permit of having a 7-foot center-table, two 3½-foot side benches and two 24-inch paths. Benches should not be more than 3 feet above the walks, as this will bring every part of the bench within easy reach, and will permit of every plant being in constant sight and easily cared for, which fact is essential in the profitable cultivation of trade ferns.

The width of house is immaterial, but when houses adjoin, a width of 27 feet has been found to be very satisfactory, as this permits the construction of three 7-foot benches, two 24-inch paths, and two paths 2½ feet wide under each gutter.

Thorough provision should be made for ventilation. For a 27-foot house, a continuous row of ventilators of at least 3 feet in width should be provided, with some reliable apparatus for raising same. Heating is the next important consideration. Either steam or hot water will give equally good results if properly installed. The safest way for the average grower is to give the heating contract to some reliable firm. Water-taps should be so arranged that a 25-foot hose attached to same will easily reach any part of the house. A 25-foot hose can easily be carried about without injuring either itself or benches and plants; and iron pipe is of only half the cost of good hose. In most fern-houses drip is a source of great annoyance, and should be prevented by the use of drip-bars, by having a drip-groove plowed into the headers immediately under the ventilating-sash, and also by having a groove in sides of gutter-plates. This very slight additional expense will very soon pay for itself by saving a great number of plants, especially when growing very small ferns in houses, such as have been transplanted from spore-pots into boxes. Ventilators should fit into a groove in ridge of house and be hinged to the ridge. When ventilators are so arranged, air, which is very desirable on a good many warm rainy days in the summer, can be given without having plants in the houses suffering from excessive moisture. Burning of the foliage will also be avoided, as the plants will at no time be exposed to the direct rays of the sun. Ventilators hinged on header and opening on ridge will always give trouble. No matter what kind of covering is put over the opening, if it efficiently excludes the burning sun's rays it will also prevent the ingress of air.

A propagating-room should be provided; and in the case of general trade ferns raised from spores, it is a very safe rule to calculate on having from 60 to 70 square inches of room in the propagating-frame for every 1,000 plants desired. The propagating-frame should be 3½ feet wide, have sides 9 inches high, and, to insure an even moisture, its bottom should be covered to the thickness of 1 inch with fine cinders with the fine ashes removed, which make very clean and efficient drainage material. The frame should be covered with light sash constructed with drip-bars, to carry off condensation.

Shading of fern-houses should have close attention. It is best effected by the application of a suitable wash to the outside of glass on roof. The following composition for a wash has given excellent results for a number of years: To two gallons of benzene or turpentine add one pint (or more, according to time the shading is desired to remain on houses) of linseed oil, five pounds of pure white lead and enough whitening to make proper thickness (which can very easily be ascertained by applying some of it to a piece of glass while adding the whitening); thoroughly mix and apply to outside of glass with a soft brush of the same width as glass. This shading, by the addition of more or less linseed oil, may be made to stay on houses up to one year. If properly applied in spring, it will be just right during the hot days of summer, and in the fall and winter, when more light is gradually required, the frosts gradually will have reduced the shading, thus admitting more light at the necessary time.

Much time, annoyance and expense will be saved by a careful arrangement of the workshop, or potting-room, a thing which in most cases is totally neglected. It should be so built that potting-benches are about 3 feet above the floor and 5 feet wide. They may be permanently constructed of substantial material, in order that a number of pots of different sizes can be conveniently stored, and that potting material can be thrown from cart or wagon directly onto potting-benches. By an improper arrangement of workshop great expense, loss of time and material are incurred by having to handle material repeatedly in small quantities.

Propagation by means of spores.

To grow ferns from spores successfully, it is advisable to sterilize soil on which they are to be sown, which can best be done by subjecting it to a high temperature by means of steam under a pressure of ten to fifteen pounds; and for this purpose a properly equipped workshop should be provided with a tight box about 3 by 3 by 8 feet or larger if an uncommonly large number of ferns is to be grown. It should be fitted with a grating made of 2-inch laths spaced 1 inch apart and placed 2 inches from bottom of the box. This grating may be covered with burlap, and if a ¾-inch steam pipe is fitted between bottom of box and grating, and connected to highest point of steam boiler (to insure getting perfectly dry steam), the soil is ready to be sterilized. After having cooled off, the soil is in practically the same condition as before so far as moisture, friableness, and the like are concerned, and this cannot be said of soil that has been sterilized by burning and by other methods. This steaming process will effectually destroy all forms of life in the soil and leave it for the use of spores alone. In most localities, the water used for moistening spores is impure and full of the spores of low forms of plant life, which are very destructive to the prothalli of ferns. To prevent this, the workshop should be provided with a receptacle in which the water intended for use on ferns while in the prothallus state can be raised to a boiling temperature, which will effectually destroy all spores that may be present in the water. This is best done by leading a 1-inch steam-pipe to within 6 inches of the bottom of the receptacle and turning on a reasonable pressure of steam. If boiled twelve hours before intended for use, it will be cool enough to be applied, and will be pure. A fern workshop should also be provided with a dry closet, having a number of shelves about 12 inches apart, for storing fern-spores.

In beginning the cultivation of ferns, it is advisable to purchase the spores from some reliable firm which makes fern-growing a specialty, until a sufficient number of stock plants can be grown to supply spores for home demand. Spores will do about equally well in pots or pans. Pans 12 inches square and 4 inches deep are used for that purpose, as also are the 6-inch common flower-pots. The 12-inch pans should be supplied with 1½ inches and the 6-inch pots with 3 inches of coal cinders for drainage. Soil for sowing spores on is best composed of five parts, in the proportions of two parts good garden soil, two parts of finely screened peat and one of sharp clean propagating sand. Leaf-mold may be used instead of peat, if easier to procure. This soil should be thoroughly sterilized, as already directed. The spore-pots should be filled with the soil to within ¼ inch of the top; press firmly. The rest of the pots should be filled with the same composition after it has been passed through a screen of about ⅛-inch mesh, then made absolutely level, firmly pressed and thoroughly watered with sterilized water. Three or four hours after watering will be the best time to sow spores. The spores should be thinly scattered over the surface of the soil, a quantity that can be held on a surface of ¼ square inch being abundant to sow one 12-inch pan. Spores should not be covered with soil. Immediately after sowing, the sash of the propagating-frame should be tightly closed and kept so until spores show signs of germination, when a small quantity of air should be given and gradually increased, so that by the time the first small fronds have made their appearance they may have been sufficiently hardened off to have the sash removed entirely. In sowing spores, great care will be necessary to prevent them from getting mixed, fern-spores being very minute and so light that the slightest movement of air will carry them long distances. While sowing spores, all spore-pots should be kept tightly covered. Being kept in a very close and humid atmosphere after sowing, the spores should not require any watering for one or two weeks, by which time they will have sufficiently settled not to be dislodged by a very gentle overhead watering, which should be given whenever soil shows the least sign of being dry. Sterilized water should be used until after the first delicate fronds have been formed. As soon as the first little fronds have made their appearance, care should be taken to weed out all undesirable varieties, which, even with the very best of care, will occasionally creep in. A temperature of 65° F. should be maintained in the propagating-house.

1488. A fern pan.

As soon as the first small fronds are evenly formed all over the surface of the pot, the little plants should be transferred in clumps of four or five plants each, to well-drained pans (Fig. 1488) or boxes filled with soil composed of one-half rich garden soil and one-half peat or leaf-mold, finely screened. In transplanting, great care should be exercised not to cover the remaining prothalli, but to have them just level with the surface of the soil. The clumps of plants should be kept as loose as possible, as this will give each individual plantlet a better chance to form the necessary number of rootlets, and it will, later on, also be easier to separate the plants. Boxes for transplanting ferns are most convenient when 4 inches deep, 14 inches wide and 22 inches long. These boxes will hold about 200 plants placed about 1 inch apart. As soon as the little plants have formed two or three fronds each, they should be separated and transplanted singly into boxes similarly prepared as before, where they may remain until sufficiently strong to be potted into 2- or 2¼-inch pots.

Times of sowing fern-spores are the first weeks of March, July and October. When making three sowings a year, and allowing a sufficiently longer time for slower-growing varieties, a constant supply of plants will be assured. In calculating on time of sowing spores of commercial varieties of ferns, it will be helpful to divide them into two classes, as some varieties are considerably slower of growth and will consequently have to be sown earlier, in order to be ready for sale at the same time as the more rapid-growing ones. The following popular commercial kinds will require from nine to ten months between times of sowing and potting. The names are those that the plants bear in the trade:

Adiantum cuneatum.
“ “ variegatum.
“ “ grandiceps.
“ Bausei.
“ decorum.
“ Fergusonii.
“ gracillimum.
“ mundulum.
“ tenerum.
“ Wiegandii.
Cibotium Schiedii.
“ regale.
Cyathea medullaris.
Cyrtomium caryotoideum.
“ Fortunei.
“ falcatum.
Davallia tenuifolia stricta.
“ “ Veitchiana.
Dicksonia antarctica.
Doodia aspera.
Doodia aspera multifida.
Doodia caudata.
Doryopteris nobilis.
Lastrea aristata.
“ “ variegata.
“ chrysoloba.
“ opaca.
“ Sieboldii.
Lygodium japonicum.
“ scandens.
Nephrodium hirtipes.
Nephrolepis exaltata.
“ cordata compacta.
Platyloma Bridgesii.
“ falcata.
Polypodium aureum.
“ fraxinifolium, etc.
Polystichum coriaceum.
“ setosum.
Pteris Victoriæ.
“ tremula Smithiana.

The following trade ferns will develop into plants large enough to be potted in about six months after sowing spores:

Adiantum pubescens.
“ hispidulum.
Alsophila australis.
Gymnogramma calomelanos.
“ chrysophylla.
“ decomposita.
“ peruviana.
“ sulphurea.
Lomaria ciliata.
“ gibba.
“ “ platyptera.
Nephrodium immersum cristatum.
Nephrodium molle corymbiferum.
Onychium japonicum.
Pteris argyræa.
Pteris cretica albo-lineata.
“ “ magnifica.
“ “ Mayii.
“ “ nobilis.
“ hastata.
“ “ adiantoides.
“ internata.
“ Sieboldii.
“ leptophylla.
“ Ouvrardii.
“ palmata.
“ serrulata.
“ “ cristata.
“ “ “ nana.
“ tremula.
“ Wimsettii.

It should also be borne in mind, when calculating time of sowing, that spores sown in the autumn will require about four weeks longer for development than those sown at other times of the year.

Fern-spores are borne on the back or under side of fronds. In some cases they are borne naked on under surface of frond, while in others they are produced under a scale-like membrane or indusium. In some cases, as in Pteris, the edge of the pinnæ is folded back over the spores, while in adiantums a small part of the leaflet is folded back over each little fruit-dot to serve as a shield or indusium. Davallias form a small sack-like receptacle at the extremity of the pinnæ. The proper time of gathering spores is when they assume a light brown, rather dry appearance, or in the indusium-bearing kinds when the indusium or shield begins to open. Spores should be gathered on a dark day when the fronds are slightly moist, as they will be better retained in that condition, and will not be so liable to get mixed when disturbed. Fronds, or parts of them, should be cut off entirely in most cases, put up in tight paper bags and stored on shelves in a dry closet for a week, by which time, in most cases, they will be sufficiently dry to have spores removed from them by rubbing the frond in a sieve which has about twenty meshes to the inch. When thus separated from fronds, the spores should be put up in small seed-bags and placed in air-tight jars until required for sowing. Cared for in this manner, perfect success has been invariably secured, even after keeping spores for years.

Propagation by other means.

Some ferns form little plants at the ends of pinnæ and of fronds, which upon attaining to sufficient size may be detached from parent plants, planted into shallow, well-drained seed-pans, and for a week or two left in the propagating-frame, where they will soon form roots, when they can be potted. Among such are *Adiantum caudatum, A. Edgeworthii, A. lunulatum* var. *dolabriforme, Asplenium Belangerii, A. bulbiferum, A. salicifolium, Polystichum angulare* var. *proliferum*, and many more.

A very useful decorative fern is *Nephrolepis davallioides* var. *furcans*, and it will make a beautiful specimen plant in a comparatively short time. To grow large quantities, the old plants should be cut back to within 6 inches of surface of soil and placed in a house where a bottom heat of 90° F. may be secured, when they will soon form a large number of short, strong fronds. At this time they may be divided into a number of small plants, potted off and placed in the same position as the parent plants. A somewhat slower method is to plant out a number of plants on a bench into 5 inches of soil, in which soil the rhizomes, running over the surface, will form a number of small plants, which may be detached and grown on.

A beautiful fern is *Adiantum Farleyense*, and it deservedly ranks as the greatest favorite among fern-lovers. It is best propagated by division. From old plants, cut off all fronds down to the rhizomes, wash off soil, cut rhizomes into pieces ½ inch long, insert same into well-drained fern-boxes about ½ inch apart, in 1½ inches of clean, sharp propagating sand. Place same in propagating-frame in a temperature of 70° F. In this position each little fragment of rhizome will form two or three little fronds in about fifteen or twenty days, when they may be potted off singly into 2-inch pots and kept in a temperature of 70° F. The soil best adapted to *A. Farleyense* is finely chopped sod which has been piled for about six months, with one-fifth well-decomposed cow-manure added. To attain perfection in growth and coloring, *A. Farleyense* should be kept in a light, airy and sunny house, in which every condition of moisture and atmosphere can be kept under absolute control. In a house of this kind, the greatly admired and beautifully pinkish tint may be easily obtained and fronds will be hardy and of good substance. A temperature of 70° F. is at all times desirable.

General culture.

To grow ferns such as are used for jardinières and decorative work and mentioned in the two preceding lists, a temperature of no less than 55° F. should be maintained at all times at night in coldest weather, with a rise of temperature in the daytime of 10° or 15°. To keep ferns in a healthy and growing condition, to prevent and to kill insect pests and diseases, a proper condition of atmosphere should be carefully maintained at all times. Extremes in heat, moisture or dryness should never be allowed. On a warm, dry, sunny day, when a great deal of air has to be admitted, much of the moisture of the house is consequently carried off; it will be of great benefit then to syringe the ferns once or twice a day, also occasionally to dampen floor of houses. An excessively dry atmosphere induces the development of the very troublesome pests, thrips and red spider. On damp and rainy days a saturated atmosphere should be prevented by supplying a little artificial heat, even if some air has to be admitted at the same time. This slight expense of heating on damp days will abundantly pay for itself by causing the growth of strong, thrifty plants. An excessively moist atmosphere causes parts of fronds of a great many plants to turn black and to rot off, besides inducing the development of almost incurable fungoid diseases.

The soil for deep-rooting ferns should be as follows: Three parts fibry loam, one part fibry peat, one part leaf-mold, one part sand, one part sphagnum moss, one-half part broken crocks and one-half part broken charcoal. These ingredients should be thoroughly mixed and ample drainage provided. For shallow-rooting ferns the following compost should be used: One part fibry loam, one part peat, one part leaf-mold, one part sphagnum moss, one-half part broken crock, one part sand, one-half part broken charcoal. If the charcoal cannot be readily secured, half the amount of sand and finely broken crocks will answer, although the composition as prescribed is preferred, as charcoal keeps the soil sweet and may spare time for repotting.

In potting ferns after they pass 4-inch pots, a potting-stick should always be used as the potter cannot very well firm them with his fingers, and it secures eveness in potting. Ferns should be potted tight, especially old plants. Also old plants should be partly shaken out and the roots shortened somewhat, and if carefully handled will quickly reëstablish themselves and make better plants. A potting-stick is very handy also for pressing the compost between rhizomes, and it can be done much more neatly than with the hand.

In the selection and growing of stock plants, the careful grower should always be on the watch for types which are most perfect in shape, in character of individual fronds, in coloring, freedom of producing spores, and exemption from the attacks of insects and fungous diseases. In a large number of ferns a great difference between the different plants of the same species will be apparent to the careful observer. Some plants of same species have beautifully developed fronds, but are carried on long, weak stems, which makes them unfit for general use. Others may be of compact, sturdy habit of growth, but with poorly shaped individual fronds. In some individuals the coloring will be greatly superior. By closely studying all these points and by continually selecting only the most perfect types of ferns from the young plants, one can in a few years work up a very desirable and superior stock. The same stock plants of the rapid-growing varieties of ferns should not be carried over for more than three or four years, but young and more desirable plants should continually be selected and grown to take their places.

The stock should be shifted into larger pots whenever necessary, and placed in a light, airy house, in which all necessary conditions are under perfect control, and in which a temperature in coldest weather of 55° F. at night, with a rise of 10° or 15° in daytime, can always be maintained. The house should be shaded just enough to prevent fronds from turning yellow. Proper attention to atmospheric conditions of stockhouse should never be neglected. Stock plants should not be permitted to remain potbound for too long a period of time, except with a few kinds, such as alsophilas, dicksonias, cyatheas, cibotiums, *Pteris tremula*, *P. argyræa*, some davallias, and *Polystichum coriaceum*, which, if given too much nourishment, will often be very slow in setting spores.

1489. Cyrtomium falcatum. Young plant.

Insects which are most troublesome to ferns are thrips, red spider, scale and mealy-bug. They are mainly present in a too-dry atmosphere. Thrips, red spider and mealy-bug are easily prevented by a properly moistened atmosphere, also by spraying of foliage once a week with tobacco water. As tobacco greatly varies in strength, every grower will have to determine to his own satisfaction how strong to make his solution. The preparation known as "Rose-leaf tobacco extract," has proved very efficient in destroying these insect pests. To fifty gallons of water add one quart of the extract, and apply with some good insecticide sprayer and a force pump. Fifty gallons of this solution will be enough to spray 100,000 ferns in 2¼-inch pots.

Bearing in mind the foregoing advice, the amateur fern-grower may determine the proper way in which to raise his plants. He may not have a fern-house, but he can have a tight glass box or Wardian case. The bottom should be a zinc tray, to prevent drip on the floor and to prevent too rapid drying out of the soil. The top or roof of the box should be hinged, so that it can be raised. In this miniature greenhouse many interesting ferns can be grown. Lycopodiums and selaginellas (which see) are treated in much the same way as ferns.

Nichol N. Bruckner.
X. E. E. Schmitt.†

List of tender ferns. (X. E. E. Schmitt.)

Acrostichum. A widely distributed class of ferns found in tropics of both hemispheres; some have fronds that are solitary, while others are pinnatifid; some are deep-rooting and require a loamier soil, while others are shallow-rooting and require a very shallow and porous soil. They are a class varied in many respects; the fertile fronds are totally covered on the under side with the spores, generally brown in color, and when ripe, after shedding the spores, will perish and be succeeded by the barren fronds. Propagated by division and spores. Winter 55° to 60° night. They should have a perfect drainage, the deep-rooting ones of ordinary depth, but the shallow-rooting are best grown in a depth of about 2 inches of soil and very porous, as for davallias, the shallow-rooting species; they all love a moist and shady atmosphere except *A. aureum*, which will stand sun with its roots in 2 inches of water; it is found in Florida and tropical America.

Actinopteris. A low-growing and charming class of ferns with palm-like or rayed fronds. They thrive best in a compost of loam, peat, chopped sphagnum moss, coarse sand and crocks (broken small), in equal parts; they should have ample drainage, filling the pots about half-full with crocks. They require a good light and plenty of moisture; they are best propagated by spores; they can also be divided. Winter temperature, 58° to 60°.

Adiantum. The maidenhair ferns with fronds, the individual pinnæ of which vary from not more than ⅛ inch in width in *A. gracillimum* to the large *A. peruvianum* with pinnæ 2½ to 3 inches long. They are hardy, stove and temperate ferns, and require a deep rich soil and plenty of water during the growing season, and less during the resting-period, which is usually from December to the latter part of February. They should be allowed to get fairly dry but not wilted before they are watered again. In most species or varieties of garden origin, remove part of the old fronds just as growth commences; with some of the denser-growing sorts, all the fronds may be cut away just as the new growth is commencing, as it is very tedious and there is not much gained thereby. It should be cut close, but with sparser or large-growing sorts as *A. trapeziforme* and many other strong-foliaged sorts, it is better to leave all the good foliage possible to stimulate the new growth; turn the plants out of the pot, cut away the lower half of the ball and trim in the sides of the old ball close to the rhizomes with a large knife, then loosen slightly the edge of the ball with a sharp-pointed stick so that the roots will feel the effect of the new move readily; never round off the sides in a slant or sloping manner as the old crowns are very closely knit together and trouble would be experienced in getting them wet through again. Should they become too dry, give a little water every few minutes until they are given enough to penetrate the old ball. The crowns should be let down a little deeper than they were when turned out of the pot. The surface should be slightly pointed here and there which will help the water more readily to penetrate. Have the pots well drained, placing a thin layer of sphagnum moss over the crocks which will keep the drainage clean. Fill in the soil, pack firmly with a potting stick up to the height required to receive the ball, which should be low enough to give a light covering of soil; they throw out their new roots from top, bottom and sides; then place in a layer of soil, tightening it with the potting stick, place layer after tightening as before until it has reached the required height; give a fair watering, fill about twice the space left from the top of the soil to the rim of the pot. They will not require any water for two or three days, then give a light sprinkling with a watering-pot with a rose on. They will require to be looked over every other day or so. In about a week's time they will require a moderate watering, but not so heavy as at first. After potting, an increase of 8° to 10° in temperature, both by night and by day, is necessary. Some of the smaller-growing sorts will require a deeper drainage and smaller pots. Adiantums with a few exceptions will not tolerate syringing at any time, particularly during dull or cloudy weather, as damp may settle in the foliage and ruin several plants, but care must be taken that they have sufficient water at the roots, as in the growing season they take a good supply of water. The temperature in winter for greenhouse ferns should be 52° by night, adding 6° to 8° by day; stove should be 56° to 58° by night, adding about 6° by day. Adiantums require a mixture of chopped or hand-broken fibry sod that has been stacked about six months, one-half part peat, one-half part leaf-mold, one part well-decayed cow-manure preferred (as they are good feeders), one and one-half part sand, one part chopped sphagnum, one-half part broken crocks and one-half broken charcoal about ¾ inch in size, using fine and all; place in even layers in the order above stated, then turn three or four times which will leave the whole evenly mixed, when it will be ready for use. For cult. of *A. Farleyense*, see p. 1212.

Alsophila. Tree ferns, natives of tropical America and Australia. *A. australis* and *A. excelsa* will stand sun with a copious supply of water. Soil as for Dicksonia. Winter temperature for Australian species, 50° to 55°; for West Indian, 58° to 60° night.

Anemia. A pretty class of small-growing ferns, sometimes called the flowering ferns, as the fertile sprays appear along with the sterile frond. They require an open porous soil and are not deep-rooted. Moderate temperature, 52° to 55° winter temperature by night. Propagated by spores.

Angiopteris. Giant ferns, more resembling a cycad than a fern, were it not for the spore cases. They are native of tropical Africa, tropical Asia and the Philippines. They are deep-rooting, with heavy and fleshy roots, and enjoy a rich deep and porous soil. They require a high and moist temperature, not less than 60° by night in winter and will stand 90° or more in summer. They require shade during summer, with more light during winter. A soil as for dicksonias, with the addition of a little manure is satisfactory. They should be potted just as growth is commencing. Care should be taken not to bruise their fleshy roots; should any be damaged they should be cut off with a sharp knife. Propagated by spores and division, both a slow process, but more readily by the large and fleshy scales carefully removed from the old plants, laid between sphagnum moss, sand and broken crocks in a case with a bottom heat of 80° or a little more; they should be laid on a slant with inner side of scale facing upward. When they have formed buds, emitted roots, and made two or three leaves, they may be detached and potted singly in as small pots as their roots will permit; return to case and inure to more light and air gradually; each scale may bring four or five plants.

Blechnum. Ferns of easy culture, requiring moderate shade. Allied to Lomaria. Several of them are dwarf tree ferns; others have spreading rootstock. They will not stand dryness; require a moderately strong soil containing a small amount of manure.

Cheilanthes. A class of dainty and graceful ferns. They require an open and porous soil; will not tolerate syringing, and require a good light at all times. Propagated by spores and division, spores preferred. They will not stand an overabundance of moisture at any time, but will well repay proper care, as they are all very beautiful. Some have fronds resembling the palmate fronds of Doryopteris, while others are very much divided. The soil should consist of one part fibry loam, one part peat, one part leaf-mold, one part sand, one-half part broken crocks, one part sphagnum moss and one-half part broken charcoal, broken quite small, the whole thoroughly mixed together and the pots well drained. A temperature of 50° to 55° suits them best in winter.

Cyathea. Beautiful tree ferns, native of New Zealand and tropical America. *C. medullaris* will grow to a great height, from 60 to 75 feet, and is often seen in its wild state far above the surrounding vegetation. Will stand full sun. Temperature for New Zealand species, 50° to 55° winter; tropical American, 55° to 60° nights. Soil as for Dicksonia.

Cyrtomium. Fig. 1489. Ferns of easy culture. Require a greenhouse temperature of 48° to 50° by night in winter; will stand a strong light and partial shade. Useful for fern-dishes. Allied to Aspidium. General culture for ferns.

Davallia is a beautiful class of ferns found both in the tropical and subtropical zones. The smaller-growing forms can be grown in shallow baskets or pans and have a fair amount of rest in winter. The Japanese fern-balls are probably *D. bullata* and *D. Mariesii*, and can be laid out in the garden and frozen down to zero and when the growing season returns watered and they will begin to grow again. Davallias with heavy rhizomes or any of the surface creeping sorts will want to be kept a little on the dry side during the resting period, which is from the beginning of December to about March, when they will gradually recommence, and water should be given accordingly. They must be syringed at least twice daily in winter, as black thrip is liable to attack them; should they be attacked, dip in a medium solution of aphine or fresh tobacco water. Should the plants be too large to handle, syringe them with aphine or tobacco water at night and give a thorough syringing with clear water the next day; apply two or three times, then stop for two or three days, then repeat, after which the troubles will be over. The cooler kinds will commence their growth about a month later than stove kinds. They should be repotted or top-dressed just as growth commences, if they require it.

D. pallida is a fern which rests from December to March, at which time gradual increase of water may be given it and by the end of March it will be commencing its growth. It should be carefully separated, taking care not to injure the points of the rhizomes. Many of them will be found all the way to the bottom of the pots or pans in which they have been growing. It is well to leave an old specimen undisturbed for three or four years and only give a light top-dressing in the spring as growth is commencing, and weak liquid manure about every two weeks as the fronds are unfolding; but always water with clear water first, then follow with liquid manure. It requires a stove temperature of 58° to 68° by night, adding 6° to 8° by day on bright days, during its resting period, with corresponding increase during the growing season of about 20°. It needs a good strong light but also shade. It requires a good supply of water during its growing season and only a small amount once a week, but must be syringed twice daily. The composition of the soil should be an open and porous material consisting of the following: two parts fibry loam which had been stacked about six months and broken up by hand (not sifted or pulverized), one part fibry chopped peat, one part leaf-mold, one part sand, one-half part broken charcoal, using in the same manner as the crocks, one part sphagnum moss chopped roughly, all the parts of this composition placed in even layers in the order named four times, first to the left, then to the right, when it will be of the proper texture ready for use. The pots or pans should be well drained by placing a flat piece of crock over the holes flat side down. The soil should be hand-picked so as to be free of worms and insects. This process is slow and tedious, but when there is taken into consideration the length of time a plant is to remain undisturbed, too much care cannot be taken. Place the curved pieces one against the other until the entire bottom is covered, then place a good sprinkling of clean ¾ inch soil (no dust), and cover the whole with a thin layer of sphagnum moss, covering the crocks evenly so that no soil will pass through. The receptacle is now ready for the soil. Place some of the roughest of the soil directly over the moss, then filling up to within 2 inches of the top, pack down evenly with a wide potting stick so that they will not sink afterward; now put in the rhizomes one by one, setting the points so that they will be evenly distributed, and firm the soil tightly with the fingers, as a potting stick cannot well be used on account of bruising; let them be about even with the top on the sides and slightly rounded in the center; stake the fronds with light stakes to keep them steady, which will give them a neat appearance as they will have to remain until the new growth has developed and the plant is reëstablished with new roots, when they will sustain themselves without any supports. The plant is now ready for watering; one even watering is all that will be required and a light syringing four times a day. Should the surface become dryish a light watering should be given as when first potted, but after this the plants will require water more frequently as they will be making roots rapidly as will be indicated by the foliage that has developed. Directly after potting keep the house close and increase the air gradually until full air can be given. Hard-leaved ferns like davallias can stand a light syringing three or four times a day on all bright days but none on cloudy days unless there is artificial heat on. Decrease syringing as the cool nights of the end of summer and autumn approach; the temperature may also be lowered until it falls to the winter temperature with the declining season. The foregoing soil is suitable for most shallow-rooting ferns.

Dennstædtia. With creeping rootstock. Winter temperature, 52° to 55°. Propagated by spores and division. Culture as for Microlepia.

Deparia. A small group of ferns with arching fronds. Stove winter temperature, 55° to 58°. Propagated by spores or bulbils that form on the fronds. Culture, see main article (p. 1210).

Dicksonia. An interesting class of tree ferns from Australia. They require a cool temperature and partial shade in summer, but their stems must be syringed frequently. They must never be allowed to dry at the roots, and even more copiously watered in summer. Winter temperature, 45° to 48°; can be stood outside in summer. Can be propagated by spores or side growths carefully removed from the parent stem without injuring the heel. Require a soil of three parts loam, one part peat, one part leaf-mold, a little more than one part sand, some broken crocks and sphagnum moss with the whole, and well drained.

Didymochlæna. An interesting group of ferns of distinct habit and growth. Winter temperature, 55° to 58°.

Diplazium. A rather coarse-growing but interesting class of ferns, grown mostly in the greenhouse. Allied to Asplenium. A fairly porous soil suits them best. Propagated by spores or division. Winter temperature, 55° to 60.°

Doodia. A small and distinct class of ferns of cool temperature, 48° to 52°. Propagated by spores and division. For culture, see main article (p. 1210)

Drynaria. Plants with a thick and downy rhizome. Propagated by spores and division. All stove ferns allied to Polypodium.

Dryopteris. Small stove ferns. Require a winter night temperature of 55° to 58°.

Gleichenia. A genus of most beautiful and graceful ferns, natives of Australia, New Holland and tropical America. They thrive best in a compost of one part loam, one part peat, one-half part sand, one-half part broken crocks, one part sphagnum moss; in potting, the center of the plant should be dropped a little below the rim of the pot so that the outer rhizomes can rest on the new soil, leaving the center a little deeper than the outer edge; pin the rhizomes down carefully but do not cover; pot firmly; give a gentle watering; syringe several times a day, but take care not to overwater. They love a cool, moist atmosphere; the tropical American ones can stand a little more heat, also a little sun; winter temperature for New Holland ones, 48° to 52°; American, 50° to 55°. Care should be taken at all times not to overwater or let them get too dry; the best way is to sound them with your knuckles, and in fact almost any plant of careful treatment should be treated the same way.

Goniophlebium. Mostly a deep and free-rooting class of ferns, demanding culture as for Polypodium.

Hemionitis. An interesting class of low-growing stove ferns requiring a porous soil. Winter temperature, 55° to 58°. Propagated by spores, or by pinning a mature frond having formed buds, on a surface of porous sandy material, which readily form new plants.

Hemitelia. A distinct and striking class of tree ferns, native of tropical America and the Philippines. They are all stove ferns requiring 60° winter night temperature and ample moisture and shade at all times; soil as for Dicksonia, as they are heavy and deep-rooting.

Hymenophyllum. A class of ferns of most graceful and delicate structure; native of tropical America. They require a deep shade and a shallow compost to grow in as they are found growing on tree ferns and sandstone; the following will suit them best: sandy, lumpy peat with very small pieces of sandstone and live sphagnum moss, carefully placed between the small rhizomes and grown in a dense shade. Their foliage should never be allowed to become dry; they should be grown in a case. Winter temperature, 52° to 55°.

Hypolepis. A class of ferns with creeping rootstock, of easy culture, requiring shade. Propagated by spores and division. General culture of ferns.

Leucostegia. A class of ferns allied to Microlepia and Davallia, which see. Deep-rooting ferns of easy culture. Winter temperature, 52° to 55°.

Lygodium. A class of ferns of easy culture, requiring a deep rich loamy soil. *L. palmatum* is hardy. For culture, see main article (p. 1210).

Marattia. A bold, distinct, and interesting class of ferns. Allied to Angiopteris, which see for treatment.

Meniscium. A small class of interesting low-growing ferns. Require a medium temperature of 52° to 55° in winter. General culture of ferns (p. 1210). Propagated by spores.

Microlepia. A class of mostly strong-growing and graceful ferns of easy culture; *M. hirta* var. *cristata*, being crested, makes a beautiful specimen. They like a strong open soil with a little cow-manure added and a fair supply of water at all times. They require good light but shady. Propagated by division or spores.

1490. Pteris cretica var. albo-lineata. (× ½)

Nephrolepis. A large group of ferns having more garden forms than any other class of ferns, and the end is not yet in sight, as every year or two another form appears; the type *N. exaltata* will grow fronds 4 to 5 feet long, while some of the variations will grow them as short as 8 inches long. All the forms of *N. exaltata* will stand sunshine under glass. A compost of three parts good fibry loam, one part manure, one part sand, a small sprinkling of leaf-mold and sphagnum moss thoroughly mixed, suits them best. They like a fair supply of water at all times. When potting, always drop the plant down so as to cover ¼ inch, as the young fronds will readily push through the soil. *N. Bausei* is deciduous. *N. Duffii* is a small fronded and beautiful species. Propagated readily by runners, of which they furnish an abundance; pin the runners down over the surface of the soil; in a short time they will make a lot of young plants which can be taken up when they have made two fronds, potted up into 2-inch pots, kept close for about two weeks, when more air can be given them; then pot on as required.

Notholæna sinuata. Native of Mexico; an interesting and graceful fern of downy foliage. Grows well in a medium temperature. Care must be taken in watering; it will not stand syringing. An open porous soil suits it best. Propagated by division or spores, spores preferred.

Onychium. A class of interesting and graceful ferns of easy culture for which see main article. Winter temperature 48° to 52°. Propagated by spores or division.

Pellæa. A very interesting class of low-growing ferns of neat and graceful habit. Winter temperature 55° to 58° at night. Requires a porous soil and good light; will not stand very much moisture on foliage. Thrip and mealy-bug are the worst enemies. Readily propagated by spores or division.

Phlebodium. Ferns of strong-growing habit. See *Polypodium.*

Phyllitis. A class of shallow-rooting ferns of easy culture. Allied to Polypodium, which see.

Phymatodes Somewhat shallow-rooted, but fairly strong-growing ferns, of easy culture. Best grown in pans. Require partial shade and a porous soil as for shallow polypodiums or davallias. They may also be used to cover walls in greenhouses, and to grow on trunks of tall tree ferns.

Platycerium. The stag and elk's-horn ferns. A distinct and most interesting class of ferns. They naturally grow in the forks of trees and on rocks. They are best grown on blocks or rafts; fibry peat and live sphagnum moss suit them best. They should have plenty of water in the growing season and a moist atmosphere at all times. Winter temperature at night, 58° to 60°, adding 5° to 7° by day.

Polypodium. Comprising many divisions and many of them in common cultivation. They are native of all climes. Some are hardy with hardly any protection, while some require stove temperature. Some are deep-rooting, while others are very shallow-rooting and require a very porous soil. They are mostly evergreen excepting the hardy species, which are deciduous. Some of the shallow-rooting species will grow on a surface of very shallow material composed of peat and moss, while others require an addition of loam. They are varied and distinct and can be employed for many purposes, to cover walls in a greenhouse or conservatory or rockwork out-of-doors. Some are very decorative and bold in habit, while others are graceful and beautiful. The deep-rooting kinds require a compost of two parts loam, one part leaf-mold, one part peat, one part sand, one part sphagnum moss, one-half part broken crocks and one-half part broken charcoal; they require ample drainage and an ample supply of water when growing, and reduced amount when at rest in winter. The shallow-growing sorts will require ample drainage and a compost of one part fibry loam, one part peat, one part sphagnum moss, one-half part broken crocks and one-half part charcoal. Some of the sorts will grow on a mossy surface or can be employed to cover walls or unsightly places in a greenhouse and by receiving an occasional syringing will do well, while others are better grown in pots or pans. Pans for many are preferred.

Polystichum. Many of these are hardy or will winter out-of-doors with moderate protection. Propagated by spores or by pinning down the fronds on a porous surface until small buds are fairly well rooted, when they may be detached and potted singly. A moderate soil suits them best.

Pteris. Fig. 1490. A various group, some of them hardy, others suitable for greenhouses and for stoves. They are not particular as to soil; a mixture of two parts peat, one part loam and one part sand will suit them. The variegated forms should be protected from very strong light. Some of the species propagate readily by division of the creeping rhizomes. Most of the tender species thrive in an intermediate or greenhouse temperature.

Selaginella. A class of plants of decorative and useful character and varied in form of growth as *S. cæsia*, *S. arborea* and *S. Willdenovii;* will grow to 15 or more feet, while others will not rise over 2 inches or so. Propagated by cuttings in the larger-growing kinds, division in most kinds, and pegging in some tall-growing species. Take down a tall-growing sort and peg it to mossy and sandy surface and in a short time when fairly well rooted, it may be potted separately in the regular mixture for Selaginella. Compost for Selaginella, two parts loam, one part fibry peat, one part leaf-mold, one part sand, one part sphagnum moss, one-half part broken crocks and one part charcoal. Mix the whole thoroughly, drain well as recommended for ferns. *S. grandis* and *S. Lyallii* require a Wardian case and will need a very moist atmosphere at all times, also a temperature of 60° by night, with corresponding increase by day in winter; in summer, 80° to 90° by day.

Todea. The filmy ferns of New Zealand are *T. superba*, the finest of them all; they are rare and seldom met with; they love a deep shade and coolness at all times; a temperature of 40° to 45° in winter suits them best. Their fronds should never be allowed to become dry. The strong-fronded ferns are stove ferns, requiring a winter temperature of 55° to 60°.

Trichomanes. A class of filmy ferns of great beauty, requiring a cool and moist atmosphere. They should be grown in fibry peat, sphagnum moss, sand, and broken crocks in equal parts. They are very shallow-rooting and must be handled with the utmost care in repotting. They must be potted tight, and if small broken sandstone can be had, all the better; the depth of the soil need not be more than 1 to 1½ inches. Temperature 45° to 50° in winter. They should be grown in a Wardian case, kept close except an opening on the coolest side. The fronds should never become dry; but should be sprayed several times a day if there is danger of their becoming dry.

Vittaria lineata. A very unusual fern growing naturally on trees in southern Florida. It does best fastened on a block in a mixture of fibry peat and sphagnum moss or in shallow baskets in the foregoing materials with a portion of sand, broken crocks and charcoal broken small. Pot firmly but let the material be shallow. It loves plenty of water at all times and a good light. Propagated by division and spores. Winter temperature 55° by night.

Cultivation of hardy ferns.

The hardy ferns are easy to transplant and tenacious of life under adverse conditions, but since the beauty of fern foliage is brought out only by luxuriance of growth, it should be the aim to plant only where such can be secured.

Ferns in general require positions in which the soil retains an even amount of moisture at all times. Most species do not grow well in a cultivated border or where the space between the plants is not mulched or given a ground cover of mosses or other plants which hold the temperature and moisture of the soil surface more evenly and allow the ferns to grow roots near and on the surface of the ground. Also when the earth is bare between the plants, the rains dash mud on the under side of the fronds—a condition under which no fern can thrive. However, some of the stronger-growing species, as the osmundas, because of their height and strong deep roots will do well in a cultivated border. A study of the soil surface where the fern is growing well in the wild will show about what is necessary.

Some ferns, as the maidenhair (Adiantum), have strong wiry stems which will push up through a very heavy covering of leaves, while other species, as all of the evergreen ferns, grow in positions in which the annual fall of leaves does not remain on their fronds. The larger number of ferns prefer no heavier mulch than is made by the death of their own fronds, which naturally fall away from the center of the plant, mulch the surrounding soil but leave the crown of the plant uncovered and unhindered for its growth in the spring. Many of the smaller ferns which have neither deep nor strong creeping roots require a ground cover of other plants or simulated conditions to prevent their being heaved out of the ground during the winter. A number of species with strong creeping roots as *Dennstædtia punctilobula* (*Dicksonia pilosiuscula*) and *Dryopteris* (*Aspidium*) *novaboracensis* eventually form thick masses which completely cover and fill the ground with roots. When this condition has been attained, no soil mulch or cover is needed, and even the old fronds had best be removed before growth starts in the spring.

Ferns may be separated into two classes by their stems: (1) those with creeping stems, and (2) those having a central crown or cluster of crowns.

Those with creeping stems spread and form large masses. They not only send up a crop of fronds in the spring but continue to grow new fronds during the season. This class of ferns may be transplanted at any season with ordinary care, in fact the fronds may be mowed off and the roots taken up in sods and relaid like turf, but better results will be secured with more care to preserve the younger and newly started fronds.

Those ferns with distinct crowns naturally send out only one set of fronds each year. This class of ferns is best moved after the plants have ceased growth in the fall or before growth starts in the spring. Especially is this the case with those species having deciduous or fragile fronds which easily become wilted or broken. When transplanting while in leaf, it is necessary to preserve fully half of the fronds to insure a good growth the following year. The evergreen species, as the Christmas fern (*Polystichum* or *Aspidium acrostichoides*), *Dryopteris* (*Aspidium*) *marginalis* and others with hard coriaceous foliage, can with reasonable care be transplanted at any season of the year.

In general, the soil for ferns should be rich in humus and mineral matter and sufficiently friable to allow penetration by the fine roots. A heavy clay is not satisfactory but may be corrected by the addition of a sandy soil and thoroughly rotted manure or leaves. A pure leaf-mold is not a good fern soil because it is lacking in minerals and is too light and loose for any fern except the Adiantum. A good sandy loam with too little clay to bake and not enough vegetable matter to be spongy will suit the larger part of ferns. It will be noticed that most species of ferns with crowns grow in the wild where their roots reach through the surface mold to a more mineral soil underneath; in fact they often grow in apparently poor yellow loam.

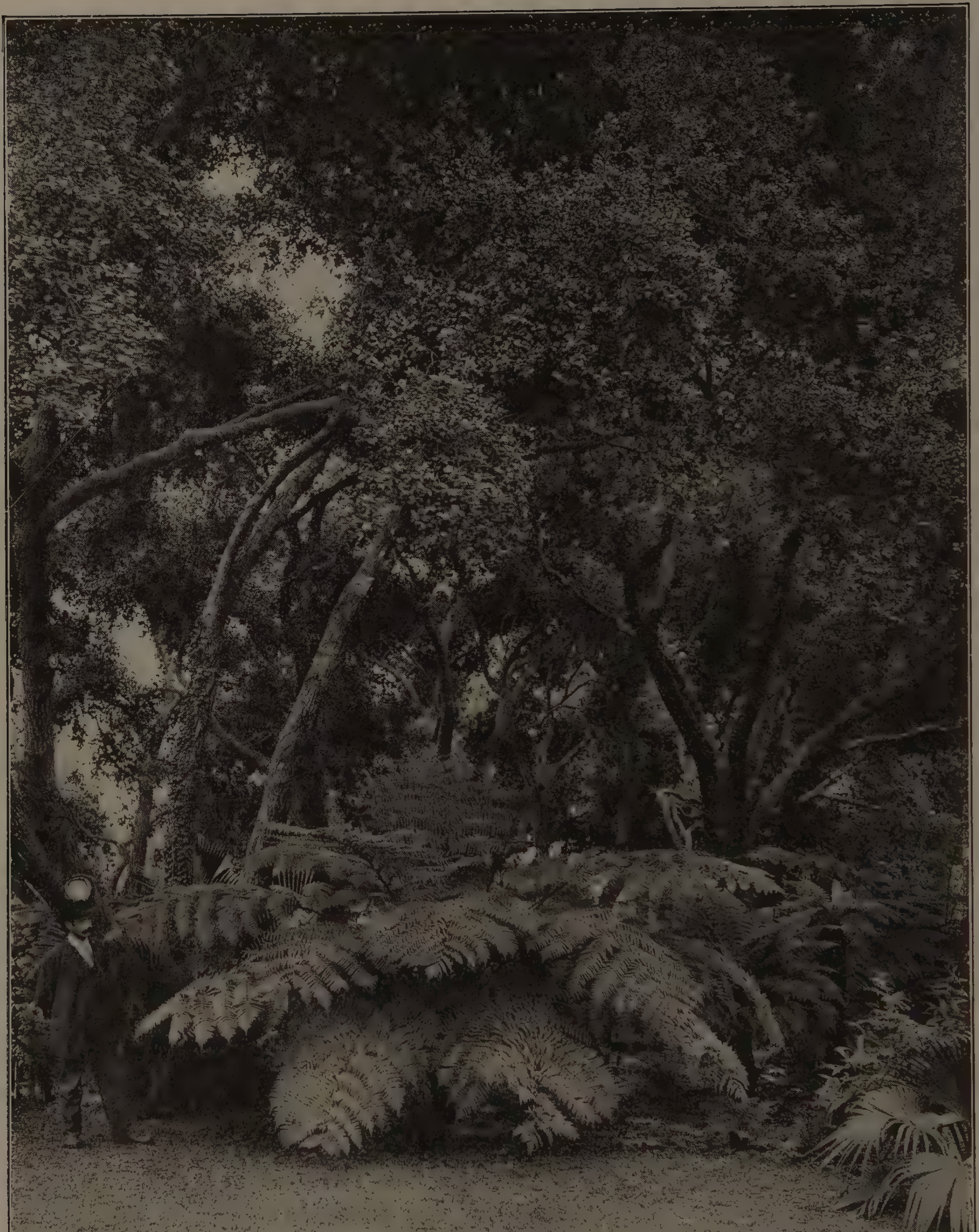
The following ferns grow luxuriantly in full sunlight with suitable conditions of soil and moisture: *Pteris aquilina*, *Onoclea sensibilis*, *Dennstædtia punctilobula* (*Dicksonia pilosiuscula*), *Dryopteris* (*Aspidium*) *novaboracensis*, and the osmundas.

Practically all the remaining species prefer more or less protection from the direct rays of the sun, but darkness or dense shadow is not required. Even the species which grow in deep, dense shade apparently need only the humid atmosphere found there, since near waterfalls and springs they grow in the open. In mountainous regions in which the atmosphere is cool and not drying, many species grow in full sunlight which require more or less shade in drier climates. Among such might be mentioned *Asplenium Filix-fœmina*, *A. acrostichoides*, *Phegopteris hexagonoptera*, *P. polypodioides*, *Dryopteris* (*Aspidium*) *Thelypteris*, *D. cristata*, *Onoclea Struthiopteris*, *Woodwardia virginica*, and *W. angustifolia*.

1491. Dryopteris simulata.

There are about seventy-five native American species which can be grown in northern gardens, and also a good number of quite distinct varieties. There are hardy species in foreign countries so that a complete collection of hardy ferns would probably reach 150 species.

The following species not natives of the United States are hardy at Philadelphia: *Dryopteris chrysoloba*, *D.*



XLI. A good fern in southern California.—Alsophila australis.

dilatata, D. Filix-mas, D. pseudo-mas Pinderi, Nephrodium hirtipes, Polystichum Braunii, P. lobatum and *P. setosum.*

The following notes are drawn from experience in cultivation of these native ferns in the neighborhood of Philadelphia.

Adiantum pedatum prefers light, loose, rich soil in cool, moist shade, with yearly mulch of leaves. Soil conditions are more important than shade. Where established in a wild state will endure the full sunshine coming with the removal of trees until soil conditions change or it is crowded out by stronger plants.

Adiantum Capillus-Veneris. Soil conditions about the same. See that leaf-covering is not of too large and heavy leaves.

Asplenium acrostichoides. Culture as A. Filix-fœmina.

Asplenium angustifolium thrives on rich rather moist soil in shade. Avoid complete removal of fronds when planting in early fall, as this fern quickly sends up new fronds to the weakening of the following season's growth.

Asplenium Bradleyi. A small rare fern. See Camptosorus and A. pinnatifidum for cultivation.

Asplenium ebenoides. Culture same as for A. pinnatifidum or Camptosorus.

Asplenium Filix-fœmina. Give good rich loam, moist, with drainage, with some shade. Endures full sunlight in cool climate. A beautiful and extremely variable fern. A number of forms are catalogued.

Asplenium montanum. Cultivated as Camptosorus or A. pinnatifidum.

Asplenium pinnatifidum. A small evergreen fern found in the wild in cool shaded places in which there is an uniform amount of moisture in the soil and when the air is not given to quick extremes of temperature and humidity. Ferns of this character need about the same careful placing as do real alpine plants. Planting between stones is advisable. No winter cover, no bare soil and no plant stronger-rooted than a moss near it.

Asplenium platyneuron prefers partial shade. Care must be taken to prevent smothering by leaves, and to plant where the least likely to be heaved by frost. It is found most plentifully as a native on banks growing with grass and other plants in partial shade. The fronds are evergreen, but become discolored in severe weather. Any good loam suits it. Easy to move at any season but difficult to maintain in masses.

Asplenium resiliens (A. parvulum). Culture of A. platyneuron,

Asplenium Ruta-muraria. Culture same as A. pinnatifidum.

Asplenium Trichomanes. A small fern growing well where A. platyneuron does. The shade of a small rock will suit it.

Asplenium viride. See A. pinnatifidum for culture.

Camptosorus rhizophyllus. WALKING-LEAF FERN. In wild state is found in cool, shaded positions not subject to excessive drought or moisture. It prefers a moist atmosphere but this is not necessary for good growth but where the best soil and atmospheric conditions prevail the leaves often attain a length of 18 inches before rooting. Avoid all winter covering.

Cheilanthes. Low-growing rock ferns generally doing well in fairly dry positions. *C. lanosa* prefers deep shade and more moist soil. *C. lanosa, C. tomentosa* and *C. Fendleri* at least of the species are perfectly hardy at Philadelphia.

Cryptogramma acrostichoides should have shade throughout year.

Cystopteris bulbifera. Will do well in usual deciduous shade in any loam, but grows best and produces far more numerous bulblets when planted on a moist bank of gravelly soil in the shade of kalmia.

Cystopteris fragilis should be planted in shade in positions where it will receive no covering of leaves. The fronds die in early August in the drier situations. It will grow in positions which become exceedingly dry in midsummer. It forces well in a coolhouse.

Dennstædtia punctilobula (Dicksonia pilosiuscula) prefers shady, moist situations where it does not receive any covering by falling leaves of large size. Grows well in sunshine. May be transplanted at any season, and takes kindly to heavy enrichment. The best fern to grow in quantity for cutting during the summer. Can be readily grown as a north border to a shrubbery in any medium to light loam.

Dryopteris Bootti is found in a wild state in moist, shaded positions, but will grow well in shade in quite dry positions. Does not need shade in winter. Use good loam.

Dryopteris cristata prefers moist to wet soil in shade. Will often burn with direct sunlight. Evergreen, quite variable. Var. *Clintoniana* is larger. The fern and variety appear to need swamp conditions to grow well.

Dryopteris Filix-mas. Practically the same conditions as for D. marginalis.

Dryopteris Goldieana prefers deep, moist, rich soil in cool shade. Grows finely in shaded places and soil suited to rhododendrons.

Dryopteris marginalis wants rich soil in rather deep shade during the entire year, but will grow well in partial shade—and endure even full sunlight, though not growing so luxuriantly. This is one of the native ferns commonly sold by collectors in city markets. It is evidently seldom established by purchasers of plants in full leaf. Once wilted the plants will not recover.

Dryopteris noveboracensis does best in rather moist, rich soil in partial shade, but will endure full sunlight with good soil conditions. Prefers light rich loam. One of the common field ferns growing in large masses either alone or with Dennstædtia punctilobula. When cut it wilts quickly so is of little value for bouquets. Easily transplanted at any season. Will not endure heavy mulch of leaves. Not evergreen.

Dryopteris spinulosa is less common in America than the var. *intermedia*, which occurs wherever conditions favor its growth. It has the finest cut or divided fronds of any of the large evergreen ferns, being almost the equal of the deciduous fern, Dennstædtia punctilobula, in this respect. The fronds are gathered extensively for florists' use. In culture, give the same conditions as for Polystichum acrostichoides, with heavier shade and more moisture. The best fern to grow under coniferous trees.

Dryopteris simulata (Fig. 1491) is much like the following and requires similar conditions. It occurs in boggy woods from Maine to Maryland and perhaps westward.

Dryopteris Thelypteris prefers quite moist situations with at least partial shade. With congenial soil and moisture does well in sunlight. A distinct and pleasing deciduous fern.

Lygodium palmatum is rather difficult to establish. Give a deep rather moist light loam in partial shade.

Onoclea sensibilis prefers a rich, moist soil in partial shade or full sunshine. It will also grow in shade. It likes a heavier soil than most ferns and uniform moisture. Does poorly in dry soils.

Onoclea Struthiopteris should be given a rich, moist soil with at least partial shade. The fronds will "burn" in fierce sunlight. A good fern to grow north of a wall or building where specimen plants are desired.

Osmunda cinnamomea prefers moist, partially shaded situations, but will grow well in full sunshine in rich soil not exceedingly dry. Perhaps the most beautiful of the osmundas. Best to move while dormant.

Osmunda Claytoniana, a native of low ground, both in shade and sunshine, but will grow equally well in rich soil only fairly moist. Best transplanted when dormant.

Osmunda regalis prefers a peaty soil in very wet, boggy position in partial shade, but will grow as well in full sunshine if soil is rich and not dry. A very distinct fern.

Pellæa atropurpurea prefers rather dry positions in partial shade, winter and summer. It will not endure heavy mulching. Will grow in full sunshine, but not to its full size. It may be transplanted at any season.

Phegopteris Dryopteris prefers good soil in shade not over moist or dry. Avoid coating of leaves. It is a beautiful species and useful for planting on rockwork in shade. The fronds die in August.

Phegopteris hexagonoptera needs good soil in shade. Fronds die down rather early. Will not grow well through a leaf mulch.

Phegopteris polypodioides prefers moist, shaded positions, but will grow in any good soil not too dry. The fronds die down in late summer, especially in the drier positions. Any winter covering of leaves must be removed.

Polypodium vulgare prefers good, light soil in well-drained but moist situations in shade, with no other plants growing with it. It will endure very dry places, but will be dwarfed. Will also do well in full sunlight if soil conditions are good. As a native it grows in positions in which it does not receive any yearly coating of fallen leaves, and, wherever planted, should not be covered with coarse material. Plant perfectly evergreen; height 6 to 10 inches.

Polypodium incanum of Virginia and the South is hardy but not vigorous at Philadelphia.

Polystichum Braunii. This fern needs good deep light loam, not spongy, with humus and shade winter and summer. A distinct and beautiful evergreen fern open to improvement by selection and culture, although belonging to the class of "crown" or "tree" ferns which do not have the chance to vary or "sport" which the species with vegetative roots do.

Polystichum (Aspidium) acrostichoides should be given shade both summer and winter for best results, and in no case can shade in summer be omitted. The plants will endure sunshine for a few years but will not be thrifty, and will eventually die. One of the more common florists' ferns—the Christmas fern—the sterile fronds of which are gathered and stored by the million for winter use by florists. They are found on the north side of the hills and the best grade grows not in low ground nor where the soil is shallow but where good loam with no winter leaf covering are the conditions. The planting of this fern for the sale of the fronds may become profitable as demands increase and its wild habitats become forbidden grounds to pickers. In culture give (1) northern exposure; (2) good corn land; (3) no loose or bare earth between plants; (4) no grass; (5) no real cover of leaves in the fall. Give with these a good supply of moisture such as the lower half of a hillside can easily be made to receive from the overflow from rainfall on the upper half. There must be good drainage.

Polystichum fragrans. Positions in the wild suggest dense cool moist shade with good drainage.

Polystichum Lonchitis. Grows well under conditions for P. acrostichoides as far south as Philadelphia.

Pteridium aquilinum, to be grown to perfection, should have considerable sunlight, with moist, rich soil, kept cool and loose with a coating of leaves or other material. In such a position it should grow to 4 to 5 feet high, with other dimensions corresponding. However, it will grow in almost any position. It has strong, creeping rootstocks, so that attention is necessary to keep a healthy group within bounds. The earliest fronds put forth die in late summer, but those of later growth remain green until frost, so that with attention to the removal of dead fronds a group will look well until fall. The rootstocks break or crack easily so that plants are injured by transplanting and grow poorly until again established. Early spring is the best time to move plants.

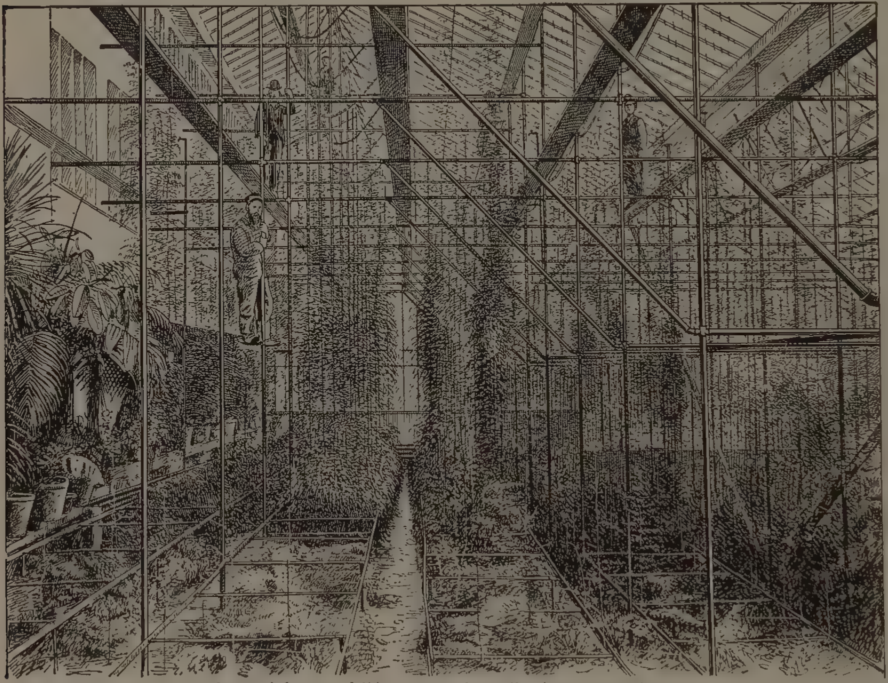
Woodsia. Small rock ferns mostly requiring winter shade and doing best on rock banks facing the north.

Woodwardia angustifolia wants a moist situation in deep shade. Does well in moist peat north of a bank or wall. Will endure full sunlight in positions where it has become established, but will not grow well when transplanted to sunny position. *W. virginica* needs more moisture.

F. W. Barclay.

Culture of asparagus fern (Fig. 1492).

The sprays of *Asparagus plumosus* look so much like certain ferns or selaginellas, that the plant is commonly known as asparagus fern; and the cultivation of it is therefore treated at this place. (For the botanical account, see p. 407, Vol. I.) The first and all-important factor in the cultivation of asparagus fern is the construction of the bed. To meet with any degree of success, the bed must have perfect drainage. The house should be 25 or 30 feet high, and wired at the top and bottom. The wires beneath are made fast to each side of an iron trellis about 8 inches apart and at the top an equal distance apart, in order that the strings may be as nearly straight as possible.



1492. A house of "Asparagus ferns."—Asparagus plumosus.

The early growth of *Asparagus plumosus* var. *nanus* is very slow; but as soon as it is transplanted and well rooted in a rich soil, the growth is more rapid, the tender shoots developing into a vine which will be ready to cut for the market in about a year. There is great difficulty in securing the seed of the nanus. In a whole house, there may be only a few seed-bearing strings. After being picked, the berries are allowed to dry for a month, and are then ready for planting. A good, rich soil, covered with a thin film of sand, serves very well to start them. The temperature should be about 65°, and as nearly constant as possible. When the plant is well rooted, it is removed to a deeper soil or potted in 3- or 4-inch pots and placed on a bench. Here it remains a year, and is then placed in the bed.

Up to this time a small amount of labor suffices to keep the plant growing in a healthy condition; but from now on great care must be taken and much labor expended to produce the best crop. The bed into which the young plant is set should be carefully laid with rocks at the bottom, so the water can escape freely. Over this place 2 or 3 feet of soil, manure, and dead leaves. It is but a short time now that the roots have room to expand before the shoots appear above the trellis, and the stringing begins. Strong linen thread is used for strings.

The first crop will not be ready to cut before the end of the second year,—that is, from the time the seed is planted. As soon as this crop is exhausted, new strings are put in place of the old, and another crop is started. This goes on year after year. Now that the plant has gotten its growth, it is more hardy, and is constantly sending up new shoots. If the bed is well made in the beginning, the asparagus need not be disturbed for eight or ten years. However, at the end of that time it is well to take the plants up and fill the beds with fresh soil and manure.

In the spring, when the sun gets high, the asparagus houses are shaded with a light coating of white lead, whiting and kerosene oil. This is absolutely necessary, as the summer sun would in a very short time burn the tops of the vines. The vine flowers in the fall, and only on strings that have been matured six months or more.

The vine alone is not the only source of profit. When the plant is a year old, a few of the most nearly perfect sprays may be taken without injuring its growth. These are very desirable in the market. There is, of course, some waste in working up the Asparagus to be shifted, but on the whole, it is very slight. The different forms in which it is sold utilize by far the greater part of it.

Insects destroy the shoots and sprays. This is prevented to a great extent by insect powder. The cut-worms do the most damage. About the only way to get rid of them is to pick them off the strings during the night, as they generally seek shelter under the thick clusters of the plant at daylight.

There are many drawbacks in growing asparagus, among which are expensive houses, the slow growth of the plants (which makes it necessary to wait at least two years before receiving any return from the expenditure), injury from insects, and the great amount of labor involved in looking after the houses.

William H. Elliott.

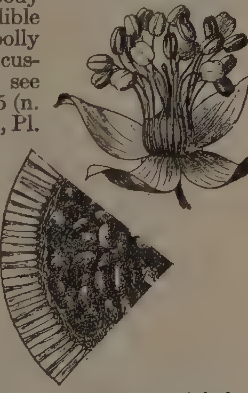
FERNS, POPULAR NAMES OF. **Adder's Tongue F.**, *Ophioglossum vulgatum.* **Asparagus F.**, *Asparagus plumosus.* **Beech F.**, *Phegopteris.* **Bird's-nest F.**, *Asplenium Nidus.* **Bladder F.**, *Cystopteris.* **Boston F.**, *Nephrolepis exaltata* var. *bostoniensis.* **Brake**, *Pteridium.* **Bristle F.**, *Trichomanes.* **Buckler F.**, *Dryopteris.* **Californian Gold F.**, *Ceropteris triangularis.* **Chain F.**, *Woodwardia.* **Christmas F.**, *Polystichum acrostichoides.* **Cinnamon F.**, *Osmunda cinnamomea.* **Climbing F.**, *Lygodium.* **Dagger F.**, *Polystichum acrostichoides.* **Deer F.**, *Lomaria.* **Elk's-horn F.**, *Platycerium alcicorne.* **Female F.**, *Asplenium Filix-fœmina.* **Filmy F.**, *Hymenophyllum.* **Floating F.**, *Ceratopteris.* **Flowering F.**, *Osmunda*; sometimes also *Anemia.* **Gold F.**, *Ceropteris.* **Grape F.**, *Botrychium.* **Hart's-tongue F.**, *Phyllitis Scolopendrium.* **Hartford F.,** *Lygodium palmatum.* **Hay-scented F.,** *Dennstædtia punctilobula.* **Holly F.,** *Polystichum Lonchitis.* **Lace F.,** *Cheilanthes gracillima;* also *Dryopteris intermedia.* **Lady F.,** *Asplenium Filix-fœmina.* **Lip F.,** *Cheilanthes.* **Maidenhair F.,** *Adiantum;* more particularly *A. Capillus-Veneris* abroad and *A. pedatum* at home. **Male F.,** *Dryopteris Filix-mas.* **Marsh F.,** *Dryopteris Thelypteris.* **Oak F.,** *Phegopteris Dryopteris.* **Ostrich F.,** *Matteuccia Struthiopteris.* **Pod F.,** *Ceratopteris thalictroides.* **Rattlesnake F.,** *Botrychium virginianum.* **Royal F.,** *Osmunda regalis.* **Sensitive F.,** *Onoclea sensibilis.* **Shield F.,** *Dryopteris* **F.,** and *Polystichum.* **Stag-horn F.,** *Platycerium.* **Sun F.,** *Phegopteris.* **Sweet F.,** *Myrica asplenifolia;* abroad, various *Dryopteris.* **Sword F.,** *Nephrolepis exaltata.* **Venus' Hair F.,** *Adiantum Capillus-Veneris.* **Walking F.,** *Camptosorus rhizophyllus.* **Wall F.,** *Polypodium vulgare.* **Wall-rue,** *Asplenium Ruta-muraria.* **Washington F.,** *Nephrolepis exaltata* var. *washingtoniensis.*

FERÒNIA (from Feronia, Roman goddess of forests). *Rutàceæ,* tribe *Cìtreæ,* subtribe *Feronìnæ.* Spiny deciduous tree with hard-shelled fruit; related to Citrus, for which it can perhaps be used as a stock.

Leaves odd-pinnate, deciduous: fls. small, perfect or by abortion male in terminal or axillary panicles; petals 5 (rarely 4 or 6); stamens twice as numerous as the petals; filaments much longer than the anthers, dilated at base and densely pubescent on the sides and within; ovary at first 5-celled, later becoming by confluence 1-celled: fr. with a hard, compact woody shell; seeds oval, lenticular, with a thin hairy brown testa immersed in an acid edible pulp; cotyledons fleshy, aërial in germination.—Only 1 species is known.

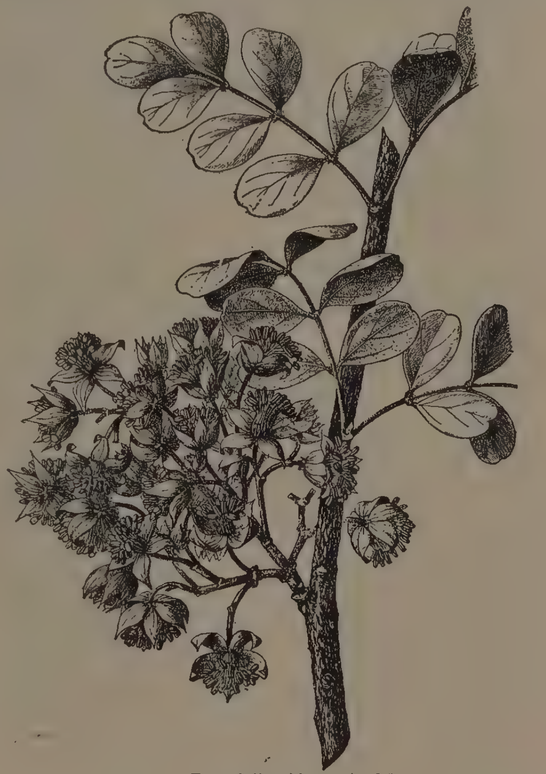
Limònia, Swingle (*Schìnus Limònia,* Linn. *Limònia acidíssima,* Linn. *F. elephántum,* Corr.). Wood-Apple. Spiny deciduous tree, native to India, Ceylon and Indo-China: bark gray, rough: lvs. odd-pinnate, 3–7-foliate; lfts. opposite, obovate, blunt at the apex, sometimes emarginate, entire-margined with a short petiolule; rachis margined, articulate, spines long and straight, axillary: fls. (sometimes male by abortion of the ovary) dull red, small, in terminal or axillary long-pedicelled panicles; petals 5 (rarely 4 or 6); stamens 10 (rarely 8 or 12), filaments short, dilated at base and densely pubescent on the sides and within; anthers large; ovary 5-celled, with many ovules in each cell; stigma cylindrical, sessile: frs. globose or oblate, 2½–3 in. diam., having a hard, woody rind filled with a pinkish edible pulp in which the numerous woolly seeds are immersed. For discussion of name and synonomy, see Journ. Wash. Acad. Sci. 4:325 (n. 12, June 19, 1914). Ill. Roxbg., Pl. Coromandel., Pl. 141. Gt. 34:1206. Wight, Ic. Pl. Ind. Or., Pl. 45; Beddome, Fl. sylvat. South Ind., 1:121; Talbot, For. Flor. Bombay, fig. 124; Engl. & Prantl, Nat. Pfl.-fam. III. 4, 193, fig. 112.—The pulp of the fr. which is acid, is used for making jellies somewhat similar to black currant jelly. It is also made into a kind of chutney with oil, spices and salt by the natives of India. The fls. and lvs. of this tree have an odor of anis and are used as a stomachic. The commonly cult. species of Citrus can be grafted on this plant and wood-apple seedlings are now being tested as stocks by the U. S. Dept. of Agric. in Calif. and Fla. and also in the greenhouses in Washington, D. C.

Walter T. Swingle.


1493. Flower and fruit of Feroniella oblata. (fl. nat. size, fr. ×⅔.)

FERONIÉLLA (diminutive of Feronia, Roman goddess of forests). *Rutàceæ,* tribe *Cìtreæ,* subtribe *Feronìnæ.* Small much-branched spiny tree, related to Feronia and suggested as a possible stock for citrous fruits.

Leaves odd-pinnate, persistent, 3–6-paired; rachis cylindrical, sometimes narrowly winged; spines solitary, in the axils of the lvs.: fls. in much-branched axillary infl., perfect or by abortion male, usually 5-parted, having 4 times as many stamens as petals; filaments much longer than the anthers, dilated at base and having a hairy appendix on the inner side; style long, stigma cylindric, caducous; ovary at first 5–6-celled, later becoming by confluence 1-celled: fr. spherical or depressed globose, with a hard shell composed of radially arranged prismatic elements; pulp edible; seeds numerous, oblong or elliptical, with a smooth crustaceous testa; cotyledons aërial in germination.—Two species are known.


1494. Feroniella oblata. (×⅔)

oblàta, Swingle. Krassang. Figs. 1493, 1494. Spiny tree, 25–65 ft. high, native to Cambodge and Cochin-China: lvs. odd-pinnate, 3–4-paired; lfts. covered with small whitish hairs, especially when young, pellucid-punctate, oval or obovate, crenulate when young, often emarginate, with a very short petiole; rachis pubescent; fls. in many-fld. panicles, white, very fragrant, usually 5-parted, with lanceolate pointed petals; stamens 4 times the number of petals, anthers large, oval, filaments joined together at the base by the woolly pubescence of the appendices occurring on their inner side: fr. borne in clusters of 3 or 4, flattened spheroid, 2 to 2½ in. diam.; pulp subacid, pinkish, edible. Ill. Swingle in Bul. Soc. Bot. de France, 59, pl. 18 and fig. *a,* p. 778. Lecomte, Fl. gén. Indo-Chine, 1:685, fig. 72, 1–5.—This species occurs commonly in the forests of Cambodia and is sometimes cult. by the natives for its frs. which, when young, have a pronounced orange odor and are used as a condiment in sauces. Young plants of this species are growing in the greenhouses of the Dept. of Agric. at Washington, D. C.

lùcida, Swingle (*Ferònia lùcida*, Scheff.). Kavista Batu. Small spiny tree, native to Java: lvs. odd-pinnate, 3–6-paired; lfts. oval or obovate, coriaceous, shiny above, margins entire or slightly crenulate, obtuse or emarginate at the apex; petioles pubescent, the terminal lft. sessile; rachis pubescent, articulated: fls. perfect or by abortion male, fragrant, white, rather large; sepals small, linear, pubescent; petals pointed-oval; stamens 4 times as many as the petals: fr. globose 2½–2¾ in. diam.; seeds small, with a thin hard testa, immersed in the glutinous pulp. Ill. Icones Bogor. 2:149.—The pulp is sometimes eaten in Java, like that of the wood-apple (*Feronia Limonia*). It grows wild in the drier parts of Java and has been intro. into the U. S. where it is being tested by the Dept. of Agric. as a stock for citrous fruits.

Walter T. Swingle.

FERRÀRIA (Giovanni Battista Ferrari, 1584–1653, Italian Jesuit, botanical writer and collaborator with the celebrated artist Guido Reni). *Iridàceæ.* Half-hardy bulbous plants from the Cape of Good Hope (and recent species from other parts of Africa), rarely growing more than 6 inches high.

Corm large and irregular: foliage glaucous; lowest lvs. long and linear, the others ovate, clasping, successively smaller, and topped by inflated sheaths from which emerge the fugitive fls.; these have 6 triangular, spreading, crisped, petal-like lobes, marked with many dull colors, as yellow, green, purple and brown; each spathe contains several fls., and the fls. are united at the very base, connivent and cup-shaped below the spreading lobes; the fls. last only from morning to afternoon of a single day, but there is a fair succession; some are visited by carrion flies: fr. an ellipsoid membranous caps.—Only one species, *F. undulata*, is much known in cult., but the other 5 or 6 species of the Cape are doubtless of equal interest. This was known to pre-Linnæan authors as *Flos indicus* and *Gladiolus indicus*. The bulbs should be stored like gladiolus in a dry, warm place, away from mice.

A. *Fls. dull brownish purple.*

undulàta, Linn. St. stout, erect, sometimes exceeding 1 ft: basal lvs. sword-shaped, 1 ft. and more long, flat, clasping and dilated at base; upper lvs. and spathes 1½–2 in. long: fls. 2 in. across, largely dull purple; anthers oblong, with parallel cells. B.M. 144.

AA. *Fls. greenish.*

uncinàta, Sweet. St. short, little branched: lvs. 2–3, linear: fls. 2, the perianth greenish and with narrow very acuminate segms. 1 in. long; anthers small, the cells nearly parallel.

AAA. *Fls. dark purple.*

atràta, Lodd. St. about 6 in.: lvs. about 4, sword-shaped, firm, strongly ribbed, twice longer than st.: fls. 3–4, bright dark purple, 1½–2 in. diam. when expanded; anthers oblong, with cells parallel.

Other names are advertised by Dutch bulb-growers, as *F. canariensis, F. cælestis, F. conchiflora, F. grandiflora, F. immaculata, F. liliacea, F. rosea, F. Pavonia:* these are to be sought under Tigridia.

Wilhelm Miller.

FERTILITY of soils: that condition of soils which makes them productive. The elements of productivity are, a full supply of available plant-food, a suitable and continuous supply of moisture, good physical conditions of the soil, coupled with suitable seed and climate.

Land may contain vast quantities of potential nitrogen, potash, phosphoric acid and other plant-food, and yet be unfruitful,—infertile. Most of the potential plant-food in the soil is lazy, or not available in sufficient quantities in a single season to produce maximum crops. Average arable land which contains from 3,000 to 4,000 pounds of nitrogen, an equal amount of phosphoric acid and four times as much potash in the first 8 inches of an acre, may produce only fifteen bushels of wheat to the acre, which requires, with the straw, but twenty-four, thirteen and twenty pounds of these three elements respectively. Therefore, land may contain a great abundance of potential plant-food, and yet not contain enough of that which is available for a full crop. To make land more fertile, one or more of the following means may be employed. Usually deeper and more thorough tillage should first be resorted to, since most lands, by reason of careless farming, contain much inert plant-food. Superior tillage is almost certain to produce fruitfulness, and therefore should be resorted to before more expensive methods are tried. Tillage not only makes plant-food more available, but it improves the physical conditions of the soil, thereby making it more adaptable to the plant; it may also assist in relieving the land of surplus water, and give to the soil the power of retaining stores of moisture by capillary action.

Moisture plays such an important part in productiveness that it may be said to constitute its prime factor. Clay soils are usually composed of such fine particles that water percolates through them slowly, hence the larger part of the rainfall must either run off over the surface, or remain to be evaporated. The aim should be so to prepare the land by subdrainage, plowing and surface tillage, and by introducing at least one crop of tap-rooted plants in the rotation, that the surplus water will filter through the soil in a reasonable time. Percolation of rainwater through soils makes them more friable and warmer in spring, aërates the land, promotes beneficial biological and chemical changes, and brings to the soil the nitrogenous compounds contained in the rainwater. Soils that are reasonably porous have the power of retaining more moisture, and of giving it up to plants, when needed, to a greater extent, than either open sandy or close clay soils. Fertility, which results in fruitfulness, is governed very largely by the water and moisture conditions of the soil, and these, in turn, are to a considerable extent governed by the texture of the land and the amount of humus that it contains.

Legumes, used either as a harvest or cover-crop, promote fertility. A cover-crop of clovers planted August 1, and analyzed sixty-four days after planting, contained nitrogen, in roots and tops, to the acre as follows:

	Tops Pounds	Roots Pounds	Total Pounds
Crimson clover	125	30	155
Red clover	63	40	103
Mammoth clover	67	78	145

Clovers and other legumes may be used to fix and store up the uncombined nitrogen of the air and to digest and make available the mineral constituents of the land, thereby greatly increasing the fertility of the soil.

In most of the semi-arid districts of the United States, except where irrigation can be successfully undertaken in the rich valleys, the problem of permanently maintaining and increasing the productivity of the soil is as yet unsolved. Better tillage may serve in many cases to prolong the time of profitable cultivation, but unless something is done toward restoration it only postpones for a short period the day when the land must be left to the tooth of time and to the growth of such hardy plants as can maintain themselves on a depleted soil. All such pasture lands may be greatly benefited by sowing, even in small quantities, in early spring with red and alsike clover in humid districts, and bur clover in the rainless-summer regions. Lands adapted to orcharding that have become depleted and that have a tenacious subsoil may be benefited by exploding a charge of dynamite in a hole about 1 inch in diameter and 2 feet deep at each place where a tree is to be set. Such treatment tends to promote filtration, to set free plant-food by aëration and to improve the physical condition of the adjacent soil, while at the same time it lessens the labor necessary to prepare the ground for tree-setting.

Barn manures, when properly cared for and intelligently applied, not only furnish acceptable plant-food but humus as well. Fertility and high productivity usually may be maintained many years by means of superior tillage, leguminous harvest and cover-crops, and the manures of the farm. In some cases a high state of fertility can be maintained only by occasional applications of commercial mineral fertilizers, such as phosphates and potash, but too often expensive fertilizers have been substituted for tillage, leguminous plants and barn manures.

Fertility may frequently be promoted by light applications (ten to twenty bushels to the acre) of quicklime. Lime serves to make plant-food more available, to improve soil texture and to correct acidity. It may also be applied beneficially to a green-manure fallow. Lime tends to sink into the soil, therefore it should be applied after the last plowing preceding the seeding, and should be covered and mixed with the soil by tillage. Hydrated, or biting lime, not only tends to set free plant-food but to flocculate the soil, thereby improving its physical condition. Its use is especially recommended on clay and moist lands and in orchards where the ground is much shaded. Applications of gypsum and salt are sometimes beneficial in maintaining fertility, but they, as well as lime, usually act indirectly, as the soil is seldom deficient in these constitutents so far as they are required as plant-food. On high-priced lands, especially those devoted to horticulture, the soil should be made and kept fertile—well up to its highest productive power.

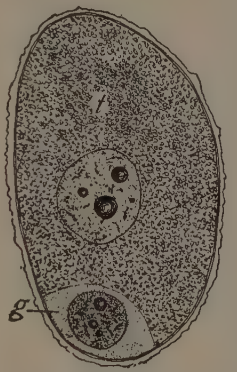
A bare summer fallow of one to three plowings and suitable surface tillage will not only destroy weeds, but liberate plant-food as well, while storing moisture in the soil for the immediate use of young plants. But a bare fallow, if not accompanied by the addition of some plant-food, may hasten the depletion of the soil. It is a matter of judgment, then, as to whether the particular soil contains such abundant supplies of plant-food that some of them may be removed; or whether it is very deficient. In the latter case a green fallow would be far preferable to a bare one. In many cases a bare fallow is merely a method of mining-farming which hastens the time when the land must be turned out to pasture for economic reasons. Often productivity is increased more satisfactorily by means of green-manuring than by bringing plant-food to the land from outside sources. In most of the humid districts early sowed peas (which withstand late frosts) followed by buckwheat, and both plowed under some time before they mature, can be grown in time to fit the land for seeding in September to wheat, rye or timothy, the nurse crop being omitted. When the land might be made too porous by this method, rye sowed in the fall, plowed under before coming to head and followed by peas, would greatly improve the light and sandy soils by bringing stores of nitrogen and humus.

Nature, in producing and storing fertility, provides a great variety of plants and an infinite number of ways of multiplying them so that the land is fully covered with vegetation—except in desert regions. Upon the best of these lands a vast animal life is maintained while the remainder produces other plants to feed other animals. In the densely settled agricultural districts of China, for the last two thousand years the farmers have been returning as much to the land as they have taken from it; and the soil is now more productive than it was when first brought into cultivation. The problem of conservation and restoration of soils is now in America the most serious one the agriculturist has to solve.

Sometimes soils are rendered unfruitful by the presence of deleterious substances, as organic acids or alkaline salts, or a superabundance of some one or more of its usually useful ingredients, as water or nitrogenous compounds. An excess of nitrogen stimulates the growth of stalk and straw at the expense of grain, or in the orchard it tends to the formation of wood rather than to fruitfulness. The acidity should be corrected by lime, as noted above, the surplus water removed by drainage, the nitrogenous matter reduced by the production of such crops as are not harmfully affected by its superabundance, such as forage crops which are prized for their foliage rather than for their seeds, while the alkalinity may sometimes be overcome by deep tillage, irrigation or application of gypsum in suitable amounts.

I. P. Roberts.

FERTILIZATION is the fusion of sexually differentiated cells, and with special reference to the seed plants it means that a cell (a fertilized egg, or zygote) is thus formed which is capable of developing into the embryonic plant later recognized in the plantlet of the seed. The fusing cells, or gametes, are (1) the egg (female cell), which is organized in the ovule, as described below, and (2) a sperm-cell, or nucleus (male cell), developed in the germinating pollen-tube. Fertilization is a process which may not be readily observed in the seed-plants except through the use of careful histological methods, both in the fixation of material and in the subsequent processes of imbedding and staining. The phenomena are illustrated in Figs. 1495–1497.

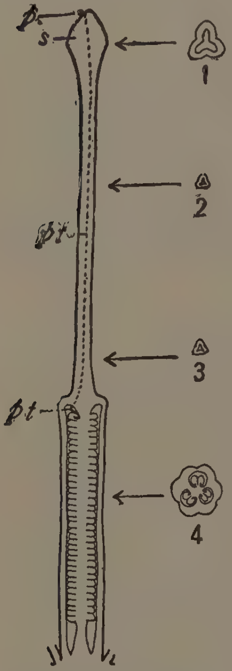


1495. A pollen-grain of Lilium philadelphicum.

Section of a single grain before the anther opens; *t*, the tube-cell; *g*, the generative cell. The large spherical body in each cell is the nucleus. (Magnified 500 diameters.)

The term "fertilization" has always implied the union of male and female cells; but formerly, when less was known regarding the details of the phenomenon, "fertilization" included the mere mechanical process whereby pollen from the anther was transferred by any agent to the stigma of the flower. For this reason "fertilization by insects" or "fertilization by wind"—meaning the transfer of pollen by these agencies—are frequent expressions in the work of Darwin and Wallace. In this last-mentioned sense, the word pollination is appropriate, and now commonly employed. If the silks of corn are pollinated with corn pollen, fertilization normally ensues and seeds are produced; but if the corn-silks are pollinated by the pollen of the lily, no seeds will be formed. It is obvious that cross-pollination has no limits; but cross-fertilization is limited to those cases in which the sexual cells unite and a new organism develops.

The development of some structures essential in fertilization are of interest in this connection. The mature pollen-grain consists of a large tube-cell and nucleus and a small generative cell and nucleus. When lodged upon a suitable stigma the pollen-grain germinates by the development of a tube which enters the loose tissue of the stigma and grows further into the conducting parts of the style. In some cases, definite stylar canals are present, but usually the tube wedges itself between the yielding cells, absorbs nutrient in its course, and forces or dissolves its way to the ovule or seed-case, where, as a rule, it enters the micropyle and approaches the embryo-sac and egg-cell. In its course the pollen-tube is doubtless "directed" by the distribution of food. Meanwhile, the generative nucleus of the pollen-tube divides into two sperm (male) nuclei, and these migrate to the growing end of the tube.



1496. Outline of a pistil of Lilium philadelphicum.

A lengthwise view of pistil almost through the center; *s*, stigma on which pollen-grain, *p*, has been lodged. The course of the pollen-tube, *pt*, is indicated by broken line. At the right, *1*, *2*, *3*, *4*, are cross-sections of the pistil at the levels indicated by the arrows: *1*, the stigma; *2*, *3*, the style, show the triangular canal which leads into the three chambers of *4*, the ovary, in each chamber of which are two rows of ovules. (Natural size.)

With the formation and opening of the flower, the embryo-sac attains its development. This structure is too complex to require full treatment here, but it is sufficient to say that, when approaching maturity, it consists of one large cell containing eight nuclei, four of which collect at each end of the cell. One nucleus from each end marches to the center, and the fusion which then commonly results gives a nucleus the divisions of which ultimately organize a so-called food, or endosperm, tissue, which may surround the embryo when formed.

At the micropylar end of the embryo-sac, another nucleus organizes the egg-cell—a prominent cell with considerable protoplasm—and the other two degenerate or form the subsidiary cells of an "egg apparatus." The cells at the antipodal end of the embryo-sac are also of little present significance. At about the time of the maturity of the egg-cell the tip of the pollen-tube reaches and penetrates the wall of the embryo-sac, then dissolves and liberates the two male nuclei. One of these fuses with the egg-cell, and this is the important act under consideration. The other sperm nucleus often fuses with the endosperm nucleus, but that does not affect the characters of the embryo. The fusion of egg and male nucleus unites, on the other hand, the characters of the ovule-bearing and pollen-bearing plants in the fertilized egg, which may proceed immediately to develop the embryo.

B. M. Duggar.

FERTILIZERS. It is now well recognized that shade trees, ornamental shrubs, small fruits, and flowering perennials, as well as annual flowering and foliage plants, are often as greatly benefited by the use of proper fertilizers and manures as vegetables and ordinary farm crops. There are, nevertheless, occasional soils on which fruit trees, and shade trees in particular, require little or no artificial fertilization or manuring. For example, it was not found profitable to fertilize apple trees at the Agricultural Experiment Station in Geneva, New York, whereas at the Pennsylvania Agricultural College the use of fertilizers was not only strikingly helpful, but practically vital to successful orcharding. Instances of such contrasts in connection with trees and shrubs are always to be expected. On this account the giving of rule-of-thumb directions for fertilizing, in a work of reference which is designed to be generally applicable to the entire United States, is not only well nigh impossible, but may, if followed, lead to the most unreasonable procedure on the part of those not sufficiently conversant with their own particular soil conditions. For this reason this discussion will be confined largely to the general principles involved, since they not only fail to mislead the novice, but may serve as a safe and rational basis for general procedure for all.

Shade trees, ornamental trees and shrubs.

Because of the fact that trees have an extensive root-system, and hence possess a wide feeding range, they often stand less in need of artificial manuring and fertilizing than certain shrubs, especially if the latter have already been set for a long time.

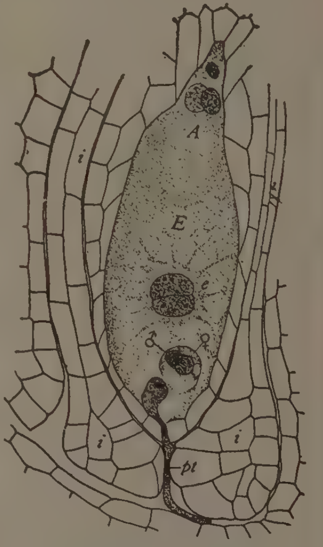
It is to be presumed that most soils contain enough iron and magnesia to meet the needs of trees and shrubs, yet since these substances are just as essential to their growth as any of the three so-called "essential elements," it is well to bear in mind that very rare cases may be met with in which even iron or magnesia may be helpful. In this connection it may be mentioned that the soil in a section of northern Michigan is said to contain so little iron that certain farm animals, if fed exclusively on the plants which grow there, cannot be reared successfully. It has even been found that manganese compounds are sometimes helpful to plants, and if the supply of iron is insufficient, they aid in promoting chlorophyl formation in the leaves, without which the higher plants cannot exist.

Some soils are relatively deficient in magnesia as compared with lime, and when such is the case, growth is likely to be restricted until enough magnesia is added to create a proper balance between the two. A much more frequent lack, in soils of the humid regions, is lime.

Unfortunately, an extended and systematic study of the lime requirements of trees and shrubs has not yet been made, although many valuable isolated observations are on record. It would be of great value if such experiments were conducted on an extensive scale. Such experiments as were made in this direction in Rhode Island showed, for example, that the American elm (*Ulmus americana*) and the basswood (*Tilia americana*) were both greatly helped by liming when grown on the very acid granitic soil of that state. From this it may be inferred that benefit from liming would also follow on many of the soils of the humid regions which are derived chiefly from granite and from certain of the sandstones, shales, slates, gneisses, schists and conglomerates.

The sugar or rock maple was found to be but little helped by lime, even where the elm and basswood showed striking benefit. The common white birch seemed to be even less responsive to liming than the sugar maple.

The use of much



1497. Section of an ovule of Lilium philadelphicum.

Cut lengthwise; *i*, *i*, inner integument, inclosing except at a narrow orifice (micropyle) where the pollen tube, *pt*, enters the body of the ovule which is chiefly occupied by the large embryo-sac with three nuclei, one much disorganized. *e*, the endosperm nucleus, just being formed by fusion of two nuclei from the respective ends of the embryo-sac. ♂, male nucleus, which has just migrated from pollen-tube and is about to fuse with ♀, the egg nucleus. The synergidæ, or "egg apparatus," have disappeared. (Magnified 670 diameters.)

lime may sometimes interfere with the growth of the Norway spruce. It is also unfavorable to at least some of the pines. The effect of liming on certain of these conifers is observable not only by way of its lessening the growth of the tree, but also by its causing a shortening of the needles.

The chestnut tree is reputed not to need liming, but even to be seriously injured, if lime is used.

Among the flowering shrubs, general experience points to the fact that lime should be avoided in connection with the growth of the laurels, rhododendrons, azaleas and the Ericaceæ generally. There is, however, no doubt as to the benefit to be derived from the use of lime in connection with many of the other ornamental and flowering shrubs. Experiments by Hogenson appear to show that sulfate of magnesia may sometimes be very helpful to certain shrubs which are ordinarily injured by lime, although this work needs to be extensively supplemented before being accepted as a sure basis of procedure.

In general, the need of nitrogen for trees and shrubs is indicated by insufficient limb and leaf growth, although any other lacking essential ingredient may ultimately have the same limiting effect.

Whenever trees or shrubs are being set in poor land, it is well to work into the soil generous amounts of ground, steamed bone or superphosphate. The latter phosphate possesses, however, a very distinct advantage for subsequent application, due to its high content of soluble phosphoric acid. Basic slag meal should be avoided for those trees and shrubs likely to be injured by lime, whereas for others it may be employed at the time of planting. These materials may be used when the trees or shrubs are set, if well mixed with the soil, and from one to four pounds may be used for a tree or shrub, according to their size.

High-grade sulfate of potash or muriate of potash may be similarly worked into the soil at the rate of half a pound to a pound a tree when potash is known to be deficient, but even in such cases it is sometimes advisable to withhold it until a year after setting, and then make the application alone, in conjunction with superphosphate, or in a complete fertilizer. Twice as much double manure salt or four times as much kainit is required to replace either the sulfate or the muriate of potash.

If the growth is not satisfactory, after the trees or shrubs have been set for some time, a complete fertilizer containing from 2 to 4 per cent of ammonia, from suitable sources, may be worked into the soil about the trees or shrubs, or it may even be scattered on the surface of the ground, in case the land is kept in grass.

Care should be taken to keep the fertilizer away from the base of the trees or shrubs, and it should be applied for at least a considerable distance beyond the reach of the branches. For this purpose, quantities of fertilizers, ranging from two to thirty-five pounds, may be used for each tree, according to its kind, size and age, although even for large shrubs, from two to six pounds will usually be sufficient.

Just as the keen observation of the feeder is necessary in the fattening of the animal, so also the judgment of the experienced gardener is essential to the proper gaging of the amounts of fertilizer for trees and shrubs of all kinds.

Much is claimed, by those who have had experience in renovating old trees, for the plan of making a large number of holes under the tree, to a depth of 1 foot to 2½ or 3 feet, and placing the fertilizer in these holes. This procedure has much justification, owing to the great "fixing" power of the soil, especially for phosphoric acid and potash salts which are otherwise prevented from being quickly and readily carried down in large quantities to points where the deeper roots can immediately reach them. Even if fertilizer is employed in this manner it is also well to apply some of it to the surface, in order to insure an even lateral distribution of at least a part of it.

Another drastic method of procedure in renovating old trees is to trench around a part or the whole of the tree, at a suitable distance from the trunk, to a depth of several feet, and then fill the trenches with new soil mixed with manure and a complete fertilizer containing slowly-acting phosphatic and nitrogenous materials, and suitable amounts of potash salts. In such a case it is a part of the plan to cut off many of the ends of the old roots in order to make them branch and thus increase their feeding capacity.

Apples and pears.

Apple trees, as a rule, respond to liming rather better than pear trees; nevertheless, on very acid soils there are several good reasons for liming even pear trees. An occasional application of magnesian lime may be desirable, but if used it should be alternated with applications of purer lime.

On land known to be very rich naturally, or which has been highly manured for a series of years, neither fertilizer nor manure will be required for newly set apple or pear trees, and in only exceptional cases will they be needed, even for those just coming into bearing. When such exceptional conditions do not exist, it is usually a safer plan to fertilize the land with liberal amounts of potash, phosphoric acid, and rather slowly available sources of nitrogen, or else to employ such small amounts of quickly available nitrogen as will surely be used up before or by midsummer. If, on the other hand, excessive amounts of farmyard manure or nitrogenous fertilizers are applied, or if the application is too long delayed, late growth is promoted, with the result that the wood remains too soft. In such cases cracking and other serious injury is likely to follow during the winter season.

As a rule, the orchard may be used to advantage for some years after the trees are set, for the growing of quick-maturing crops, such as peas, early cabbages, radishes, and potatoes, or even for tomatoes, melons, or squashes. These crops may be well fertilized, and many of the earlier ones can be followed in the late summer by a cover-crop of crimson (scarlet) clover, or hairy vetch. If the soil is already rich enough, or is too rich, in nitrogen, barley or rye may be substituted for the legumes. These cover-crops can then be plowed under the next spring. Some growers even prefer weeds to any of these cover-crops because of saving the outlay for seed.

When the stage is passed in which extended cropping between the trees is possible, and the burden of fruit becomes great, especial care should be taken to apply an abundance of potash and phosphoric acid annually, and only enough nitrogen from legumes or fertilizers to insure adequate foliage, satisfactory wood-growth, and abundant fruit-spurs. For this purpose a suitably compounded complete fertilizer may be employed. If legumes are found to supply enough nitrogen one may employ annually from 200 to 600 pounds an acre of acid phosphate or basic slag meal, and from 50 to 400 pounds an acre of the muriate or high-grade sulfate of potash. If the double manure salt is used as the source of potash instead of the muriate or the high-grade sulfate of potash, the total application should amount to approximately twice as much an acre, because of its lower potash content.

The nitrogen for the orchard may be supplied in one, or, on light open soils, in two applications of nitrate of soda at such a rate that the total application for a season will not exceed from 100 to 300 pounds an acre, dependent upon the slowness of the growth of the trees. It is usually much simpler to make a single application of a complete fertilizer, in which the nitrogen is present in nitrates, ammonium salts, soluble organic compounds and in less quickly available organic forms, than to apply nitrates at two or more different times. When such complete combinations are used the danger of loss by leaching is greatly lessened and a satisfactorily continuous but properly decreasing supply of nitrogen for the trees is assured. The fertilizer application should not be made later than just after the time the fruit has set. Many good authorities even advise waiting until this time in order to gage the application according to the probable yield and requirement of the trees.

At the Massachusetts Agricultural Experiment Station, far better results were secured with double manure salt (sulfate of potash and sulfate of magnesia) than with muriate of potash, but in experiments elsewhere the muriate of potash has given as good results as the high-grade sulfate of potash. It is probable, in view of the known lack of carbonate of lime in the Massachusetts soil, that this rather serious deficiency was responsible for the poorer results with muriate of potash, for in soils elsewhere where the lime supply was sufficient, muriate of potash has acted well. It is, of course, possible that the magnesia of the double manure salt was helpful in the Massachusetts experiments. The results furnish, however, no positive evidence to that effect, but indicate strongly that the chlorin of the muriate of potash was probably injurious because of a lack of carbonate of lime.

The idea that the proportion of the various fertilizer ingredients affects the color of apples in a direct way has little to support it. It is rather tenaciously claimed, nevertheless, that basic slag meal has special value in adding color to apples, but this may be due solely to its adding a proper balance of mineral ingredients which could perhaps be equally well supplied by other phosphates. There is abundant evidence, however, that over-fertilization with nitrogen leads to the development of exceptionally heavy and abundant foliage; and the excessive shading lessens the color of the fruit. Direct exposure of the apple to the sunlight also lessens its tendency to shrivel. This is due, probably to its effect either on the proportion of the various chemical constituents of the skin, or to its thickness, by which evaporation of water is hindered. In order to insure even distribution of the color on the individual apples, severe thinning is essential, for otherwise one apple will partially shade another.

In some European countries the fertilizer for orchards is placed from 4 to 5 inches deep in holes 20 inches apart, at the rate of about an ounce and a quarter a hole. This method is, however, probably too expensive to employ in this country, though it may be especially effective for orchards which are in sod. If the work were capable of being done by machinery or by some suitable implement the method might possibly prove of economic value.

Peaches.

Peach trees are less in need of lime than apple trees, yet liming is nevertheless often desirable, even for its indirect benefits. The fertilizer required for peaches is much more than for apples, for the reason that the trees grow far more rapidly and bear early and abundant crops. On poor soils generous fertilizing must be provided from the outset, but if the land is very rich or heavily manured, fertilizer may be omitted for the first year or two. If a soil is very poor it should receive at the outset from 300 to 500 pounds an acre of a fertilizer containing a moderate amount of nitrogen derived from appropriate materials, a fair quantity of available phosphoric acid, and a generous amount of potash in muriate of potash. On soils in which potash is naturally very abundant, the supply can be greatly lessened.

When the peach trees come into bearing, more nitrogen will be required than at the outset, and the total quantity of fertilizer may then be increased one-half, or even more than doubled. In the case of peach trees, constant watchfulness is required to make sure that neither too little nor too much nitrogen is used. An excess of nitrogen will prevent proper ripening of the fruit, and of the wood in the autumn, whereas too little will mean abbreviated crops, loss of vigor, and at the same time the lack will create conditions favorable to disease. In any case, ample supplies of phosphoric acid and of potash, as muriate, should be provided to meet any possible need. If a little extra nitrogen is required in the spring, it may be applied in nitrate of soda, or, if the soil is properly limed, sulfate of ammonia may be substituted for the nitrate of soda if desired.

In case one wishes to stock the land with phosphoric acid in advance, large applications of bone or basic slag meal may be made, ranging from 400 to 1,000 pounds an acre of the former and from 500 to 1,200 pounds an acre of the latter. The old plan of heavily stocking the soil and waiting a long time for the returns is, however, giving way to the frequently more economical plan of more nearly meeting the fertilizer needs from year to year, instead of tying up a large amount of money in a long-time investment.

Plums, cherries and apricots.

The plum and cherry, regardless of whether the latter is a sour or sweet variety, are certainly far more in need of liming than the peach, but data are not at hand as to the relative requirements of the peach and apricot. The fertilization of these fruits should not vary widely from the treatment required for peaches, excepting that the quantity may be rather less, and the same care should also be exercised not to use excessive amounts of nitrogen.

Blackberries, raspberries, gooseberries and currants.

The blackberry is especially at home on very acid soils and a very light application of lime will meet all possible requirements of the plants, if indeed it is needed at all. The blackcap raspberry is more likely to be helped by liming than the blackberry, although it is well adapted to moderately acid soils. The Cuthbert raspberry is appreciably helped by liming on quite acid soils, and the same is probably true of most or all of the red and yellow varieties. The gooseberry and currant, including the white and various red varieties are greatly benefited by liming. As much as two to four tons of ground limestone an acre, or its equivalent of slacked lime, are often very helpful to these plants. Raspberries, in particular, thrive well on a heavy, freshly rotted sod, as for example, on old grass land plowed the autumn before the plants are set. In many cases all that is required on such land is to supply an adequate mixture of an available phosphate and a potash salt, but whenever the cane growth is weak and unsatisfactory, or, when gooseberries and currant bushes do not show satisfactory growth, a moderate amount of complete fertilizer containing a fair amount of nitrogen in gradually available forms is likely to be beneficial. The use of heavy applications of nitrogen for raspberries, currants and gooseberries is not advised, for it will induce too great a growth of canes and foliage and interfere with the maturing and ripening of the fruit. The plants will also be rendered more readily subject to mildew.

Strawberries.

The strawberry grows well on moderately acid to very acid soils, and if lime is used the application should be light, rarely exceeding 1,000 to 2,000 pounds of ground limestone an acre.

An important point to be recognized by strawberry-growers is, that weak plants are not likely to be heavy bearers the next year. In consequence, the plants when set should be supplied with a fertilizer reasonably rich in available nitrogen. This fertilizer should usually be applied at the rate of 1,000 to 1,500 pounds an acre at the time of setting, and in the later years just after picking the crop of fruit, fertilizer may be scattered in a furrow turned away from each side of the bed, after which the furrow may be turned back again. Early each spring fertilizer should be applied broadcast over the beds. This should contain liberal quantities of soluble phosphoric acid and potash but only enough nitrogen to promote reasonable growth. This nitrogen should, however, be largely in readily soluble and available form. If too much nitrogen is used in the spring the fruit will lack color, and it may be soft and unsatisfactory, especially for distant shipment. It may even be necessary to omit all nitrogen in the spring, if the soil is exceptionally rich in humus or has been well manured previously. This can only be decided by the observant grower.

On many soils superphosphate is preferable to basic slag meal as a source of phosphoric acid for strawberries, for the reason that too much lime is to be avoided, and furthermore, the phosphoric acid is largely soluble and better adapted to top-dressing. On an exceedingly acid soil the use of basic slag meal may be permissible for application at the time of setting, for the action of the soil aids in rendering it available to the plants.

Grapes.

Grapes may show some gain from the use of lime under certain circumstances, but they do not require it in even approximately the same degree as the cherry, plum, currant, and gooseberry. The chief need of this crop is available phosphoric acid and potash. If nitrogen is used, the quantity must be carefully regulated, and in Europe slow-acting forms of organic nitrogen are in special favor. Basic slag meal or bone-meal may be used as sources of phosphoric acid when the grapes are set, but later, superphosphate is to be preferred, especially if it is not most thoroughly worked into the soil. Sulfate of potash is often considered preferable to the muriate of potash for grapes, for it is alleged to give a better quality of fruit.

Quinces.

The quince responds to liming in about the same degree as the cherry and plum. It should receive enough nitrogen to insure reasonable growth, but no more; and on exhausted soils a moderate amount of available phosphate and muriate or sulfate of potash will be helpful.

Cranberries.

The cranberry thrives better at the outset, even on certain very acid soils, than after its acidity has been lessened by liming. If more nitrogen is needed than that naturally available from the humus of the bog, it is usually recommended that it be applied in small quantities, as nitrate of soda or preferably as nitrate of potash, provided the bog is already fairly dry and is likely to remain so; but if wet, sulfate of ammonia may be better The chief need of the cranberry vine is usually phosphoric acid and potash. The phosphoric acid for top-dressing may be in superphosphate, but if applied just before the plants are set one may employ bone-meal, or, if on very acid peat or muck soil, even raw rock phosphate.

In case spring applications of fertilizer are made, it must not be expected that they will always affect the cranberry yield of that particular season as much as the yield of the crop which follows. Such applications should ordinarily be made after the water is drawn off and the land has dried out to a reasonable extent. It is often helpful to apply fertilizer just after the cranberry crop is harvested, but late spring applications develop stronger vines for the next season.

Pineapples.

The requirements of the pineapple crop vary widely, dependent upon the rainfall and soil conditions. Where the winter season is likely to be fairly cold, nitrogenous fertilizers should not be applied in the autumn, for otherwise injury from frost may follow. Nevertheless, potash salts have sometimes been used at that time with good effect. On certain acid soils, liming is necessary at fairly frequent intervals in order to bring out the best effect of superphosphates. If lime is not used, bone-meal or basic slag meal may sometimes be preferable to superphosphate as sources of phosphoric acid. From one and three-fourths to two tons of fertilizer an acre, annually, have been recommended for pineapples by the Agricultural Experiment Station of Florida. It is said that the fertilizer should contain 5 per cent of nitrogen, 4 per cent of available phosphoric acid and 10 per cent of potash, in order to meet the conditions in that state. During the first year and a half the applications of fertilizer are made four times a year, but after this period of time is passed, the first application of the year is made either in February or March, and the second after cutting the summer crop. It is obvious that this rule might require modifications on other soil and also as influenced by different climatic or other local conditions.

Table beets, mangels, sugar beets and Swiss chard.

These plants are among the vegetables most in need of liming. Certain of them also have much greater ability than the cabbage and turnip to appropriate from the soil the required supply of phosphoric acid, for beets have been found to yield fair crops where cabbage plants, on account of a lack of available phosphates, failed to develop salable heads.

These plants are able to profit to a considerable extent, as concerns physiological functions, by the soda of nitrate of soda, provided the supply of potash is insufficient, yet it is unwise to limit the supply of potash intentionally, in order to bring out this action, for if this is done the net loss in crop due to insufficient potash may more than offset the advantage of attempting to make the soda fully effective.

All of these plants and many others take up, in varying degrees, considerable more mineral matter than is represented by the sum of the minimum requirements, as determined for each essential ingredient in the presence of an abundance of all of the others. If, therefore, the fertilizer contains soda, it will be taken up in considerable amounts by the plant to satisfy this "luxury" or "excess" consumption in conjunction with the potash physiologically necessary to the plant. Thus the extra potash which would otherwise be taken up to satisfy this excess in the mineral requirement is conserved in the soil for future crops. The use of nitrate of soda, therefore, as one of the ingredients of a fertilizer for these crops, results in insuring the crop against a shortage of potash and prevents the plants from taking up an unnecessary excess of potash, provided an abundance is already present in the soil or is supplied in the fertilizer.

In Europe, beets of all kinds, and especially mangels, have been found to respond very favorably to nitrate of soda in comparison with the results with sulfate of ammonia, yet with certain cereals the yields, under similar conditions, have been larger with the latter. Notwithstanding this favorable action of nitrate of soda on these crops, it is so subject to loss by leaching that it is often better on very open soils to use it in conjunction with several other forms of nitrogen, rather than alone. This is especially true in consequence of the frequent occurrence, in certain sections of the country, of very sandy and gravelly soils and especially in view of the long period of growth of the chard, sugar-beets and mangels.

These crops all require generous supplies of nitrogen, a fair amount of available phosphate, and high percentages of potash. In the case of sugar-beets, if grown for their sugar-content, the proper relationship of these fertilizer ingredients to one another is of great importance.

Cabbage, kale, cauliflower, brussels sprouts, turnips and kohlrabi.

These crops are all remarkably helped by liming on soils which are fairly acid. Liming, especially with caustic or slaked lime, has a tendency to lessen the development on these plants and on turnips, of the disease known as "club-foot" and "finger-and-toe."

What has been said of the action of the soda of the nitrate of soda, in connection with beets, is true also to a considerable degree of these crops; nevertheless, when the period of growth is long and the soil is either a heavy silt or clay, or exceptionally open and subject to leaching, a combination of several sources of nitrogen in the fertilizer, is usually preferable. The reference to heavy silt and clay soils is made in consideration of the fact that sodium carbonate is left as a residual product after the plant has taken up the nitric acid of the nitrate of soda; and this sodium carbonate tends to deflocculate such soils and make them stiffer and more difficult to work than before.

Heavy applications of nitrogen are required for all these crops and some of them, as shown at Rothamsted and elsewhere, are more dependent than beets upon generous supplies of soluble and available phosphoric acid. These plants require also large quantities of potash.

The Swedish turnip, or rutabaga, usually responds to liming rather more than the flat turnip, although lime is often very helpful to the latter.

Several of these plants are especially dependent for their quality on rapid growth; hence, the nitrogen and phosphoric acid must be derived, to a large extent, from readily available materials.

One or two experimenters in this country who have grown turnips in pots and boxes claim to have found that the turnip can utilize rather unavailable forms of phosphoric acid, yet these results need further substantiation in the field before their final acceptance, and in the light of the past field evidence, generous fertilizing with soluble phosphates appears to be desirable. These plants, like the group described previously, respond to liberal amounts of potash salts, yet these salts seldom give very satisfactory results unless they are used in conjunction with liberal amounts of superphosphate and nitrogenous fertilizers.

Carrots and chicory.

The carrot is less likely to show benefit from liming than most root crops, and chicory is even subject to injury by lime when carrots are slightly benefited. Owing to their long period of growth the nitrogen supply for these plants should not only include small amounts of nitrates and ammonium salts, but also soluble and insoluble organic nitrogen, in order that some of the nitrogen may be continually at the disposal of the plant throughout the growing season. These plants are dependent upon reasonable supplies of phosphatic manures, and generous amounts of potash are likewise highly essential. The carrot responds in a less degree than mangels, to applications of soda.

Spinach, lettuce, endive and cress.

These plants are all likely to be greatly benefited by liming, even on soils of moderate acidity. Because of the fact that the quality and market value of these plants depends upon their making a rapid growth, large amounts of immediately available plant-food are essential. Some of the nitrogen should be present in the fertilizer in nitrates, some in ammonium salts and some in quickly available organic forms. No attempt should be made to economize unduly in the use of readily available phosphates and potash salts, for the reason that these crops must have ample supplies of both. The growth of early lettuce, and of spring spinach in particular, may often be pushed forward with remarkable rapidity in the early spring by the use of fertilizers containing generous amounts of nitrates. In fact, these crops may be brought to maturity by such means much faster than by the sole employment of farmyard manure, especially if the manure is poor in nitrogen and not thoroughly rotted.

Onions.

The onion will not thrive and mature properly on highly acid soils which are extremely deficient in carbonate of lime. It is often possible, where fairly good crops can still be grown without the use of lime, nevertheless to hasten the maturity of the onion crop from ten days to three weeks, by its employment. A lack of lime is often one of the causes of thick necks and of failure to ripen properly.

Since the onion crop is planted very early in the season, and because of the consequent opportunities for the loss of nitrogen if too large a part of it is applied in nitrates, appropriate proportions of nitrogen in ammonium salts and in suitable organic forms should also be employed in order to insure an adequate supply as needed.

Generous amounts of potash are required by these crops and it is of vital importance to use for the onion a large amount of superphosphate, because of the fact that it, like lime, hastens the maturity and the proper ripening of the crop. It is also equally important not to use such a large amount of nitrogen as to make it out of balance with the potash, and in particular with the phosphoric acid, for if this is done growth will be unduly prolonged, the onions will have thick necks, and they will not ripen satisfactorily nor quickly.

Potatoes.

Fertilizers for potatoes must be very different according to the section of the country in which they are grown. For example, in the North, where the season is short, the nights cold, and where the crop must be hurried along to the utmost, unusually large proportions of nitrates and of ammonium salts are indispensable, whereas in warmer regions, organic sources of nitrogen may be employed more largely, or perhaps in some favorable cases, they may be used exclusively. The potato crop is in need of quite large quantities of nitrogen, ranging usually from forty to ninety pounds an acre.

The percentages of potash required in potato fertilizers should be adjusted more particularly with reference to the locality, and whereas in many of the potato regions of New England 200 pounds of potash (equivalent to 400 pounds of muriate of potash) are considered necessary for each acre, the quantity could be reduced to one-half or even less in certain portions of the Middle West, or it might perhaps in some exceptional cases be omitted altogether.

For several reasons it is important to insure high percentages of soluble and available phosphoric acid in potato fertilizers, since it often becomes the limiting factor in potato-production over large areas of the United States.

The effect of the fertilizers may be somewhat nullified or intensified, according to the choice of seed. In all cases, seed which has heated or which has been exposed to frost, should be avoided. It has also been shown at the Agricultural Experiment Station in Rhode Island that, if other things are equal, seed tubers which are rich in nitrogen will usually give larger crops than those in which the nitrogen-content is low. The advantage of the high nitrogen-content of the tuber becomes magnified in case they are sprouted once or twice before planting. No amount of nitrogen applied in the field appears to be able to offset finally and fully the disadvantage of the tubers with the low nitrogen-content. This doubtless explains the advantage of early dug potatoes, for seed purposes, as compared with those which are allowed to mature, for the former are usually richer in nitrogen.

Asparagus.

Sandy soil is ideally adapted to the growing of asparagus. Nevertheless, whenever it is intended to establish a plantation on land of this character, it is wise to turn under considerable stable manure or else a heavy leguminous crop such as hairy vetch. If this is done, the general soil conditions are rendered much more favorable and the asparagus has a better chance to gain a good foothold. Wherever the land needs liming, some lime should be plowed under and a further application should be made on the surface after plowing. The land should then be thoroughly harrowed or otherwise tilled.

Fine ground bone and basic slag meal have been used for asparagus very successfully when worked into the soil at the outset, although the latter is rather better adapted to it on account of the greater availability of the phosphoric acid and the fact that it contains considerable lime.

Some of the best growers of asparagus, on sandy soils, have found that muriate of potash is a better source of potassium than the sulfate.

In humid regions fertilizers for asparagus should contain a considerable amount of nitrogen in nitrates, though other forms of nitrogen are also particularly to be desired on light soils, such as those usually employed for this crop, because of the danger of the loss of nitrates by leaching. It is obvious that, for top-dressing, superphosphate is preferable to any other form of phosphoric acid, because of its greater solubility. An ideal fertilizer for asparagus should contain superphosphate, potash salts, and high percentages of nitrogen, a part being derived from nitrates, some from ammonium salts, and also some of it from organic sources.

Sandy soils are likely to be very deficient in phosphoric acid; hence, the quantity of this ingredient should be high. The fertilizer should likewise carry a high percentage of potash on sandy soils, excepting in regions in which it is known not to be needed. Although potash is usually the least deficient element in the sandy soils of humid regions, the demand of the asparagus plant on this ingredient of fertilizers is so great as to make its use profitable, whereas on other sandy soils in semi-arid regions, potash might not be required.

Melons.

On soils that are very acid, it is imperative to use considerable quantities of lime for canteloupes and muskmelons. Such soils will, nevertheless, produce good crops of watermelons, even if liming is omitted, and heavy liming with slaked or burned lime may, in some cases, even decrease the yield.

Owing to the fact that these crops are generally grown on light, gravelly or sandy soil, a fertilizer is demanded for humid regions containing a fairly high percentage of nitrogen. This should be represented by nitrates, to a still greater extent by ammonium salts, and a part should be from suitable organic sources. It should also contain a high percentage of soluble and immediately available phosphoric acid and generous amounts of potash in order to bring the crop to maturity as rapidly as possible. Plants of this character which have an extensive amount of foliage, usually require high percentages of potash. Special care should be taken to keep the fertilizer from coming in contact with the seed.

Squashes and pumpkins.

The common summer squash, as well as the Hubbard and crookneck varieties, are less in need of liming than canteloupes or muskmelons. Nevertheless, on very acid soils liming is decidedly helpful. These crops are all heavy feeders on nitrogen, a considerable part of which should be in immediately available nitrates and ammonium salts. Moderately high percentages of soluble and available phosphoric acid are necessary, although the summer squash, at least, responds much less to phosphoric acid and more to potash than the cereals and most other cultivated crops. On this account, the percentage of potash in fertilizers for squashes should be high, excepting, of course, where the soils are already rich in available forms of this ingredient.

Celery.

Celery is a crop that will thrive well on slightly acid soils. Nevertheless, where the acidity is great, liming is very beneficial. The quality of this crop depends very largely upon its making a rapid and steady growth. On this account a constant water-supply is one of the most important features connected with its culture. It is of the highest consequence that celery should have a large supply of nitrogen embracing suitable proportions of nitrate nitrogen, ammonium salts and organic materials. Fair amounts of soluble and available phosphates are desirable, and on the muck or peat soils where this crop is frequently grown, especially large quantities of potash should be employed, since this is the fertilizer ingredient which they lack to the greatest extent. The form of potash usually preferred on such soils is the muriate, although frequently kainit is said to have given excellent results. Either is perhaps preferable to the high-grade sulfate of potash or to the double manure salt.

Cucumbers.

Cucumbers are considerably more in need of liming than squashes. In other respects they should have essentially the same fertilizer treatment. Great care should be taken in connection with squashes and pumpkins, as well as with cucumbers, not to allow the seed to come in close contact with the fertilizer, or, indeed, with soil into which large quantities of fertilizer have been introduced. If fertilizer is used in the hill it is well to have it thoroughly incorporated with the soil. Subsequently, this soil should be covered with fresh earth before the seeds are planted.

Tomatoes.

The tomato will grow quite well even on soils that are distinctly acid. Nevertheless, moderate liming is often helpful. When tomatoes are grown in greenhouses it has been found that very large quantities of lime are helpful, by virtue of lessening the tendency to certain diseases, but the necessity for it is less in the field because of the lower temperatures and less humid conditions.

In order to hasten the ripening of this crop, it is very important to have large quantities of soluble and available phosphoric acid, and abundant potash in the fertilizer. One of the most important features is to have the nitrogen supply so regulated as to bring about at once a rapid and vigorous growth of the plants, but the quantity must not be so great as to prolong the growing period unduly, since this will prevent early ripening; and it is a well-known fact that the early fruit generally sells for a much higher price than that which matures later. Furthermore, a large proportion of the nitrogen should be present as nitrates and ammonium salts which can be readily utilized. It is also desirable to apply the entire amount at the time when the plants are set, or, at least, very shortly afterward, for if successive applications are made at a later date they will result in prolonging the growing period and delay the ripening of the fruit.

Peas and beans.

Peas are usually much more helped by liming than beans. The latter vary widely in their lime requirement as shown by the fact that on a soil so greatly in need of lime that the Golden Wax and Low's Champion (a green-podded variety) will scarcely produce half a crop, the pole Horticultural bean is only slightly benefited, and the lima bean is practically indifferent to it.

Notwithstanding that these plants are capable of assimilating atmospheric nitrogen, it is nevertheless usually desirable, especially when they are grown to be marketed in the green state, to employ a fertilizer containing a small or moderate amount of readily available nitrogen. This will aid in developing a root-system until such a time as the plants can draw their nitrogen supply to a considerable extent from the air.

Peas and beans also require moderate amounts of potash and phosphoric acid, in fact much more than would be the case if they did not grow so rapidly, and hence reach the crop-producing stage in a short interval of time. The common white field bean has been found to require potash more than phosphoric acid, under conditions in which the cereals and the common farm crops showed a greater response to the latter.

H. J. Wheeler.

FÉRULA (old Latin name, perhaps from the verb *to strike;* possibly the stems were anciently used as ferules). *Umbelliferæ.* Giant Fennel. Hardy striking herbs, prized for their spring and early summer foliage.

Stout perennial glabrous usually glaucous thick-rooted herbs, of perhaps 50 species in S. Eu., N. Afr., and W. Asia: lvs. pinnately decompound, the ultimate segms. filiform or small (rarely broadish and dentate): fls. small, in elevated compound many-radiate umbels; petals broad, mostly ovate-acute, the point often inflexed: fr. orbicular or ovate, plano-compressed, membranous-bordered.—The giant fennels are valued for the excessive fineness with which their foliage is cut, and their clusters of perhaps 40–50 umbels of minute yellow fls. borne on stout sts., which rise far above the foliage. In spring the masses of foliage are very refreshing. The bold fl.-sts. make the plants useful for bordering plantations and for stream sides. The ferulas yield gum-ammoniac, galbanum and asafetida. The genus is now held to include Narthex, Scorodosma and Euryangium. These plants are not to be confounded with the true fennels, which belong in Fœniculum. Ferula is closely allied to Peucedanum. The species are difficult to represent in herbaria, and they are confused.

commùnis, Linn. Common Giant Fennel. Robust, 8–12 ft.: lvs. light green, very numerous, forming a fine mound or clump, the segms. linear-setaceous; lf.-sheaths very large: fls. yellow; central umbel on a branch nearly sessile, and the surrounding ones stalked and mostly male. S. Eu. to Syria.—Presumably the *F. gigantèa* of trade lists belongs here, although *F. gigantea,* Fedtsch., of Cent. Asia, is recognized botanically.

Var. **brevifòlia,** Mariz. (*F. brevifòlia,* Link. *F. Línkii,* Webb & Berth. *F. nodiflòra,* Guss.). Ultimate lf.-segms. shorter than in the type. The gum-ammoniac of Morocco comes from this plant. B.M. 8157. See history in Kew Bulletin, 1907, pp. 375–388.

tingitàna, Linn. (*F. sáncta,* Boiss.). Robust, the st. leafy below, paniculate-corymbose above: lvs. triangular-ovate, quarternate pinnatisect, the segms. narrow-oblong and cut: fls. orange, in globose umbels. N. Afr. B.M. 7267.—Long supposed to be the source of gum-ammoniac. Probably not in the trade.

glaùca, Linn. (*F. neapolitàna,* Tenore). Very tall (to 14 ft.), branching: lvs. large, pinnately decompound; segms. flaccid and broad-linear, obtusish and 1-nerved, green above and glaucous beneath: bracts at base of peduncles membranaceous, oblong, deciduous: fls. yellow, in many umbels. S. France to Dalmatia. G.C. III. 32:441, 442.

F. Assafœ́tida, Linn. (Assafœtida disgunensis, Kaempf. Scorodosma fœtidum, Bunge). St. 6–12 ft., very stout and much-branched: lvs. puberulous and minutely glandular or somewhat tomentose, the radical ones large and ternatisect with segms. oblong-lanceolate and obtuse: umbels on fleshy peduncles, 20–30-rayed, the fls. yellow. S. W. Asia. G.C. III. 32:443. An evil-smelling plant, one source of the drug asafetida.—*F. Nárthex,* Boiss. (Narthex Asafœtida, Falconer). St. 6–8 ft., with large sheaths: lvs. pubescent when young, 1–2 ft. long, ovate, the segms. either entire or irregularly serrate. S. W. Asia. B.M. 5168. A source of asafetida. A specimen described in G. F. 3, p. 523, required 16 years to attain sufficient strength to bloom.

L. H. B.

FESTÙCA (ancient Latin name for a kind of grass). *Gramíneæ.* Fescue-Grass. Annual or perennial grasses grown for ornament or as pasture grasses.

Blades narrow: infl. few-fld., paniculate; spikelets 2- to several-fld.; lemmas firm, rounded on the back, usually acute or awned from the tip.—Species about 100, in the temperate and cooler parts of the world.

A. *Spikelets awnless: blades flat, 2–4 lines wide.*

elàtior, Linn. Tall or Meadow Fescue. One to 3 ft.: spikelets 5–8-fld., about ½in. long. G. 8:179. Gn. 25, p. 428.—Frequently cult. as a meadow or pasture grass. The form called *F. praténsis* is rather smaller and has narrower panicles (Dept. Agric., Div. Agrost. 20:155), sometimes sold under the name *Bromus pratensis,* meadow brome-grass. Eu.

AA. *Spikelets awned: blades narrow involute.*

B. *Sts. loose and decumbent at base.*

rùbra, Linn. Red Fescue. One-half to 2 ft.: base of sts. usually red. Eu.—Occasionally used in mixtures for pastures.

BB. *Sts. in close erect tufts.*

C. *St.-blades flat, the basal blades long and slender.*

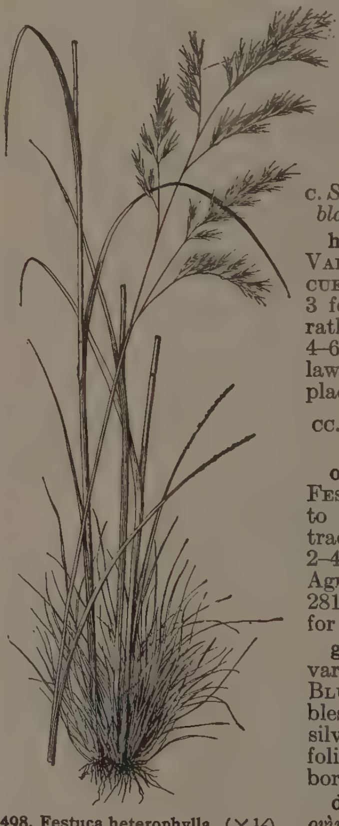
heterophýlla, Lam. Various-leaved Fescue. Fig. 1498. One to 3 feet., slender: panicle rather loose; spikelets 4–6-fld. Eu.—Cult. as a lawn grass in shady places.

CC. *St.- and basal blades involute.*

ovìna, Linn. Sheep's Fescue. Fig. 1499. Six to 20 in.: panicle contracted after flowering, 2–4 in. long. Eu. Dept. Agric., Div. Agrost. 20: 281.—Sown in mixtures for pastures.

glaùca, Lam. (*F. ovìna* var. *glaùca,* Hack.). Blue Fescue. Resembles *F. ovina* but has silvery blue, or glaucous foliage. Eu.—Used for borders.

duriúscula, Linn. (*F. ovìna* var. *duriúscula,*



1498. Festuca heterophylla. (× ½)

Koch). HARD FESCUE. Blades firm and comparatively thick, ½line diam., often rough. Eu.—Pasture mixtures.

vaginàta, Waldst. & Kit. (*F. amethýstina,* Hort., not Linn.). Sheaths and panicles purplish: foliage bluish: panicle 8 in. long. Eu.—Used for ornament.

A. S. HITCHCOCK.

FETTICUS. Another name for *Corn-Salad.*

FEVER-BUSH: *Benzoin.*

FEVERFEW: *Chrysanthemum Parthenium.*

FEVER-TREE: *Pinckneya pubens.*

FEVERWORT: *Triosteum.*

FIBER PLANTS are treated only incidentally in this work, and with particular reference to the horticultural values of the groups to which they belong. See Cyclo. Amer. Agric., Vol. II, p. 281.

FÌCUS (ancient Latin name). *Moràceæ.* The fig, the India rubber plant, the banyan tree and the creeping fig of conservatory walls belong to this vast and natural genus, which has over 600 species scattered through the warmer regions of the world.

Ficus has no near ally of garden value. It is a genus of trees or shrubs, often climbers, with milky juice. In the common fig the lvs. are deeply lobed, but in most of the other species they are entire or else the margin is wavy or has a few teeth or an occasional small lobe. The lvs. are nearly always alternate, *F. hispida* being the only species of those described below which has opposite lvs. The foliage in Ficus varies from leathery to membranous, and is variable in venation, so the veins are very helpful in telling the species apart. Ficus is monœcious or rarely diœcious, the apetalous or sometimes naked minute fls. being borne inside a hollow more or less closed receptacle; stamens 1–3, with short and united filaments; pistillate fls. with 1-celled sessile ovary, ripening into an achene that is buried in the receptacle. What the horticulturist calls the fig, or fruit, is the fleshy receptacle, while the fruit of the botanist is the seed inside (Fig. 1500). In the following account, fruit is used instead of receptacle.

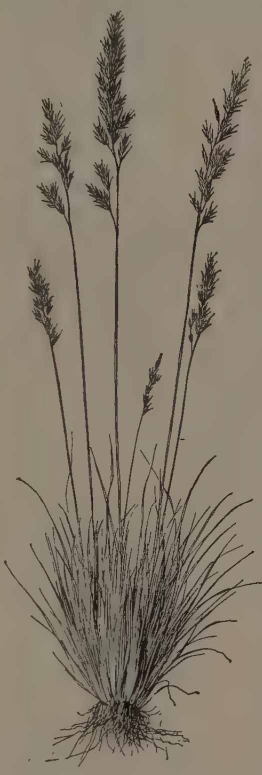
The fertilization or caprification of the fig is one of the most interesting and complicated chapters in natural history, and is of great practical importance. See *Fig,* where the culture of *F. Carica* is discussed.

The most important ornamental plant in the genus is the India rubber plant (*F. elastica*), which ranks amongst the most popular foliage plants for home use indoors. This is not the most important rubber-producing plant, both *Hevea brasiliensis* and *Castilla elastica* being producers of more and finer rubber.

The creeping fig (*F. pumila,* better known as *F. repens* or *F. stipulata*) is one of the commonest and best climbers for covering conservatory walls. It clings close and makes a dense mat of foliage, which is about as dark in color as the English ivy. The plant has been cultivated since 1771, but within the last half-century has come to be recognized as the best plant for its special purpose. Once in a long while it fruits in conservatories, and the fruiting branches are very unlike the barren ones. They stand out from the conservatory wall instead of lying flat and close. The leaves of the barren branches are less than an inch long and heart-shaped, with one side longer than the other at the base and a very short petiole; the leaves of fruiting branches are 2 to 3 inches long, elliptic-oblong, narrowed at the base, and with a petiole sometimes ½ inch long (Fig. 1501).

Among the many wonders of the genus Ficus are the epiphytal habit of some, the huge spread of the banyan tree (*F. benghalensis*), and the fact that some species ripen their fruits under ground. Some of the tallest tropical trees are members of this genus, and often they begin life by climbing upon other trees. The ficus often overtops and outlives the other tree, which may be seen in every stage of decay, or may have entirely disappeared, leaving the giant climber twined spirally around a great hollow cylinder. The banyan tree sends down some of its branches (or aërial roots) into the soil, these take root, make new trunks, and eventually produce a great forest, in which it is impossible to tell the original trunk. The banyan in the botanic gardens at Calcutta sprang from a seed probably dropped by a passing bird into the crown of a date palm a little more than a century ago. The main trunk not many years ago, was 42 feet in circumference, with 232 additional trunks, many of them 8 to 10 feet in circumference, and the branches extend over an area 850 feet in circumference, forming a dense evergreen canopy through which sunlight never penetrates. The banyan under which Alexander camped, and which is said to have sheltered 7,000 men, now measures 2,000 ft. in circumference and has 3,000 trunks. Other species have the same method of propagation, but *F. benghalensis* is the most famous.

The various species are cultivated both indoors northward and as shade and fruit trees in Florida and California. In this country the most important commercially is the fig, *Ficus Carica,* now widely grown in California. For the botanical treatment of this difficult genus recourse has been had to King's "The species of the Indo-Malayan and Chinese countries" in Ann. Bot. Gard. Calcutta 1:185 pp. + 232 plates, 1888, and wherever possible below reference is made to the splendid illustrations of that work, thus, K. 130.= King, plate 130. For the African species the recent treatment of Mildbraed and Burret on Die afrikanischen Arten der Gattung Ficus. Engler's Bot. Jahrb. 46:163–269 (1911), has been consulted.



1499. Festuca ovina. (×⅓)

The cultivation of Ficus elastica. (H. A. Siebrecht.)

The rubber plant (*Ficus elastica*) which is known all over this country, is perhaps the most popular and satisfactory house plant that has ever been cultivated. It is a plant for the million. Some florists have several houses especially devoted to the propagation and cultivation of this tough and thrifty plant. There are also thousands upon thousands of young plants or rooted cuttings from thumb-pots imported into this country, especially from Belgium and Holland, for marketing every spring. It is estimated that from 80,000 to 100,000 rubber plants are sold in America in a single year. There are several varieties of the rubber plant, but the true *Ficus elastica* is the best, both for growing and for selling. It can be easily told from the smaller-leaved variety, which is smaller and lighter colored in all its parts, the stem being smoother, and the sheath that covers the young leaves lacking the brown tint, which often runs into a bright Indian red.

The method of propagating now popular in America employs old bushy stock-plants, either in pots or tubs, or planted out into a bed where the night temperature can be kept from 60° to 75° F. As soon as the young shoots are 5 to 6 inches long they are operated upon. An incision is made at the place where it is intended to root the young plant, cutting upward on a slant midway between two eyes, making the cut anywhere from 1 to 2 inches long, according to the thickness and length of the young shoot or branch. A small wedge, as a piece of match, is then inserted to keep the cut open. A large handful of clean, damp, well-prepared moss is then placed around the branch to cover the cut and is tied moderately firm with twine or raffia. Some use a small piece of charcoal for a wedge in the cut; others coat the two cuts with a mixture of charcoal dust and lime. The latter practice is beneficial in that it expedites the callusing of the cuts and the rooting of the young plant after being cut and mossed. The moss should be kept constantly moist, and the higher the temperature, within reasonable limits, the quicker the rooting process goes on. The roots of the young plant usually appear on the outside of the oval-shaped bunch of moss. A complete cut can then be made below the moss and the young plant potted. The smaller the pot at first the better. The leaves of the young plants should be tied up in order that they may not be injured by coming in contact with one another or by lying flat on the pots. The young plants now require a gentle bottom heat and frequent syringing,—a dozen times on clear days. As soon as the young plants are taken from the stock-plant, a little wax should be put on the end of the cut to prevent the milky sap from escaping. The best time of the year to propagate and root ficus is from the first of January to May. The European growers never start much before the Christmas holidays; and from then until spring they make all their cuttings.

The older method of propagating rubber plants is still the favorite one abroad; it employs single-eye cuttings. Sometimes, if the branches are very thick, only one-half the stem is taken with the eye and a single leaf, the leaf being curled up and tied with raffia, and the small piece with the eye set into the propagating-bed. This is a bed of sharp sand, or sometimes of sand and chopped sphagnum moss or fine cocoa-fiber. Frequently the single-eye cuttings are put at once into the smallest-sized thumb-pot, with a mixture of very finely ground potsherd and charcoal filling about one-half the pot, and either soil or sand for the remainder. A small stick is used to hold the leaf upright. These pots are plunged into the propagating-benches in either sand, moss or fiber, and a steady bottom heat of 75° to 80° is applied and kept up until the plants are rooted. As a rule, such beds are inclosed in a glasshouse, in order to keep about them a close, warm and moist atmosphere. Only ventilation enough to permit the moisture caused by the evaporation to escape is allowed on these beds. In this country, propagation by the first described method can be continued nearly all the year round. From experience of both methods, the writer can say that the top-cutting and mossing process is better by far, especially where plenty of stock plants can be maintained.

1500. Young figs. Showing how they arise from the axis of the leaves.

After being shifted from the smaller-sized pots into 3- or 4-inch pots, the young plants will stand a great deal of liquid manure as soon as they are rooted through or become somewhat pot-bound. Many propagators plant out the young plants from 3- and 4-inch pots into coldframes after the middle of May, or when all danger of night frost is past. They do very well in the bright, hot, open sun, but must receive plenty of water. After being planted out in frames, they should be potted not later than September, and for early marketing as early as August. The plan of planting out and potting in the later part of summer or early autumn is a very practicable one, as the plants do not suffer so much from the severe heat during the summer.

INDEX.

altissima, 28.
aurea, 12, 30.
australis, 26.
Barteri, 9.
Bellingeri, 27.
benghalensis, 32.
Benjamina, 13.
brevifolia, 16.
Carica, 1.
comosa, 13.
Cunninghamii, 23.
diversifolia, 18.
Duvivieri, 12.
elastica, 12, 26.
erecta, 17.
glabella, 15.
glomerata, 25.
heterophylla, 11.
hispida, 6.
humilis, 11.
indica, 31.
infectoria, 22.
Krishnæ, 8.
lutescens, 18.
macrocarpa, 3.
macrophylla, 19.
minima, 4.
nitida, 29.
oppositifolia, 6.
Palmeri, 21.
pandurata, 10.
Parcellii, 7.
populnea, 16.
Pseudo-Carica, 2.
pumila, 4.
quercifolia, 11.
radicans, 5.
religiosa, 14.
repens, 4.
retusa, 29.
Roxburghii, 24.
rubiginosa, 26.
Sieboldii, 17.
stipulata, 4.
variegata, 5, 12.
villosa, 20.

KEY TO THE SPECIES.

A. *Fr. large, edible: lvs. deeply lobed, deciduous for at least 5 months: plants almost hardy from N. Y. southward.*
  B. *Lvs. wavy-margined or lobed* .... 1. **Carica**
  BB. *Lvs. deeply lobed: fr. roughish* .... 2. **Pseudo-Carica**
AA. *Fr. not usually edible, at least not as the fig is edible: lvs. entire or toothed, but not deeply lobed and not deciduous for such a long time: plants, with exception of F. macrophylla, not hardy, and cult. in greenhouses or outdoors in frostless areas of Fla. and Calif.*
  B. *Habit climbing or trailing, often clinging to walls.*
    C. *Plant a climbing shrub or tree: lvs. about 5 in. long* .... 3. **macrocarpa**
    CC. *Plant a creeping vine: lvs. less than 4 in. long.*
      D. *Lvs. unequally heart-shaped at base*... 4. **pumila**
      DD. *Lvs. only slightly notched at base*..... 5. **radicans**
  BB. *Habit erect or straggling, shrubs or trees; not climbing or trailing.*
    C. *Lvs. usually opposite* .... 6. **hispida**
    CC. *Lvs. always alternate.*
      D. *Foliage variegated* .... 7. **Parcellii**
      DD. *Foliage not variegated, except in a variety of F. elastica.*
        E. *The lvs. cup-shaped* .... 8. **Krishnæ**
        EE. *The lvs. not cup-shaped.*
          F. *Length of lvs. more than 4 times the breadth* .... 9. **Barteri**
          FF. *Length of lvs. less than 3 times the breadth.*
            G. *Form of lvs. fiddle-shaped or banjo-shaped, very large* ....10. **pandurata**
            GG. *Form of lvs. not as above.*
              H. *Lvs. lobed, much as in the native oaks: a shrub* ....11. **quercifolia**
              HH. *Lvs. not so lobed.*
                I. *Primary lateral nerves more than 8 pairs, usually much more.*
                  J. *The primary lateral nerves 50 pairs or more* ....12. **elastica**
                    K. *Sheath rosy, showy: lvs. 4–12 in. long* ....13. **Benjamina**
                    KK. *Sheath inconspicuous: lvs. 2–4½ in. long.*
                  JJ. *The primary lateral nerves less than 50 pairs.*
                    K. *Color of fr. purplish.*
                      L. *Tree 100 ft. or less: lvs. very long-acuminate*....14. **religiosa**
                      LL. *Tree small: lvs. short-acuminate* ....15. **glabella**
                    KK. *Color of fr. not purplish.*

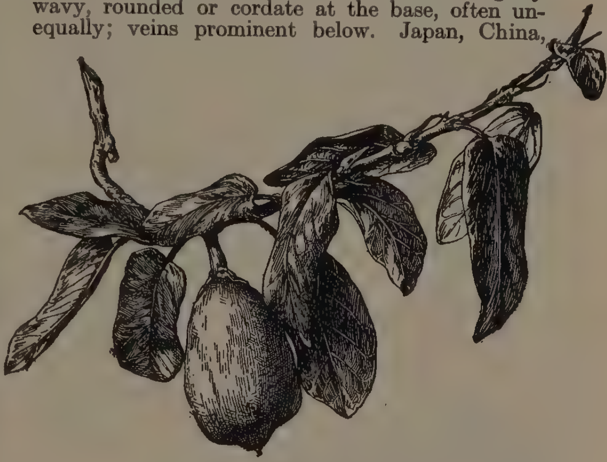
L. *Fr. globose and stalked*..16. **brevifolia**
LL. *Fr. if stalked, pear-shaped, often nearly sessile*.....17. **erecta**
II. *Primary lateral nerves less than 8 pairs.*
J. *The primary veins distinctly bifurcating*........18. **diversifolia**
JJ. *The primary veins not bifurcating*
K. *Stipular sheaths large and showy, rosy*.............19. **macrophylla**
KK. *Stipular sheaths not large and showy.*
L. *Whole plant brown-hairy*.20. **villosa**
LL. *Whole plant not brown-hairy: lvs. often hairy or villous.*
M. *Frs. white or whitish.*
N. *Young lvs. densely woolly beneath; mature lvs. not abruptly acuminate*.........21. **Palmeri**
NN. *Young lvs. not densely woolly; mature lvs. abruptly acuminate*.22. **infectoria**
23. **Cunninghamii**
MM. *Frs. red or yellowish.*
N. *The frs. on scaly leafless branches.*
O. *Lvs. almost orbicular* ....24. **Roxburghii**
OO. *Lvs. ovate to ovate-lanceolate*........25. **glomerata**
NN. *The frs. sessile or short-stalked.*
O. *Young lvs. woolly or rusty.*
P. *Lvs. cordate at base.*
Q. *Diam. of fr. about ½in.*.........26. **rubiginosa**
QQ. *Diam. of fr. 1¼–1½ in.*.......27. **Bellingeri**
PP. *Lvs. not cordate at base*............28. **altissima**
OO. *Young lvs. not woolly or rusty.*
P. *Base of lvs. narrowed.*
Q. *Stipules glabrous.*
R. *Lvs. 2–4 in. long: fr. yellow or reddish*....29. **retusa**
RR. *Lvs. 3–4½ in. long: fr. orange-yellow*.30. **aurea**
QQ. *Stipules not glabrous*........31. **indica**
PP. *Base of lvs. rounded*........32. **benghalensis**

1. **Càrica,** Linn. Figs. 1500, 1505, 1506. Height 15–30 ft.: lvs. 3–5-lobed, the lobes more or less wavy-margined or lobed, and with palmate veins, whereas nearly all species mentioned below are pinnately veined: fr. single, axillary, pear-shaped. Supposed to be a native of Caria, in Asia Minor.—Makes a fine pot-plant, and fruits freely in northern conservatories. For cult. see *Fig.*

2. **Pseùdo-Càrica,** Miq. Resembling the fig of commerce, but the lvs. more deeply cut than in *F. Carica*, 3- or sometimes 5-nerved: fr. axillary, round, roughish. Abyssinia.—Franceschi says of the Calif. cult. specimens "fr. said to contain very much sugar, but so far (1914) it has never come to perfection in Calif., where, however, it is now attracting considerable attention, it having proved to be the very best home for. . . . small wasps (Blastophaga) which are indispensable for the fertilization of the so-called 'Smyrna figs'."

3. **macrocárpa,** Wight. Becomes a large, climbing shrub, very rarely a small tree: lvs. 5 in. long, membranous, broadly ovate; petiole 2–2½ in. long; primary lateral nerves about 3 pairs: fr. 1–2½ in. thick, spotted, globose, in cauline clusters. India. K. 208.—This name was once advertised as a shrub with leathery lvs. The true species is a climbing shrub.

4. **pùmila,** Linn. (*F. stipulàta*, Thunb. *F. rèpens*, Hort., not Rottl.). CREEPING FIG. Fig. 1501. Prostrate or climbing shrub, clinging close to conservatory walls and then flattened: lvs. more or less 2-ranked, on very short petioles, ovate, obtuse, entire or slightly wavy, rounded or cordate at the base, often unequally; veins prominent below. Japan, China, Austral. B.M. 6657. R.H. 1891:448. K. 158. G.C. II. 14:560, 561, 717. H.U. 4, p. 359 (the last two as *F. stipulata*). Var. **mínima** (*F. mínima*, Hort.) has smaller lvs. The species is sometimes used for hanging-baskets.


1501. Ficus pumila, fruiting branch.

5. **radìcans,** Desf. Garden plant, with green, oblong-acuminate lvs. and trailing habit. Imperfectly known. Habitat unknown. Var. **variegàta,** Hort. W. Bull., has lvs. irregularly marked with creamy white, the variegation beginning at the margin. G.C. III. 22:185. A.G. 19:527. R.B. 28:37.—Useful for hanging-baskets. Intro. 1897.

6. **híspida,** Linn. f. (*F. oppositifòlia*, Willd.). Shrub or small tree, all the parts mostly hispid-pubescent: lvs. entire or toothed, opposite, rough-hairy: fr. clustered on old wood or leafy branches, hispid, yellowish. Asia, Trop. Austral. K. 154, 155.—Scarcely cult. in Amer. outside of botanic gardens.

7. **Parcéllii,** Veitch. Lvs. thin, membranous, light green, mottled with cream-white, more or less in the manner of mosaic, oblong-oval, acuminate, dentate. Islands of Pacific. F.S. 22:2273. F.M. 1874:124. A.F. 29:1290. G.C. III. 35:13.—Intro. by Veitch about 1874. A warmhouse shrubby plant; probably the most popular of the variegated forms of Ficus. Readily prop. by cuttings of half-ripened wood placed in sand in brisk bottom heat. Also cult. in S. Calif., where it bears tricolored fr.

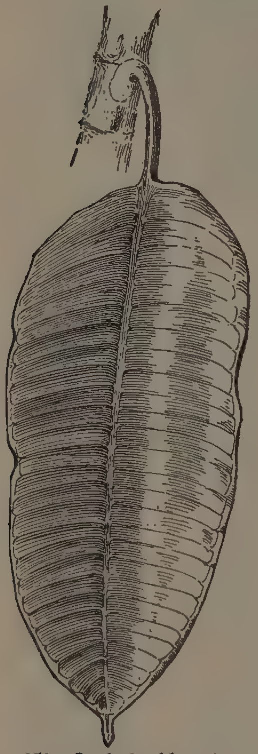
8. **Kríshnæ,** DC. KRISHNA BOR. Small tree with gray bark, the branches puberulent: lvs. cup-shaped, the limb of the cup containing the mid-rib, with 4–5 pairs of lateral nerves: fr. axillary, sessile, solitary or sometimes in pairs, yellow, about ½in. diam. India. B.M. 8092, where there is also an account of the superstitions in regard to the tree among the Indians.—The large showy and extraordinarily cupped lvs. of this most distinct fig will undoubtedly make it popular. Little known as yet in U. S.

9. **Bárteri,** Sprague. A shrub or small tree 6–25 ft. tall in nature, lower in cult., smooth, with thick ridged branches: lvs. petiolate, the blade the narrowest of almost all the figs, 6–14 in. long, and less than 1½ in. wide, bright green above, paler beneath; primary lateral

nerves 16–18 pairs: frs. in axillary clusters of 2–3, almost round, orange-colored when mature, and edible. S. Nigeria.—Little known in U. S. as yet, but worthy of cult.

10. **panduràta**, Hort., not Hance, which is an acuminate-lvd. Chinese fig, apparently not in cult. A showy shrub or tree with distinctive fiddle-shaped or banjo-shaped lvs. frequently a foot long, decidedly emarginate at the apex, cordate at the narrowed base, dark glossy green, the prominent nerves whitish: fr. unknown. G. 28:682. G.C. III. 33:284. Gng. 16:34. Gn. M. 8:268. A.F. 23:239; 26:203.—A showy stove fig now widely grown. Intro. in 1903.

11. **quercifòlia**, Roxbg. The oak-lvd. form is the typical one, but King includes *F. humilis*, Roxbg., in which the lvs. are serrate or nearly entire and not lobed. Lvs. 2–5 in. long, "thickly membranous;" nerves 5–7 pairs; petiole ½–1 in. long: fr. in axillary pairs, egg- or pea-shaped. Burma, Malaya, where it is a shrub. L.B.C. 16:1540. K. 95. (The plant fruiting soon after importation, when 2 ft. high.)—Advertised in 1895, and grown for years at the Montarioso Nurseries. Voss refers this, with many other synonyms, to *F. heterophylla*.


1502. Leaf of rubber plant, Ficus elastica, showing venation. (×¼)

12. **elástica**, Roxbg. (*F. Duvivièri*, Hort., a form with thinner lvs.; otherwise the same). India Rubber Plant. Figs. 1502, 1503. Lvs. 4–12 in. long, shining, leathery, oblong to elliptic, with an abrupt, dull point; nerves parallel, running at nearly right angles from midrib to margin: fr. in pairs, sessile, in axils of fallen lvs., covered at first by a hodded involucre, when ripe greenish yellow, ½in. long. Damp forests of Trop. Asia. G.F. 2:547. H.U. 6, p. 108. K. 54.—Becomes 100 ft. high in tropics, but becomes unsightly under glass at 8 or 10 ft. Cult. plants mostly have a single st., but there is a growing demand for compact and branching plants. Var. **variegàta** (var. *aùrea*, Hort.) is much less popular. Lvs. creamy white or yellow near the edges. Liable to fungous diseases. This species is also grown S. as a shade tree. The nervation is very characteristic. So, also, is the handsome rosy sheath which incloses the young lvs., and which soon drops off. This is regarded as a stipule of exceptionally great size.

13. **Benjamìna**, Linn. A rather unimportant tree horticulturally, with small lvs., and smooth throughout: lvs. thin, not much coriaceous, shining, ovate-elliptic, entire, the apex sharply acuminate, 2–4½ in. long; lateral primary nerves very numerous, freely intermingling near the margins of the lvs.: frs. in pairs, axillary and sessile, smooth and blood-red when ripe. Malayan Penins. K. 52, 83*h*. Var. **comòsa**, Kurz. Fig. 1504. Sepals lanceolate-acuminate rather than spatulate: fr. ¾ in. diam., narrowed at base rather than globose or ovoid.

14. **religiòsa**, Linn. Peepul Tree of the Hindoos. Lvs. ovate-rotund, at the apex produced into a long, linear-lanceolate tail-like appendage; petiole 3–4 in. long; stipules minute: fr. in axillary pairs, sessile, dark purple, ½in. thick. India. Gn. 1, p. 435. K. 67*a*.—Grows 100 ft. high, and the lvs., suspended on their long, flexible petioles, rustle in the slightest breeze. "Quite hardy in S. Calif. but not attaining very large size."—Franceschi.

15. **glabélla**, Blume. A small tree, ultimately glabrous throughout: lvs. petioled, thin, not very leathery, obovate-oblong, acuminate, entire, 2–4 in. long, 3-nerved, and with 8–10 pairs of primary lateral nerves: fr. all lateral, sometimes axillary, usually not so, sessile, or very rarely stalked in cult. specimens, dark purplish, sometimes with yellow dots, less than ½in. diam. Malaya Penins. K. 60.

16. **brevifòlia**, Nutt. (*F. popúlnea*, Willd.). An evergreen tree, sometimes epiphytic in nature, 10–30 ft.: lvs. thin and only slightly leathery, ovate or rarely obovate, 1½–4 in. long, acute at the apex, broad at the base; primary lateral nerves 14–16 pairs: fr. distinctly stalked, yellow when young, ultimately bright red, about ½in. diam., and nearly globose. Fla.—Of little value horticulturally, except for the frs.

1503. Ficus elastica, the rubber plant of florists.

17. **erécta**, Thunb. Extraordinarily variable: shrub to small tree, glabrous, pubescent, or almost strigose: lvs. broadly ovate, obovate or elliptic (lanceolate in var. *Sieboldii*), entire or with here and there a lobe, or rather coarsely dentate above the middle: fr. single or in pairs, peduncled or subsessile, and either globose and not stalked or pear-shaped and long-stalked. Himalayas, China, Japan. B. M. 7550 (where the lvs. look rather leathery). K. 178.—Procurable through dealers in Japanese plants.

18. **diversifòlia**, Blume (*F. lutéscens*, Hort.). Mistletoe Fig. A smooth shrub or small tree with short-stalked or sessile lvs.: lvs. broadly obovate, the much-narrowed base glandular, 1–3 in. long, midrib branched once or twice, glandular at the joints: fr. axillary, solitary, or rarely in pairs, always stalked, dull yellow or reddish when ripe. India and Malay Penins. R.B. 30:156. K. 174.—The small lvs. and usually solitary fr. suggest the mistletoe, and in nature the plant is often an epiphyte.

19. **macrophýlla**, Desf. Moreton Bay Fig. Lvs. 6–10 in. long, 3–4 in. wide; stipules 2–4 in. long: fr. nearly globular, 9–12 lines thick, axillary, in 3's or 4's, on short, thick peduncles. Austral.—Much planted in S. and Cent. Calif., where, however, it does not perfect seed. F. von Mueller says it is perhaps the grandest of Australian avenue trees. Ernest Braunton claims for this species partial or perhaps complete immunity from frost. He cites a specimen in Calif. which leaved out after a heavy frost and is still (1914) healthy after more than a year has elapsed since the frost.

20. **villòsa,** Blume. A straggling shrub, the whole plant brown-hairy: lvs. thick and leathery, petioled, oblong-ovate, sharply acuminate, the base cordate, 3–5-nerved at the base, the primary lateral nerves 5–6 pairs, 5–6 in. long: fr. short-stalked, in axillary clusters. Malaya. K. 172.—A good stove climber, but little known in Amer.

21. **Pálmeri,** Wats. Tree, 8–12 ft. high, branching near the ground: lvs. 3 in. long, 2–2½ in. wide; petiole 1 in. long: fr. in pairs, axillary, globose, ½in. thick, white, according to Franceschi needing much heat to develop. Discovered on San Pedro Martin Isl., N. W. Mex., 1887.—Perhaps the best adapted to severely hot and dry places. Franceschi says it attains 30 ft.

22. **infectòria,** Roxbg. A low tree, all the parts smooth; often deciduous for some weeks at a time: lvs. 3½–5 in. long; nerves 5–7 pairs, not prominent: fr. in axillary pairs, sessile, globose, ¼in. thick, whitish, flushed and dotted. Trop. Asia, Malaya. K. 76–79. —Grows 60 ft. high, and is one of the best shade trees.

1504. Ficus Benjamina var. comosa.

23. **Cúnninghamii,** Miq. A large tree, resembling *F. infectoria* and differing only in the form and acumination of the lf. from that species: in *F. infectoria* the primary lateral nerves are easily detected; in *F. Cunninghamii* they are fine and so much intermingled as to be almost indistinguishable. Austral.—Recommended as a shade tree for extreme S. Fla. by Reasoner Bros. Cult. in temperate house northward. Deciduous for several months each year.

24. **Róxburghii,** Wall. A low tree, 10–20 ft.: lvs. broadly-ovate or rounded, 5–15 in. long, 4½–12 in. broad, sometimes cordate at the base; primary lateral nerves 5–7 pairs, prominent on both sides: fr. 2 in. diam. on short leafless cauline branchlets, reddish. India. K. 211.—The lvs. are frequently almost orbicular; very ornamental.

25. **glomeràta,** Roxbg. Cluster Fig. Lvs. 4–7 in. long; nerves 4–6 pairs: fr. clustered on leafless, scaly branches, pear- or top-shaped, 1¼ in. thick, reddish. India, Burma. K. 218, 219.—"A quick-growing, evergreen shade tree."—Reasoner. "A dense shade tree: lvs. have a peculiar metallic luster and are deciduous for a short time at the end of winter: small frs., much relished by cattle and children but dry and woody." —Franceschi.

26. **rubiginòsa,** Desf. (*F. austràlis,* Willd.). Lvs. leathery, rounded or cordate at base, notched at tip: fr. mostly in pairs, globular, 5–6 lines thick, usually warty. Austral., where it throws out aërial roots like the banyan tree. B.M. 2939.—The rusty color is a beautiful feature. Voss considers this a form of *F. elastica.*

27. **Béllingeri,** C. Moore. Tall glabrous tree: lvs. ovate, sharp-pointed, leathery, 5–6 in. long, dark green and shining above, light green and paler underneath; petioles 2–3 in. long: fr. 1¼–1¾ in. diam., marked with small scattered warts. New S. Wales.—According to Franceschi it grows faster than *F. rubiginosa,* its nearest relative. Rare in cult., but advertised in 1914.

28. **altíssima,** Blume. A tall tree with only a few aërial roots, when mature wholly glabrous: lvs. petiolate, thick and leathery, broadly ovate, sometimes inequilateral, but not cordate, shining, 3–5-nerved and with 5–6 pairs of lateral primary nerves, 4–7 in. long: fr. axillary, sessile, in pairs, yellowish when ripe. India. K. 30, 30*a*.—Said by an American dealer to resemble *F. pandurata,* but this must be an error. Franceschi says it is taller-growing and finer than *F. elastica.*

29. **retùsa,** Linn. (*F. nítida,* Thunb., and Hort., not Blume). Lvs. 2–4 in. long; nerves 5 or 6 pairs; petiole 3–6 lines long: fr. sessile, in pairs, axillary, 4 lines thick, yellow or reddish. Trop. Asia, Malaya. K. 61, 62.—A large evergreen tree with a few aërial roots.

30. **aùrea,** Nutt. Branches pale, smooth, furrowed: lvs. 3–4 in. long, smooth, oblong, entire, narrowed but obtuse at each end, stout-petioled: fr. orange-yellow, globose, 4 lines thick. S. Fla.—Reasoner says it is a handsome decorative plant for the florist, and that it grows 60 ft. high. Chapman describes it as a small tree; he says nothing about stipules. Too tender for outdoor cult. in S. Calif.

31. **índica,** Linn. Not the banyan tree. Glabrous throughout, except stipules: lvs. 4–7 in. long; nerves about 4–6 pairs, not very prominent; petiole 4–12 lines long; stipules 6–9 lines long: fr. in crowded pairs, sessile, globose, smooth, yellowish red, 4 lines thick. Trop. Asia, Malaya. K. 45.—This species is greatly confused in botanical literature with *F. benghalensis,* but *F. indica* does not take root from its branches, as does the banyan tree. In recent writings, *F. indica* is often given as a synonym of *F. benghalensis,* but the distinctions here given are those made by King, in Flora Brit. India 5:499 (1890). Tree grows 50 ft. high.

32. **benghalénsis,** Linn. Banyan Tree. Also written *bengalensis.* Young parts softly pubescent: nerves prominent; petiole 6–18 lines long; stipules 9–12 lines long: fr. in pairs, sessile, globose, puberulous, red, about the size of a small cherry. Trop. Afr., India.—A tree, 70–100 ft. high, rooting from the branches, thus forming accessory trunks and extending the growth of the tree indefinitely. For an explanation of the confusion between *F. benghalensis* and *F. indica,* see Hooker's Flora Brit. India 5:499, 500. K. 13.—There are vigorous specimens growing outdoors at Miami, Fla.

F. Afzélii, Don, is a plant from S. Afr., never described by Don. The plant in the trade is said to be F. eriobotroides. Once advertised for indoor ornament.—*F. carnòsa,* Hort. Advertised 1895 for indoors.—*F. Chauvièrii,* Hort. In Eu. this is said to be second only to F. elastica. Franceschi says it has broader and more oval lvs., large red figs, not edible, and comes from New Caledonia, where it attains 60 ft. J. D. Eisele says that it has oval lvs. with creamy white veins, is strong-growing, and should be valuable for subtropical gardening. The name is unknown in botanical literature. A plant cult. at N. Y. Bot. Gard. as this species has orange fr.—*F. Coòperi,* Hort., is cult. indoors from Trop. Amer. Advertised 1895. The name is unknown in botanical literature. G. 1:757.—*F. Dryepóndtia,* Hort., is a striking shrub with long-stalked lvs. that are silvery green above and dark purple beneath. Probably not a Ficus. R. B. 32, p. 85. Said to be a native of Afr.—*F. eetveldiàna,* Hort., is a species "with large broadly oval lvs. and with the veins and nerves colored," something as in Caladium. The name is unknown in botanical literature. G.C. III. 28:303.—*F. criobotroides,* Kunth & Bouché. Habitat unknown. See F. Afzelii.—*F. falcàta,* Miq., is cult. but not advertised. A creeper, with lvs. often of 2 forms, leathery, tesselately dotted and colored beneath. It is a form of F. punctata, with lvs. oblong or subrhomboid, obtuse, not tapering below. India.—*F. Luciànii,* Hort., "has large lvs." Intro. 1900. Otherwise unknown.—*F. lùcida,* Dry. From India, but not described in Flora of British India. Advertised 1893 for indoors.—*F. maculàta,* Linn., described by Franceschi (1914) as with lvs. "large, oval, light green, not glossy. Cochin-China." must be some other plant than the true F. maculata, which is a serrate-lvd. fig from Santo Domingo.—*F. nemoràlis,* Wall., is a "small tree or bush" with smooth, petioled lvs. which are 3-nerved and dark-colored beneath: fr. smooth axillary, about ½in. diam. India. K. 206, 207.—There are many forms.—*F. prínceps,* Kunth & Bouché. Brazil. Cult. by Franceschi, who says it grows 60 ft. high and has magnificent foliage, which is bronze and copper-colored when young.—*F. pyrifòlia* may be F. Benjamina, F. erecta, F. Fontanesii, or F. rubra. The name is advertised by Yokohama Nursery Co., who also advertise F. erecta.—*F. rugòsa* is a trade name for some fig as yet undeterminable. The true F. rugosa, Don, is perhaps a Trop. African species, but was not characterized by Don, and the status of the name is uncertain.—*F. Syco-*

mòrus, Linn. (Sycomorus antiquorum, Gasp.), is a tree with petioled, ovate, entire 8–10-ribbed lvs. which are deciduous for some months each year: fls. greenish or yellowish in pedunculate racemes: fr. small but abundant, extensively used for food: it is a branching tree 30–40 ft. high, the lvs. smaller than those of the fig, more or less angular or even lobed. Egypt and Syria; the sycamore of the Bible; Pharaoh's fig. Intro. in U. S., but not in the trade.—*F. vásta*, Hort.=F. populifolia, an Abyssinian species not in cult. —*F. Wéndlandii* has lvs. "10–12 in. long by 8–10 in. wide, of a dark green color, and light green ribs and veins." Its habitat and fr. are unknown.—*F. Wrìghtii*, Benth., a creeping or climbing fig not cult. in Amer. outside of fanciers' collections: lvs. 3–4 in. long, wedge-shaped, 3-nerved. Probably=F. foveolata, Wall. China.

N. Taylor.†

FIG (Plate XLII) is *Ficus Carica*, a native of Asia. It is a warm-temperate fruit, although it will stand 10° to 20° of frost under favorable conditions. It was early introduced into North America, but until recent years it has been little grown commercially. It has been known to fruit in the open in Michigan without other protection than a high board fence inclosure, but usually, if grown north of Philadelphia, the plants are lifted in early November, with good balls of earth, kept in a dryish cellar over winter, and planted out the next spring. From Philadelphia to the Carolinas it may be bent to the ground and covered with earth or pine boughs. The fruit is borne on the young wood, and often on young trees. This fruit is really a hollow pear-shaped receptacle with many minute seeds (botanically fruits) on the inside; it grows like a branch from the side of the shoot. Inferior, run-wild forms are frequent in the southern states, where they are sometimes called "old man and woman" by the negroes. Figs may be grown under glass, being planted permanently in a border after the manner of hothouse grapes. They usually bear better if the branches are trained more or less horizontally. Two or more crops may be expected in one year under glass. Eastern nurserymen sell fig trees. As early as 1833 Kenrick ("New American Orchardist") described 23 varieties. Popular varieties for amateur cultivation in the East are Turkey, White Genoa, Black Ischia and Celeste. In order to facilitate the ripening of the fruit in cool climates or under glass, it is a custom to dress the surface of the nearly full-grown figs with sweet oil. As a dessert fruit figs are usually eaten in the fresh state, in which condition they are scarcely known to people in cool climates. They are also cooked, and preserved. The commerical fig is the dried fruit.

The fig is propagated very easily from hardwood cuttings, as grapes are. Take cuttings in the fall, removing just below a bud. If wood is scarce, single-eye cuttings may be used, being started preferably in a frame. From cuttings, bearing plants may be expected in two to four years. New varieties are obtained from seeds.

Various fruit books give directions for the growing of figs. Publications in California and of the United States Department of Agriculture discuss them. But the only independent American writing seems to be James T. Worthington's "Manual of Fig-Culture in the Northern and Middle States," Chillicothe, Ohio, 1869. Although regularly copyrighted, it is a pamphlet of only ten pages. It recommends the laying down of the trees in late fall and covering them with earth. This practice gave better results than covering with other material, or carrying the trees over winter in cellars, either in tubs or transplanted from the open (p. 1552). L. H. B.

Figs in the southeastern and Gulf states.

In the southeastern Atlantic and Gulf states the fig has been cultivated since the days of the earliest settlements. The exact time of introduction and indeed the exact origin of many of the more important varieties are unknown. For many years the trees, or more properly bushes, found a place as dooryard or garden plants, and to this day some of the finest specimens are to be found near the shelter of buildings in country, town or village. The fruit was used by the owners of the bushes and the surplus found its way into the local market.

Within the last ten to twenty years, attention has been given to the fig as a commercial fruit and it has found a place as an orchard fruit in many localities. Its culture may be said to extend from Norfolk, Virginia, southward along the Atlantic coast, and around the Gulf of Mexico into Texas. In proximity to the water it is grown without protection, but inland, particularly in the northern limits of its range, the bushes are protected during the winter months, by bending them down and covering with boards, straw, heavy paper, in fact anything that will cover them. With some care in protecting the plants by laying them down and covering in winter, the fig is grown beyond the region in which it has a place as an orchard fruit. Most of the orchard plantings have been made in close proximity to the ocean or gulf.

The propagation of the fig in this region is almost entirely by cuttings made from well-ripened wood and planted during winter or in early spring. The hardened wood from old bearing trees gives the most satisfactory results. The cuttings should be 4 to 5 inches long, and cut through the nodes. In planting, the cuttings are set with the upper ends level with the surface of the earth.

Soils best adapted to the growing of the fig are clay soils, or heavy soils, which are or may be kept uniformly moist. No greater mistake can be made than to attempt the culture of the fig in light sandy soils, more or less deficient in moisture in the lower South. Under these conditions, the nematode (root-knot) works serious damage to the roots of the trees and the planting soon dies out. But on heavy soils, the nematodes are not able to work such havoc and the fig thrives in spite of their limited attacks. On light soils, the fig may be grown in the well-packed earth of yards or planted against buildings where the roots may find their way into the soil beneath the buildings, where the nematode has been starved out for lack of food plants. The shaded condition of the soil is also beneficial. It is doubtful whether a successful planting can be made on any large scale on light soils in the lower South for the reasons just indicated

Varieties.

The varieties which may be grown successfully in the area indicated belong to the group which will carry good crops of fruit without pollination. On account of climatic conditions, it is doubtful whether figs of the class requiring caprification can ever be successfully grown.

The more important varieties are the following:

Black Ischia.—Size medium to large; color of skin bluish black, almost entirely covered with delicate bluish bloom; flesh creamy white; quality good. Strong grower, not a heavy bearer but quite hardy. Season late.

Brunswick.—Fruit very large, broadly pear-shaped with short, rather slender stalk; ribs well marked, eye large, open with rosy scales; skin tough, dark brown in color; pulp thick, pink, soft, quality fair. Midseason and late.

Celeste.—Small to medium, pear-shaped, ribbed; violet-colored, sometimes shading purplish brown, covered with bloom about half way up from the neck; stem short, stout; flesh whitish, shading to rose-color at center, firm, juicy, sweet, excellent quality. One of the hardiest varieties of figs, and can be grown far outside of the usual limits of culture; very desirable for canning and preserving. Season early.

White Ischia.—Fruit of medium size, turbinate; skin greenish yellow; pulp rosy, red, soft, melting; quality rich, sweet; a variety of high quality. Very productive. Season late.

Lemon.—Fruit medium to large, flattened, faintly

XLII. A young Celeste fig tree, as grown in Georgia.

ribbed, light yellowish green; stem short, stout; flesh white, sweet, rather soft; quality fair to good. Vigorous and prolific. Early.

Magnolia.—Fruit of large size; amber-colored; flesh pinkish amber, handsome. Vigorous grower; prolific; excellent for canning. Midseason and late.

Turkey (*Brown Turkey*).—Size medium to large; broadly pear-shaped, with short, thick stalk; ribs few in number; color coppery brown; flesh white, or slightly amber-colored, shading to pink about the seeds; flesh solid, excellent quality. It is very hardy and prolific. Midseason and late.

Of the varieties just described, the more important commercial sorts are Celeste, Turkey, Brunswick and Magnolia.

Magnolia is the favorite variety along the coast in Texas from Beaumont southward. In the eastern Atlantic states it is not so favorably regarded, as the fruit splits and sours on the trees during the rainy weather which so often comes when the crop is maturing. It is entirely distinct from the Turkey fig. Turkey or Brown Turkey is very hardy, of dwarf growth and therefore a favorite in the colder sections in which the trees must be protected during winter. Celeste equals Turkey in hardiness, but it is a more robust grower. It is the most commonly planted variety from Beaumont, Texas, eastward, and in the southeastern states should generally be given preference for orchard planting. Brunswick, on account of its large handsome appearance is a desirable variety for the production of fresh fruit for market.

General cultivation.

In setting the fig in orchard, the trees are commonly placed 10 by 15 feet or 12 by 20 feet in thoroughly plowed and pulverized soil. January and February in the lower South are favorite months for planting, but in the colder sections it is usually better to delay planting until after spring opens. While setting the trees, great care should be taken to prevent the roots from becoming dried out. This point must be strongly emphasized, as the character of fig roots is such that they will not stand drying.

It is not best to attempt to train the figs to tree form, but to allow them to develop with three or four trunks. To start them in bush form it is necessary to cut the plants back hard at time of planting. In case of severe weather during winter there is much less danger of losing whole trees if grown with several stems or trunks than if grown with single trunks. Subsequent pruning should be done to remove any sprouts or suckers that come up from the ground, to remove dead or injured branches, and to shape the form of the trees during the first few seasons. Branches that have to be removed for any cause should be cut back entirely rather than to stubs. The fig will not stand severe pruning year after year, such as has sometimes been attempted, and it is best to prune as little as possible to keep the trees in good shape.

As the fig is a shallow-rooted tree, deep tillage is impossible. The orchard should not be plowed and implements for shallow cultivation only should be used. There is no better tillage tool than an ordinary hoe, but its use is too expensive on large plantings. It may, however, be used in the garden plot. Cultivation should begin in spring just in advance of the starting of growth and should continue at weekly or ten-day intervals until about July 1. Cover-crops of cowpeas or beggarweed should then cover the ground until autumn. In the handling of plantings of the later-ripening sorts, cultivation should be continued later in the season, and a winter cover-crop used instead of a summer one. Stable manure and commercial fertilizer should be used liberally to supply the necessary plant-food.

A considerable amount of fruit can be and is handled in the markets as fresh fruit. It should be carefully cut from the trees early in the morning, selecting only well-colored but firm fruit, packed in strawberry carriers and shipped by express. When the work is properly handled in this way, its marketing presents no serious difficulties within a radius of 100 miles or so in the lower South and even greater distances in the northern area of its possible culture. By far the greater quantity of fruit is used by the canneries in the manufacture of preserved figs. A very delicious product is manufactured in the lower South, and meets with a ready sale.

H. Harold Hume.

The fig in California.

The fig, as grown in California at the present time, illustrates, perhaps more than any other fruit, the difficulties that arise in the course of the introduction of any new and highly specialized industry. Years of time and the united labors of many persons have at last resulted in the permanent establishment of fig-culture on a large scale in some parts of California. The successive steps by which this has been accomplished form one of the most remarkable chapters in our horticultural history.

The edible cultivated fig is a native of southwestern Asia and undoubtedly ranks as one of the most ancient, beautiful and valuable of all fruit trees, forming a large part of the daily food of the people in those countries in which it thrives. The common name fig comes from *Ficus*, and that from the Hebrew "feg." The importation of figs, dried, canned or preserved, into regions unsuited to their growth, forms an immense and increasing group of industries. The literature of the fig, always very large, is receiving continual additions, as new varieties are introduced, as new values are found for the varied products and as its culture is being extended far beyond what were thought, twenty years ago, to be its inflexible climatic limitations.

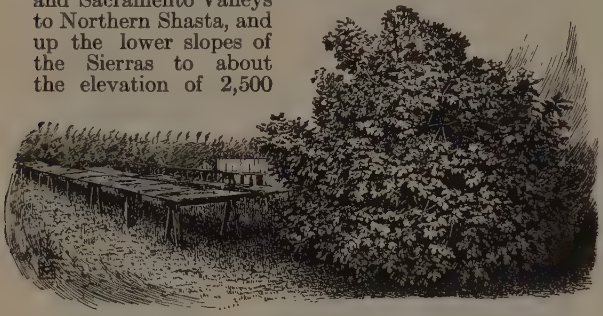
1505. White Adriatic fig.

The botanical varieties of the edible fig (*Ficus Carica*) as generally recognized include the following: (1) *Ficus Carica* var. *sylvestris*, the all-important wild fig of Asia Minor; (2) *Ficus Carica* var. *smyrniaca;* (3) *Ficus Carica* var. *hortensis;* (4) *Ficus Carica* var. *intermedia.*

The first of these, commonly known as the Capri fig, is not edible, but it was discovered ages ago that the famous little fig-wasp, formerly called *Blastophaga psenes* but now determined as *Blastophaga grossorum,* breeds within it and is able to cross-pollinate the flowers of the invaluable Smyrna fig which otherwise will not perfect fruit. This process is termed "caprification" and is absolutely necessary for the maintenance of the highest grades of commercial orchards. The third of these groups includes all the self-fertilizing table and preserving varieties of the common fig. The fourth variety (*intermedia*) has the ability to mature one crop without cross-pollination, but not a second. The best figs for drying are all of the second class (var. *smyrniaca*) and three crops are the usual thing in average seasons. In fact, nearly all the cultivated figs bear three more or less distinct crops; in many orchards and gardens of California one may gather ripe figs every day from late July until frost and rains destroy the very perishable fruits.

Figs have been cultivated on the Pacific coast for more than two centuries, as it is thought that they were in the Mission gardens at Loreto, Lower California, before 1710. Father Zephyrin's monumental "History of the Franciscan Missions in Calfornia," three volumes of which have now been issued (1913), contains many facts about the first Mission gardens from San Diego to Dolores and Sonoma. The fig was in them all, and was spoken of by the early visitors to California, such as Malaspina, Menzies, Mocino and Vancouver. Santa Clara Mission had rows of very large fig trees before 1792.

At the present time (1913), the fig has become established over almost the entire horticultural area of California, wherever the temperature does not fall below 18° F. It does not thrive where there is much fog or where the summers are cold and windy, but even in such places if somewhat protected by walls or buildings, it matures fruit. When planted close to its climatic limits, a young tree needs special protection the first few years until the wood is mature and the growth less rapid. The fig is most at home in southern California, over the Coast Range Valleys, the San Joaquin and Sacramento Valleys to Northern Shasta, and up the lower slopes of the Sierras to about the elevation of 2,500 feet in central California—to 3,000 feet and upward farther south. Magnificent single trees and stately avenues abound in various places. Many trees now standing have trunks 3 feet in diameter. One in Stanislaus County is 80 feet in height; another in Butte County has rooted from drooping branches until it seems a whole grove. This is the notable General Bidwell tree at Chico (Mission Black variety) which covers a circle of 200 feet in diameter and has long been the pride of the region. Superb fig trees are found in all the old foothill and valley towns of California. A magnificent grove is on the old Thurber farm near Vacaville. Large commercial fig orchards have been planted, especially in Nesuo, Los Angeles, Butte, Santa Barbara, San Bernardino, Tulare, Merced, Sonoma, Placer, San Joaquin and Shasta Counties. The Maslin orchard near Loomis and the Roeding orchard east of Fresno are two of the most famous and successful ones in California. Fresno County now has 220,000 bearing fig trees, and Los Angeles nearly 100,000.



1506. Young fig tree, and fig-drying in open air, California.

Varieties.

There are many horticultural varieties known to the markets and catalogues under innumerable synonyms. Their classification is by shape, color of skin and color of flesh. The shape is round or turbinate in some sorts, pyriform or obovate in others. The skin varies in color in different varieties from green through pale yellow, buff, light brown, reddish brown and purple, to black. The flesh is almost white, opaline, or various shades of red; it can be described as melting, spicy, juicy, coarse or even dry in a few old sorts. The size varies from those hardly as large as a green gage plum to others that sometimes weigh four or five ounces apiece. Eisen, in his useful and thorough monograph on the fig published by the Department of Agriculture (Division of Pomology, Bulletin No. 9, 1901) lists and describes nearly 400 varieties from different parts of the world. Eleven of these are Smyrnas, and twenty are varieties of the Capri or wild fig, differing in season so as to afford a succession and thus increase their value in caprification. Baja California, and Sonora, fine regions for the fig, have produced some varieties of promise, and others have been reported from South Africa, New Zealand, Australia, Tasmania, northern India, Algiers and many other places.

When the earlier California nurserymen began to grow figs, they first secured the Black Mission variety which the padres had brought from Mexico, and the little White Marseilles, which was at Santa Clara and Santa Barbara before the discovery of gold. They also obtained from Ellwanger and Barry, of Rochester, and from Berckmans, of Georgia, between 1860 and 1870, all the varieties then grown in America, principally for pot and greenhouse culture, not more than twenty-five sorts in all, chief among which were the Brown Turkey, Celeste, the Green and Black Ischias and the large Brunswick. Georgia and the Gulf coast were cultivating in gardens these sorts for home use, especially Celeste, which is fine for canning and preserving. There was therefore, much early correspondence between California nurserymen like William B. West, John Rock, Felix Gillet, James Shinn and others, and the fig-growers in the South, whose main drawback was in the frequent summer rains. Almost immediately, however, the Californians began to import trees from France, Italy, Spain, and later began to study the Smyrna fig industries. The catalogues of California nurserymen, by 1880, contained about 150 named varieties—with plenty of duplications, as was natural. The University of California experiment stations, by 1890, had about seventy-five varieties under trial and distributed them with great energy. The late John Rock, one of the most ardent horticulturists of his time in America, made many trips abroad and seldom failed to send back new kinds of figs. The inevitable and essential sifting down continued for over thirty years from 1880 until the nurseries of today list not to exceed thirty varieties. The principal sorts now in general cultivation, besides the very important Smyrna and Capri varieties sent out chiefly by George Roeding of Fresno, are the following:

Adriatic (Grosse Verte).
Agen.
Angelique.
Black Ischia (Black Marseilles; Black Provence; the Reculver of England).
Bourjasotte Blanche.
Brown Turkey.
Brunswick.
Celeste (Celestine)
Col di Signora Nigra.
Dauphine.
Doree.
Drap d'Or.
Du Roi.
Lardaro.
Madeline.
Mission (California Black).
Negro Largo.
Pastiliere.
Pingo de Mel.
Ronde Noire.
Ronde Violette Hative.
Royal Vineyard.
San Pedro (white).
Smyrna (common type).
White Genoa.
White Ischia.
White Marseilles.

A large amount of new experimenting has been done in California with fig varieties by the Bureau of Plant Industry which took up the work so well begun by Hilgard and others at the California Station. Lack of means and a general change of the University policy toward the sub-stations (where the fig orchards were located) led to the abandonment of those useful trials about 1902. Fortunately, the United States Department of Agriculture had become deeply interested in the Smyrna fig problem, and soon established plant gardens in California. Beagles, who has charge of the one near Chico, furnishes the following list of the varieties being tested there in 1912, in addition to a great many seedlings and crosses under numbers and not yet in bearing. The list, as furnished by Beagles, is arranged in the order of securing the varieties, not alphabetically, and the first forty-four sorts are from the well-authenticated collection at Chiswick, England:

De l'Archipel.
Bontard.
Grosse Marseilles.
Peau dure.
Negronne.
Bourjassotte noire.
Poulette.
Ceil de Perdrix.
Du Roi.
Grosse Violette de Bordeaux.
Datte.
Monstrueuse.
Bourjassote grise.
A' Bois Jaspee.
Royal Vineyard.
De Grasse.
Euscaire Preto.
Trois recoltes.
Monaco bianco.
Bondance Precoce.
Trifer.
Green Ischia.
Hirta du Japon.
St. Johns.
Vebra.
Datte Quotidienne.
Arbal.
De Jerusalem.
Nebian.
Vigasotte Bianco.
Grise Savantine bifere.
Quarteria.
Douro Vebra.
Reculver.
Gourand Rouge.
D'Agen.
Lampa.
Large Black Douro.
Adam.
De Constantine.
Biberaeo.
Grosse Verte.
Violette Sepor.
Dr. Hoggs Clare.
Hardy Prolific.
Figue d'Or.
Recousse noire.
Black Douro.
Grassale.
Martinique.
Crave.
White Ischia.
Brown Turkey.
Pastiliere.
Negro largo.
De la Madeleine.
Col di Signora Bianca.
Doree Nobis.
Pingo de Mel.
Black Ischia.
Toulousienne.
Gouraud noir.
Doree.
Brunswick.
Gentile.
White Adriatic.
Pacific White.
Vendome.
Barbillonne.
Figuires Blanch.
Warren's Brown Turkey.
Capri Milco.
Trojano.
Capri Solms No. 1.
Capri Solms No. 2.
Capri Solms No. 3.
Capri Solms No. 4.
Dauphine.

The California Experiment Station, under Hilgard, found that several varieties which are no longer in ordinary cultivation were important. Chief among these was a French fig of compact growth, Hirta du Japon, a medium-sized, turbinate, dark purple fig of high quality. It is excellent for house culture and for small gardens.

Smyrna figs.

The story of the introduction of the fig-wasp, the indispensable Blastophaga, to California fig orchards is one of the amusing, pathetic and fascinating romances of outdoor life. Smyrna figs were planted early, and they did not bear; the trouble was indistinctly charged to "the climate;" growers laughed at the absurd "book notion" that the Asia Minor Greeks depended on "some sort of an insect" to secure abundant crops of fruit. The late John Bleasdale, who had been in Portugal, told many persons about fig-caprification early in the 1870's. Some of the nurserymen took it up with energy and managed to secure cuttings of Smyrna figs and of Capri figs, but no insects. The San Francisco "Bulletin," between 1880 and 1882, secured and distributed over California about 14,000 cuttings. The fig-growers in Asia Minor became anxious to prevent importation of the insects to California or of the Capri fig cuttings, and the difficulties grew worse. Eisen and Rixford cross-fertilized figs by hand as soon as the wild fig trees blossomed. This was done on the James Shinn farm at Niles and at the California Nursery (managed by John Rock) in the same neighborhood. Then the Roedings of Fresno became interested, through Eisen, and planted a Smyrna fig orchard, but had no Blastophaga. Meanwhile the Department of Agriculture took hold. Walter Swingle was detailed and in 1899 secured the Algerian Blastophaga for the Californians. James Shinn, of Niles, had also obtained the Blastophaga in 1891, but his location was not suitable so that it perished and the work was done over again by both Swingle in 1899 and George Roeding, of Fresno, in 1896, working separately at different points of the problem. But all this time, the fig-wasp had accidentally become established near Modesto, about 1869, on the Gates farm. The wild fig tree there was, possibly, imported by West, of Stockton, in the form of cuttings carrying some of the "mamme" or winter generation of fruits containing the Blastophagas.

The literature of this whole subject is fascinating. It may be studied in the reports of the Department of Agriculture and in the following papers: "Some Points in the History of Caprification and in the Life History of the Fig," Walter T. Swingle, before the Thirty-fourth Fruit-Growers' Convention of California (1908); also his paper on the Maslin seedling fig orchard in the report of the thirty-fifth convention; also papers of his in the thirty-sixth and thirty-eighth reports; an essay by G. P. Rixford, read before the Forty-first Convention of California Fruit-Growers, in Santa Barbara, in 1912. His botanical and entomological paper, read in 1911 before the Pacific Association of Scientific Societies, on the "Fructification of the Fig by Blastophaga" traces the whole subject down from the days of Linnæus. A practical paper on the subject is to be found in George C. Roeding's "California Horticulture," a pamphlet issued in 1909.

Caprification.

The work of study and experimentation has gone forward steadily since the first importation of the Blastophaga; it is likely that more has been done in this line in California in the past twenty years than in all the rest of the world put together. The practical methods of keeping the fig insect prosperously established so that every fruit can be fertilized are now well founded, and as the profits of the industry are generally recognized, large plantings can be expected. There are some obscure problems still undetermined relating to the different crops of figs and the fructification of some of the non-Smyrna types. But in California the industry as a whole finds possibly the most favorable soil and climate known to exist anywhere. It seems probable, therefore, that fig-growing will soon rank in importance with the growing of citrous fruits. The cultivated varieties of Smyrnas are doubtless capable of much improvement as regards size, crop and season.

Only thirty Capri figs are needed to caprify a large fig tree, so abundant are the insects and the pollen in good seasons, and one tree of the wild fig is sufficient for one hundred Smyrna trees. The male of the fig-wasp is without wings, but the female has wings and saw-like mandibles; she cuts her way through scales which interlock over the apex of the half-grown Smyrna fig. She loses her wings in entering, dies in the fig and is absorbed by the vegetable cells. If she lays her eggs they also perish and the continuance of the species depends upon those individuals that remain upon the wild fig trees.

Propagation.

The fig grows readily from cuttings. Use well-ripened wood of the previous season's growth, cut at the joint, and give them the same treatment required for grape cuttings. They will even grow from single-eye cuttings. Bottom heat is not necessary in California where the cuttings are set in nursery in December or January and are ready for the orchard in a year. In the eastern states, winter-made cuttings can be started with bottom heat, or, in April, in the open air.

Budding is best done by the annular or ring method, so useful for the chestnut and walnut. The fig can be cleft-grafted in February in California, but extreme care must be taken to exclude the air. Seedlings are easily grown from the fertile seeds of the imported Smyrna figs, and from the few fertile seeds occasionally appearing in common varieties. Maslin, of Placer County, began to raise seedlings from imported dried figs in 1885 and these are now bearing.

Forcing.

The fig requires more heat under glass than does the grape. The temperatures preferred are, at first, 50° F. at night and, 65° for the day; later increase to 60° or 65° at night and 75° or more in the day. Figs must have much air and moisture till the crop is set. The best varieties for forcing are Early Violet, the White and Brown Ischias, White Marseilles, Hirta du Japon and Negro Largo. A soil of turfy loam with plenty of top-dressing is suitable for pots and tubs. Brown Turkey, Marseilles and Brunswick are the standard varieties for walls.

Cultural methods in California.

The fig tree in California requires much space, hence it is used as an avenue tree or if in orchard form other trees are set between, to be afterward removed. In good soil, fig trees, like walnuts, should finally stand not less than 40 feet apart, and 50 feet is considered to be better.

Little pruning is required for the fig. Trees grown for table figs are headed low, about 18 inches from the ground, to facilitate picking. Trees grown for drying figs are headed higher so that they can better be kept smooth and clean, as the figs are usually allowed to ripen and fall. Cultivation is necessary until the trees completely shade the ground.

Figs begin to bear early in California, often the second or third year. Some trees prove barren or very poor bearers and must be replaced by others. The tree appears to be as long-lived as the olive, has very few insect enemies, and is not subject to disease. It is a good ornamental tree.

The fruit in some districts, in some seasons, ferments on the trees ("fig-sour"). This sometimes seems to come from over-irrigation, sometimes from lack of vitality, and most often occurs in very tender and juicy varieties.

The very dangerous fig moth (*Ephestra cautella*) is now widely distributed in America, although not yet in California. During the last few years, many cargoes of imported figs have been seized in New York and destroyed on account of this insect, which fills the fruit with eggs and ultimately with its larvæ (Bulletin No. 104, 1911, Bureau of Entomology). Asiatic dried figs are not only subject to this pest but contain less sugar (1½ per cent less) and less proteids (1⅓ per cent) than do the California dried figs.

Fig-drying.—The fig crop is handled with much care and cleanliness in California, and labor-saving methods are used in all cases. The figs must remain on the trees till fully ripe; then they shrivel and drop off, are picked up, dipped in boiling brine (three ounces salt to one gallon water), placed on trays exposed to the sun and turned once. The later drying is done in the shade. The figs are next placed in the "sweat boxes" and "mixed" so as to equalize the moisture. They are then washed clean in a weak brine, drained off and taken to the packing-room. Exceeding care, cleanliness and much experience are required to produce high-grade results.

Fig avenues.—There is a growing interest felt in the fig as an avenue tree in California, since it is deciduous and so does not shade the road in winter, and since it thrives without culture or pruning where the moisture is sufficient and the soil deep.

Culture in other places.

While California probably offers the best climate on the continent for commercial fig-growing, the industry has a future over much of Arizona, New Mexico, Texas, the extreme South, Hawaii, Australia, large portions of South Africa, Mexico and the west coast of South America.

Fig-culture in the northern and middle parts of the United States is essentially different, of course, from the outdoor and orchard methods. The tree can be grown as a bush and protected each winter by covering the branches with several inches of soil. In the southern middle states, fig bushes are grown by covering in winter with matting and straw. One crop, or at most two, is all that can be expected. See the discussions on pages 1234 and 1235.

The crop.

Statistics are not well kept at present in the fig industry, but the annual California crop exceeds 4,000 tons (dried figs) while the local consumption of fresh figs is large and increasing. The fig pastes, conserves, and the like, and the use of figs in wafers and other forms is also general. As Smyrna exports about 30,000 tons in good years, there is evidently room for the California industry. The dried Smyrnas of California are equal to the best of Asia Minor and contain 64 per cent of sugar (Roeding's Calimyrna variety, the Erbeyli variety of its native country). Besides this variety, persons at Fresno are planting on a large scale the Kassaba, the Checker Injir of Scios, the Bardajic and what is called in California the purple Bulletin Smyrna.

Related species of Ficus.

The famous and useful "Sycamore fig" of the Orient (*Ficus Sycomorus*) produces fruit in racemes on the older branches. It is too tender for outdoor culture in America. (See page 1234.) The beautiful peepul tree of India is the sacred fig (*Ficus religiosa*) of the Brahmans and Buddhists, and it is now found in many private collections in southern California. *Ficus elastica*, the India rubber tree, is often seen in the warmer parts of California. In 1914 a tree of *F. elastica* fruited heavily at Niles and the children seemed to like the figs. The true banyan fig has not yet been successfully grown in the state, but ought to be tested. In the American tropics many interesting kinds of Ficus may be expected.

CHARLES H. SHINN.

FIG. **Adam's Fig:** *Musa paradisiaca.* **Barbary Fig:** *Opuntia vulgaris.* **Devil's Fig:** *Argemone mexicana.* **Hottentot's Fig:** *Mesembryanthemum edule.* **Indian Fig:** *Opuntia vulgaris.* **Keg Fig:** *Diospyros Kaki.* **Pharaoh's Fig:** *Sycomorus antiquorum.*

FIG-MARIGOLD: *Mesembryanthemum.*

FÍLAGO: *Gifola.*

FILBERT. One of the group of nuts produced by species of Corylus. The nuts of Corylus are variously grouped or classified; those are usually known as filberts that are provided with a tubular husk much longer than the nut itself; as cobs, if the husk is little or not at all longer than the nut; and as hazels if the husk is much shorter than the nut. The filbert nuts are usually oblong in shape; the cobs roundish and angular; and the hazels rather small, roundish and thick-shelled. These are derived from different species and hybrids of Corylus (which see) of the Old World; and these vernacular names do not seem to be very definitely or accurately used. The name filbert is of disputed origin; the idea that it comes from "full-beard," in allusion to the long husk, is undoubtedly erroneous.

Filberts are grown in many parts of Europe, and they are exported to America in large quantities. Many attempts have been made to grow them in this country but without success owing, apparently, to lack of hardiness, to fungous disease, and to the want of varieties bred for American conditions. Probably some of the failure is due to lack of discrimination in soils and to unskilled methods of growing. See *Hazel-nut.*

L. H. B.

FILIPÉNDULA (Latin *filum*, thread, *pendulus*, hanging; alluding to the numerous small tubers hanging together by thread-like roots). Syn., *Ulmària. Rosàceæ* MEADOW-SWEET. Hardy herbs grown for their showy panicles of white, pink or purple flowers.

Perennials with fibrous or tuberous rootstock: lvs. stipulate, interruptedly odd-pinnate, the terminal lft. often much larger and palmately lobed: fls. in cymose corymbs; calyx-lobes and petals usually 5; stamens 20–40, with the filaments narrowed toward the base; carpels distinct, 5–15, 1-seeded, indehiscent.—Nine species in N. Asia and Himalayas, N. Amer. and Eu. Filipendula has usually been united with Spiræa, but is very distinct in its herbaceous habit, pinnate stipulate lvs. and indehiscent 1-seeded achenes.

The meadow-sweets are hardy plants with rather large pinnate or palmately lobed leaves and white, pink or purple flowers in showy terminal corymbs, borne on erect leafy stems rising 1 to 10 feet from a rosette of radical leaves. They bloom in early summer or midsummer and are very handsome border plants. Most of them delight in a rather moist and rich soil and are especially decorative if planted on the borders of ponds and brooklets, but *F. hexapetala* prefers drier situations and likes full sun, while most of the others also thrive well in partly shaded positions. *F. purpurea* should be mulched during the winter in the North. Propagated by seeds sown in fall in pans or boxes and kept in the cool greenhouse, or sown in spring; also by division of older plants.

A. *Lfts. numerous, almost alike, small, pinnately lobed.*

hexapétala, Gilib. (*F. Filipéndula,* Voss. *Ulmària Filipéndula,* Hill. *Spiræa Filipéndula,* Linn.). MEADOW-SWEET. DROPWORT. Fig. 1507. One to 3 ft. high, with tuberous rootstock, glabrous: radical lvs. 6–20 in. long; lfts. sessile, oblong, pinnately lobed and serrate, 1 in. long: fls. in a loose corymb, white, about ¾in. across, with usually 6 petals: achenes about 12, pubescent, semi-cordate. June, July. Eu., W. Asia and Siberia. Var. **flòre-plèno** has double fls., and is common.

1507. Filipendula hexapetala (plant about 2 feet high). Commonly known as Spiræa Filipendula. One of the plants called meadow-sweet.

AA. *Lfts. few, the terminal one much larger and palmately 3–9-lobed.*

B. *Lateral lfts. 3–5-lobed.*

rùbra, Rob. (*Spiræa lobàta,* Gronov. *Spiræa palmàta,* Linn. *F. lobàta,* Maxim. *Ulmària rùbra,* Hill). QUEEN OF THE PRAIRIE. Height 2–8 ft., glabrous: terminal lft. large, 7–9-parted, with oblong, acuminate incisely serrate lobes; lateral lfts. smaller, 3–5-lobed, on the upper lvs. missing, green on both sides, only pubescent on the veins beneath: fls. pink, in a rather large paniculate cyme: achenes 6–10, glabrous. June, July. Pa. to Ga., west to Mich. and Ky. Mn. 2:145. B.B. (ed. 2) 2:249.—Beautiful. Var. **venústa,** Voss. Fls. deep pink or carmine. Var. **álbicans,** Hort. Fls. light pink, or almost white. R.B. 3:169.

palmàta, Maxim. (*Spiræa palmàta,* Pall. *Ulmària palmàta,* Focke. *Spiræa digitàta,* Willd.). Height 2–3 ft.: lvs. whitish tomentose beneath or glabrous; terminal lfts. 7–9-parted; stipules large, semi-cordate: fls. pale pink at first, changing to white: achenes 5–8. July. Siberia, Kamchatka and Saghalin.—This species is but rarely cult.; the plant common under the name *Spiræa palmata* belongs to *F. purpurea.*

BB. *Lateral lfts. none or few and ovate.*

C. *Achenes usually 5, ciliate: lateral lfts. none or few.*

camtschática, Maxim. (*Spiræa camtschática,* Pall. *Spiræa gigantèa,* Hort. *Ulmària camtschática,* Rehd.). Height 5–10 ft.: lvs. glabrous or villous beneath, often with rufous veins; terminal lft. very large, cordate, 3–5-lobed, with broadly ovate, doubly serrate lobes; lateral lfts. usually none; stipules large, semi-cordate: fls. white. July. Manchuria, Kamchatka.

purpùrea, Maxim. (*Spiræa palmàta,* Thunb. *Ulmària purpùrea,* Rehd.). Height 2–4 ft., glabrous: terminal lft. very large, cordate, 5–7-lobed, with oblong, acuminate, doubly serrate lobes; lateral lfts. none or few, oblong-ovate; stipules narrow: fls. carmine or deep pink, in large paniculate cymes with crimson peduncles and sts. June–Aug. Japan. B.M. 5726. I.H. 15:577. F.S. 18:1851. J.H. III. 51:201. F.W. 1869:33. Gn. W. 23: suppl. June 16. Gn. 17:36.—This is undoubtedly the finest species of this genus. It is also sometimes grown in pots and forced. Var. **álba,** Hort., has white fls. and var. **élegans,** Voss, white fls., with red stamens and usually several lateral lfts.; the latter is said to be a hybrid. R.B. 4:7. G.Z. 22:25.

CC. *Achenes about 10: lateral lfts. present, ovate.*

Ulmària, Maxim. (*Spiræa Ulmària,* Linn. *Ulmària pentapétala,* Gilib. *U. palústris,* Moench). QUEEN OF THE MEADOWS. Height 2–6 ft.: lvs. glabrous or puberulous above, whitish tomentose beneath; terminal lfts. 3–5-lobed, 2–4 in. long, lateral lfts. smaller, ovate, coarsely doubly serrate: fls. white, in rather dense paniculate cymes: achenes about 10, semi-cordate, almost glabrous, twisted. June–Aug. Eu., W. Asia to Mongolia; naturalized in some places in the eastern states. B.B. (ed. 2) 2:249. Var. **denudàta,** Maxim. (*F. denudàta,* Rydb.). Lvs. green beneath and nearly glabrous. Var. **aùreo-variegàta,** Voss, has the lvs. variegated with yellow. Var. **plèna,** Voss (var. *flòre-plèno,* Hort.). Fls. double.

F. angustifòlia, Maxim. (Spiræa angustifolia, Turcz. Ulmaria angustifolia, Rehd.). Similar to F. lobata: fls. white: lvs. glabrous or whitish tomentose beneath. Dahuria, Manchuria.—*F. vestìta,* Maxim. (Ulmaria vestita, Rehd. Spiræa vestita, Wall.). Similar to F. camtschatica, but only 1 ft. high and lvs. grayish tomentose beneath: fls. white. Himalayas. B.R. 27:4 (as S. kamschatica var. himalensis).

ALFRED REHDER.

FINGER-GRASS. Species of *Chloris* and *Panicum.*

FIORIN: *Agrostis stolonifera* and *A. alba.*

FIR. Strictly, species of the genus Abies, but popularly it includes many trees known to nurserymen and others as Picea, and by some it is applied to Pinus, Larix, and others.

FIRE-CRACKER, FLORAL: *Brevoortia.*

FIRE-ON-THE-MOUNTAIN: *Euphorbia heterophylla.*

FIRE-PINK: *Silene virginica.*

FIRE-PLANT: *Euphorbia heterophylla.*

FIRE-WEED: *Epilobium angustifolium* and *Erechtites hieracifolia.*

FISH-GRASS: *Cabomba.*

FITTÒNIA (Elizabeth and Sarah Mary Fitton, authors of "Conversations on Botany," and friends of Robert Brown). *Acanthàceæ.* Low-growing herbaceous perennials, valued for the brilliant variegation made by red or white venation of their large heart-shaped leaves.

Leaves prominent or rather large, cordate, beautifully veined: fls. borne singly in the axils of the overlapping bracts, which form a peduncled, terminal spike; calyx-segms. linear-bristly; corolla-tube slender; lip long, narrow, shortly lobed at the apex; stamens 2, affixed near the throat; style filiform, truncate at apex: fr. an ovate-acute 4-seeded caps., some of the seeds likely to be aborted.—Species 3, in Peru. Fittonias may be grown with philodendron, *Cissus discolor*, *Episcia cupreata,* nephthytis and selaginellas. There is often a bare, unsightly space under the benches that can be transformed into a tangle of tropical creepers by the use of such plants. A board may be placed slanting toward the walks and covered with rotten stumps, chunks of peat, and moss for the plants to run in. The open borders near the walks have hardly sufficient drainage. They may also be pegged down in mossy coverings for tubs of palms, as they can stand much watering.

Fittonias are most useful and ornamental plants for growing in a deeply shaded place in the tropical greenhouse. The beautiful markings of their foliage always attract attention; and being of easy culture, they can be used effectively for places in the foliage house in which no other plant would thrive. The best time to root fittonias is early spring, as after a year's growth they are likely to have a rather straggling appearance, and need a general overhauling. Remove the points of the shoots, with two leaves attached, and one joint to insert in the sand. These make the best cuttings, but any part of the stem will root and grow provided there is a joint on it. After cuttings are rooted, which will be in two or three weeks in a temperature of 65°, pot them singly in 2-inch pots, in equal parts of loam leaf-mold, and sand.—When they are well rooted in these small pots, choose the size of pan they are intended to grow in, and fill it with the same proportion of loam, leaf-mold and sand, as advised for the first potting. This time, however, the loam is better to be more of fibrous and in a rather lumpy state, and the leaf-mold should not be too well rotted, but rather flaky in texture. In filling the pan with the compost, raise it in the center above the rim. This gives the plant a mound appearance, which adds to its beauty. The small plants should be planted in the large pan about 2 inches apart; water them gently with a fine rose, so as not to disturb the earth in the receptacle. As stated above, these plants require, at all times, to be grown in a shady position, and except in the dead of winter should never be in a temperature of less than 60° by night. In severe zero weather, it will not harm them to drop as low as 55°.—Pyramid-shaped plants of some of the fittonias can be grown. Pot them along singly and tie them to a stake. When about four or five pairs of leaves are formed, pinch out the heart of the plant. This will encourage side breaks to start, which should be pinched after they have made three pairs of leaves. After the leading shoot has been pinched, two breaks will start away, and after two leaves have been well formed, one of the shoots should again have the heart taken out of it. The other must now be taken for the leader and allowed to make three or four more joints before it is stopped again by removing the heart. In this way the desired height will be attained, and at the same time plenty of side breaks will be encouraged to start. The side shoots must be carefully watched; pinch back all the strong shoots, so that a plant of symmetry may be formed. When these plants are well rooted in the pans, or have attained the desired size in pyramid form, water them occasionally with soft-coal soot, a handful to an ordinary watering-pot, which generally contains about two and a half gallons. Water twice in between with clean water. The soot tends to bring out the brilliancy of the markings, making the whole plant have a glossy appearance. Scale, and other insect pests are sometimes found on these plants, but if fumigated with hydrocyanic gas, as advised for other plants, will give very little trouble. (George F. Stewart.)

1508. Fittonia argyroneura. (×¼)

A. *Habit erect: height 1½ ft.*

gigantèa, Lind. (*Gymnostàchyum gigantèa,* Hort.). Sub-shrubby, branching, 1½ ft.: sts. reddish violet only between the joints, with 4 ranks of silky, white, erect hairs: lvs. opposite, elliptical, not notched at the base, with 2 ranks of hairs, tapering more than in the other species, dark, shining green; veins carmine-red: fls. pale, with a reddish brown band in the middle of the side and upper lobes, and a dark yellow spot in the middle of the lower lip. R.H. 1869, p. 186. I.H. 16:611.

AA. *Habit trailing or dwarf: height about 6 in.*

B. *Veins of lf. red.*

Verschafféltii, E. Coëm. (*Fittònia* and *Eránthemum rubronérvum* and *rubrovenòsum,* Hort. *Eránthemum rùbro-vènium,* Veitch. *Gymnostàchyum Verschaffèltii,* Lem.). Lvs. ovate, notched at the base, dull green, often yellowish, veined carmine. F.S. 15:1581. I.H. 10:372. Var. **Pèarcei,** Hort. (*F.* and *G. Pèarcei,* Hort.). Lvs. light, bright green; veins light, bright carmine; under surface somewhat glaucous. Var. **Dàveana,** Hort. (*F. Dàveana,* Hort.). "Foliage with light center, bordered very dark green." More robust than the type and with veins of stronger red.

BB. *Veins of lf. white.*

argyroneùra, E. Coëm. Fig. 1508. Dwarf: lvs. dark, shining green. F.S. 16:1664. Gn. 36, p. 527; 2, p. 319. G. 11:7.—The velvetiness of the upper surface of *F. Verschaffeltii* is due to large projecting epidermal cells with an apical nucleus. Instead of these characteristic cells, *F. argyroneura* has small cells and conical hairs, which are partitioned off and have tubercles at the base.

WILHELM MILLER.

FITZRÒYA (Capt. R. Fitzroy, of the British Navy; died 1855). *Pinàceæ.* Two evergreen trees or shrubs, one of the mountains of S. Chile (*F. patagònica,* Hook. f. B.M. 4616), and one of Tasmania (*F. Árcheri,* Benth.). Lvs. small, 3-verticillate or decussate-opposite, imbricated: catkins very small, globose. They are little known in this country, and may be expected to thrive only in the milder parts. The former species is a tree, has lvs. mostly verticillate, ovate-oblong, in 2–4 rows, anthers commonly 4-celled, 3 ovules, and seeds 2-winged; the latter is bushy, has opposite decussate keeled lvs., anthers 2-celled, ovules 2, seeds 3-winged. The Biltmore Nursery, N. C., lists *F. patagonica,* "a tree of variable dimensions, native of the Andes, from Chile to the Straits of Magellan. Lvs. dark green above, with 2 white lines beneath. . . . Its value in cult. in the U. S. has not yet been fully proved;" but it is said to possess sufficient hardiness to withstand the winters in the S. It is reported as being hardy in S. England. It is monœcious, the small cones consisting of about 9 scales; the lvs. on small trees are reported as varying much in the way in which they stand on the st., but they are 4-rowed and decurrent; pollen-sacs mostly 4.

L. H. B.

FIVE-FINGER: *Potentilla.*

FLACOÚRTIA (Etienne de Flacourt, 1607–1660, General Director of the French East India Company, Governor of Madagascar and author of a history of Madagascar). *Flacourtiàceæ.* One of the species, a shrub with edible fruits, is cultivated in the tropics and has been introduced in southern California and perhaps elsewhere.

Shrubs and small trees, often spine-bearing: lvs. short-stalked, toothed or crenate, simple, alternate: fls. small, diœcious, in small racemes or glomes or panicles (the fertile ones sometimes solitary); sepals

4–5, scale-like, ciliated, overlapping; petals none; stamens many; styles 2 to many; ovary 2–5-celled: fr. a berry, often edible, usually with 1 seed in each cell.—Fifteen to 20 species in Trop. Afr., Asia, and islands.

Ramóntchi, L'Her. GOVERNOR PLUM. BATOKO PLUM in the Zambesi region. Fig. 1509. An excessively variable shrub or small tree, as customarily defined, native in Trop. Afr. and Asia, and planted in the American tropics: glabrous or nearly so, spiny or spineless (spines axillary): lvs. oblong to elliptical and obovate, obtuse or pointed, variously crenate-dentate, short-petioled: sterile fls. in short racemes, the fertile few or solitary or in pairs, all small; styles 5–7, very short, radiate: fr. cherry-like, to 1 in. diam., roundish and pulpy, with 8–10 seeds, purple, red, or blackish, bearing on top the remains of the stigmas; edible, ripening in the farther West Indies early in the year but some specimens sometimes remaining till Sept. There are various forms, as var. *inermis* and var. *macrocarpa*. Hooker & Thomson in "Flora of British India" recognize 5 marked varieties, and include within the species *F. sapida* of Roxburgh. The species is reported as "common throughout India, wild or cult." and as having a distribution from Madagascar to the E. Archipelago. Duthie, in "Flora of the Upper Gangetic Plain," says that the var. *sapida* (with pubescent branchlets, elliptic or suborbicular lvs. which are glabrous or puberulous only on the veins beneath) produces fr. that is eaten raw or cooked, and twigs and lvs. that are used as fodder. "Ramontchi" is said to be the native name in Madagascar. L. H. B.

FLAG: *Iris.* **Cat-tail Flag:** *Typha.* **Corn Flag:** *Gladiolus.* **Sweet Flag:** *Acorus Calamus.* **Yellow Flag:** *Iris Pseudacorus.*

FLAMBOYANT: *Poinciana.*

FLAME-TREE: *Sterculia acerifolia.*

FLAX: *Linum.* **False Flax:** *Camelina.* **New Zealand Flax:** *Phormium tenax.* **Toad Flax:** *Linaria.*

FLEABANE: *Erigeron.*

FLEMÍNGIA (John Fleming, Pres. Medical Board of Bengal; author of "A Catalogue of Indian Medicinal Plants and Drugs," 1810). *Leguminòsæ.* Of this genus, two shrubs are cultivated in southern California and southern Florida.

Herbs, sub-shrubs or shrubs of the Old World tropics, erect, prostrate or twining: lvs. mostly with 3 digitate lfts., rarely 1; stipules striate, often caducous: fls. papilionaceous, red or purple and mixed with yellow, in crowded racemes or panicles, or sometimes solitary; standard obovate or orbicular, auricled at base; wings obliquely obovate or oblong, often adhering to the incurved or nearly straight keel; stamens 9 and 1: pod short, oblique, swollen, 2-valved.—Species above 20, mostly of Trop. Asia, but occurring also in Trop. Afr. and to the Philippines. Allied to Dalbergia and Rhynchosia.

congésta, Roxbg. Shrub, 4–6 ft., erect: lfts. oblong or broadly lanceolate, the side ones 2-nerved, middle one 3-nerved: racemes axillary, dense, shorter than the lf.-stalks; fls. purple, with a silky-hairy calyx and a scarcely exserted corolla: pod ⅝in. long, 2-seeded.—A variable species of India.

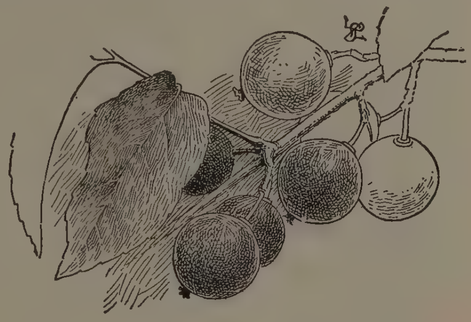
strobilífera, R. Br., has been intro. in S. Fla. It is an erect shrub, 8–10 ft., with slender velvety branches: lvs. simple, oblong, subacute, rounded at base, somewhat silky beneath: racemes zigzag, 3–6 in. long, with very large bracts that hide the fls.; calyx ¼in. long, hairy and with lanceolate teeth; corolla purple: pod less than ½in. long. India. L. H. B.

FLOATING HEART: *Limnanthemum.*

FLOÉRKEA DOÙGLASII: *Limnanthes.*

FLORA'S PAINT-BRUSH: A common name for *Emilia flammea.*

FLORICULTURE, or the growing of plants for ornamental purposes, particularly for flowers, is yearly assuming larger proportions in the United States. The industry consists in growing annual, biennial and perennial plants either under glass or outdoors, and in the disposal of the same in wholesale or retail markets. These products are sold as cut-flowers or potted plants to be used for indoor or outdoor home ornamentation, or for planting in public parks, about schools and other public buildings, or in cemeteries for ornamental purposes. (For home flower-gardens, see p. 1747.)



1509. Flacourtia Ramontchi. (×½)

Importance of the industry.

The floricultural statistics taken from the census of 1910 show a marked increase in the importance of this branch of agriculture within the previous decade. The acreage, as given for this census, was 18,248 as compared with 9,307 as given for the census of 1900. The total valuation, as given in this census, was $34,872,000, an increase of 85.9 per cent as compared with the report of the census for 1900. The figures were compiled in nine large geographical divisions of the United States. These were New England, Middle Atlantic, South Atlantic, East North Central, West North Central, East South Central, West South Central, Mountain, and Pacific.

From its beginning the industry has centered around such large cities as Boston, New York, Philadelphia, Baltimore and Washington. The business is now assuming considerable importance in Chicago, St. Louis and other large cities in the Middle States, the South and West. Statistics show that the largest floricultural output comes from the Middle Atlantic section. The states which compose this section are New York, New Jersey and Pennsylvania. The total valuation of products from this section is $11,810,076. The second section of importance is the East North Central, composed of Ohio, Indiana, Illinois, Michigan and Wisconsin, in which the figures given were $9,029,125. The third important section was New England, where the total valuation was $4,677,316. The smallest output comes from the Mountain section, composed of Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah and Nevada. Here the output was $753,914. The most rapid increase in the industry during the decade seems to have been in the Pacific section, composed of Washington, Oregon and California, where the valuation of flower products sprang from $726,968 in 1899 to $2,175,572 in 1909. New York leads other states in floricultural products, having an output of $5,110,221. The rank of other important states is Pennsylvania, Illinois, New Jersey, Massachusetts and Ohio.

Floriculture is intensive agriculture; consequently the acreage devoted to the industry is not so large as in other branches of agriculture. The amount of capital invested in glasshouses and their equipment is considerable. The return from the products, however, is immediate. Commercial growers and men making a business of greenhouse construction, estimate that it costs from 60 to 90 cents a square foot of ground covered to build and equip a modern range. The growers estimate that the products from such an area the first year should cover the cost of construction.

The flower-growing industry in the United States has not yet assumed the large proportions that it has in many European cities. The early colonists were an extremely practical people and paid little attention to the distinctly ornamental features about the home. As wealth increased, however, there came to be a more liberal use of flowers and plants; hence a larger demand for them in the industrial world.

Floricultural statistics for the Dominion of Canada are less complete than for the United States. The following are figures furnished through the courtesy of W. T. Macoun, Dominion Horticulturist:

Capital invested, approximately	$1,500,000
Square feet of glass	6,000,000
Annual output	$1,000,000
Area covered	120 acres

History of the industry.

The early history of the floricultural industry is obscure. It was merged to such an extent with other branches of horticulture and other industries that it could hardly be called a distinct industry. Previous to 1825 there is record of but few commercial flower-growing establishments. From 1830 to 1840, rapid progress was made in all branches of the work. The demand for glasshouse products increased to a considerable degree. Better houses were built, better systems of heating were devised, and consequently better products were put on the market.

Even the glasshouses of this period were extremely crude affairs. The framework was of large dimensions, the glass small in size, heavy and thick. The roofs were largely portable, being made of sash. About 1855 the first house having permanent sash-bars was built by Frederic A. Lord in Buffalo. The wooden superstructure of this house was heavy and the interior light conditions correspondingly poor, but it was a vast improvement over sash-houses. This type of construction was met with favor by glasshouse men, and many houses of a similar type soon were built. Glass of larger size was used, and this was embedded in putty instead of being placed on the outside as in sash-houses.

Previous to 1870 the principal business of the florist was the growing of potted plants. The flowers from these were often sold as cut-flowers, but the business centered about growing potted plants for outdoor bedding and other ornamental purposes. The cut-flowers of that early period were comparatively of a small-flowered, short-stemmed sort—heliotrope, camellia, tuberose, bouvardia and those of a like nature. Although the carnation was introduced as a florist crop about 1852, it was of little commercial importance previous to this date. About 1865, Dailledouze & Zeller of Flatbush, Long Island, began to breed the carnation, and between 1866 and 1872 several new varieties were introduced by this firm. Garden roses had been popular for many years, but few attempts were made to grow them under glass previous to 1870. They then came rapidly into public favor.

From 1870 to 1880 the demand for both potted plants and cut-flowers increased rapidly. More attention was paid to city and home ornamentation, and consequently more park and private conservatories were built. Each year witnessed improvements in construction, and consequently better grades of florists' products. In the last twenty years the advances which have been made in cultural conditions and the improvements in florists' crops have completely revolutionized the industry.

Improvements in glasshouse structures, and their heating.

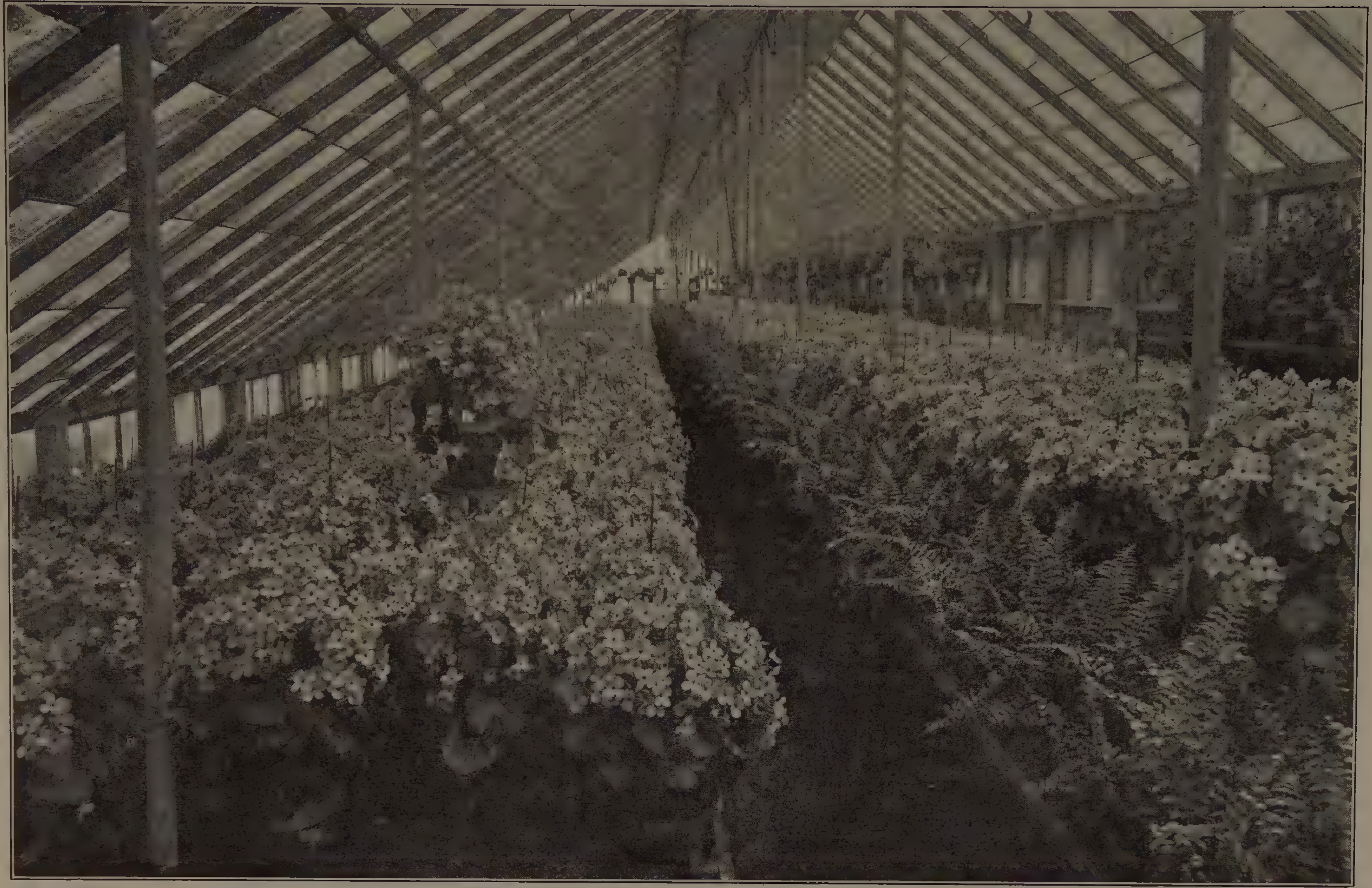
The tendency among flower-growers now is to build large houses in preference to smaller ones. It has been proved that the cost of construction is cheaper and that these may be more easily heated, that plant-growth is healthier because of a more uniform temperature, that they are easier to construct and can be cared for with greater economy of labor. Glass of larger size is now used, and more attention is given details of construction to increase the light factors in the house. There have been many changes in methods of heating glasshouses during their history. From the crude methods of flues, various devices for heating with hot water and steam have been devised. Both of these methods have their advantages. In the earlier methods of hot-water heating, the pipes were large and the system was an expensive one to install. Steam, therefore, came into popular favor, especially in large commercial establishments. It is still generally used. In some sections of the country and in the growing of some species of plants, hot water is still used; but here better systems for forcing the circulation of water have been installed so it is possible to use pipes of smaller dimensions.

Improvements in flower crops.

The work of the plant-breeders began to produce results in the the early nineties of last century. Many new varieties of chrysanthemums and carnations were put on the market. The violet then became an important florist crop. The early part of the twentieth century, however, witnessed a deluge of new varieties in practically all species. Breeding and improved cultural methods brought the qualities of the products far above anything produced in the previous century. Large-flowered carnations on long, stiff stems, violets of much larger sizes, and improved strains of chrysanthemums, roses and other species gave a remarkable impetus to the industry.

Previous to the beginning of the twentieth century, the American florist had interested himself in the culture of a wide variety of plants. In many cases the larger part of the products were sold at the range. The business, however, assumed such proportions that many up-to-date florists found that they could not profitably raise and dispose of their products at retail; consequently the retail flower-stores became more and more important factors in the disposal of the products. Wholesale commission houses and wholesale flower-markets were established in the larger cities so that the grower could devote nearly his entire time to the production of his crop. Many of the more progressive florists came to feel that they could not afford to grow a wide variety of plant species, but that it paid them better to grow one or two crops and to devote their whole attention to growing these in the finest manner possible so that they could produce flowers which were first quality in every respect; hence men came to be known as carnation, rose, violet, chrysanthemum, fern, palm and other specialists. This led to a wonderful improvement in the quality of flowers produced, and there was no call in the market for the inferior grades.

The buying public has had its influence in producing a better quality of florists' products. It has demanded not only better quality but something out of the ordinary. People tired of roses, carnations, violets and bulbous stock continually. The early part of the twentieth century witnessed a remarkable interest in orchids. The commercial man had to meet this demand. Twelve years ago an orchid could hardly be found outside of private conservatories. They were considered impossible to grow with financial success. Today nearly every



XLIII. Floriculture.—A house of begonias, with a row of ferns.

up-to-date retail grower has his section of orchids, and nearly every large floricultural center has its orchid specialist. For many years it was considered impossible to get satisfactory results from sweet peas under glass. The introduction of new strains and careful study of cultural conditions made the culture of this crop possible. The forcing of hardy herbaceous perennials like antirrhinums, delphiniums, and the like, and the forcing of hardy shrubs and other rare, hardy stock has furnished the flower-grower with a wonderful range of the more unusual plants.

Many large American flower-producers are now managing their business on a departmental scale. There are retail and wholesale departments; palm, carnation, orchid, rose, chrysanthemum and bedding departments, each in charge of a specialist in growing that particular crop.

The flower exhibitions held from time to time in the larger cities have had a beneficial effect on the uplift of the business. These exhibitions have been viewed by thousands of retail buyers. The choicest products of the flower-grower's skill have been exhibited, and the public has become dissatisfied with the inferior grade of commercial flowers offered for sale in the average flower-shops. They have demanded better products, and it has been the work of the flower-grower to produce these qualities.

Literature.

Within the last ten years there has been a remarkable increase in literature on flower-growing. Such papers as "The Florists' Exchange," "The American Florist," "Florists' Review," "Horticulture," "Gardening," "Gardener's Chronicle of America," have kept the grower closely in touch with the work in the gardening world. Many publications for the amateur, like "The Garden Magazine," "Country Life in America," "House & Garden," "Suburban Life" have assisted in giving the American people much valuable information regarding flower-growing about the home.

A long list of books might now be given, dealing with commercial and home flower-growing. Among these, valuable for the commercial man, are: "The American Carnation," C. W. Ward; "Commercial Rose-Culture," Eber Holmes; "Chrysanthemums for the Million," Charles H. Totty; "Violet-Culture," B. T. Galloway; "Orchid Culture," William Watson; "Florist's Manual," William Scott; "Plant-Culture," G. W. Oliver. Excellent books for the amateur are: "The Rose," H. B. Ellwanger; "Window-Gardening," H. B. Dorner; "The Garden Month by Month," Mrs. M. C. Sedgwick; "Making a Bulb Garden," Grace Tabor; "Roses and How to Grow Them," Doubleday, Page & Co.; "House Plants and How to Grow Them," Parker T. Barnes.

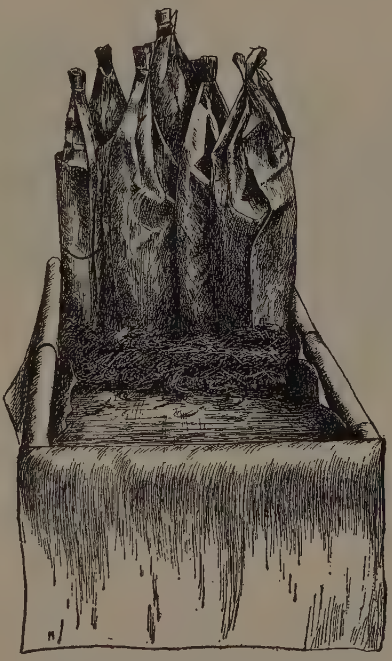
E. A. White.

FLORIDA ARROW-ROOT: *Zamia integrifolia.*

FLORIDA SWAMP LILY: *Crinum americanum.*

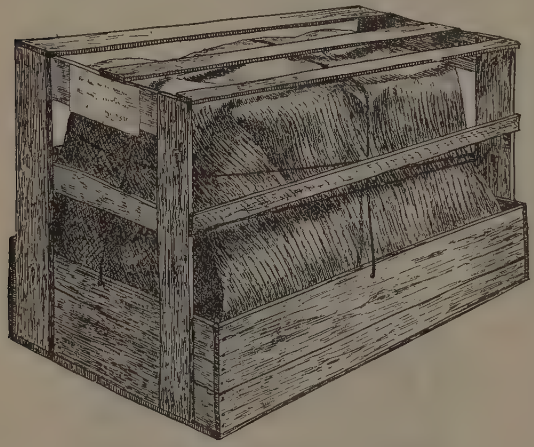
FLORISTS' PLANTS. A half-century ago the florist plant trade, although perhaps relatively of greater importance than at present, was not a prominent feature of the holiday trade. At Christmas there was some acceleration in the business, but this was overshadowed by the trade in cut-flowers. Easter was not a time of great plant sales. Church decorations in Protestant churches were not common. The sales of plants were more evenly distributed throughout the year, and the variety of plants sold was greater because the grower and consumer came in contact with each other, thus enabling the grower to dispose of plants which would not withstand the handling experienced by the plants of the present day. With the changing conditions in the family life of city residents, plants are no longer largely desired for window-gardens, but for temporary decoration of the living-rooms. The old type of plant-grower with his botanical collection has passed away, and in his place is the large commercial grower of a few staple plants which are grown in perfect condition. These growers produce a large quantity of plants for Christmas and then begin operations for Easter, as both of these dates now are times for the sending of gifts.

The trade in florist plants in the U. S., including bedding plants, is not less than $10,000,000, and it is encouraging that it is annually increasing without any diminution in the volume of the cut-flower business. Every up-to-date florist makes Christmas and Easter displays, and often special exhibits of chrysanthemums, and so on, are made when in season. The most successful of these displays are made in houses arranged for the purpose, for when made in an ordinary greenhouse with high benches, the taller plants are above the level of the eye and the effect is sacrificed. The best houses for displays are those of the conservatory type such as are seen in connection with some of the best flower stores. An ordinary greenhouse is often adapted for the purpose by constructing low benches, 18 to 20 inches high, for displaying bulbous plants and omitting them entirely for tall plants. The object sought in all cases is to have the plants placed so that the buyer looks down upon them. The show house is not very large for the reason that it is not always advisable to have too many plants of a kind in sight and also because at Easter the occurrence of warm, bright, unseasonable weather prevents keeping the plants in good condition. It is generally recognized that the display must be maintained in good condition by removing all unsightly plants and faded flowers. The stock should be replenished and rearranged every day.


1510. Pot-plants being packed for shipment.

The good salesman is one who has a knowledge of the care of plants, as well as their good points, their appropriateness for special occasions, and so on. Judicious advice on these points has much to do in winning and retaining customers. When a sale is made, the plants are carefully tagged with the correct address and the time it is to be delivered. If the plant is intended as a present, the sender's card is usually placed in a waterproof envelope which is fastened to the delivery tag. Deliveries of Christmas and Easter plants particularly should be promptly made, for nothing creates more dissatisfaction than late delivery. This requires skill in systematically arranging the plants according to the delivery routes, thus avoiding traversing the same territory a second time. It is axiomatic that the plant should be at its best on the day or at the function for which it is to be used. The weather has much to do with the condition of plants upon delivery. At Christmas, stock may be sent out twenty-four hours in advance, while at Easter stock delivered thus far in advance may not be satisfactory on Sunday.

All plants in pots, with the possible exception of the woody kinds, are staked and tied before handling. Plants are neatly wrapped with several thicknesses of paper to insure safe delivery. Plants with flowers which are easily bruised are usually wrapped with a sheet of cotton batting or waxed paper and then six to eight thicknesses of newspaper with clean plain paper outside. When plants must be shipped in cold weather, they must be wrapped as indicated and then set in strong wooden boxes. These boxes are approximately 4 feet long, 2 feet wide, and 8 inches deep. The corners are strengthened by the use of extra cleats. The box is first lined with corrugated paper, and then several thicknesses of newspaper which are left hanging over the edges of the box all around. Slightly dampened excelsior is used around the pots to prevent breakage and to make the package secure. The paper is then brought up over the plants and fastened (Fig. 1510). Over the top a frame is built of ½ x 4-inch cleating lumber which prevents damage to the plants (Fig. 1511).



1511. The completed crate for shipment.

The number of plants that can be had in perfection at Christmas is limited and does not change from year to year. Among the leading flowering plants are poinsettias in pots and pans, azaleas, cyclamen and Lorraine begonias. The more expensive plants are ericas (*E. melanthera*) and camellias.

The berried plants commonly grown are the Jerusalem cherry (*Solanum Capsicastrum*), Christmas pepper (*S. Pseudo-Capsicum*), aucubas, ardisias, holly and Otaheite oranges.

The foliage plants include araucarias, boxwood, crotons, nephrolepis, *Pandanus Veitchii*, *Ficus pandurata* and *F. elastica*, Dracæna (*D. terminalis*, *D. fragrans*, *D. Mandæana*, *D. Godseffiana*, *D.* Lord Wolseley) and Adiantum.

Easter is a great plant day and there is a great variety of suitable plants. The leading flowering plant is, of course, *Lilium longiflorum*.

It would be difficult to determine the relative market value of the different plants, but among the bulbs tulips, hyacinths, narcissi and lilies-of-the-valley are staples. These are sold in pots or pans, singly or in plant combinations. A very large amount of bulbous material is sold at Easter. Cinerarias, *Primula obconica* and *P. sinensis* are a smaller factor than formerly on the large city markets, but still remain an important item in the smaller cities. Marguerites and spirea (*Astilbe japonica*), when well grown, find a good sale in New York. A number of violets and pansies planted in low dishes, and small blooming geraniums, from 3-inch pots, planted in 6- to 12-inch bulb pans, are salable plants in many localities. Among the shrubs the azaleas are most important, although in some cities they show a decline in popularity. Following these are genistas, which have been for many years a popular Easter plant. *Hydrangea rosea* and *H. Otaksa* were long standard varieties, but now will probably give way to the new French varieties. In some cities hydrangeas are less used for Easter than for Memorial Day. Lilacs, Charles X, Marie Legraye and Madame Lemoine are among the best. The lilac has the disadvantage of a great display of wood and leaves before the terminal flowers charm the eye. It therefore requires accessories to relieve this effect, and the demand for this plant is limited. Rhododendrons are slowly gaining in popularity. Acacias and ericas are becoming more common each year. *Acacia longifolia* and *A. paradoxa* are now grown for market. *Erica Cavendishii* is used for individual plants, while *E. cupressina* is used in making up baskets of plants. *Bougainvillea Sanderiana*, like the rambler roses, may be made to assume definite forms which are especially beautiful when the bracts are well colored. Among the other shrubs more or less common are *Azalea mollis*, *Deutzia gracilis*, *Spiræa Van Houttei*, double almond, hawthorns, and *Wistaria multijuga*. In the last decade the rambler roses have taken a prominent place among Easter plants and each year a larger number are grown. The crimson rambler was first used, but is now superseded by the more beautiful Dorothy Perkins, Tausendschon, Lady Gay, Newport Fairy and Hiawatha. The rambler roses possess the advantage that they can be trained into pleasing forms. The polyantha roses are popular also, and among the varieties used are Madame Norbert Levavasseur (Baby Rambler), Mrs. Cutbush and Orleans. The latter are very satisfactory when sold either as individual plants with waterproof crepe paper pot-covers or in baskets with other plants. The hybrid perpetuals are still grown, but not in so large quantities as formerly. The varieties now grown are Frau Karl Druschki, Mrs. John Laing and Magna Charta.

Easter brings a demand for some of the larger sizes of foliage plants for decorations in churches, retail stores, and the like. The small-sized ferns, dracenas and palms are required in making up baskets of plants.

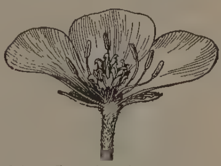
The florist of fifty years ago thought that a good blooming plant did not need any aids to make it attractive. This has changed, and the florists are seeking every means to make their plants more attractive. The most inexpensive method of doing this is to use pot-covers of waterproof crepe paper in color suited to the subjects. Porto Rican or raffia matting in color is used in a similar manner.

The trade of the present day disposes of a great many plants in baskets or boxes. Individual plant-baskets, with handles, to hold even as large as 6- to 8-inch pots are often used. Baskets, usually of the peach-basket shape, are also utilized for an endless variety of combinations of flowering and foliage plants (Fig. 1512). The baskets are supplied with a metal receptacle or lining so that the pots may be removed from the plants, giving them the appearance of having been grown together. Formerly these receptacles were filled by the retailers, but now many are prepared at the greenhouses according to order and sent to the stores where all that is needed is to add the basket and the ribbons. The latter plan relieves the store of much work in the busy season, but may not result in as artistic combinations as can be secured by a person trained in the work. The manufacturers of florist supplies are striving to meet the demand for something new in baskets and boxes. New material, weaves and shapes, are seen every year. There is also a great variety of coloring. There are green, gilt, white, red, ivory, bronze and copper shades as well as two-tone effects, as red and green, white and green, blue and white, pink and white, and yellow and white. The variety offered is such that baskets can be secured in sizes to suit either the high-class or popular trade. The small florist usually begins by using some of the willow, rattan or splint baskets which are filled with inexpensive plants. Cedar tubs, wood and terra-cotta boxes are also used. The demand for pleasing arrangements of flowering and foliage plants in boxes, jardinières, hampers, baskets, pans and dishes of fanciful design, light and airy, dainty and graceful, is increasing and is receiving the attention of the growers of holiday plants. It is generally recognized that the work offers as wide a scope for inventive genius and artistic discernment as any phase of the florist business. A. C. Beal.

1512. A made-up basket of living plants.

FLOWER is a popular or semi-technical term for the aggregate of structures having to do with sexual reproduction in the higher plants. The concept usually includes color, and a definite organization as outlined below; therefore, gymnosperms, ferns, and the lower plants are said not to have true flowers. As ordinarily understood, the flower is a showy structure useful for esthetic purposes, gratifying in color and often in odor, and in some way intimately connected with the production of seed; but analogous although inconspicuous structures are sometimes popularly recognized as "flowers." To the layman, many of our common herbs, shrubs and trees are said not to bear flowers at all, although the botanist recognizes that at least inconspicuous greenish flowers are borne by all of these plants unless they be ferns or gymnosperms.

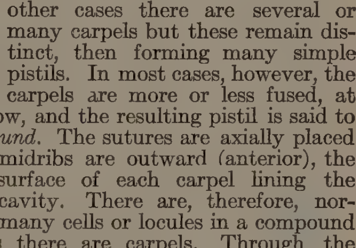
Botanically considered, the flower when complete consists of four sets of organs from the center outward: the gynœcium, andrœcium, corolla, and calyx, to which may possibly be added a fifth, the disk (Figs. 1513–1516).



1513. Longitudinal section of a buttercup flower.

The gynœcium Figs. 1517–1519).—In the center are one or more small flask-like or pouch-like organs (*pistils*) which are hollow and contain tiny bud-like growths (ovules). The pistils collectively are termed the *gynœcium* (female household). The hollow ovule-bearing part of the pistil is the *ovary*. At the summit of the ovary is a more or less sticky or roughened surface, the *stigma*, which may rest directly on the ovary (*sessile*) or may be raised aloft on a stalk (the *style*). From the ovules seeds are developed (see *Fertilization*).

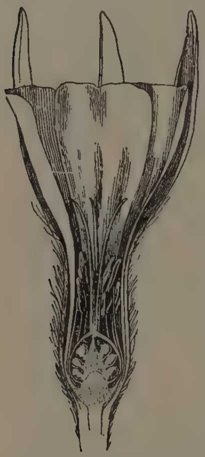
The fundamental or unit foliar organ of the gynœcium is termed a *carpel*. In the simplest case there is but one carpel, folded to form a pouch with the upper ventral leaf-surface within, and the margins forming a suture down one side. The structure thus formed is a *simple pistil*. The suture bears the ovules and is termed the *placenta*, and is normally ovuliferous throughout, but frequently only the uppermost or basal ovule of the row is present (*apical* and *suspended*, or *basal* and *erect*). In other cases there are several or many carpels but these remain distinct, then forming many simple pistils. In most cases, however, the carpels are more or less fused, at least below, and the resulting pistil is said to be *compound*. The sutures are axially placed and the midribs are outward (anterior), the ventral surface of each carpel lining the ovarian cavity. There are, therefore, normally as many cells or locules in a compound ovary as there are carpels. Through the partical opening-out of each carpel while the margins of adjacent carpels still remain united, the ovary may become one-celled though still compound, as in the violet. The placenta will in this case be *parietal* (on the walls). In certain families (Caryophyllaceæ, Primulaceæ) the compound ovaries are one-celled but have a *basal placenta*, or this basal placenta may project upward into the single chamber of the ovary as a central post on which the ovules are borne (*free-central placenta*) (Fig. 1515). To determine the number of carpels in a given pistil is often difficult. If there are several separate stigmas or styles, it is usually safe to infer that each represents a carpel. If the ovary is several-celled, each cell usually denotes a carpel and in one-celled ovaries the placentæ, if parietal, denote the number of carpels. In the case of a pistil with a one-celled ovary, basal placenta, one style and one stigma, only developmental or phylogenetic studies will show how many carpels are present.



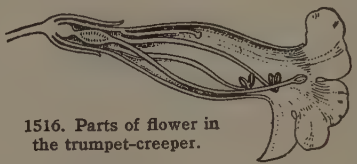
1514. Structure of flower.—The plum.

se. sepals; *p.* petals; *sta.* stamens; *o.* ovary; *s.* style; *st.* stigma. The pistil consists of the ovary, style, and stigma. It contains the seed part. The stamens are tipped with anthers, in which the pollen is borne. The ovary, *o*, ripens into the fruit.

Ovaries are sometimes raised on a stalk within the flower, as in the caper family (*gynophore*) and in Coptis (*thecophore*). The styles and stigmas are frequently much modified for pollination purposes, as in the orchids and in the pitcher plant (Sarracenia).



1515. Section of a flower of corn-cockle.
Showing torus, ovary, styles, stamens and floral envelopes.



1516. Parts of flower in the trumpet-creeper.

The andrœcium (Figs. 1520–1522).—Surrounding the pistils are found one or more whorls of organs called *stamens,* collectively termed the *andrœcium* (male household). A stamen normally consists of a slender stalk (*filament*) capped by an enlarged part (*anther*), although this stalk is often wanting. The anther contains one, two or four cavities (locules or "cells") in which a powdery mass (*pollen*) is located. The so-called cells are not to be confused with the cells of the plant tissue. The gynœcium and andrœcium, which are both necessary for the production of good seed, are termed the *essential organs* of the flower. Ordinarily each stamen represents one foliar unit. When many stamens are present, this increase in number is brought about in one of three ways: by an increase in the number of whorls of stamens (Caryophyllaceæ, Rosaceæ) or an increase in length of the spiral (Ranunculus), by the conversion of petals into stamens, or by a breaking up of each individual stamen into many (St. John's-wort). The first method is by far the most common. In the last method, the origin is usually betrayed by the aggregation of the stamens in fascicles. Normally both filament and anther of each stamen is free from its neighbors, but in some cases the filaments are all joined into a tube around the pistil (*monadelphous*) as in the hollyhock, or into two groups (*diadelphous*) as in the pea family. These two groups are usually very unequal in the pea tribes, nine stamens being united while the tenth is free. In other cases the anthers may be coherent while the filaments are free (*syngenecious*), as in the Compositæ. In the Sterculiaceæ, the filaments or tube of filaments are variously toothed, crested or otherwise modified; while in the Orchidaceæ they are fused with the style to form the so-called *column* or *gynandrium* of the flower. In the milkweeds, each stamen bears a cornucopia-like appendage which together form the *crown.* In Viola, two of the filaments bear nectar-spurs.

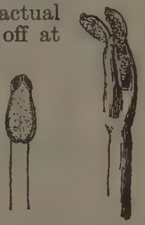
1517. Compound pistil of catnip.
Showing 4-parted ovary, long style, 2 stigmas (*s*).

1518. Head of simple pistils in hepatica.

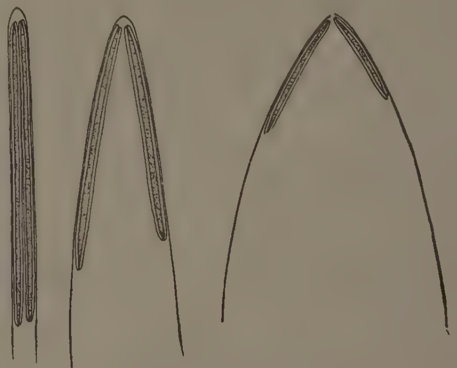
The anthers are usually oval or oblong bodies fixed to the filament by the base (*basal*), or by the center (*versatile*). At maturity they contain normally two pollen-sacs separated by a sterile tissue (*connective*) which is a prolongation of the filament. The anther-sacs are sometimes four in number, sometimes reduced to one through fusion. The walls of the sacs contain a peculiar fibrous layer by the hygroscopic properties of which they are enabled to curve back, thus opening the pollen-chamber along definite prearranged lines and allowing the pollen to escape. The dehiscence is usually by a longitudinal slit, but it is frequently by terminal pores as in the Ericaceæ, or rarely by transverse slits. In Vaccinium, the pores are carried aloft on long tube-like extensions of the anther, while in Berberis the pores are provided with an uplifting trap-door.

1519. Compound pistil of a St. John's-wort. It has five carpels.

The pollen-grains are normally spherical or oval cells in which the two or three nuclei representing the male gametophyte are found. The wall consists of a delicate inner layer (*intine*), surrounded by a thicker cutinized layer (*exine*) which is either smooth or externally sculptured in various ways. Specialized places in the extine serve as germ-pores through which the pollen-tubes easily emerge. These pores are sometimes provided with actual lids (pumpkin and squash) which pop off at the proper time. The pollen in the Orchidaceæ and Asclepiadaceæ is more or less waxy and coheres into one or several masses (*pollinia*). The pollinia are in many cases produced into minute stalks which connect with a sticky gland that is designed to become attached to visiting insects. On the departure of the insect the gland, together with the attached pollinia, is carried away to the next flower. The pollen-grains of orchids, heaths and a few other plants are composed of two to four cells (*compound*).

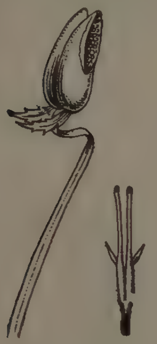


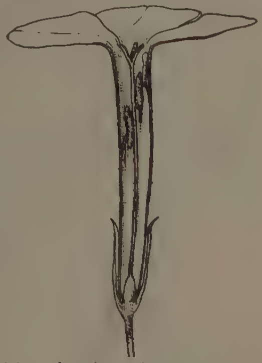
1520. Anthers, showing dehiscence; azalea on left, barberry on right.



1521. Transitions from stamens to petals in the water-lily.

Corolla (Figs. 1523–1527).—Outside the stamens is found a whorl of flat leaf-like usually colored organs termed *petals* or collectively the *corolla.* The petals are usually in one whorl and follow the numerical plan of the flower closely; rarely are they fewer or numerous. They are normally flat or concave colored bodies distinct from one another (*polypetalous*) and regularly spreading from the receptacle. But in many plants the petals are connate (*gamopetalous*) into one structure for a greater or less distance toward the apices. The united part is the *tube,* the lobed border the *limb* of the gamopetalous corolla. The lobes or segments are either all alike and equally placed (*regular corolla*) or they vary much among themselves (*irregular corolla*). If the lobes are united higher up into groups of two and three, as in many mints, the upper more or less erect, the lower spreading, the corolla is *bilabiate* (Fig. 1526). A particular type of irregular polypetalous corolla is the so-called *papilionaceous corolla* (Fig. 1527) found in the pea family and consisting of a *standard*, two lateral *wings*, and a *keel*. A regular corolla is radially symmetrical, possessing an infinite number of planes of symmetry (*actinomorphic*), while most irregular flowers possess but one plane of symmetry (*zygomorphic*). A few possess no such plane (as Canna). Gamopetalous corollas fall into certain types based on the shape of the tube and limb. The more common types are *rotate*, *salverform*, *funnelform*, *bell-shaped*, *tubular*, and *urceolate*.

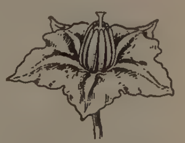

1522. Stamens of erica (left) and vaccinium.


1523. A salver-shaped corolla.

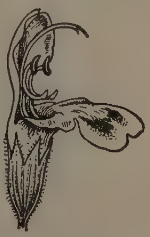
1524. Funnelform corolla of morning-glory.

The corolla may be variously colored. White flowers owe their color to light reflected from air which is between the cells of the petals, as shown by the fact that when waterlogged these petals become transparent. Yellows and oranges are usually due to abundant minute color bodies (*chromoplasts*) located within the cells of the petal. Reds and blues are due to colored cell-sap.

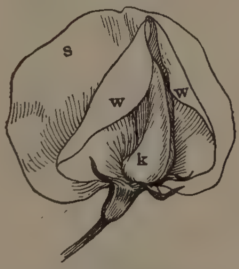
Calyx.—Surrounding the corolla is another set or whorl of organs, the *calyx*, the individual organs of which are *sepals*. The calyx is usually composed of as many sepals as there are petals, but in the Portulacaceæ there are but two sepals, while in some plants there are many. In many of the Ranunculaceæ and other families they are colored like petals and replace these organs. In the Easter lily and tulip they are similar to the petals. In the Compositæ the calyx is reduced to scales or bristles or is absent entirely. The sepals are frequently connate (*gamosepalous*), and the resulting structure is often irregular. The calyx and corolla are together termed the *floral envelopes*. If they are similar in appearance, and, therefore, difficult to recognize, as in the Easter lily, they are collectively termed *perianth*.


1525. Rotate corolla and connivent stamens of solanum.

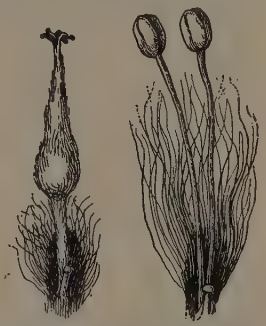
Disk (Figs. 1528, 1529).—In many plants a glandular *disk*, or series of glands corresponding to such a disk, is found. When present, this disk may lie either between the stamens and pistil (*intrastaminal*) as is the common case, or more rarely between the stamens and petals (*extrastaminal*). The genus Acer is peculiar in having some species with an intrastaminal disk while in others it is extrastaminal. By some morphologists this disk is considered a fifth set of organs in the flower, while by others it is considered merely as an outgrowth of the floral axis or receptacle on which all other parts of the flower are inserted. The disk is in many cases characteristic of whole families, which led Bentham and Hooker to place these families together in the series Discifloræ. The disk also occurs in other families not obviously related. It forms a ring about the styles in some Rubiaceæ. The glandular cup of Populus and the finger-like gland of Salix are probably to be referred here, although by some they have been interpreted as a reduced perianth. The disk usually functions as a nectary. In shape and structure it is very diverse. It may be cup-shaped, saucer-shaped, annular, regular, or irregular; or it may be of separate glands, either simple or variously lobed. It may line the cup of the perigynous flower or it may be adnate to the surface of the ovary.


1526. Labiate corolla of salvia.

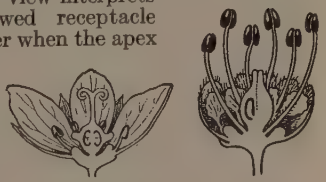
Receptacle (Figs. 1530, 1531).—The apex of the stem on which the various floral organs are inserted is termed the *receptacle* or *torus*. This is normally a simple club-shaped thickening of the summit of the stem. In the strawberry it is much enlarged and fleshy, forming the greater part of the fruit. In the raspberry it remains on the plant when the "fruit" is removed. In the Compositæ there is a common receptacle for all the flowers of the head, as well as for each individual flower. In the caper family the receptacle is often prolonged upward, forming a stalk for the ovary within the flower (*gynophore*).



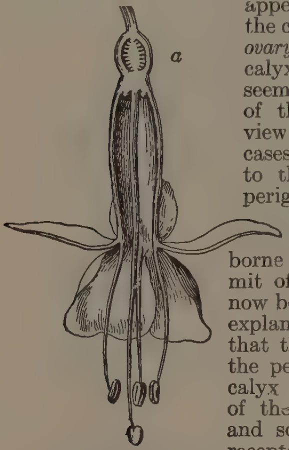
1527. A papilionaceous corolla.—The sweet pea. *s*, standard; *w*, *w*, wings; *k*, keel.


1528. Showing the disk in the willow flower. Pistillate flower at *a;* staminate flower at *b*.

In the Rosaceæ, Onagraceæ, Saxifragaceæ, and in various other plants, the stamens, petals and sepals are *perigynous*, that is they are inserted on the edge of a cup-shaped organ which springs either from below the ovary or from its summit. The view has been held that the gamosepalous calyx here bears the stamens and petals on its tube. Another early proposed view has in recent years gained ground rapidly and is now widely accepted. This view interprets the cup as a hollowed receptacle likened to a glove-finger when the apex is slightly pushed in. The ovary at the bottom of the cup is really apical as usual, while the sepals, petals and stamens, located at the higher margin of the cup,

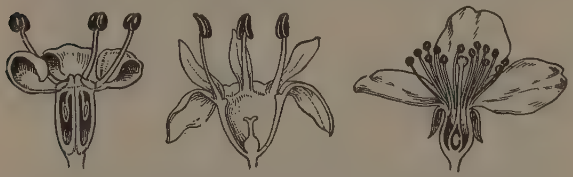

1529. Disks in flowers of maple family.

are as usual inserted morphologically lower on the receptacle. While in most flowers the ovary is inserted on the summit of the receptacle (*superior ovary*), in others, as in the Orchidaceæ, Onagraceæ, Umbelliferæ, Rubiaceæ, and Compositæ, the ovary appears to occupy the center of the club-shaped structure (*inferior ovary*) below the insertion of the calyx, corolla, and stamens which seem to spring from the summit of the ovary (*epigynous*). The view has been held that in such cases a gamosepalous calyx similar to that described above in the perigynous flower has grown fast to the surface of the ovary, and that the other organs are borne on the calyx-tube at the summit of the ovary. The opinion is now becoming general that the true explanation of the phenomenon is that the cup-shaped receptacle of the perigynous flower, and not the calyx has grown fast to the surface of the ovary. In the Onagraceæ and some other plants, the hollow receptacle has not only grown fast to the whole surface of the ovary but projects beyond it so that such flowers have an inferior ovary and are also perigynous (Fig. 1530).



1530. The fuchsia flower in longitudinal section.

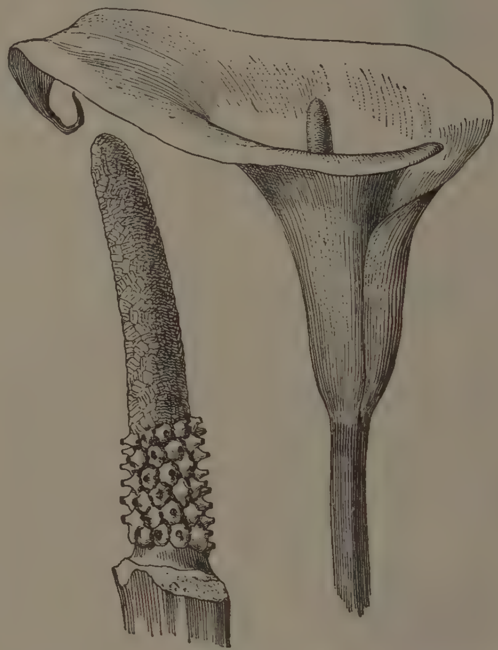
Bracts.—The leaves on the peduncles and upper parts of the stem adjacent to the flower deserve a word. They are often much modified in size, shape and color from the normal foliage leaves, being often much reduced. They sometimes form an involucre around the flower, and are calyx-like, as in hepatica and strawberry. In other cases, they form a showy corolla-like involucre, as in Cornus and Poinsettia, and are then often mistaken for a corolla. In the Arum, a single huge bract (*spathe*) envelopes the entire flower-cluster (*spadix*); these are well shown in Figs. 1532, 1533.



1531. *a*, **epigynous flower;** *b* **and** *c*, **perigynous flowers.**

Incomplete flowers.—Not all of the floral sets described above are always present. The flowers may be *incomplete.* Thus the corolla may be wanting (flower *apetalous*) as in hepatica and anemone, or both calyx and corolla may be absent (*naked* or *achlamydeous*) as in willow and pepper, or the stamens may be wanting (*imperfect* or *unisexual*, pistillate flower) as in willows and oaks, or the pistils may be absent (*staminate* flowers of willows and oaks). At least one set of essential organs is necessary for a functional flower, but in some cases, through specialization for other purposes, both sets may be absent. Thus the marginal flowers of the hydrangea are enlarged and showy for insect attraction, but are *neutral.* In the case of unisexual flowers, the stamens and pistils may be borne in different flowers on the same plant (*monœcious*) as in the oak and birch, or on separate plants (*diœcious*) as in the willow and poplar. In some plants, as in the maple, certain flowers are unisexual while others are perfect, a condition termed *polygamous.*

The plan of the flower.—If the numbers of parts in each set are counted, a certain number will be found to be common to many or all of the sets of the same flower. This is the *numerical plan* of the flower (Fig. 1534). Thus in geranium there are five sepals, five petals, ten stamens, and five parts to the pistil. The stamens, when numerous, are often in multiples of this numerical plan. The parts of the pistil, on the other hand, frequently show a reduction from the numerical plan as exhibited by other parts of the flower. The number of parts in some flowers is so irregular that a numerical plan can be made out only with difficulty, while in some flowers such a plan is apparently wanting.



1532. The great white spathe (and the spadix) of the garden calla.

The members of each floral set are usually inserted all at the same height on the floral axis (receptacle), and are therefore in whorls, although frequently more than one whorl occurs in the andrœcium and rarely in other sets. The parts of one set normally fall between those of the set next outside and next inside, and are said to alternate with these. In some families, as for example in the Ranunculaceæ and Magnoliaceæ, some or all of the organs of the flower are inserted spirally on the receptacle like scales on a pine cone. In such cases there is often a marked intergrading between the organs of the adjacent sets at the boundary line. The relative position of parts of the flower may be graphically indicated by means of a diagramatic cross-sectional plan, called the floral diagram (see Fig. 1534.). Information in regard to the number and union of parts may also be indicated by so-called floral formulæ as follows:

$$\underset{5}{\mathrm{K}}\qquad \underbrace{\underset{5}{\overset{\frown}{\mathrm{C}}}\qquad \underset{5+5}{\mathrm{A}}}\qquad \underset{2}{\overset{\frown}{\mathrm{G}}}$$

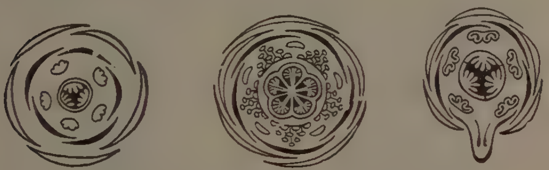
In this formula, the letters from left to right indicate calyx, corolla, andrœcium, and gynœcium respectively. The brackets over the letters indicate a fusion of parts in the same set, while the bracket underneath indicates a fusion of different sets. The above flower would be polysepalous with five sepals, gamo-

1533. Spathe and spadix of Jack-in-the-pulpit.

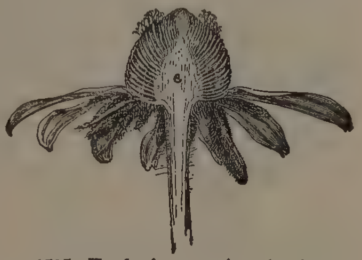
petalous of five fused petals, have ten stamens in two whorls all inserted on the corolla, and two carpels united into one pistil with a superior ovary.

Double flowers.—Occasionally in nature and very frequently in cultivation, the number of petals becomes very greatly increased, often to the exclusion of the stamens and pistils, so that the flower presents a full rosette-like appearance. Such flowers are popularly said to be "full" or "double." The increase in petals is apparently a mutation, but is stimulated by changes in nutrition due to cultivation. Most double-flowered varieties tend strongly to run out. The origin of the extra petals is not always the same. In most cases, as in double hollyhocks and carnations, the stamens and even carpels have been transformed into petals; in rarer cases the extra structures are interpolated organs. Double "flowers" in the sunflower, golden glow, and the like, are simply heads in which all disk-flowers are converted into ray-flowers (see next paragraph).

False flowers of the Compositæ (Figs. 1535, 1536).—The so-called flowers of such plants as the white daisy, sunflower, aster, goldenrod, and dandelion are found on close study not to be flowers at all, but flower-clusters of the type termed *heads*. These heads are remarkably specialized for economy and division of labor. This community of flowers functions as does one individual flower in other cases, and the whole make-up of the head simulates a flower to a remarkable degree. Around the head is a calyx-like involucre of bracts, functioning like a calyx as a protection in the bud. In daisy, sunflower and others there is a corolla-like part consisting of highly modified *ray-flowers* or *ligulate flowers*. The central part of the head in these plants is occupied by *disk-flowers*. The aster, goldenrod, cone-flower and many others are like the daisy, while in the dandelion, chicory, hawkweed and sow thistle the head consists of ligulate flowers only, and in the thistle, boneset and iron weed the head contains only disk-flowers. The morphology of the less specialized disk-flower is as follows: A one-celled, one-seeded inferior ovary is surmounted by a variously modified calyx, which is often wanting, and a tubular five-toothed gamopetalous corolla. On the corolla-tube are borne five syngenesious stamens, and from the summit of the ovary projects a single style which is two-branched above. The ray-flowers have been developed from the disk type in the course of evolution by greatly increasing the size of such a tubular corolla, and by splitting the tube down one side, at the same time flattening out the slit portion. In the sunflower, there was no great change in color as the ray-flowers evolved, while in the daisy and the asters the rays are of a different color from the disk-flowers. Since the involucre performs for the whole head the same function that the individual calyx does normally for each flower, there is no longer any necessity for the calyx. Therefore, following the general rule that a useless structure tends either to disappear or take on a new function, the calyx has become obsolete in some cases while in others it has become modified into scales, awns or bristles (*pappus*) which aid the fruit in dissemination. In many cases the ray-flowers have been sacrificed entirely for insect attraction and have become sterile. By this massing of the flowers, more flowers may be pollinated by one insect visitor, and more easily pollinated. Efficiency and economy run through the whole organization of the composite head to a remarkable degree.

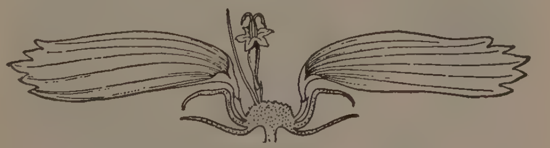

1534. Diagrams of the flower of drosera, vismia and viola.

The biology of the flower.—The flower is a structure developed by plants to promote and safeguard sexual reproduction, primarily in land plants, and to bring about cross-pollination in these plants. The three definite agents of cross-pollination with which the flower is concerned are water, wind and insects. The agent for which the flower is adapted exerts a profound influence on the structure of the flower. Only insect-pollinated flowers are normally showy. Water- and wind-pollinated flowers are usually green and small, with often a total loss of corolla or of both corolla and calyx. The pollen in such plants is produced in abundance to make up for great loss, as it is wafted indiscriminately through the air. Water plants usually flower at the surface and are wind- or insect-pollinated. The true water-pollinated or hydrophilous plants are few in number. Naias, Zannichellia, Zostera and Ruppia may be mentioned, all of which belong to the Naiadaceæ. In Zostera, the pollen-grains are long and spiral as a further adaptation to water-pollination.



1535. Head of composite, showing receptacle at *e*, bearing the disk-flowers. The long rays are shown, and beneath them the hairy involucre.—Rudbeckia.

Wind-pollinated or anemophilous flowers (Figs. 1537, 1538) are very numerous. Elodes and Vallisneria (eel-grass) among aquatic plants may be mentioned. Vallisneria is remarkable because the staminate flowers break off before anthesis, rise to the surface, expand, and are floated about by the wind, the three reflexed sepals acting as floats which cannot be upset. The pistillate flowers are attached to long peduncles which extend to the surface of the water, whether it is shallow or deep. The pistillate and staminate flowers are so shaped that when the two float together the stamens are in exactly the right place to touch the stigmas. After pollination, the peduncle coils up and the fruit matures under water. The catkin-bearing trees are all anemophilous and have very much reduced flowers. The willows are both wind- and insect-pollinated. Among herbs the grasses, sedges, rushes, and sorrels (Rumex) are wind-pollinated. Interesting in this respect is Thalictrum (meadow-rue) of the Ranunculaceæ, the flowers of which are wholly green and insignificant with large exserted anthers and abundant pollen and feathery stigmas. It thus exhibits perfectly the various adaptations to wind-pollination in a family that is normally insect-pollinated and has showy flowers. The time of flowering of wind-pollinated flowers often shows a distinct relation to efficiency. The wind-pollinated trees and shrubs bloom in early spring before the leaves interfere with the passage of pollen through the air. The grasses and other herbaceous anemophilous plants bloom before the tall growth of late summer has matured, at which time plants are mostly insect-pollinated. The pollen-grains of anemophilous plants are nearly always smooth and very light, and usually con-


1536. Parts in the head of a coreopsis.

tain starch as a reserve food instead of oil. This pollen is capable of withstanding greater desiccation than is the pollen of most insect-pollinated flowers. In the pines, each grain is provided with two air-sacs to increase the buoyancy and to expose greater surface to the wind.

1537. Wind-pollinated flower of juncus. (Enlarged)

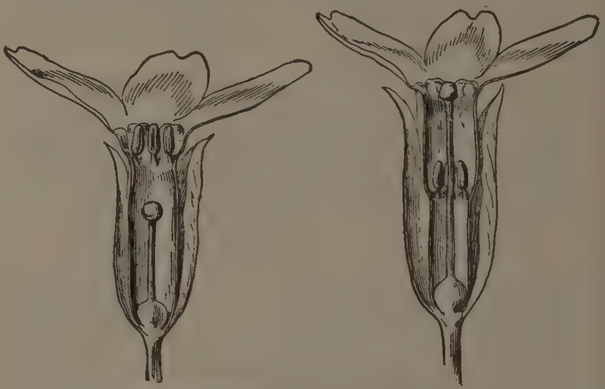
Insect-pollinated or entomophilous flowers must meet two distinct problems: they must entice the insect to the flower; and they must guide the insect in such a way that cross-pollination will be assured. The attractive agents are four in number,—color, honey, scent, and abundant pollen (for pollen-eating insects), but they are not usually all found in one species. Color is provided mainly by the corolla, but the calyx (in Anemone) or even the bracts around the flowers (in Cornus and Poinsettia) may function thus instead. Attempts have been made to show that certain colors are more attractive than others to certain groups of insects. Yellow has been designated as the color for flies and beetles, blue and red for hymenoptera, browns for carrion insects and wasps, and whites for night-flying insects especially. Honey (nectar) is produced in a great variety of flowers and it is a reward for the insect visit. The honey-secreting glands (nectaries) are borne either on the disk or on the petals, but more rarely are they staminal or ovarian. In order that the honey may not be appropriated by undesirable insects which would not effect cross-pollination, it is frequently placed at the end of spurs or grooves which are adapted to the proboscis of the insects for which the flower is adapted. Various markings of the corolla, such as bright eye-spots and dark converging lines, called honey-guides, often direct the insect accurately to the honey, and in such a way that cross-pollination will be accomplished. An interesting case is the violet, where the honey is produced by staminal nectaries but is collected and stored in the spur of the lower petal. To this storehouse honey-guides in the form of purple lines lead. The beard in the throat of the violet flower protects the pollen from rain and also discourages the insect from entering the flower on the wrong side. Scent as a means of attracting insects is very general, and is especially frequent in nocturnal and crepuscular (twilight) flowers. The scent is due to volatile oils produced mainly by the petals. These oily compounds are comparatively few in number and often re-occur in plants that are wholly unrelated. Thus the clove scent is found also in some orchids, and the violet scent is found with slight modification in the flowers of several plants. Flowers that attract pollen-eating insects are often yellow, as buttercups and dandelion, but flowers of other colors are frequently visited at least by bees that carry away quantities of pollen in their femoral pollen-pockets.

1538. Wind-pollinated flower of a grass. —Poa. (Enlarged)

Most pollen is injured by exposure to rain and dew. The grains tend to swell and burst owing to the excessive osmotic pressure. It is for this reason that pollen when studied or germinated in the laboratory must be mounted in a sugar solution approximating the density of the stigmatic fluid. It is not a surprise, therefore, to find that nature has protected the pollen of many flowers from rain, by structural means. Thus, bell-shaped hanging flowers, salverform corollas with a small eye which requires pressure to force a drop of water in, closed corollas of the snapdragon type, beard in the throat, flowers that droop only in wet weather, flowers that close up during rain, and many other contrivances, are adaptations, in part at least, for the protection of the pollen.

The protection of the honey and pollen from unbidden insect guests and the safeguarding of the flower from self-pollination by such insects, has led to various protective devices. The closed throat of the toadflax and snapdragon, the small eye of the salverform corolla, the beard in the violet, setose peduncles and stems over which insects can walk with difficulty, glandular peduncles and bands of viscid matter which serve as a sort of sticky fly-paper to prevent wingless insects from reaching the flower, are all adaptations of this nature. Remarkable in this respect is the teasel, which has connate-perfoliate leaves. These leaves form a basin around the stem at each node. The basins fill with water during each shower, and, as the water will not evaporate for several days, there is a veritable moat around the stem at each node which climbing insects cannot pass.

Cross-pollination is frequently rendered more certain by various mechanical devices. Thus a device of great efficiency found in many plants is the separation of stamens and pistils in different flowers (*diclinism*) which renders self-pollination impossible. In this respect, the diœcious plant is the most perfect type. Diclinism is especially common in anemophilous plants, in which the pollen is blown about indiscriminately. Another efficient device consists in the early maturation of the stigmas (*proterogyny*) or of the stamens (*proterandry*) before the other sex in the same flower (condition of *dichogamy*). Still another, although much less common device, is the production of two or three types of flowers in the same species in which the styles and stamens are of different lengths (*heteromorphism*). Thus in the primrose (Fig. 1539) one flower may have long stamens and short style, and another flower short stamens and long style (*dimorphic*), so that an insect coming from a long-stamened flower will have pollen on his proboscis at exactly the right height to brush the stigma of the long-styled flower. In *Lythrum Salicaria*, the various combinations between the length of style and of each of the two sets of stamens furnish three types of flowers (*trimorphic*). Other devices are often found. Thus in some flowers the pollen of another plant is prepotent in fertilization over that of the same plant if both are placed on the stigma at the same time. There are also many special structural mechanisms in individual species, a study of which forms one of the most interesting chapters in biology. Here may be



1539. Dimorphic flowers of primula.

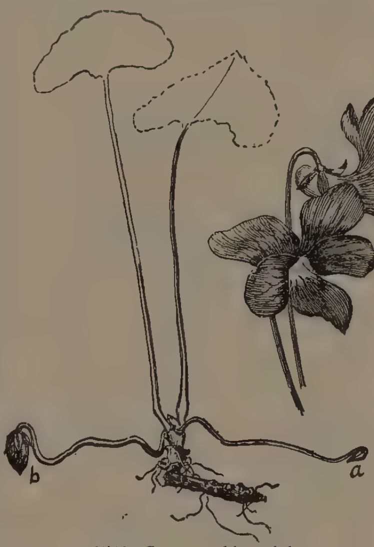
mentioned the wonderful adaptations of the orchid flowers, the catapulting of the pollen of the orchid Catasetum against the insect, the lever-hammering stamens of Salvia, the deliberate stuffing of the Yucca stigma with pollen by the Pronuba moth as she deposits eggs in the ovary, the gall flowers and caprification of the fig, and many other equally extraordinary cases.

Although most plants seem to need cross-pollination and to have structures adapted to this end, there are some in which definite preparation is made for close- or self-pollination. Thus certain plants, as violet, barley, Polygala, Dalibarda (Fig. 1217) and others, produce *cleistogamous flowers*, which are small green apetalous structures often hidden by the leaves or are even subterranean. The calyx of these flowers never opens. The anthers lie against the stigma, and on opening, the pollen is immediately applied to the stigma of that same flower. Seeds produced by such flowers are often much in excess of those produced by the showy flowers of the same species. In the violet (Fig. 1540), cleistogamous flowers are produced in abundance through the summer after the showy flowers have disappeared. Incidentally it is interesting that these flowers in violets are more important in classification than are the showy ones.

Evolution of the flower.—In the Thallophyta, Bryophyta and Pteridophyta there is no flower as that term is here used. The sporophyte shows an increasing complexity through these groups, but there is no differentiation into an organ that could popularly or even technically be called a flower. Among the Gymnosperms, the cones of the Pinaceæ have been likened to a flower with many carpels but with no calyx or corolla, while those of the Gnetaceæ are still more flower-like. The true flower, however, is a structure characteristic of the Angiosperms.

There are two prominent theories in regard to the origin of the flower. First, the foliar theory holds that sepals, petals, stamens and carpels are real leaves modified in the course of evolution from the foliage-leaves of their ancestors. Floral parts are, therefore, metamorphosed leaves. The evolution in this case would have been from below toward the apex of the floral shoot, or from the foliage leaves toward the carpels. Certain teratological conditions have been cited in support of this theory, especially when petals, stamens and sometimes carpels have been replaced by green leaves. This has been considered merely a reversion to ancestral conditions. *Trillium grandiflorum* frequently furnishes cases of this sort. This theory has been exclusively held in the past. Recently another wholly different theory has been proposed by Bower, and is now accepted by very many botanists. This has been termed Bower's sterilization hypothesis. It holds that the foliage-leaves together with the sepals and petals are sterilized sporophylls and that evolution has been from above downward. Specifically it holds that although the simple sporophyte of the mosses consisted as at present of a capsule and seta undifferentiated into stem and leaves, in some special groups of mosses, however, the spore-bearing region around the columella of the capsule became segmented into transverse belts separated by sterile belts. Coincident with this, the exterior of the capsule became lobed in such a way that each fertile belt came to lie in the axil of a lobe. From this it is easy to postulate an increase in size of the lobes to form the scale-leaves of the club-mosses and selaginellas, and an increase in specialization of the fertile belt to form the axillary sporangium of these plants. It is but a step now to the angiospermous flower, in which some of the sterile sporophylls have become modified into petals and sepals instead of leaves. The demand for a large independently growing sporophyte is thought to have led to the sterilization of the sporophylls. According to this theory, leaves are recent rather than primitive structures. The sterilization theory has the advantage of being more in accord with modern knowledge of the evolution of organs in these groups.

Floral evolution within the angiosperms is also difficult to follow and botanists differ as to its course. It is by many held that the most ancient type is the acyclic type as represented by the Ranunculaceæ, Magnoliaceæ and the like. Another although gradually diminishing school holds that the simple flowers of the Gramineæ among the monocotyledons and the Amentiferæ among the dicotyledons are the most primitive. The high specialization of other parts of these plants and the likelihood that the flowers have been simplified because of the adoption of the wind method of pollination, strongly suggests that these flowers are not primitive but specialized.



1540. Common blue violet.

The familiar flowers are shown, natural size. The corolla is spurred. Later in the season, cleistogamous flowers are often borne on the surface of the ground. A small one is shown at *a*. A nearly mature pod is shown at *b*. Both *a* and *b* are one-third natural size.

The flower from standpoint of comparative morphology.—The newer evolutionary morphology has brought about changes in viewpoint in regard to floral parts, and a new terminology has arisen. According to present knowledge, there is in some algæ and in all bryophytes, pteridophytes and spermophytes a definite alternation of two generations or phases in the life-history of each plant, separated by a unicellular condition of the organism. One of these, the more primitive, bears only sex-cells (eggs and sperms) called *gametes* and is termed the *gametophyte*, while the other bears spores only and is termed the *sporophyte*. These generations have exactly reversed their relative size, complexity and degree of independence as evolution has progressed. The originally independent carbon-assimilating gametophyte of the mosses has become in the higher plants wholly parasitic on the sporophyte and is entirely lacking in green color. On the other hand the sporophyte, represented in the mosses and liverworts by the dependent capsule and seta stalk, has become the real plant, bearing leaves and flowers in the higher group. The thalloid reduced gametophyte of the ferns is termed a *prothallium*, bearing sperm-cells in *antheridia* and an egg-cell in an *archegonium*. This prothallium has become differentiated in the more specialized family Selaginellaceae into two types differing in size and complexity of structure, and originating from spores of different size. The large type of spore (*megaspore* or *macrospore*) gives rise to the large female prothallium which bears the archegonia; and the small spore (*microsspore*) gives rise to the small male prothallium bearing only a single antheridium. The prothallia of both sexes are very much reduced and permanently inclosed within the spore wall. In the flower-bearing plants, the reduction and dependence of the gametophyte have been carried much farther. The male gametophyte or

male prothallium is inclosed in the pollen-grain and the female prothallium within the embryo-sac. The spore-bearing chamber or chambers (*sporangia*) corresponding to the capsule in the mosses are borne on leaves (*sporophylls*) in the ferns and fern allies. If these terms used for the mosses and ferns are now applied to the organs of the higher plants the terminology will be as follows: Stamens, *microsporophylls;* anther-chambers, *microsporangia;* pollen-grain, *microspore;* nuclei within pollen-grain, *male prothallium* (male gametophyte); carpel, *megasporophyll;* ovule, *megasporangium;* embryo-sac, *megaspore;* cells within embryo-sac except embryo, *female prothallium* (female gametophyte); the embryo growing from the fertilized egg is the *daughter sporophyte.* A mature seed, therefore, contains parts of three generations; seed-coats and nucellus, if present=sporophyte; endosperm (according to one interpretation)=gametophyte; and embryo=daughter sporophyte. This terminology is now gaining ground over the old in morphological circles for it shows the relation of the flower to organs in the lower groups.
K. M. Wiegand.

FLOWER-DE-LUCE. The origin of the Fleur-de-lis of the French coat of arms is not known. By some it is supposed to represent the head of a spear, by others the flower of a lily. It has also been derived from the points of a crown and from several animal forms, as bees and toads. Apparently, the iris has nothing to do with the heraldic Fleur-de-lis. This name as applied to iris is of later origin and of a purely botanical significance, referring chiefly to *I. germanica.* See under "Fleur," Larousse, Dictionaire du XIX Siècle, 8:450.
H. Hasselbring.

FLOWER-FENCE, BARBADOES: *Poinciana pulcherrima.*

FLOWER-OF-AN-HOUR: *Hibiscus Trionum.*

FLOWERING MAPLE: *Abutilon.*

FLÚGGEA (for Fluegge, a German botanist of early 19th century). *Euphorbiàceæ.* Tropical shrubs, sometimes cult. in the greenhouse: lvs. alternate, simple, entire: fls. apetalous, the staminate in axillary clusters, with imbricate calyx and rudimentary pistil, the pistillate borne singly, and with a lobed disk present, styles slender—ovules 2 in each of the 3 cells: seeds grooved on the inner face.—Six species in the Old World tropics. Related to Phyllanthus. One species, *F. leucopy̆rus,* Willd., with orbicular to obovate lvs. and edible white berries has been intro. to cult. in Eu. It is a bushy shrub from Asia south to Austral. and is said to need rich mold and moist high temperature. Prop. by cuttings.
J. B. S. Norton.

FŒNÍCULUM (diminutive from the Latin for *hay,* because of its odor). *Umbellíferæ.* About four species of annual, biennial and perennial herbs, spread from the Canaries to W. Asia, one being the Fennel of gardens (which see). Glabrous, often tall: lvs. pinnately decompound, the segms. linear or filiform: fls. yellow, in compound umbels, the calyx-teeth obsolete, the petals broadish, emarginate: fr. oblong or ellipsoidal, not laterally compressed, the carpels half-terete, ribbed and flattened. **F. vulgàre,** Hill (*F. officinàle,* All. *F. Fœnículum,* Karst.), of S. Eu., the fennel, is a perennial of short duration, cult. as an annual or biennial for its aromatic seeds and lvs.: erect and branched, 3–5 ft.: lvs. 3–4 times pinnate, the ultimate segms. very narrow and thread-like and rather stiff in the wild and in dry places but very slender when cult., the petioles broad and clasping: umbels large, of 15–20 or more rays. Often run wild.—Under cult., the petiole has become broad and sheathing and other changes have taken place. What are considered to be horticultural forms have been described as distinct species: var. **piperìtum,** Hort. (*F. piperìtum,* DC.), the carosella of S. Italy, the young sts. of which, inclosed in the sheathing petioles, are eaten raw in the early season; var. **dúlce,** Alef. (*F. dúlce,* Mill.), the finocchio or Florence fennel, a low-growing condensed plant, with very large lf.-bases.
L. H. B.

FOKIÈNIA (named after the Chinese province Fokien where the tree grows). *Pinàceæ.* A tree intermediate in its characters between Chamæcyparis and Libocedrus, resembling the latter in the foliage and in the seeds having 2 very unequal lateral wings; the cone is subglobose and composed of numerous peltate scales, each bearing 2 seeds.—One species in Fokien. **F. Hódginsii,** Henry & Thomas (*Cuprèssus Hódginsii,* Dunn). Tree to 40 ft.: branchlets much flattened, the lateral lvs. with spreading acute apex, green above and with white markings below: cone 1 in. long, ripening the second year. G.C. III. 49:66, 67.—Suited only for cult. in warmer temperate regions.
Alfred Rehder.

1541. House constructed without rafters.

FOLIAGE PLANTS. A term used to designate plants that are grown for the general effect of their foliage rather than for their flowers. The term is indefinite. In some cases, and more correctly, it is used for plants with unique or interesting leaves—usually colored—as coleus, Rex begonia, peperomia, calathea, farfugium. In other cases it is used to designate plants of full foliage and graceful habit,—plants that are prized for their general habit quite as much as for the characters of the individual leaves. Of this latter class, ferns, palms, grevillea, screw pine, araucaria, fatsia, ricinus, are leading examples. The latter class contains the most popular commercial subjects, and they are much used in room and table decorations. The plants are often rented for use in temporary decorations. For the culture of foliage plants, refer to the various genera.

FONTANÈSIA (after Réné Louiche Desfontaines, prominent French botanist, 1752–1833, director of the botanical garden at Paris). *Oleàceæ.* Shrubs grown for their handsome foliage.

Deciduous, glabrous: branches quadrangular: lvs. opposite, short-petioled, entire: fls. perfect, small, in axillary clusters forming terminal leafy panicles; calyx minute, 4-parted; petals 4, narrow, small; stamens 2, exceeding the petals; ovary superior, usually 2-celled; stigma 2-lobed: fr. a flat, winged nutlet.—Two species in W. Asia and China.

These are slender-branched shrubs with rather narrow leaves and small whitish flowers in short terminal panicles. They retain the foliage unchanged until late in fall, and are well adapted for shrubberies, growing in any good garden soil. *F. Fortunei* is hardy as far north as Massachusetts, *F. phillyræoides* only half-hardy. Propagation is readily effected by greenwood cuttings under glass in early summer; also by layers and by seed.

Fórtunei, Carr. (*F. phillyræoìdes* var. *sinénsis,* Debeaux. *F. califórnica,* Hort.). Shrub, to 15 ft.: lvs. lanceolate or ovate-lanceolate, acuminate, shining, quite entire, 2–4 in. long: fls. in axillary and terminal clusters, forming a narrow, leafy panicle: fr. broad, oval or ovate, ¼–⅓in. long. May, June. China. R.H. 1859, p. 43.—Sometimes united with the following, to which it is superior by its more vigorous growth, the darker and larger foliage, and by the greater hardiness. In China it is used as a hedge plant and may be recommended for trial in this country.

phillyræoìdes, Lab. Shrub, to 10 ft.: lvs. ovate-lanceolate or narrow-elliptic, mostly with rough, minutely denticulate margin, 1½–2½ in. long: fls. and frs. like those of the preceding species. W. Asia. L.B.C. 14:1308. Var. **angustifòlia,** Rehd. (*F. angustifòlia,* Dipp.). Lvs. narrow-lanceolate or oblong-lanceolate.

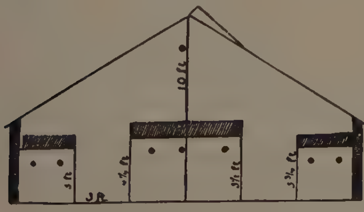
Alfred Rehder.

FORAGE PLANTS are mentioned only incidentally in this work, as they belong to agriculture rather than to horticulture. They are mostly grasses and leguminous plants, and have a very large special literature, much of which can be secured from the United States Department of Agriculture, Washington, D. C., the various experiment stations, and separate books. Some of the forage plants are of interest to horticulturists as green-manures and cover-crops.

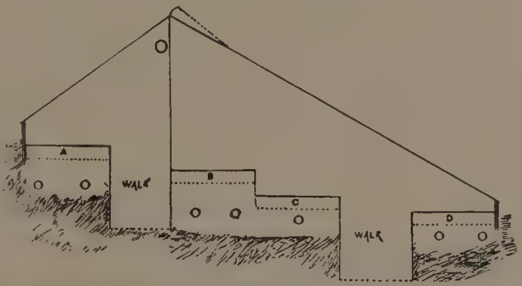
FORCING. The word forcing is variously used. Properly, it should designate the growing of plants outside their usual or normal season. This distinguishes forcing from the ordinary purpose of the glasshouse, which is to imitate the usual season in which plants grow. For example, begonias are not forced: we endeavor to protect them and to give them the season and the conditions under which they grow in the wild. Carnations when flowered in the winter are forced, because we transpose their seasons. Chrysanthemums blooming in October and November are not forced: they are only protected. Sometimes the word forcing is used in a very special sense, to denote the production of flowers from bulbs or tubers in a very short time under the influence of a very high temperature. Thus, the lily-of-the-valley may be placed in a temperature of 90° or above, and the large buds be forced to throw out their flowers before the plant secures a firm foothold on the soil.

A forcing-house is a building in which plants are forced; but the term has come to denote a simple glasshouse in which plants are grown only for sale, in distinction from private conservatories, or more elaborate structures used for the display of plants. See *Greenhouse.*

The forcing industry in America is very large. At first it was confined mostly to cut-flowers (which see), but pot-plants, vegetables and fruits are receiving more and more attention. The staple forced flowers are the rose, carnation, violet, lily-of-the-valley, and various bulbs. These are treated under their respective names. Of vegetables, the most important forcing species is lettuce. This is followed by tomato, cucumber and radish. Other vegetables are of very minor importance as forcing products. The growing of fruits under glass is receiving attention in this country. Very little of this fruit-raising is really forcing, however, since the glass inclosure is used chiefly to protect the plants and to enable better care to be given: the fruit does not ripen much ahead of its normal season. Of this category are glasshouse grapes. Strawberries are really forced, however, the whole period of vegetation and bloom being greatly forwarded. Much attention is now given by florists to the forcing of hardy plants; and this is one of the most delightful of horticultural operations for the amateur. Many of our native plants can be forced with the greatest satisfaction, but the business is usually confined to imported stock of florists' plants.



1542. Even span forcing-house, 20 feet wide, heated by steam.



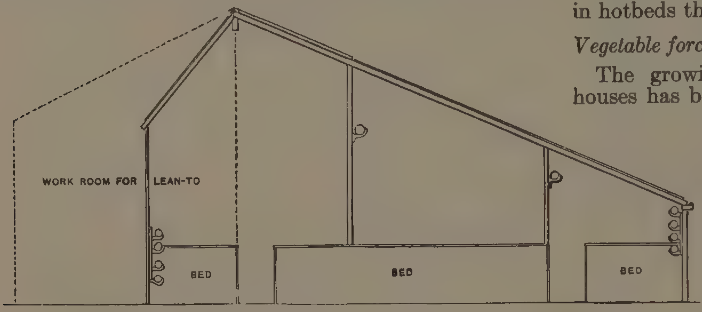
1543. Uneven span forcing-house, 20 feet wide, on a side hill. Heated by steam.

The forcing-house should be of the simplest construction. The plan should secure the greatest amount of light, economy of space and of heating, and directness and simplicity in every operation. The simple sash-bar frame, without rafters (Fig. 1541), is most satisfactory when properly constructed. The side walls should be low and the roof comparatively flat. Often there is no glass on the side walls. Under most conditions, the house should run north and south, particularly if even in span (Fig. 1542), but the lay of the land and the location of existing features usually determine the direction. If the house runs east and west, or if it stands on sloping land (Fig. 1543), an uneven or broken span is usually advisable. The widely different opinions respecting the merits and demerits of the different spans are proof that each is good under certain circumstances. It is the prevailing opinion that, in broken spans, the long roof should be to the south; yet formerly some glasshouses had the short span—which is then very steep—facing the south (Fig. 1546).

In America, all forcing-houses are heated by means of small wrought-iron pipes, which fit together with threads. The old-time cast-iron flues may be employed for conservatories, but they are too bungling for forcing-houses. They do not admit of sufficient modification in layout to adapt them to the long and often crooked runs of forcing-house establishments. The wrought-iron pipes are heated either by steam or water. Each system has its advocates, which means that each has its merits. Steam is less costly to install, since less pipe is required. It also admits of greater variation in the layout. Crooks and obstacles are more easily overcome. In a large establishment, the place may be heated up sooner. Hot water gives a milder heat because the pipes are less hot. Of itself, it is less liable to fluctuations. Theoretically, it is less expensive in fuel; but in practice, the cost of running is found to depend more on the character of the particular system and the operations of the fireman than on the medium itself. When properly installed, steam is as uniform in action as water, and it is adapted to larger areas and to higher temperatures (p. 1403).

Very good shape for a forcing-house in the proportion of breadth to length is probably as 1 is to 4 or 5. The best houses are rarely less than 18 or 20 feet wide, and rarely more than 30 to 35 feet. From 400 to 800 feet is considered to be a good range of profitable length.

Houses of greater length are constructed, but they must be considered as special cases. Parallel houses are often "nested" with good results,—the adjoining houses resting on a common wall. When the various houses are to be used for one kind of crop, the partitions between them may be omitted; a very large space may then be covered with practically one house without the necessity of rearing a high roof. The size of house tends constantly to increase.



1544. Uneven span forcing-house, 30 feet wide. Hot water.

The accompanying illustrations (Figs. 1541–1548) show old and recent styles of American forcing-houses. For further discussion of glasshouses, see *Greenhouse.*

L. H. B.

The forcing of vegetables.

The title "vegetable-forcing" may be applied to any method of growing vegetables which will cause them to mature or to become suitable for use in a shorter time or at a different season than when grown under normal conditions. This includes the growing of vegetables in coldframes, hotbeds and vegetable forcing-houses.

Coldframes.

Coldframes are box-like structures about 6 feet in width and of any desired length. They usually are built to run east and west and with the north side a foot or so higher than the south side. These frames are sometimes covered with muslin but usually with sash in which glass is fastened. The frames serve not only as a protection against cold winds and frost but as a means of catching the sun's rays which may pass through them. In this way, a higher temperature can be maintained in these frames than that which prevails in the open at the same time. Coldframes are used for the purpose of starting crops early and thus growing them to maturity earlier than they can be grown outside, and also for the growing of plants for the field-crops.

Hotbeds.

Hotbeds are similar in construction to coldframes. The chief difference is that in the hotbeds fresh horse-manure is used to supply heat. The manure is firmly packed to a considerable depth, in a pit dug for that purpose inside the frame. Rich garden soil is placed over the manure to a depth of about 6 inches. As the manure ferments, the heat thus formed penetrates the soil above, thus furnishing a satisfactory medium for plant-growth.

Hotbeds are in common use in connection with private gardens in all sections of the country except where freezing weather does not occur. They are used extensively in a commerical way in and near most of the large cities in northern latitudes, and especially such cities as Philadelphia, Cincinnati and St. Louis. Crops are grown to maturity more commonly in hotbeds than in coldframes.

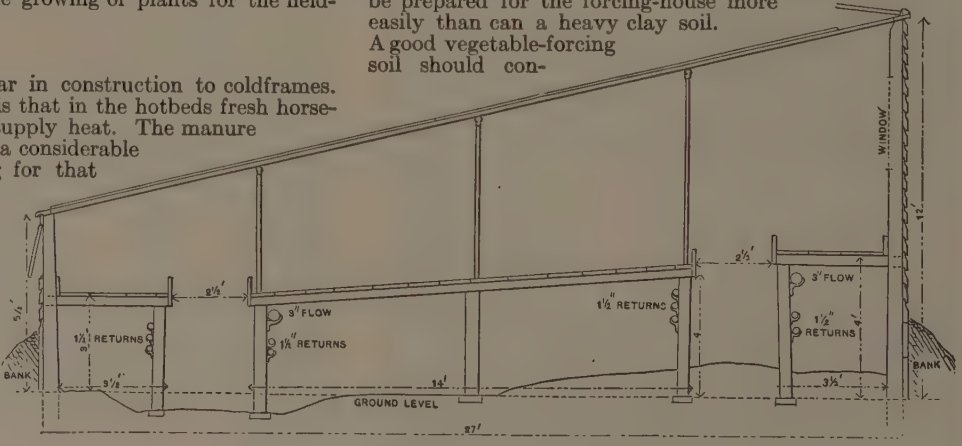
Vegetable forcing-houses. Figs. 1547, 1548.

The growing of vegetables in vegetable forcing-houses has become a very popular and profitable line of work in many sections of the country. The area of glass devoted to vegetables has increased with great rapidity during the last few years. The first section of the country to become noted as a forcing center was Boston, Massachusetts. Soon afterward Grand Rapids, Michigan, became an important vegetable-forcing locality. The Grand Rapids growers did not copy after the Boston growers, however, as their soil, houses, varieties and methods in general differed very materially from those used by the Boston growers.

Vegetable-forcing, as conducted by the Boston growers, was rapidly extended to other places in the eastern part of the United States. The development of the industry was even more rapid and became more extensive in Michigan and nearby states. Grand Rapids methods, with modifications, were followed very largely in this section of the country. The greatest development has occurred in northern Ohio, especially at Ashtabula, Toledo and Cleveland. However, nearly every city of much size, in the northern part of the United States, has in or near it one or more vegetable forcing-houses. The amount of money invested in these houses is enormous. A single acre under glass represents an expenditure of $15,000 to $25,000, depending on the kind of material used and the cost of the material at the time the building was done.

Success in the growing of vegetables under glass does not depend upon climate. Vegetables can be grown in greenhouses in any state of the Union and in any country on the earth in which vegetation flourishes. However, vegetables can be grown under glass more cheaply in moderately warm climates than in cold regions, and more easily where much sunshine occurs than where cloudy weather is prevalent.

As the gardener makes his own soil for the forcing-house, to a considerable extent, the character of the native soil is not so important as is the case with most field-grown crops. However, a sandy soil can be prepared for the forcing-house more easily than can a heavy clay soil. A good vegetable-forcing soil should con-



1545. Lean-to lettuce house, 26 feet wide. Hot water.

tain an abundance of plant-food, should have a good water-holding capacity, be capable of easy working and be as free as possible from weed seeds and disease germs.

A very important factor in determining the financial return from vegetable-forcing is nearness to market. Other things being equal, the closer the grower can get to the consumer the greater the profit. Cheapness of fuel for heating purposes is also very important. If coal is to be used, the hauling should be considered when estimating the cost.

No one thing has more to do with the success or failure in vegetable-forcing than the man who runs the business. To be a success he must enjoy the work. He should have an understanding of the requirements of the crops to be grown and ability to apply himself diligently to his work. Careful attention to details is of greater importance in connection with vegetable-forcing than with any other line of vegetable-growing. Besides being a good grower, he should be a good salesman.

The forcing of lettuce. Fig. 1548.

Head lettuce.—As this crop has special treatment elsewhere, it will need but brief mention here. The Boston growers grew head lettuce from the beginning. They were successful in the growing of it and the markets in which they sold demanded head lettuce. The soil used by the Boston growers is of a very loose texture, being well filled with organic matter. In working over the soil in the houses it is spaded to a depth of 1½ to 2 feet. Large quantities of manure are added at frequent intervals. Some growers practise steam sterilization. Heavy watering is done before the plants are set in the beds. The water-holding capacity of the soil is so great that usually no further watering is necessary until the following crop is to be put in. The lettuce is allowed to develop until the heads become large and solid, when they are cut, trimmed, washed and carefully packed in boxes, three dozen heads in a box. If the lettuce is to be shipped some distance it is put up in cases holding one barrel. It is sold by the dozen heads.

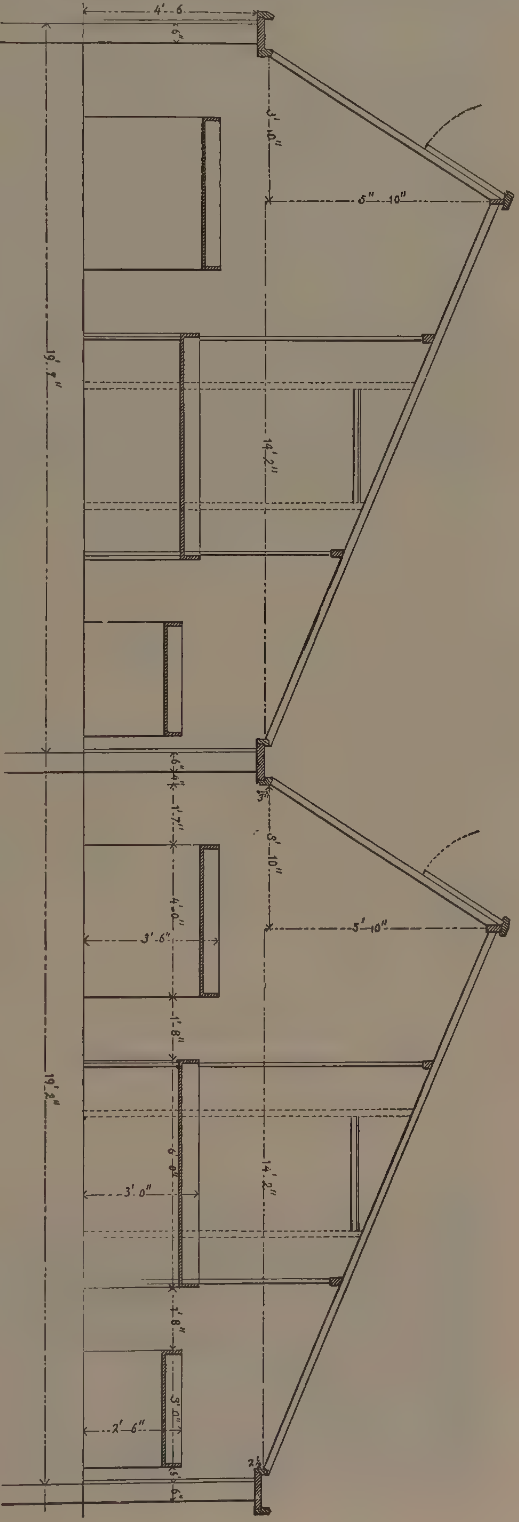
Leaf lettuce.—It was not until Eugene Davis, of Grand Rapids, Michigan, originated and introduced the Grand Rapids leaf lettuce that lettuce-forcing became popular in the middle West. The growing of head lettuce under glass did not prove a success in this region. The cry of "over-production" was heard soon after the forcing of leaf lettuce began and has continued until the present time. With the exception of short periods during the fall months of some years, there has been no over-production of this crop.

Cultural methods.

When leaf lettuce is sold by the pound, the usual practice is to grow three crops of lettuce followed by one of cucumbers or tomatoes. When the lettuce is sold by the dozen, more than three crops are commonly grown before the ground is given over to the other crop. Lettuce sold by the pound is usually grown to a much larger size than when it is sold by the dozen.

The seed for the first crop of lettuce is sown from the first to the middle of August. It is sown in flats or in solid beds, usually broadcast but sometimes in rows. It is sown very thickly and if covered at all with earth the covering is very shallow, not enough soil being used to hide the seeds entirely from view. In warm weather one thickness of heavy brown paper or burlap is thoroughly moistened and placed over the seed as soon as it has been sown and watered. The covering is left on until the seed germinates which will vary from two to five days according to the amount of sunshine and degree of heat in the house. It should not be left on too long as spindling, nearly worthless plants will result. In cold, cloudy weather seeds sown in flats will germinate best if covered with glass for a few days after sowing.

In about a week, in bright weather, and from ten days to two weeks in cloudy weather, the seedlings will



1546. Short-span-to-the-south forcing-houses. A type of house formerly somewhat in use.

be ready to prick off. This operation is tedious and requires deft hands and practice to do it well and rapidly. The plants are separated one from another, care being taken not to injure them, and transplanted into other flats or beds. They are spaced about 2 inches apart each way. All diseased and poorly rooted plants are discarded. The number of plants that can be pricked off in a day of ten hours will vary from 5,000 to 10,000 according to the skill of the operator. Some of the best growers sterilize the soil in which the seeds are sown and the seedlings grown. This not only insures plants free from disease but eradicates all weeds by destroying the vitality of the weed seed.

All the care that is required for the seedlings is to keep the planthouse at the proper temperature, see that the soil is supplied with the right amount of moisture, remove all weeds which appear and stir the soil when necessary to keep it from crusting. The house in which the plants are grown should be well ventilated in order to guard against the damping-off of the seedlings. An occasional smudging with some form of tobacco is necessary to keep the green aphis under control. The cabbage butterfly frequently deposits eggs on fall-grown plants and these hatch into green worms which feed upon the lettuce in the beds. The butterflies should be killed when seen flying near the plants and should be guarded against as much as possible.

In the fall when the days are long and many of them bright, lettuce will be large enough to set in the permanent beds about four weeks after it is pricked off. When lettuce is sold by the pound it should not be set closer than 7 by 7 inches or farther apart than 8 by 8 inches for best results. When sold by the dozen it can be set as close as 5 by 5 inches, although the best distance will depend upon the size of plants which are found most profitable to grow. The first crop of lettuce will be ready to cut, when sold by the pound, in six to eight weeks from the time the plants are set in the permanent beds. It should give a yield of at least three-quarters of a pound a square foot.

The prices that the growers have realized for the first cuttings of lettuce have, during recent years, been rather low. The cost of growing this crop is small, however, as little fuel is needed for heating purposes. The second and third crops will require more time for their proper development than the first. They should give a heavier yield, however, and the prices secured are usually better.

It is very important to have plants of the right size to set in the beds as soon as the ground can be prepared after a crop is out. To be able to do this, it is necessary to make frequent sowings of seed. In large greenhouse establishments, seeds should be sown every day or every other day, while in a small forcing-house a sowing should be made once a week throughout the season. No time should be lost between crops as time is money in the vegetable-forcing business. Considerable time can be gained by making a second transplanting for the second and third crops. The plants should be removed from the flats before they begin to crowd and placed in 2-inch pots. These pots should be plunged in the soil between the newly set plants in the permanent beds. The pots should be placed in the beds as thick again as the permanent plants are set. By following this plan, the plants can be grown to a much larger size without injury than is possible when they are grown only in the flats.

Grand Rapids lettuce will stand a wide range of temperature without serious injury, but the lower the temperature the slower the growth and tougher the leaves, and the higher the temperature the more rapid the growth and more tender the leaves. A low temperature will produce heavy lettuce and a high temperature light lettuce. As long as thorough ventilation is given, little danger of injury from high temperature will occur, but high temperature and closed ventilators invite disaster. The best results are secured when the temperature is held at 45° to 50° at night until the lettuce has attained sufficient height, 8 to 10 inches, when it should be kept as near 45° as possible. The lowering of the temperature at the finishing of the crop will increase the weight considerably. If the houses are arranged so that it is possible to keep but one temperature, a night temperature of 45° to 48° is most satisfactory. The day temperature may vary greatly without injuring the lettuce if the ventilators and heating pipes receive proper attention. Ventilation should be given at all times during the day except when the weather is very cold or stormy. The heating pipes should be turned off whenever the heat from the sun is sufficient to give the proper temperature in the houses.

Sub-irrigation is the most satisfactory method of watering lettuce. The water can be applied at any time through the tile without wetting the foliage. This method is not in general use because of the expense of installation. Water-tight benches or beds are essential for its successful operation.

The overhead or Skinner system of watering is in

1547. A range of forcing-houses.

common use, especially in large establishments. It is a great improvement over the old method of watering with the hose. It is not only more efficient but requires much less time and labor than the hose method. With it, water can be applied in any quantity desired and so gently that no baking of the soil will occur.

Whatever the method of watering, the soil should be thoroughly soaked as soon as the plants are set. It should not be allowed to dry out, as the plants will be damaged by the resulting check in growth. When the water is applied to the surface, the watering should be done only on bright days and early enough in the day so that the lettuce leaves will dry off before night.

Insects and diseases of lettuce.

The one insect that is always ready to make its appearance is the green aphis. Fumigating regularly, at least once a week with tobacco stems or extract of tobacco will keep this insect under control. In case it secures a foothold and one smudging does not do the work, a second the following night will put the aphis under control. Tobacco dust scattered on the surface of the soil before the plants are set will help to repel the aphis.

The cabbage worm is often troublesome, especially on the fall crop. Poisoning when the plants are small, and hand-picking when the crop approaches maturity, are the most practical remedies. Snails and slugs sometimes do damage, but do not as a rule appear when clean methods of culture are practised. Other insects, such as the white fly and black aphis, make their appearance on lettuce occasionally but seldom become serious.

Among the more common diseases affecting lettuce is the drop or stem-rot. This rot acts very much like the damping-off of the seedlings. It is a fungous trouble and can be controlled to a large extent by thorough ventilation. Sterilization of the soil with steam sometimes becomes necessary in extreme cases. There are other less serious forms of rot affecting leaf lettuce, all of which can be kept under control, as a rule, by proper ventilation. Watering at night or during cloudy weather and high temperatures with closed ventilators are practices which will tend to induce attacks of rot.

Another lettuce trouble of common occurrence is "rosette." This is a disease which attacks the roots, retarding and in some instances stopping the growth of the plants. Sterilizing with formaldehyde, used at the rate of two pounds to fifty gallons of water and applying one gallon of the mixture to each square foot of space, has frequently given good results. Sterilizing with steam, while more expensive, is more certain to prove effective. When the lettuce is allowed to suffer from the lack of sufficient moisture in the soil, it will often have the appearance of lettuce rosette. The grower should examine the soil carefully when the lettuce appears stunted in growth to be sure that the trouble is not lack of water instead of a diseased condition before going to the expense of sterilizing.

Cutting and packing lettuce.

There is a certain time in the development of leaf lettuce when it is of just the right size and of the proper degree of maturity to cut for market. This can be determined by the feeling and appearance of the lettuce. When ready to cut, the lettuce plants will feel firm when the hand is pressed gently on the top. If the edges of the leaves show a few brownish spots, the cuttings should be done without delay. The ability to judge just when the lettuce should be cut will be acquired by practice.

Some of the large growers who make a business of shipping lettuce, pack it in barrels. It is placed with the top of the lettuce plants toward the outside of the barrel and, when filled, the barrel is covered with burlap. Fifty pounds are usually packed in an apple or cracker barrel and from seventy-five to ninety pounds in a sugar barrel. The lettuce is protected from frost in cold weather by lining the barrel with paper. In warm weather, holes are cut in the sides of the barrels to admit air and thus prevent heating.

1548. A modern house of lettuce.

Boxes of different sizes but usually holding about a bushel are used by many growers. When the lettuce is to be shipped, the boxes are covered with wooden covers. When it is to be sold on a local market the lettuce is covered with paper or left uncovered. At Ashtabula, Ohio, all of the growers pack their lettuce in small baskets with stationary handles. Three and one-quarter pounds is packed in each basket and the lettuce and basket are covered neatly with paper.

The kind and size of the package and the amount of lettuce put in is not of so much importance as the quality of the lettuce and the care with which it is prepared for market. Bright, clean, crisp lettuce will sell much more readily than tough, dirty lettuce. All dead or yellow leaves should be removed and all dirt washed off.

Marketing.

At some of the large forcing centers the growers are organized for the purpose of marketing their crops. One man is selected to do the selling of the entire output. The growers endeavor to put up a uniform grade of produce, and inspection is provided to see that no inferior stock goes in with that which is up to the standard. This plan insures better feeling among the growers and secures better returns for them than is possible when each grower sells his own products in competition with the other growers.

A grower who has a local demand for all the lettuce he can grow has a decided advantage over the man who is obliged to ship his lettuce some distance. The person having a market within easy driving distance can, if he grows good stock and puts it up neatly, not only cut out the cost of shipping, the commission and much of the package cost that the man who must ship is obliged to pay, but he can also get a higher price for his lettuce, as he can put it on the market in better condition than is possible with shipped lettuce.

Forcing of cucumbers.

Cucumbers are forced very commonly as a spring and early summer crop in many regions. The New

England growers devote a considerable area under glass to cucumbers in the fall and winter months. Eastern-grown cucumbers are sold in western markets at the time of the year at which most of the western growers are devoting all of their glass to lettuce or tomatoes. Some of the vegetable forcers in Illinois and farther west grow cucumbers in the fall and winter.

Varieties.

The long English type of cucumber is not popular for commercial purposes in this country although it is grown to some extent in private greenhouses. The American forcing-man prefers a type of cucumbers for forcing which is of the White Spine order. The first requisite of a good forcing cucumber is prolificacy. It should be from 8 to 10 inches long, even a foot in length not being objectionable, of regular and uniform diameter, not too thick, and free from what some term "neck" ends. It should be dark green in color. The fewer the seeds and the more poorly they are developed the better it will please the consumer.

Cultural methods.

Cucumber seed is planted in pots or flats about four weeks before the plants are to be set in the permanent beds. When planted in pots two to four seeds are placed in each pot. When planted in flats the seeds are sown rather thickly in rows about 2 inches apart. The flat-grown plants are pricked off, when large enough to handle, into pots, one plant in a pot, or into flats about 4 inches apart each way. The plants which are started in pots are not pricked off but they are thinned, when necessary, to not more than two in a pot.

Cucumbers should be kept growing all of the time to get best results. In order to do this, they must be kept in a warm house. The night temperature should be above 60° and may run as high as 70°. The day temperature should run at least 10° higher than the night temperature and on bright days it can go still higher if the ventilators are open. The seedlings should never be allowed to dry out nor should they be watered too heavily as damping off is liable to occur when the soil is too wet. The watering should always be done on bright days. Cold draughts should be avoided as they induce attacks of mildew. Judicious ventilating will insure hardy plants.

The distance apart the cucumbers should be planted depends on the method of training to be used. There are two distinct methods of training, the "A"-shaped trellis and the upright. When the trellis is to be used, the plants are set in rows from 10 to 16 feet apart and from 10 to 15 inches apart in the rows. When the vines are to be trained upright, the plants are set from 2 to 3 feet apart each way, one plant in a place.

The trellises are made of wire or slats and wire which are run across 2 by 4 pieces of timber placed at wide intervals. When the vines are trained upright, strings are fastened to wires which are run above each row, one string to each vine. When training, the vines are simply twisted around the strings and the "feelers" attach themselves and thus hold the vines in place.

Some growers use slender sticks, made especially for the purpose, on which to train the vines. The sticks are 1½ by ¾ inches and from 6 to 8 feet long. A piece about 4 inches in length is nailed across the bottom to keep the stick from sinking into the soil. The tops of the sticks are fastened to wires run parallel to the rows, one wire above each row. The vines are held in place by pairs of nails driven into the sticks at intervals of 12 to 15 inches. One of the nails of each pair is bent at right angles after being driven into the stick and the bent part is dropped onto the other nail after the vine has been placed between the nails.

The pruning of the vines is similar, no matter which method of training is used. All laterals are cut back more or less. One to three female flowers are left on each lateral. Best results are usually secured when the laterals are cut beyond the first female bloom.

Cucumbers in fruiting use an enormous amount of water if it is available. As soon as the supply of water in the soil becomes reduced below the amount required for the maximum growth of the plants and fruit, the number of short runty cucumbers will increase in proportion to the number of long ones. The Skinner system or any other similar system of overhead watering is ideal for cucumbers. Care should be taken to do the watering at a time when the foliage will dry off quickly, especially if mildew or any other fungous trouble makes its appearance. Aside from the fact that the soil must be rich in plant-food, there is no other matter of as great importance as the water-supply. Whether the water be applied a little at a time and frequently or in larger quantities and at longer intervals is not of so much impo tance as the supply itself, which should be sufficient for the needs of the plants at all times.

Pollination.

Some form of artificial pollination is necessary for best results with the White Spine type of cucumber. Hand pollinating is very tedious and is seldom employed in large houses. The usual method is to place a hive of honey bees in the house and let them do the work. In large establishments several hives are required. One strong hive for each half-acre of cucumbers will be ample. When first put in, the bees are quite uneasy but they soon quiet down and make themselves very much at home.

Insects and diseases of cucumbers.

One of the most formidable insects attacking forcing-house cucumbers is the red spider. Some growers are obliged to fight this insect every season. The best way to combat it is to prevent its making an appearance. This can often be done by keeping all of the soil, walks and other places where there is enough dirt to permit of their breeding, moist at all times. When these little animals appear on the plants they can be driven off by spraying the plants thoroughly with water. To be effective, the water must be applied with force and directed against the under side of the leaves.

Another insect which causes much damage to cucumbers is the striped cucumber beetle. The stink-bug may be included with it, as the work of the two insects is very similar in its effect upon the plants. The most serious trouble with these insects does not occur when the plants are small, as they can be protected then, but when they are large. The vines which are damaged by these enemies resemble those injured or killed by the bacterial wilt. If the vines are killed by the wilt, all of the plant dies at one time. When the damage is caused by the bugs, the upper part of the plant or a lateral branch will wilt and dies first, usually but not always followed in a few days by the wilting of another branch or the remaining part of the plant. No effective means has as yet been found for combating these insects. Some growers claim that by keeping the side ventilators and doors closed most of the time the bugs will not get into the houses. To keep them out in some places the ventilator openings would have to be screened. No crops which the bugs work on should be grown near the forcing-houses. When the insects once gain admittance to the houses, they are very difficult to eradicate. The stink-bugs lay their eggs in clusters on the leaves and these should be gathered and destroyed.

The white fly is occasionally serious on cucumbers. The remedy is to fumigate with hydrocyanic acid gas, but as this gas is dangerous to both plant and animal life it is used only in extreme cases.

The green and black aphis occasionally attack cucumbers in the forcing-house. The green aphis can be controlled by fumigating with tobacco. The black aphis usually occurs in patches and can be destroyed by applying strong solutions of tobacco or soap.

Nematodes (eel-worms) often become very destructive to cucumbers. As they work entirely on the roots, their presence is indicated by a weak and stunted growth of the vines. There is no cure for a vine once attacked. Sterilizing the infested soil with steam is the usual method of eradicating them. It is not safe to set plants in an infested soil which has not been sterilized.

Cucumber wilt is a bacterial trouble which often destroys a crop in a few days. There are no satisfactory means of combating it when it becomes established. It is most likely to occur on plants which are weakened in some other way, as by having too much water applied or too little heat. Plants which are kept growing vigorously are seldom attacked by the wilt.

The downy mildew is very partial to cucumbers and often does serious damage. Cold draughts should be avoided as much as possible. Frequent spraying with bordeaux will keep the trouble in check. Another less common but sometimes serious cucumber disease is anthracnose. Bordeaux is the remedy for this disease. Root rot of cucumbers is of occasional occurrence and may be prevented by sterilizing the soil with steam.

Grading and packing cucumbers.

In sorting cucumbers for market they are made into at least two grades. The culls are seldom placed on the market. About the same kinds of packages are used in which to pack cucumbers as are used for lettuce. They vary in size from the sugar barrel to the small basket holding from two to two and one-half dozen specimens. When handled in winter they are usually packed in paper-lined boxes or baskets.

Forcing of tomatoes. Fig. 1549.

Tomatoes are forced under glass at all seasons of the year except during the time they are ripening most freely in the field. The largest area of glass is devoted to this crop in the spring and early summer. There is also quite a large area grown during the fall and early winter. Only a very few growers force tomatoes in the midwinter months.

Varieties.

There is a difference of opinion among growers as to which varieties are best for forcing. In a general way it may be said that for the fall crop the varieties having medium to small fruits are most desirable. Some growers also prefer these kinds for the spring and early summer crop. Other growers like the large fruiting sorts, such as the Stone and Globe for the summer crop. Some markets prefer pink or purple varieties and others red sorts.

Some of the requirements of a good forcing variety are: prolificacy, smoothness in form, meatiness and good flavor. If the fruit is to be shipped it should not be too tender of skin. Some varieties crack more readily than others and those that are inclined to crack should be avoided. Other qualities not lacking, those kinds which are most resistant to disease are to be preferred. Some varieties need less attention in the matter of hand pollinating than others. This is a desirable character and should be given consideration when selecting a variety for forcing purposes.

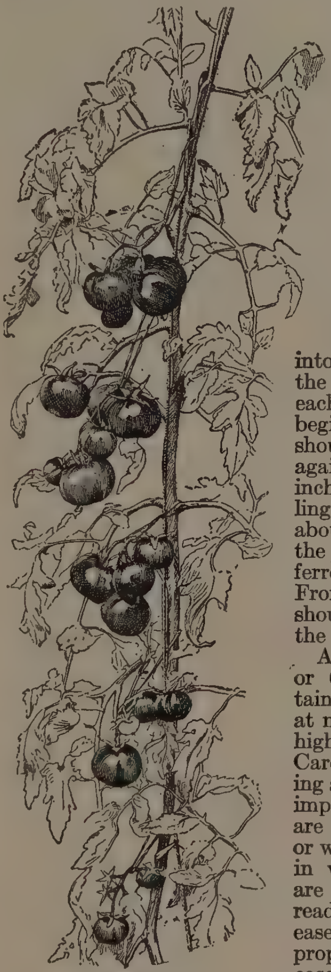
Cultural methods.

For the fall crop the seeds should be sown in June. The best results are secured from this crop when the fruit is all set and well grown before cold weather begins. The crop should begin ripening about the time killing frosts occur and the bulk of the crop should be off by the first of January.

For the spring and early summer crop the seed should be sown in time so that the plants will be ready to set in the permanent beds by the first of March. If a temperature of 60° can be maintained at night, the plants can be grown in two months from the time of the sowing of the seed. Plants set in the permanent places the first of March should ripen fruit about the first of June and should be through fruiting by the middle of August or a little before.

The care of the seedling plants is about the same for the fall and spring crops, except that owing to the difference in the amount of sunshine they can be grown more quickly and easily in summer than in winter. For either crop the seeds are sown thickly in flats or beds and in rows about 2 inches apart. As soon as they are sown the seeds should be covered with glass, paper or burlap to keep the surface of the soil moist. When large enough to handle, the seedlings should be pricked off into flats or beds, spacing the plants 2 inches apart each way. Before they begin to crowd, they should be transplanted again, this time into 2-inch pots. A third handling should be made in about three weeks when the plants should be transferred to 4- or 5-inch pots. From these pots they should be transplanted to the permanent beds.

A temperature of 60° or 65° should be maintained in the plant house at night and at least 10° higher on bright days. Careful attention to watering and ventilating is very important. Plants which are given too much water or which grow in a house in which the ventilators are seldom open will be readily attacked by diseases. Plants which are properly grown are disease-resistant to a considerable extent.



1549. Strand of winter tomatoes.

The spacing of tomato plants which is practised by different forcers is much more nearly alike than is the case with cucumbers. The plants are seldom set closer than 1½ feet nor farther apart than 4 feet. Two by 2 feet or 1½ by 3 feet are good distances. Nearly all tomatoes are trained upright and usually to one stem. When two stems are used, the tops are trained apart a foot or more, making the plant form the shape of a partly opened fan. Strings run from the foot of the vines to wires run above the rows are the usual means of support. By twisting the vines around the supporting strings, only a small amount of tying will be necessary. All laterals or side branches should be removed when small if the plants are trained to one stem. If they are to be trained to two stems, the lowest strong lateral should form the second stem. The lateral just above the first blossom cluster is usually the strongest. All other side branches should be removed. The pruning requires careful attention and consumes much time. If the laterals are allowed to grow to a large size before they are removed, it will, not only require more time to cut them off but they will take needed strength from the main branch.

Pollination.

As honey bees do not work on tomato blossoms it is necessary to do more or less hand pollinating, the amount depending on the time of the year, the number of blossoms open and the varieties grown. If the weather is such that the ventilators can be kept open wide most of the time during the day, frequent and systematic jarring of the plants will be fairly satisfactory. Artificial pollination is more necessary when the plants first begin to bloom than when the amount of bloom is abundant. Some of the English types of forcing tomatoes do not require much attention in the matter of pollinating. However, it is better to be on the safe side and do more pollinating than necessary rather than not enough. The camel's-hair brush is used by some growers and the wooden spoon and spatula with handles 15 to 18 inches in length are used by other growers as a means of transferring the pollen from one flower to another.

Grading and packing tomatoes.

Unless they are to be shipped a long distance, forcing-house grown tomatoes should not be picked until they show considerable color. The more nearly mature the fruits are when taken from the vines, the better the quality. Picking should be done every other day or at least three times a week. The fruit should be handled with care to avoid bruising, as injuries impair the keeping quality of the fruit.

In grading, unless the fruit is unusually rough or too variable in size, only one grade need be made for the average market. All very rough and otherwise inferior fruits should be withheld from the market. Some growers make a fancy grade for special trade. This stock should be of medium and uniform size, even in color and very smooth. The hotels and clubs which give orders for such stock are willing to pay an extra price for it.

Tomatoes are handled mostly in baskets. These are seldom larger than a half bushel and usually considerably smaller. The basket used by the Ashtabula growers is the same as they use for lettuce and holds ten pounds of tomatoes. A very satisfactory package for use in warm weather is the four-basket carrier or crate. The baskets which are put in this carrier hold five pounds each. When properly selected as to size, color, and smoothness, tomatoes packed in this container are very attractive. The chief objection to their use is that they are too much like the package used by the southern tomato-growers and thus not distinctive enough for the forcing-house tomatoes. During cold weather or when the tomatoes are to be shipped a long distance, each fruit should be wrapped in paper to protect it from the frost and to prevent bruising.

Dealers who have not handled forcing-house-grown tomatoes are sometimes slow to pay the price which the stock, if well grown, graded and packed, should demand. When they have once learned that forcing-house-grown tomatoes are of superior quality and will stand up much better than those which have been shipped a long distance and of necessity must be picked green or nearly so, they are usually willing to pay much more for the forcing-house-grown than for the outside-grown tomatoes.

Forcing of radishes.

Radishes have been forced by many growers but they have not become generally popular. This is no doubt due largely to the fact that the growing of them and preparation for market necessitates a large amount of hand labor; and the requirements of the crop are exacting.

The turnip-shaped sorts are most satisfactory for forcing in the forcing-house. The seed should be sown thickly in rows which should be marked 4 inches apart and about ½ inch deep. The Skinner system of watering is very satisfactory for radishes if the watering is properly done. The soil should be kept moist but not too wet on the surface. The watering should be done only when the weather is bright. Some growers have found it more satisfactory to allow the radishes to remain quite thick in the rows until a part of them are large enough to market and then pull the marketable ones and allow the others to develop, than to thin them enough when they are small to permit the radishes to mature nearly at one time. This method of thinning will enable the gardener to grow many more radishes in a given area than when the old method is used.

Some of the essential factors in successful radish forcing are: good seed, carefully sown; an abundance of light; plenty of ventilation; sufficient water and heat to keep the plants growing rapidly but not enough to cause damping-off; neatness and cleanliness in bunching, washing and packing.

Other forcing crops.

Space will permit only of a classification of other forcing crops than those previously mentioned. Nearly all kinds of vegetables which are grown in the open can be grown in the forcing-house. Whether it is practicable or not to force a vegetable in a commercial way depends principally on two things: cost of production and market demand.

The following lists include practically all vegetables which are forced commercially, either extensively or to a limited extent. The vegetables included in these lists are divided into two classes, the "cool" and the "warm" plants.

By cool plants is meant those for which the proper night temperature is from 40° to 55° and by warm plants those for which the night temperature should be from 55° to 70°. With either class of plants the day temperature on bright days should be at least 10° higher than the night temperature.

"Cool" forcing vegetables:

Asparagus
Beet
Carrot
Cauliflower
Celery
Cress
Lettuce
Onion
Parsley
Pea
Radishes
Rhubarb
Spinach

"Warm" forcing vegetables:

Bean
Cucumber
Eggplant
Muskmelon
Pepper
Tomato

C. W. Waid.

The forcing of fruits.

The forcing of fruits under glass has increased considerably in recent years and particularly so in the private establishments. Grapes probably occupy more space than any other class of hothouse fruits. Records of cultivating the vine may be traced back some thousands of years. Nevertheless, the greenhouse grape-vine has not been improved to the same extent through systematic hybridizing that many other fruits have been. Some of our oldest varieties still hold a prominent place in the forcing-houses. Some worthy claimants have been added to the list from time to time. Madresfield Court was raised over forty years ago by crossing Muscat of Alexandria with Black Morocco, producing a distinct Muscat grape with the Morocco coloring. Of later introduction may be mentioned Lady Hutt, Appley Towers and a few others which have been tested and have found favor with many growers. Another account of raising grapes under glass will be found in the article *Grape*.

Forcing of grapes.

The vine is of easy propagation. Different methods may be applied for reproducing young vines, such as cuttings or by eyes of ripened wood. Inarching and grafting may also be resorted to. However, the general method of raising young vines is from single eyes. It is advisable to choose wood of the previous season's growth or, when pruning back the vines, to take thoroughly ripened wood with plump eyes. If not ready for propagating, the wood may be heeled in a cool house until needed. The month of January is best for this purpose, for then there is usually a steady bottom heat, which is necessary. A bottom heat of 70°, with a temperature in the house of 65°, is most satisfactory. Furthermore, January-propagated plants allow for a long season to grow on the canes. In preparing the eyes for propagation, about ½ inch of wood on each side of the eye is sufficient. Make a cut on the opposite side from the eye a trifle deeper than the bark, which will callous in a short time after it is placed in heat and roots will emit in two or three weeks. These eyes may be placed in pans, flats or singly in 3-inch pots; when time is no serious object, the pots are decidedly to be preferred, as the young vine roots are very brittle. In preparing the pots to receive the eyes, half fill them with fibrous soil and fill the top with a fairly sharp sand, enough to cover the wood with the eye just level with the sand. The advantage of having the soil in the bottom is that the roots will strike down and the plants may be repotted, when ready, without a check. They must be kept growing through the summer in a warm moist house and repotted when necessary.

1550. Pot-grown apple tree in bearing.

Inarching may be found valuable at times, particularly if there is a variety in the house that is not desirable. The operation is fairly simple. There are different methods of inarching, although the most successful is with the young growing wood. For example, to inarch a variety with a permanent vine, preparations should be made the year previous. Grow the variety desired in a pot, then ripen off as for planting. Whenever the vines are started into growth, bring in the pot vine intended for inarching, about ten days after the heat has been placed in the grapery. Otherwise the pot vine will start into growth before the permanent vine. It is advisable to select shoots of about the same strength, if possible. The shoot that is operated on should be as near the base as possible. To inarch them is just a matter of bringing the two shoots together and tying with raffia. When the cion has united with the green growing shoots, which will be in a short time, gradually cut it away from its own root; also pinch the stock back by degrees to increase the strength of the cion. Usually the cion will grow away rapidly and produce a strong cane by fall so that when pruning time comes the following winter the old cane may be cut away and the new variety will take its place.

Hybridizing.

In hybridizing with the aim to produce new varieties, it is best to select a fairly strong-growing variety for the female parent, choosing the rich Muscat pollen for the male parent. No estimate can be formed as to results from a true cross, as many different varieties will appear. Grapes will produce an abundance of pollen and great care must be taken to avoid self-fertilization. Nature protects the pollen of the grapevine by a cap that surrounds the pistils and stamens, and when the pollen is ripe for distribution the caps are pushed off by the expansion of pistils and stamens, insuring pollination. To cross-pollinate one variety with another, measures should be taken in advance of natural development to prevent self-pollination. Select the bunch to be operated upon a few days before it would begin to flower. Cut away the larger part of the flowers, leaving a dozen or fifteen to be crossed with other pollen. Then secure this bunch in a fine muslin bag, which will prevent any insects from distributing undesirable pollen upon it. The muslin will allow sufficient air for the berries to set, after which it may be removed. The bag is placed around the bunch a day or so before the cap is ready to be dislodged, and careful watch must be kept when the cap begins to loosen. Have a pair of very fine plyers or pincers ready and remove the cap by force, then immediately cut away the stamens before the pollen has time to ripen. This must be executed with great care as the flowers are very delicate. Sometimes the flowers cannot all be operated upon at the same time. If so, place the bunch again in the bag and repeat the above process. When the stamens have been removed, apply the pollen chosen for the cross. This is best applied to the stigma with a camel's-hair pencil. Repeat until the whole have been gone over carefully. By using these precautions, the bunch cannot become contaminated with undesirable pollen. Grape seed will germinate very readily, although it should be sown soon after ripening as its germinating power is weakened if kept any great length of time.

Vine borders.

Good drainage is absolutely necessary for the successful cultivation of grape-vines. They will not resent an abundance of water while in active growth, in fact they demand it, but a border which the water cannot pass through freely will be found a serious difficulty. It is well in finding a location to choose, if possible, a site on elevated ground, as the drainage from the border can be carried off with less expense than in a low place, without the trouble of the drain-pipes becoming stopped up. A vine border will last for years and the advantage of a well-made border, even though expensive in building up, will be manifest in the better fruit produced.

A grapery may be supplied with both outside and inside borders, although it is not necessary. Neither would it be advisable for early forcing, for the reason that many of the roots would be out in the cold soil at quite a contrast from the ones inside. But for mid-season or late, there is no objection to this method. In fact, vines that have access to an outside border will keep healthy and vigorous several years longer than when confined wholly inside. However, an inside border will last for at least ten or fifteen years. This must be decided before the house is built as, for an outside border, the walls must be erected on arches to allow the roots access outside. One advantage of this method is that the vines do not require such close attention as when depending entirely upon the inside border. However, at present the larger number of graperies are built with inside borders only. The first thing to be done is to excavate at least 3½ to 4 feet for the border. Assuming it to be a span-roof house, lay a drain down the center, allowing enough fall to carry off the water. Use 3-inch pipes and provide openings along every 20 feet or so to take away the water. After the drain is complete, a coat of rough concrete may be placed over the bottom, which will prevent any of the vine roots from penetrating into the subsoil. Over this add a foot or 18 inches of drainage, such as broken stone or brickbats,—anything that will insure a free passage for water. From the drainage to the surface level, there should be about 2½ feet or a trifle over for soil. In some localities it is difficult to secure a grade of soil best adapted for vine-growth, although grape-vines will thrive in different kinds of soil, if not too sandy or too clayey. A good loamy soil is best, virgin loam preferred; or loam that has been in pasture three or four years may be plowed and placed directly into the border. The grass fibers are of great benefit. The vines would make a very satisfactory growth for a year or so without any fertilizing ingredients added. However, this would not be a wise policy and fertilizers of a lasting quality should be used. On that account, farmyard manure should not be used. All fruits require potash, phosphoric acid and nitrogen and therefore these manures should be applied. Do not apply the fertilizers too heavily. It is a simple matter when the vines become thoroughly established to feed from the surface. Bone is one of the very best ingredients to place in the grape border. This may be used in a coarse state or that known as ½-inch bone at the rate of forty or fifty parts of solid to one of bone. Potash may be used in the shape of hardwood unleached ashes, a trifle less in quantity than that recommended for the bone. Toward the surface, a quicker-acting complete fruit-fertilizer may be used. Such a border should grow and produce grapes for many years.

1551. Pot-grown pear tree in bloom.

A span-roof house running north and south is recommended, as a certain amount of sunlight will be had on both sides, whereas in a house running east and west, very little sun will strike on the north side. Either curvilinear or straight span answers the purpose for a private establishment.

Planting vines.

Vines may be planted either in fall or early spring. Early fall-planted stock appears to come away more freely and break stronger than spring planting. Plant the canes about 4 feet apart; there is nothing gained by too close planting. It is immaterial whether one-year-old plants are selected or two-year-old, providing they are thrifty strong canes. They should be shortened back to 2 feet to insure strong growths from the remaining buds, since, if a much longer length of cane is left, they will break away unevenly and weakly. Before planting, all the soil from a ball should be removed and the roots straightened out. Spread the roots out evenly on the border, cover with about 3 inches of soil and firm the soil well around them.

General treatment for forcing.

Grape-vines respond to the forcing treatment readily, although a newly planted grape-house should be brought along with little or no forcing the first season. There would be no advantage in forcing them, as they should not be allowed to produce fruit until the second year, when they will be thoroughly established. However, assuming that the vines are established and grapes are needed from the first to the tenth of May, the house must be started by the middle of December with a temperature of 45° to 50° at night, with a rise of 10° to 15° by day, according to weather conditions, and gradually increasing so that when the grapes are in bloom the temperature will be 65° at night and 75° to 80° by day. If a supply of grapes is demanded up to Christmas or the New Year, three compartments must be accommodated, the midseason house being started two months later and the late house about the first of April. A very important point to be considered is to give the border a thorough watering, for while the vines are at rest they are kept fairly dry. Ventilation or airing is very important, for unless this is attended to carefully serious trouble will follow, such as mildew, red-spider and the like. The heat should be allowed to rise gradually until the maximum is reached in the morning, then kept as steady as possible and toward evening gradually lowered to night temperature.

The best method of growing vines under glass is the single-rod spur system. The spurs should be 15 or 18 inches apart on each side of the rod. Then disbud to one shoot for each spur. As the young growth advances, it must be trained in place by degrees, as the young shoots are very brittle and if brought down too quickly are liable to snap off. The next step is pinching the shoots. The aim is to allow enough growth to cover the trellis with foliage but to avoid crowding. A fairly safe method is to stop the shoot at the second or third leaf beyond the bunch, also pinch all lateral growths at the first leaf.

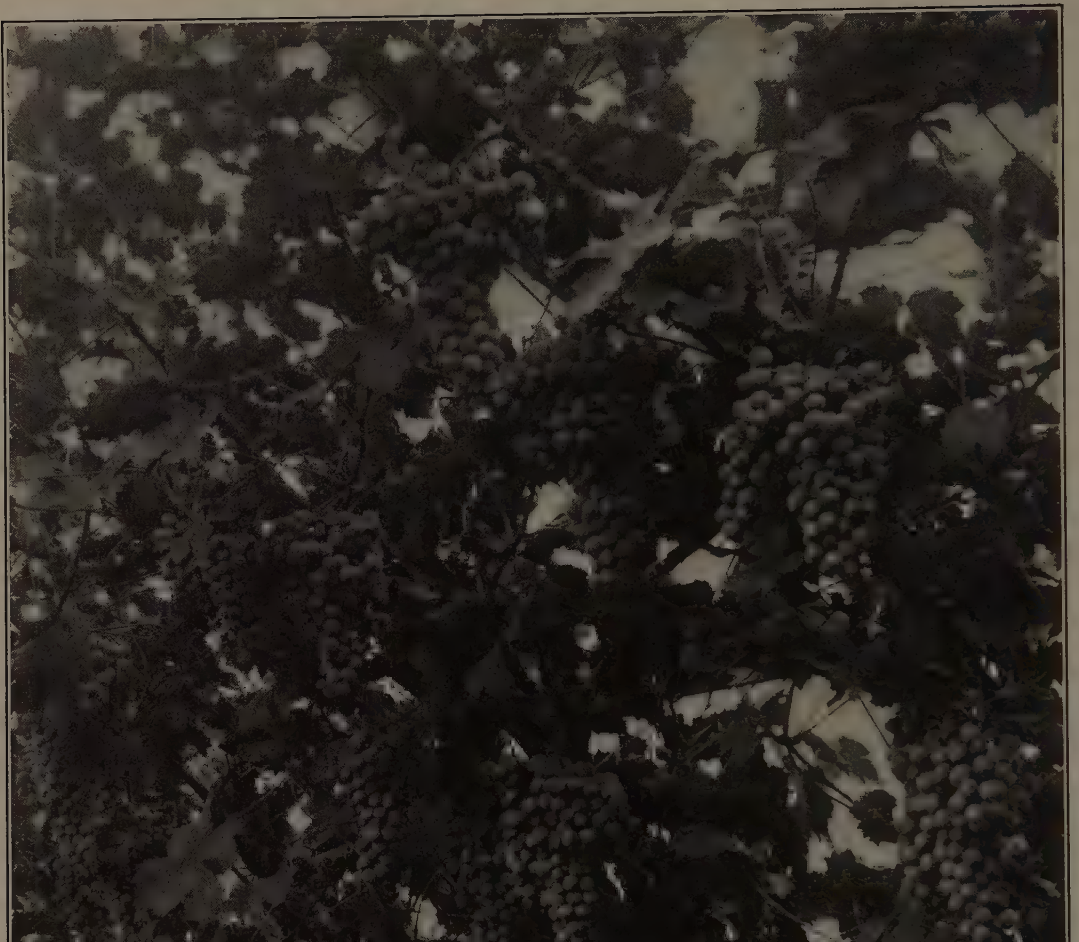
Probably one of the most anxious times with the man in charge is while the vines are in bloom or setting their fruit. Certain varieties will set their fruit much more freely than others. The Muscat family, as a rule, is a bit backward in that respect. A safe method to follow is a steady temperature with a fairly dry bracing atmosphere so that the pollen can distribute itself freely. By gently tapping the bunches around midday, they should set freely. When the berries are about the size of garden peas, they are in condition for thinning. This is a tedious operation, requiring time and patience. The bunch must never be handled with the fingers. Either a stick with a fork or a straight stick to lift the shoulders of the bunch while thinning should be used. The aim is to cut away enough surplus berries to allow the remainder to swell to full size, so that when full grown and ready to cut the bunch will keep the same perfect shape when set on the dinner-table.

Grape-vines, when in a healthy, vigorous condition, are rank feeders. There is no better time to apply food than just after the grapes are thinned and again as they take on their second swelling after the stoning period. This may be applied in the shape of liquid manure water or a complete chemical fertilizer. The grower must use his own judgment in regard to quantity, as so much depends on conditions. A healthy vine can withstand more food than one less robust. Nevertheless, it is much better to feed lightly than too heavily.

A moist humid atmosphere is necessary for grapes while they are growing or from the time they are started into growth until they begin to color, from which time a drier bracing air will be of advantage. At this stage, bottom air may be admitted by degrees during the day, and later, or when ripe, keep bottom air on day and night.

Pruning.

There are two objects in pruning: first, to keep the vines in submission and second, to encourage vigor. For the first season after planting, it would be well to allow the vines to grow freely with very little stopping of shoots. This encourages root-action and if everything has progressed satisfactorily, the canes will



XLIV. Forcing of grapes.—Muscat of Alexandria.

reach the top of the house the first season. When pruning time comes, this cane must be shortened back, allowing only about 5 feet of the season's growth to remain. The same method should be adopted the following year and so on till the full height of vine is secured. Before beginning to prune a grape-vine, one should be absolutely sure the wood is thoroughly ripe. This may easily be ascertained from well-ripened wood, for after pruning the cut will remain perfectly dry and in a few days have the appearance of an old cut. On the other hand, if the wood cuts soft with a fluid on the cut, then the wood is not ripe enough. To produce well-ripened wood from the time the crop is gathered till pruning time, an abundance of air should be allowed in the house and when the foliage has completed its functions a dry atmosphere should be maintained and the vines kept fairly dry at the roots. In the long-rod spur system, it is necessary to prune hard back, otherwise in a few years long ungainly spurs will result. One or two eyes to each spur is sufficient and, with thoroughly ripened wood, there is no danger but that a bountiful crop will follow.

Varieties.

There are many varieties for forcing purposes, although only a selection of the best varieties, early and late, is given here. The Muscat grapes are the finest of all the hothouse kinds. Unfortunately they require a longer season to ripen. Consequently one must rely on earlier-maturing varieties for early forcing. A few canes of Muscats may be planted in an early house and they will be useful after the early kinds are exhausted. It is not wise to depend on thin-skinned Muscats for late use, as there would be difficulty in keeping them in condition any length of time. The following varieties are recommended for early, midseason and late:

Early.—Black Hamburg, Appley Towers, Madresfield Court, White Buckland Sweetwater, Foster Seedling, Royton Muscat.

Midseason house should be devoted wholly to Muscat of Alexandria, which is one of the finest of all indoor grapes. It thrives better in a compartment by itself, requiring a trifle more heat.

Late house.—Gros Colmar, Gros Maroc, Barbarossa or Gros Guillaume, Alicante, Diamond Jubilee, Prince of Wales, White Lady Hutt.

Many others may be added to the list, but these will be found to cover the season and varieties sufficiently for all purposes.

Forcing of peaches and nectarines.

These fruits come next in popularity to the grape and considerable space is devoted to their culture under glass. Great improvements have been brought about in recent years with both peaches and nectarines and a large number of new varieties are constantly appearing for forcing. One of the handsomest forcing peaches is Peregrine. The color is magnificent and flavor all that could be desired, with size sufficient to please the most exacting. Others might be mentioned to show the progress of time.

Cultural methods.

The same style of house that has been recommended for grape-culture will be found ideal for peaches and nectarines, although instead of having the walk down the center of the house, it is better along each side. This will allow planting the trees crosswise of the house on trellises about 6 feet apart, which affords ample space for a well-balanced tree. Also the same arrangements in regard to borders, drainage and so on should be carried out, although a slightly shallower border would be satisfactory. From 2 to 2½ feet of soil would be sufficient; nor is it necessary to make the border quite so rich for peaches and nectarines as for grapes, as the trees would have a tendency to rank growth, a condition that should be guarded against. Peach trees budded on plum stock are superior for forcing purposes. Choose the best trees obtainable for this work. In our climate, if everything goes well, the trees will grow into large proportions in three or four years. Therefore, space should be considered with this in view. A tree that is planted in such a way that the branches are evenly balanced on both sides, causing an equalization of the sap, will insure better results. Assuming the peach-house to be 25 feet in width with the trellis crosswise the house, allowing a walk on each side, each tree would have a spread of about 18 feet. One tree in the center of each trellis is sufficient, which allows ample room for development. If desired, a tree may be planted on each side of the permanent one for two or three years, but must be cut away as the space is needed for the permanent tree. Still another method may be adopted and probably the best, which is placing trees in tubs on each side, then as space is needed they may be moved away, whereas when planted in the border one is likely to leave them too long and crowd the main tree out of shape.

It would not be wise to force newly planted trees to any extent, but rather to bring them along gradually for the first season, when they will be in condition for forcing. If ripe fruit is in demand about the first week in May, the house must be started about the middle of December. The peach tree will come on and develop its blossoms in a comparatively moderate temperature and it would not be wise to submit it to extreme heat artificially. Peach trees delight in fresh air, and will resent a too close humid atmosphere. A temperature of 40° to 45° at night and 50° to 55° by day will suit their requirements at the start. Gradually increase this so that the temperature will range from 50° to 55° at night and 60° to 65° by day or 70° with sun heat when in bloom. After the fruit is set, another 5° may be added. Give plenty of air without lowering the temperature, particularly in cold weather. Give the house a light spraying two or three times a day when the weather is clear until they come into bloom. Do not spray while they are in blossom. After the fruit is set, spraying may be resorted to again once or twice a day according to weather conditions.

Peaches are subject to greenfly. As a precaution after the fruit is thoroughly set, syringe every ten days or so with a solution of whale-oil soap, enough just to color the water. This is an excellent remedy for both greenfly and red spider, both deadly enemies to peach foliage.

The peach tree will produce many more shoots than are needed to furnish the trellis, therefore the surplus will have to be removed. This is best done by degrees rather than removing them all at once, which would be likely to cause a check. A number of shoots may be pinched at the third leaf, which in all probability would form spurs or fruit-buds for the following season. The aim is to allow enough wood to remain to cover the trellis, but to avoid crowding. As the crop advances or before the fruit becomes of much size, thinning of the fruit would be in order. It is a serious mistake to overcrop. If a tree has a tendency to rank growth, a fairly heavy crop would be of advantage. The grower must be governed according to conditions.

Watering and feeding are important. Potash is necessary for all stone-fruits and should be applied in some form, or a complete fruit-fertilizer may be recommended. It is better to feed light and often rather than too much at once. Enough water must be supplied to give the border a thorough watering from top to bottom. Then no more should be given until necessary, for if the soil is not allowed to sweeten up it would be impossible to keep the trees healthy. It is not a good policy to have the trees or borders saturated just as the fruit is ripening. It is better to give them a watering a week or so in advance, which will usually last until the fruit is gathered. The object of this is to improve the flavor of the fruit.

One should not think that after gathering the fruit the house needs little or no attention. The temperature will not need close watching, but the fruit-buds have to form and develop, and good attention to watering and spraying the foliage is a wise step toward success for the following season. Cut away any useless wood after the crop of fruit has been picked, thus allowing the remainder of the wood to become well ripened. Well-ripened wood will withstand any reasonable amount of frost during the dormant state, and fruit-buds will respond when called upon with abundance of healthy strong blossoms. Winter-pruning may be done any time after the trees have cast their foliage. This means removing any weak growths, shortening back extremely strong growth and training the young wood so that it will spread over the space about 5 inches apart.

1552. Pear in fruit under glass.—The Hardy.

Varieties.

For forcing there are many varieties to choose from. The peach crop may be extended at least seven weeks for one house, but if the compartments are at command a season of five months or more may be had by planting early, midseason and late varieties. The following varieties may be relied upon for early, midseason and late:

Early forcing peaches.—Duchess of Cornwall, Duke of York, Peregrine.

Early forcing nectarines.—Cardinal, Early Rivers, Advance, Lord Napier.

Midseason peaches.—Peregrine (Alexander, Noblesse), Bellegarde, Grosse Mignonne.

Midseason nectarines.—Stanwick-Elruge, Rivers, Orange-Chaucer.

Late-house peaches.—Crawford Late, Thomas Rivers, Princess of Wales.

Late-house nectarines.—Newton, Spencer, Humboldt, Victoria.

Numerous other varieties could be added to this list. However this will be found sufficient for all practical purposes.

Pot-fruits.

This method of producing fruit has found favor with many growers throughout the country, particularly in private establishments. It requires no specially built houses for the purpose, providing the house receives full sunlight with abundance of ventilation. There are two or three advantages of this concentrated method of growing: first, the house may be used for other growing crops after the fruit is gathered, as the trees may be placed outside or, as severe winter sets in, they may be stored away in a coolhouse close together until such time as they are needed for bringing into growth again; second, a large variety of fruits is adapted to this method of culture, such as peaches, nectarines, pears, plums, figs and the like. These trees may be grown into either pyramid or half-standard forms. Pyramids, as a whole, make a more attractive appearance in a house than any other form of training. A house for pot-fruits requires about the same treatment as that recommended for peaches planted in a permanent border. Care and watchfulness are required as to watering, particularly when first starting into growth, as at that stage there is not much foliage, consequently an over-abundance of water would have a tendency to sour the soil. Potting the trees is very important. There is no better time for this operation than early fall, or just as they are casting their foliage. Also a serious error is placing them in too large pots or tubs. They should be repotted every fall, but it is not always necessary to give them a larger tub. Often the ball may be reduced and placed into the same-sized tub. The soil should consist of a good fibrous loam used in a fairly rough state, if possible, as this will allow free action for the water to pass off. Firm potting is of great importance. Three parts of soil to one of thoroughly decayed rich manure with a little bone mixed in would be an excellent compost for the purpose. Careful watering after repotting is very important.

When the trees come into bloom, keep a fairly dry bracing atmosphere. Pears and plums will refuse to set their fruit otherwise. As the growth advances, frequent pinching or stopping the shoots should be attended to. Some growths will doubtless be much in advance of others. When the young growths reach the length of 5 or 6 inches, they should be pinched and again when they have extended another similar growth and so on. Usually in the case of pyramid trees, growth will be found more advanced at the top, hence those shoots should be stopped, resulting in more vigor for the lower branches.

Surface-dressing when the fruit is swelling is of great benefit. Either manure or a concentrated fertilizer may be mixed with the soil and added as a top-dressing, but by all means do not apply this until the fruit is swelling away freely.

Pot-fruit that has been properly cared for during the season of growth in regard to pinching and summer-pruning requires little winter-pruning aside from removing the very weakest growths.

Varieties.

The following varieties are the best:

Pears.—Souvenir du Congres, Madame Treyve, Hardy, Fondante d' Automne, Louise Bonne, Conference, Magnet, Pitmaston Duchess, Durondean, Princess.

Plums.—The Czar, Blue Rock, Oullins Golden, Early Transparent, Gage, Mallard, Denniston Superb, Belgian Purple, Golden Esperin, Transparent Gage, Green Gage, Grand Duke.

Figs.—Brown Turkey, Negro Largo, White Marseilles, Violet Sepor.

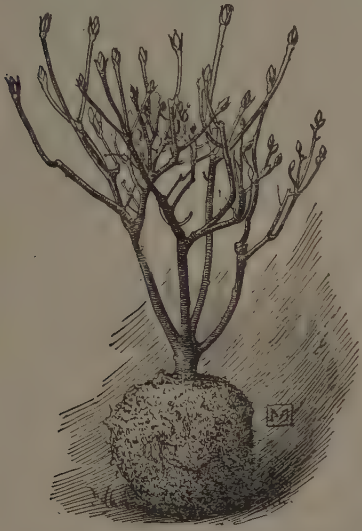
Apples and apricots also may be added, although they are not so profitable as the others mentioned.

Wm. Turner.

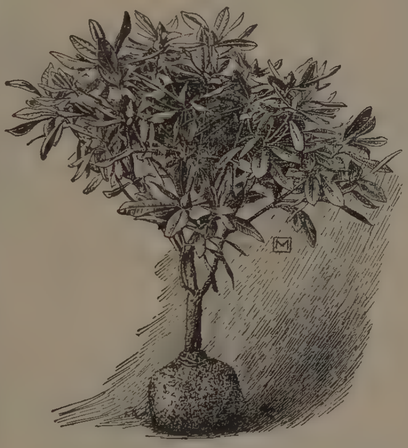
Forcing hardy plants.

Forcing is an economical method of securing large quantities of flowers in winter; it is extensively used by commercial florists for cut-flowers and flowering plants. Plants usually forced are hyacinths, tulips, narcissi and other Dutch bulbs, lily-of-the-valley, astilbe, dicentra, hybrid perpetual and rambler roses, *Deutzia gracilis*, hybrid rhododendrons (*R. sinense*) and Ghent azaleas, tender hydrangeas and lilacs.

This mode of procuring flowers at small cost has always been more or less in vogue among plantsmen, and of late years has received fresh impetus, owing to the heavy demands for decorative plants at Easter. It is not only an inexpensive method of getting flowers, but with most plants, after a little experience, the time of blooming can be easily calculated. The process has limitations, at any rate with our present knowledge of the matter, inasmuch as, with the exception of "retarded plants" and a few bulbs, it is not practicable in late autumn and early winter without the use of ether. It is possible, however, that by using "retarded plants," i.e., plants held over their natural time of flowering by keeping them in cold storage at a temperature sufficiently low to prevent growth, this difficulty may eventually be overcome. Except, however, with lily-of-the-valley, which is admirably adapted to this practice, little is known of the possibilities of this form of forcing; it is hoped that other plants, equally useful, may be treated in this way. It is evident that, on account of the cost of storage, bulky plants could not be handled.



1553. Azalea, received from Europe, now pruned for forcing.



1554. Rhododendron, received from Europe, ready for forcing.

The requirements for successful forcing are: (1) a good knowledge of the plants; (2) proper preparation; (3) a period of rest; and (4) proper care after the plants are brought into heat.

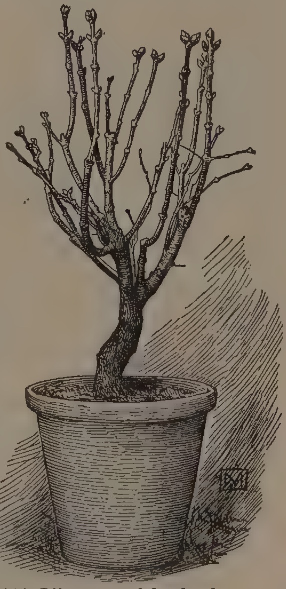
Those plants force most easily which bloom in spring and early summer. Late-blooming kinds, like *Rhododendron maximum*, clethra and *Hydrangea paniculata* var. *grandiflora*, do not give good results. No success is obtained with asters and goldenrod, unless they are retarded. These points must be studied out by the grower.

Trees and shrubs should be specially prepared for forcing by careful cultivation for one or two years before use. They can be planted out-of-doors, with plenty of room to develop, or they can be grown in pots, the latter method being used with vigorous plants, which are apt to run to growth without developing flower-buds. Close pruning is necessary, and root-pruning is helpful. Grafting, which has a tendency to dwarf and hasten maturity, is also used with strong growers. Sometimes both growing in pots and grafting are employed, as in lilacs.

A plant fit for forcing must be compact, both top and roots; economy in space is essential. It is now possible to secure from the French, Dutch and Belgian nurseries many plants grown for this purpose. A few come pot-grown, but most of them are from the open ground: very little of this work is done in American nurseries. Figs. 1553–1555 show the methods of preparing woody plants for forcing.

Herbaceous plants should be prepared for forcing with equal care, and the process may require several years. The removal of the flower-buds and growth, under high cultivation, in close, compact clumps, apparently produces the same results that pruning and grafting accomplish for trees and shrubs. Fig. 1556 shows the root-clump of an herb prepared for forcing.

Plants that have once been forced are commonly thrown away. It is generally cheaper to buy new stock, but lilacs, azaleas, and the like, can be planted out and will recover sufficient strength in two years for a second forcing, or for other use. Some species, like *Viburnum plicatum*, staphylea, and xanthoceras, if grown on in pots after forcing, may be again forced, and seem to do better the second year. This is probably explained by the fact that insufficient preparation was given for the first trial, the first forcing being really "proper preparation" for the second forcing.



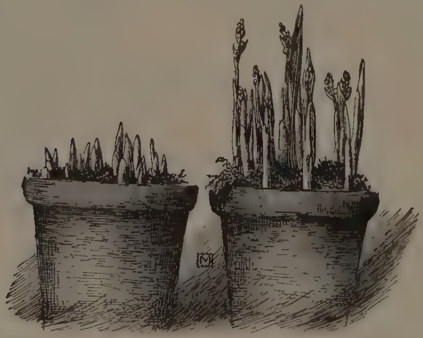
1555. Lilac pruned for forcing.

Hardy plants must have a period of rest for successful forcing, the time required varying in different species. One cannot tell, except by experiment, that Paper White narcissi will force easily in November and December, while the double Von Sion will not; the individual equation of each kind is an element which must be considered. There is a popular notion that freezing will shorten the time for resting, or, at any rate, is conducive to the welfare of the plant. This idea does not seem to stand any practical test. After potting, do not subject the plants to severe frosts (10° to 12° F.), or else the roots, now much exposed, may suffer. The large buds of lilac and rhododendron may also be injured if frozen hard.

Pot the plants as soon as they ripen their growth in autumn, beginning in September with herbaceous stock, and continuing until severe frost. It is possible, but not desirable, to lift some things after the ground is frozen hard. Plants received from abroad are potted on arrival, or, if furnished with a ball like azaleas (Fig. 1553), they can be stored and not potted until brought into heat. Dutch bulbs are boxed or potted as they are received, and buried in the earth or piled in stacks and covered with enough leaves and litter to exclude frosts. Lily-of-the-valley, astilbe and dicentra may be kept in their packing-cases in a cool pit until ready for use. Large plants in tubs and boxes can be covered with leaves and kept out-of-doors, but most plants should be stored in a cool cellar, pit or frame kept at a temperature of 35° F.; a temporary variation of 5° either way does no harm. It is well to delay this storage until as late in the season as possible, but it must be done before severe weather. Plants may be stowed compactly in several tiers if necessary. It must be remembered that no growth is to be allowed while stored; it is their period of rest, and this must be enforced. Good ventilation must be given on bright days and every precaution taken against an accumulation of moisture: if the plants are well watered when put away very little will be required afterwards. Dampness is most serious with evergreens, like kalmia, and such things as *Phlox subulata.* This stock should have the airiest positions; sometimes it can be placed in shallow frames 2 feet deep, which are drier than deep pits. In severe weather the pits are often covered with snow a week or more, but the plants will not suffer if this happens but once or twice during the winter. At such times mice and squirrels will make trouble unless trapped or poisoned.

1556. Dicentra roots prepared for forcing.

Nothing except retarded plants, a few bulbs and one or two kinds of prunus should be brought in before November. December 15 to January 1 is as early as it is safe to begin forcing most hardy plants; it will be found that as the days lengthen the results will be more satisfactory. At first the plants must be kept cool, 45° F., or thereabout. Syringe twice a day until the buds swell: after growth starts the treatment is the same as that given greenhouse plants, and they can be put in a much warmer house if so desired. It is at this time that care in handling, particularly in the matter of heat, makes it possible to time the period of blooming so accurately, but it is impossible to give any general rules satisfactorily to cover these matters.


1557. Forcing lily-of-the-valley in pots.

A few plants, like lily-of-the-valley, can be placed directly in a forcing-box, generally made over the pipes in the hottest house, where a temperature of 80° or more can be maintained. They are first soaked in water for a day or two and then kept in this heavy heat until flower-buds are well developed (Fig. 1557).

Tulips, hyacinths and other bulbs, sometimes an azalea or lilac, can also be hurried up in such a box, but it is dangerous, and not good practice; better and more lasting flowers come with ordinary treatment. Trilliums (Fig. 1558) and various early-flowering wild plants may be forced with satisfaction.

Although no rules can be given for the time required in forcing, it is knowledge not hard to acquire with even surprising exactness. Nothing is likely to require more than three months in houses ranging from 45° to 55° F.—i.e., after bringing in from the pits. A month or six weeks is good time to allow in February and March, but with the same plants and temperatures, more time would be needed earlier; with the advance of the season, the work is quicker and less uncertain. There is a great difference in plants. Rhododendrons (the hybrids) require eight weeks or more, but one species will often bloom in March, within twenty-four hours. Plants like the rose, which must make a growth before the buds form, take more time than *Rhododendron sinense.* The difference between dull and bright weather is an important factor, but with extra firing, or the use of the forcing-box, these matters even up, and the average time of flowering is wonderfully even. In this work, a man with good plant sense is most likely to succeed.

1558. Forced trillium.

The use of anesthetics in forcing.

In the latter part of the last century and early in the present, experiments were begun in Germany, and confirmed in France, England and the United States, in subjecting plants to the influence of ether and chloroform for the purpose of securing better results in forcing. Ether seems, for many reasons, the most practical agent, but, owing to its cost and the extra expense of handling the plants, this process does not appear to be in common use among florists. For a detailed treatment of this subject, the reader is referred to an article by M. Emile Lemoine in the Journal of the Royal Horticultural Society (London), Vol. XXVIII, 1903–4, p. 45. See, also, the article *Etherization,* p. 1146, Vol. II.

In the main, the treatment of plants for this purpose is as follows: A container, which can be hermetically sealed and of the proper size is provided. In it are placed the plants "as dry as possible, in equally dry sand." The temperature of the box is 62° to 65° F. Under the lid is a vessel into which the ether can be poured and the hole sealed at once. It is important to have the ether at the top as its vapor is heavier than air and consequently gravitates downward. Ether, particularly when mixed with air, is very inflammable and lighted matches, cigars or pipes must be kept away. "Thirty or forty grammes of ether are enough for one hundred cubic litres of air: one gramme equals fifteen and one-half grains, one litre equals sixty-one cubic inches." The ether used is "pure sulfuric ether which boils at 95° F." The plants are kept under the influence of the ether for two days; sometimes they are removed for two days and the etherization repeated for the same length of time. Afterwards they are placed in a coldhouse and "treated in the usual manner." Lilacs "were in full flower eighteen days after being placed in the greenhouse," one, "Marie Legraye still earlier." Johannsen made lilacs "flower regularly" the first two weeks in September which had been etherized the first week in August." With other shrubs, such as *Rhododendron sinense* (*Azalea mollis*), *Viburnum Opulus, Prunus triloba, Deutzia gracilis* and some of the spireas, the results were more or less favorable."

Trials with chloroform apparently have been less successful and other anesthetics and stimulants have been found failures.
B. M. WATSON.

FORESTIÈRA (after Forestier, a French physician). Syn. *Adèlia. Oleàceæ.* Sometimes grown as ornamental shrubs.

Deciduous, rarely evergreen trees or shrubs: lvs. opposite, entire or serrate: fls. diœcious, apetalous, with or without calyx, in small, axillary clusters in early spring, before the lvs.; stamens 2–4: fr. a small, mostly black, 1- or 2-seeded drupe.—About 15 species from Ill. south to Brazil and the W. Indies.

The species in cultivation are shrubs with rather small leaves, inconspicuous yellowish flowers before the leaves and small dark purple or black, berry-like fruits. *F. acuminata* is hardy in sheltered positions as far north as Massachusetts, while *F. ligustrina* is somewhat tenderer. They prefer moist soil and are suited for planting along streams. Propagation is by seeds and layers.

acuminàta, Poir. (*Adèlia acuminàta*, Michx.). Deciduous shrub, to 10 ft. high, sometimes spiny, glabrous: lvs. slender-petioled, ovate-oblong or ovate-lanceolate, remotely serrate, 1½–4 in. long: staminate fls. in dense clusters; pistillate fls. in short panicles: fr. narrow, oblong or cylindrical, deep purple, falcate, acute, ½in. long. W. Ill. to Texas. Michx. Fl. Bor. Amer. 2:225. B.B. (ed. 2) 2:728.

ligústrina, Poir. (*Adèlia ligústrina*, Michx.). Deciduous shrub, to 6 ft., pubescent: lvs. elliptic-obovate to oblong, obtuse, appressed-serrulate, about 1 in. long: fls. in fascicles: fr. sessile, ovoid, obtuse, ¼in. long. Tenn. to Fla. and Ala.

F. nèo-mexicàna, Gray (A. parvifolia, Coville). Shrub, to 10 ft.: lvs. spathulate, almost entire, usually glabrous, grayish green and rather small: fr. ovate or short-oblong, obtuse, ⅓in. Texas to New Mex. and Colo.
ALFRED REHDER.

FORESTRY is the rational treatment of forests; this treatment may vary with the object in view. Forests may subserve various objects, giving rise to three classes of forests: they furnish wood materials for the arts—*supply forests;* they furnish a soil cover, which may prevent the blowing of the soil and formation of sand-dunes, or may retard the erosion and washing of the soil and may regulate the waterflow, or act as a barrier to cold or hot winds, and exercise other beneficial influences on climate and surroundings—*protection forests;* or, finally, they furnish enjoyment to the esthetic and sporting elements in man, as game-preserves and parks—*luxury forests.* Any two or all three objects may be attained simultaneously in the same forest. In the end, and in a more limited sense, forestry is the art and business of making revenue from the growing of wood crops, just as all agriculture is finally concerned in producing values from food crops and other crops. In the economy of agriculture, wood crops may be grown on land that is too poor for field crops.

This art is divided into two distinct and more or less independent branches, namely silviculture, the technical branch, and forest management, the business branch. Silviculture is a branch of the larger subject arboriculture, and comprises all the knowledge and skill applied in producing the wood crop, relying mainly on natural sciences. While horticulture and silviculture have both to deal with trees, their object and with it their treatment of trees are totally different: the orchardist works for the fruit of the tree, the landscape gardener for the pleasing form; in both cases the object is attained by the existence of the tree and its single individual development; the forester is after the substance of the tree, the wood; his object is finally attained only by the removal of the tree itself. He deals with masses of trees rather than individuals: it is logs in quantity and of desirable quality, clear of knots, not trees, that he is working for; hence, his treatment differs from that of the horticulturist.

The clear long boles free of knots are secured by a dense stand, when by the shade of neighbors the lower branches are made to die and break off. When in this way clear boles to a certain height are secured, the stand is opened up by thinnings in order to secure expansion of crown and thereby more rapid increase in diameter of bole. There are several ways of reproducing the crop, namely artificially by sowing or planting, the latter being done with one- to four-year-old plants, at the rate of 1,500 to 4,000 to the acre; or by natural regeneration, either by sprouts from the stump, the so-called coppice, which is applicable to hardwoods and for the production of fuel wood and small-dimension material, or else by seed from mother or nurse trees. There are various procedures of securing a crop by seed, a so-called timber forest, which differ by the rapidity of the removal of the old crop or nurse trees, and by the size and progress of the opening—strip system, group system, selection system, and, the most refined, shelterwood system.

Since the crop takes many years to mature—sometimes a century and more—in order to carry on a continuous forestry business, from which to secure annual returns, special arrangements peculiar to this business must be made: these arrangements, naturally influenced by the economic conditions of the country, form the subject of forest organization or management.

The ideal of the forester to which he attempts a gradual approach with his actual unregulated forest is known as the "normal forest." It supposes that a rotation has been chosen, i.e. a year or period when the timber will be ripe (determined in various ways); that as many stands are at hand as there are years in the rotation, differing by one year from each other, so that each year a mature area can be harvested—a normal age-class gradation; that the increment on the whole area is the best attainable for species and site—a normal increment; that the amount of wood standing, the stock on which the increment is deposited, is the proper one for each age-class—a normal stock. This is the standard with which the actual forest is compared to judge its abnormalities, which by the management are to be, as far as practicable, removed.

Since the forest crop takes from thirty to one hundred years and more to mature, i.e., to produce desirable size, highest value, or best interest rate on the investment, it is a business which does not appeal to private enterprise: the long-time element, as well as the influence of forests on water-flow and other cultural conditions make forestry particularly a business to be conducted by the state or other long-lived corporation.

The horticulturist, as such, is mainly interested in the rational treatment of such forests as have a protective value, influencing climatic, soil and water conditions in general and locally.

The raising of trees for shade, for ornament, and for avenues is not forestry, but a branch of arboriculture (which see); the ornamental utilization of forests, as a part of grounds, is discussed under *Woods*.

B. E. Fernow.

1559. Flowers of Forsythia suspensa var. Fortunei. (×⅔)

FORGET-ME-NOT: *Myosotis.*

FORMAL GARDENING: *Landscape Gardening.*

FORSÝTHIA (after William Forsyth, prominent English horticulturist, director of the Royal Garden at Kensington, 1737–1804). *Oleàceæ.* Golden-Bell. Shrubs grown for their wealth of bright yellow flowers appearing early in spring, also for their handsome dark green foliage.

Deciduous: lvs. opposite, petioled, serrate or entire, simple or partly 3-parted to 3-foliolate: fls. 1–6, axillary, pedicelled, heterostylous; calyx and corolla deeply 4-lobed, lobes of the corolla oblong, longer than the campanulate tube; stamens 2, included, inserted at the base of the corolla; ovary superior; style slender with 2-lobed stigma: fr. a 2-celled, dehiscent caps. with many winged seeds.—Four species in China, Japan and S. E. Eu.

The golden-bells are highly ornamental, free-flowering shrubs, with simple or ternate leaves and showy yellow flowers, borne in great profusion along the slender branches in early spring before the leaves. They belong to the showiest early-flowering shrubs, and have handsome, clean foliage, remarkably free from insects or fungi, remaining unchanged until late in fall. The upright forms are well adapted for the borders of shrubberies and the pendulous form for covering walls, fences, arbors or porches. They grow in almost any kind of garden soil, and are hardy North except *F. viridissima*, which is somewhat tenderer. Propagation is readily by greenwood and hardwood cuttings; also by seeds. The branches of the pendulous form often take root at the tips when touching the ground, and send forth vigorous shoots, like some brambles or the walking-fern.

A. *Lvs. often 3-parted or 3-foliolate: branches hollow between the nodes (except in the hybrid).*

B. *Branches always hollow between the nodes: lvs. usually ovate, often 3-foliolate.*

suspénsa, Vahl. Shrub, to 8 ft., with slender branches often lopping on the ground and taking root: lvs. broad-ovate or oblong-ovate, serrate, 3–4 in. long: fls. 1–3, rarely to 6, about 1 in. long, golden yellow, tube striped orange-yellow within; calyx about as long as tube: caps. ovate, about 1 in. long. China. S.Z. 3. Gn. 73, p. 243. Var. **Fórtunei,** Rehd. (*F. Fórtunei,* Lindl.). Fig. 1559. Of upright habit with finally arching branches: lvs. often ternate, ovate or oblong-ovate: corolla with straight and spreading twisted segms. R.H. 1861:291. G. 4:79; 13:87. G.M. 50:227. F.E. 31:421. Var. **decípiens,** Koehne. A vigorous form of the preceding: fls. always solitary, on pedicels usually ½in., sometimes nearly 1 in. long, deep yellow, known only in the macrostylous form. Gt. 55, p. 203. Var. **pállida,** Koehne. Fls. always solitary, pale yellow. Var. **variegàta,** Butz. Lvs. variegated with golden yellow: fls. deep yellow. Var. **atrocaùlis,** Rehd. A form of var. *Fortunei* with dark purple branches and the young growth purplish. Cent. China. Var. **pubéscens,** Rehd. Similar to the preceding, but lvs. soft and short-pubescent on both sides or only below. Cent. China. Var. **Sièboldii,** Zabel (*F. Sièboldii,* Dipp.). Fig. 1560. Low shrub, with very slender, pendulous or trailing branches: lvs. mostly simple, broad-ovate or ovate: corolla-lobes flat and broad, slightly recurved. B.M. 4995. F.S. 12:1253. Gn. 33, p. 563. A.G. 13:94. G.F. 4:79. Gt. 55, p. 205.—*F. suspensa* is an excellent shrub for the margins of groups, because it finally rolls over and meets the greensward. It can also be trained over an arbor.

1560. Forsythia suspensa var. Sieboldii. (×½)

1561. Flowers of Forsythia viridissima. (×⅔)

BB. *Branches usually, particularly above, with lamellate pith between the nodes, pith at the nodes usually solid: lvs. only on vigorous shoots partly 2–3-parted or sometimes 3-foliolate, usually ovate-lanceolate.*

intermèdia, Zabel (*F. suspénsa* × *F. viridíssima*). Shrub, with slender, erect or arching branches: lvs. oblong to ovate-lanceolate, sometimes 3-lobed or ternate, usually coarsely serrate, 3–4 in. long: fls. almost like those of *F. suspensa* var. *Fortunei.* Gt. 1885:1182; 40, p. 397. Gn.W. 22:181. Var. **vitellìna,** Koehne (*F. vitellìna,* Koehne). With upright or spreading branches: fls. deep yellow, little over 1 in. long. Gt. 55, pp. 227, 228. Var. **spectábilis,** Spaeth (*F. spectábilis,* Koehne). Upright with spreading and somewhat arching branches: fls. somewhat paler than of the preceding, 1⅓ in. long, often 5–6-merous. Gt. 55, p. 229. G. 35: 255. Var. **densiflòra,** Koehne (*F. densiflòra,* Koehne). Upright shrub with divaricately spreading and slender arching branches: fls. crowded at the base of the branches, rather pale with flat slightly recurved corolla-lobes. Gt. 55, pp. 230, 231. Var. **primúlina,** Rehd. Upright shrub, with spreading and arching branches: fls. crowded at the base of the branches, pale yellow; lobes of the corolla revolute at the margin.—

F. intermedia is often confounded with forms of *F. suspensa*. In foliage it resembles much the following, which has the lvs. narrower, always simple, usually serrate only above the middle, with smaller teeth. It is as hardy as *F. suspensa* and very floriferous.

1562. Forsythia viridissima. (×½)

AA. *Lvs. always simple: branches, at least in their upper part, with lamellate pith throughout, including the nodes: habit upright.*

viridíssima, Lindl. Figs. 1561, 1562. Shrub, to 10 ft., with green, erect branches: lvs. oblong-lanceolate or lanceolate, always simple, and generally serrate only above the middle, very dark green, 3–6 in. long: fls. 1–3, about 1 in. long; corolla with rather narrow, twisted lobes of bright, somewhat greenish yellow; calyx about half as long as tube. China. B.M. 4587. F.S. 3:261. B.R. 33:39. H.F. 1852: 97. J.H. III. 65:423. Gn. 33, p. 563. G. 2:65; 28:39. A.G. 13:94. Var **variegàta**, Hort. Lvs. variegated with white.—Less hardy and graceful than the preceding forms.

europǽa, Degen & Baldacci. Upright shrub to 6 ft.: lvs. usually ovate to ovate-lanceolate, entire or at the end of vigorous shoots with shallow teeth, 2–3 in. long: fls. 1–3, about 1 in. long, short-pedicelled, golden yellow; calyx-lobes ovate-ciliate, shorter than the corolla-tube: caps. ovoid, about ½in. long. Albania. B.M. 8039. Gt. 54, p. 291. G.C. III. 36:123. J.H.S. 29: 663. F.E. 18:348.

F. Giraldiàna, Lingelsh. Upright shrub: lvs. elliptic to oblong, long-acuminate, broadly cuneate at the base, entire or serrulate, glabrous or hairy on the veins beneath, 2–5 in. long: fls. short-stalked: caps. ovoid with a long and slender beak. N. W. China.

ALFRED REHDER.

FORTUNEÀRIA (after Robert Fortune, who traveled during the years 1843–61 in China and Japan and introduced a large number of highly ornamental plants). *Hamamelidàceæ.* Ornamental shrub, grown for its handsome foliage.

Stellate-pubescent: lvs. deciduous, alternate, serrate, with small caducous stipules: fls. small, short-pedicelled, in terminal racemes; calyx turbinate with 5 short lobes; petals 5, subulate, slightly shorter than sepals; stamens 5, with short filaments; ovary partly superior with 2 filiform revolute styles: fr. a dehiscent woody caps., separating into 2 valves bifid at the apex; seeds glossy, dark brown; embryo with large cotyledons revolute at the margin.—One species in Cent. China. Very similar in habit and foliage to Sinowilsonia, but the fls. and the embryo are very different. In general appearance it suggests the hazel; fls. and frs. insignificant. Has proved hardy at the Arnold Arboretum. Prop. is by seeds and possibly by grafting on Hamamelis.

sinénsis, Rehd. & Wilson. Shrub to 6 ft.: lvs. obovate or obovate-oblong, short-acuminate, usually rounded at the base, sinuate-denticulate, glabrous above, pubescent on the veins below, 3–5½ in. long: fls. scarcely ⅛in. across in racemes about 2 in. long: caps. ovoid, less than ½in. long. May. Cent. China.

ALFRED REHDER.

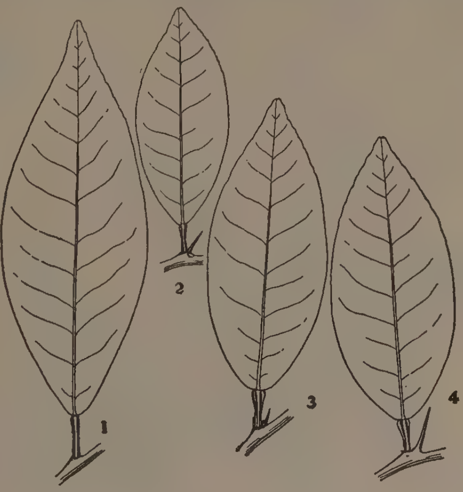
FORTUNÉLLA (named for Robert Fortune, who in 1846 introduced the first kumquat into Europe). *Rutàceæ*, tribe *Cítreæ.* KUMQUAT. Evergreen shrubs, grown for their small ornamental fruits, which are also preserved and eaten fresh. See *Kumquat.*

Leaves unifoliate, thick, pale and densely glandular-dotted below: stamens 4 times as many as the petals, polyadelphous; ovary 3–6- (rarely 7-) celled, ovules 2 in each cell; stigma cavernous: frs. like Citrus but smaller, 1–1½ in. diam., globose or oval, skin usually thick, sweet and edible; seeds green in section, cotyledons hypogeous in germination: first foliage-lvs. broadly ovate, opposite. Differs from Citrus in having a few-celled ovary with only 2 ovules in a cell, and a cavernous stigma; from Atalantia in having 4 times as many stamens as petals.—Four species are recognized.

The two commonly cultivated species of kumquats have been referred by botanists to Citrus, but the obviously related Hongkong wild kumquat has been referred to Atalantia. The kumquats are, as a matter of fact, out of place either in Citrus or Atalantia and constitute a separate genus about midway between these two. See Journ. Wash. Acad. Sci. 5:165–176 (No. 5, March 4) 1915.

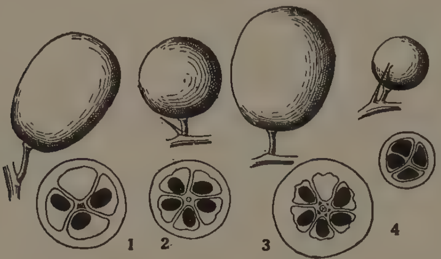
A. *Subgenus Eufortunella. Fr. 4-, 5-, 6- (or rarely 7-) celled, pulp vesicles abundant, their stalks arising from the smooth ovary wall, peel of fr. thick and fleshy. The kumquats proper.*

margarìta, Swingle (*Cítrus margarìta*, Lour.). Figs. 1563, 1564. OVAL KUMQUAT. NAGAMI KUMQUAT. A shrub or small tree, thornless or nearly so: twigs slender, angled when young, often somewhat tufted: lvs. lanceolate, tapering toward both ends, the tip abruptly rounded, sometimes emarginate, the base cuneate, margin usually obscurely crenate above the middle, dark green above, veins scarcely visible, pale green and densely glandular-punctate below: fls. arising singly or in few-fld. clusters in the axils of the lvs., small, ⅖–⅗in. diam.; pedicel short, 1½–2½ lines long; bud more or less angular in cross section; pistil short, 2–2½ lines; style persistent, scarcely longer than the ovary; stigma capitate, cavernous, with large, deep-seated oil-glands between the stylar canals; ovary 4- or 5-celled, ovules 2 in a cell, usually collateral: frs. oval or oblong, 1–1⅕ x ⅝–1 in., rarely 1⅓–1½ in. long, yellowish orange with large translucent oil-glands imbedded in the thick and fleshy skin; pulp-vesicles abundant, fusiform, pulp acid; seeds large, 5–6 x 3–3½ x 2–2½ lines, oval; embryos one or several, pistache-green in section; germination with hypogeous cotyledons: first foliage-lvs. opposite,



1563. Leaves of Fortunella. (×½) 1, F. margarita; 2, F. japonica; 3, F. crassifolia; 4, F. Hindsii.

oval, narrowed at the base but without a sharply delimited jointed petiole B.M. 6128. G.C. II. 2:336. Hume, Citr. Fr. p. 129.— The oval kumquat, the type of the genus Fortunella, is the most vigorous member of the genus, the branched shrub or tree attaining a height of 10–12 ft. and the lvs. sometimes reaching 6 in. length and 2 in. width. It was the first kumquat to reach Eu., having been brought to England by Robert Fortune in 1846. Because of its superior vigor it is the one most commonly grown commercially, but the frs. are inferior to those of the following species, the skin being harsh in flavor because of the biting quality of the oil.



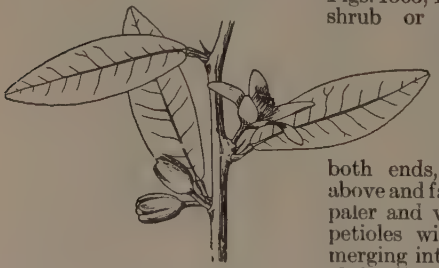
1564. Fruits with cross-sections of Fortunella. (X½) **1, F. margarita; 2, F. japonica; 3, F. crassifolia; 4, F. Hindsii.**

japónica, Swingle (*Cítrus japónica,* Thunb.). Round Kumquat. Marumi Kumquat. Figs. 1563–1565. A much-branched shrub with very short spines or none: differs from *F. margarita* in the broader and blunter pointed smaller lvs., 1⅗–4 x ⅗–1⅖ in., paler and veinless below, round frs. ⅝–1⅕in. diam., not showing any persistent rudiment of the style, and usually with 5–6 segms.: seeds small, 3½–5 x 3–3½ x 2–2½ lines, oval, blunt-pointed, the empty testa not projecting beyond the end of the embryo. Ill. Rumph. Herb. Amb. 1:110, pl. 31. Thunb. Icon. Pl. jap. 2, pl. 5. Hume, Citr. Fr. p. 129.—The round kumquat is perhaps the most handsome of the citrous frs. because of its dwarf habit, much-branched twigs, and small, bright orange-colored frs.

crassifòlia, Swingle. Meiwa Kumquat. Figs. 1563, 1564. A much-branched shrub with very short spines or none: differs from *F. margarita* in the more rounded frs. 1–1½ x 1–1⅛ in., with 6 or 7 cells, not 4 or 5, and in the thicker trough-shaped lvs. sometimes more abruptly pointed toward the tip, and paler green below: petioles narrowly winged, not merely margined. It differs from *F. japonica* in the lf. characters and the slightly oval frs. with 6 or 7 cells and a thicker peel. It differs from both species in having much broader oval or ovate pulp-vesicles.—This kumquat recently intro. into the U.S. by Japanese nurserymen is as yet but little known.

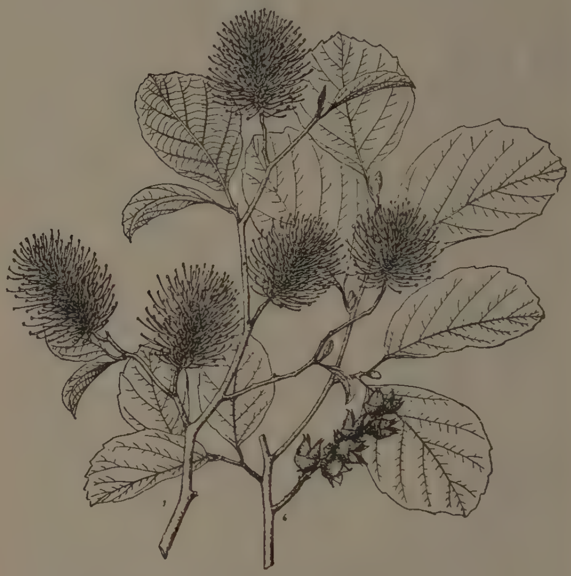
AA. *Subgenus Protocitrus. Fr. 3–4-celled, having between the stalks of the pulp-vesicles many minute wart-like, pale yellow cellular masses, peel of fr. thin and but slightly fleshy. The Hongkong wild kumquat.*

Hìndsii, Swingle (*Sclerostỳlis Hìndsii,* Champ. *Atalántia Hìndsii,* Oliver). Hongkong Wild Kumquat. Figs. 1563, 1564. A spiny shrub or small tree: twigs slender, angled when young: lvs. oval-elliptical, tapering sharply at both ends, dark green above and faintly venose, paler and venose below, petioles winged, often merging into the lamina of the lf. without a separative joint: fls. short, broad; pistil very short; style shorter than the ovary, stigma large, cavernous; ovary 3- or 4-celled, ovules 2 in a cell: frs. small, ⅗–⅘in. subglobose, bright orange-red; pulp-vesicles very few, small, fusiform; seeds thick, oval or ovate, plump, 4½–5½ x 3½–4 x 2½–3 lines, pistache-green in section. Ill. Seeman, Bot. Voy. H. M. S. Herald, 1852–1857, pl. 82.—The Hongkong wild kumquat grows commonly on the dry hills about Hongkong and on the mainland of China opposite. It is the most primitive of the true citrous frs. and doubtless the species of Citrus have evolved from such a plant.



1565. Buds and flower of Fortunella japonica.

Walter T. Swingle.



1566. Fothergilla.—Leaves of F. Gardenii and flowers of F. major. (X½)

FOTHERGÍLLA (after John Fothergill, eminent English physician, who introduced and cultivated many new plants, 1712–1780). *Hamamelidàceæ.* Dwarf Alder. Shrubs, chiefly grown for their showy spikes of white flowers and also for the handsome foliage.

Deciduous, more or less stellate-pubescent: lvs. alternate, short-petioled, coarsely toothed, stipulate: fls. in terminal spikes, perfect, apetalous; calyx campanulate, 5–7-lobed; stamens numerous, with the filaments thickened toward the end: caps. dehiscent, 2-celled and 2-seeded.—Four species in the southern Atlantic states.

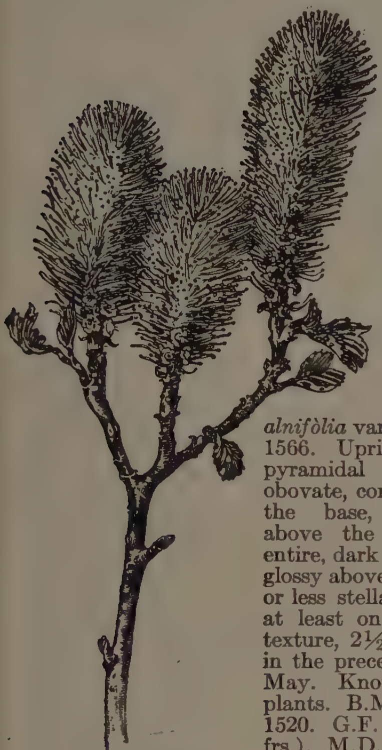
These are hardy ornamental shrubs with simple, dull green leaves, and showy spikes of white flowers in spring with the leaves: the distinct foliage resembles somewhat that of the alder, or more that of Hamamelis, and turns yellow late in fall. They grow best in moist, peaty or sandy soil. Propagation is by seeds, not germinating until the second year, or by layers, which take two years to root; the first species also by suckers and root-cuttings.

A. *Lvs. rarely exceeding 1 in., stellate-pubescent above: low shrub.*

Gárdenii, Murr. (*F. alnifòlia,* Linn. f. *F. carolìna,* Brit.). Fig. 1566. Low shrub, with generally spreading branches, to 3 ft.: lvs. oblong or obovate, rounded or cuneate at the base, coarsely dentate above the middle, pubescent above, pale or glaucous and tomentose below, 1–2 in. long: spikes ovate or oblong, 1–2 in. long, leafless at the base; stamens ⅓in. long, sometimes pinkish. April, May. Va. to Ga. B.M. 1341. L.B.C. 16:1507.

AA. *Lvs. 2–5 in. long, glabrous or glabrescent above: shrubs to 10 ft. high.*

montícola, Ashe. Fig. 1567. Upright shrub with spreading branches: lvs. roundish oval to broadly obovate or obovate, remotely dentate, often from below the middle, light green and sparingly pubescent below, often only on the veins, 2–4 in. long: spikes 1½–3 in. long with 1–3 lvs. at the base; stamens ½in. long: caps. ½in. long. April, May. N. C. to Ala.—Has proved hardy at the Arnold Arboretum, like the preceding and the following species.



1567. Fothergilla monticola. (×⅔)

màjor, Lodd. (*F. alnifòlia* var. *màjor*, Sims). Fig. 1566. Upright shrub of dense pyramidal habit: lvs. oval or obovate, cordate or truncate at the base, sinuately dentate above the middle or nearly entire, dark green and somewhat glossy above, glaucous and more or less stellate-pubescent below, at least on the veins, of firm texture, 2½–5 in. long: fls. like in the preceding species. April, May. Known only from cult. plants. B.M. 1342. L.B.C. 16: 1520. G.F. 8:445 (excl. lvs. and frs.). M.D.G. 1902:395, 396.—This species is superior to the former on account of its dense, pyramidal habit.

F. parviflòra, Kearney. Closely related to F. Gardenii. Lower and stoloniferous: lvs. nearly orbicular, rounded or cordate at the base, toothed from below the middle. N. C. to Fla.

Alfred Rehder.

FOUQUIÈRIA (Pierre Ed. Fouquier, professor of medicine at Paris in the first part of the nineteenth century). *Fouquieriàceæ.* Candlewood. Four species from the deserts of Mexico and one extending into the United States and sometimes cultivated in the larger rockeries of California. These plants are interesting as being an example of an order far removed from the Cactaceæ in flowers and fruit but reduced to something of their habit by the desert conditions.

Small trees or shrubs, becoming leafless in dry weather, with showy tubular fls. in terminal racemes or panicles: lvs. fleshy, obovate, fascicled in the axils of thorns: sepals 5; corolla with a spreading 5-lobed limb; stamens 10–∞; styles 3, separate or united: seeds with a membranous wing or fringed with long hairs. Fouquieria is by some authors retained in the Tamaricaceæ.

splêndens, Engelm. Coach-whip. Vine-Cactus. Jacob's Staff. Ocotillo. Shrub, 6–25 ft., branching near the base: branches long, gray, furrowed, erect: lvs. obovate, rounded at apex, wedge-shaped at base, ½–1 in. long: fls. scarlet or brick-red, exceeding 1 in. long, in racemose or thyrsoid elongated clusters; stamens 8–12, exserted: caps. ½–⅔in. long, the seeds white, with a long fringe of spirally thickened hairs. W. Texas and Ariz. to S. Calif. B.M. 8318. A.G. 13:759.—A hedge plant in Mex., making an impentrable barrier. The plant is a conspicuous object in the deserts from Texas westward, standing on the open exposed places and slopes, the rod-like stiff canes looking like lifeless sticks in dry weather and in its season crowned with masses of showy bloom.

L. H. B.†

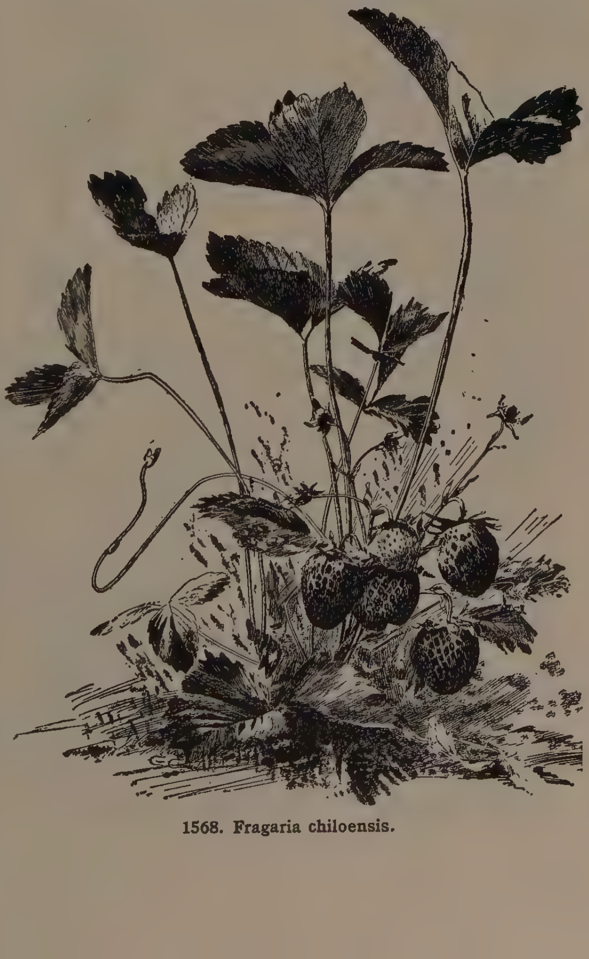
FOURCRÒYA: *Furcræa.*

FOUR-O'CLOCK: *Mirabilis Jalapa.*

FOXGLOVE: *Digitalis.*

FRAGÀRIA (Latin, fragrance, from the smell of the fruit). *Rosàceæ.* Strawberry. Low perennial creeping herbs grown for the excellent fruit, and one or two species for ornament.

Plant stemless, with scaly rootstock or crown, and rooting runners: lvs. palmately 3-foliolate and toothed, all from the crown: fls. white or reddish, in corymbose racemes on slender, leafless scapes, sometimes lacking stamens; calyx deeply 5-lobed and reinforced by 5 sepal-like bracts; petals 5, obovate, elliptic or orbicular; stamens many, short; pistils many, on a conical receptacle, becoming small and hard achenes and persisting on the enlarging receptacle, which becomes pulpy and edible.—The fragarias are exceedingly variable. About 150 specific names have been applied to them, but Bentham and Hooker would reduce them all to 3 or 4 species, and Focke (in Engler & Prantl) to about 8. Rydberg, however, accepts 27 N. American species (N. Amer. Flora, XXII, part 4. 1908). Of the true fragarias, about 4 species-types are interesting to the horticulturist as the parents of the garden strawberries:—*F. chiloensis*, the probable original of the ordinary cultivated strawberries of Amer.; *F. virginiana*, which was early domesticated, and of which some trace still remains in cult. varieties; *F. moschata*, the Hautbois, and *F. vesca*, the alpine and perpetual strawberries, which are little cult. in this country. The classical work on straw-



1568. Fragaria chiloensis.

1569. Fragaria virginiana, showing the profuse runners.

berries is Duchesne's "Histoire Naturelle des Fraisiers," 1766. See *Strawberry*. For *Fragaria indica*, see *Duchesnea*.

A. *Lfts. distinctly petiolulate, few-toothed.*

Daltoniàna, Gay (*F. sikkiménsis*, Kurz). Small plant with red sts. to the very slender runners, offered as a rock-garden subject or carpeter: hairy or nearly glabrous: fls. solitary; calyx-lobes and bracts toothed: fr. long (1 in. long by half as broad), bright scarlet, with little flavor. Himalayas, 10,000 ft. and upward.

AA. *Lfts. sessile or nearly so, many-toothed.*

B. *Lvs. normally overtopping the fls. and fr.: achenes mostly sunken in the flesh of the berry.*

chiloénsis, Duchesne. Fig. 1568. Low, but stout in all its parts: lvs. thick, more or less glossy above, bluish white below, blunt-toothed: fl.-clusters forking and long-rayed, the peduncle short, soon lopping on the ground: runners mostly appearing after the fr. is gone: berry large and firm, dark-colored, more or less musky in flavor, reinforced by a very large calyx or hull. Pacific coast region Peru to Patagonia. —A common wild strawberry of the Pacific slope from Alaska to Calif., is considered to be the same species.

Var. **ananássa**, Hort. (*F. ananássa, F. tíncta, F. calyculàta*, Duchesne. *F. grandiflòra*, Ehrh. *F. vésca* var. *anànas*, Ait.). Pine Strawberry. Common Garden Strawberry. Taller growing: lvs. larger and thinner, mostly lighter green on both sides: fr. larger, running into very many kinds.

virginiàna, Duchesne. Scarlet or Virginian Strawberry. Figs. 1569, 1570. More slender: lvs. thinner, light green above and below, the upper surface with sunken veins: fl.-clusters small, with a few hanging frs. at the top of a rather long peduncle: runners usually appearing with the fr.: berry small, light scarlet, globular or oblong-conical, usually with a constriction or neck underneath the moderate-sized calyx or hull. E. N. Amer.—Variable. A few early varieties of strawberries, as Crystal City, seem to be wholly or partly of *F. virginiana* origin. Var. **illinoénsis**, Gray (*F. illinoénsis*, Prince. *F. Grayàna*, Vilm. *F. virginiàna* var. *Grayàna*, Rydb.). A large and more robust form, more hairy, the hairs on the pedicels spreading whereas on the type they are more appressed.

BB. *Lvs. normally shorter than the fl.-clusters: achenes usually not sunken in the flesh of the berry.*

1570. Fruit of Fragaria virginiana. (Nat. size)

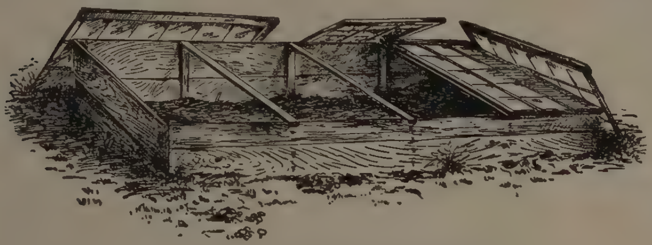
vésca, Linn. (*F. semperflòrens*, Duchesne). Alpine and Perpetual Strawberries. Erect and dark green, only sparsely hairy, the lvs. thin and light green as compared with the foregoing species, very sharp-toothed: fl.-cluster small, forking, erect: fr. firm, small, usually hemispheric, the achenes very prominent; hull spreading. Eu.—The American more slender form of this group-species, common in woods from Va. north, is var. **americàna**, Porter (*E. americàna*, Brit.), Fig. 1571, with ovoid or somewhat conical fr. usually with a distinct neck, and sparingly hairy rather than hairy-pubescent petioles and scapes, and thinner lvs. The true *F. vesca* is thought to be sparingly naturalized eastward, and probably native in many parts, particularly the white-fruited form (forma *albicárpa*, Brit.). The cult. forms are rarely seen in this country, but the quality is high, and they are deserving of more attention in home grounds. Variable in cult. There is a form with lfts. reduced to 1 (*F. monophýlla*, Duchesne. B.M. 63). This type of strawberry bears more continuously than *F. chiloensis* and *F. virginiana* in its cultivated forms.

1571. Fragaria vesca var. americana. (Separate fruit nat. size)

moschàta, Duchesne (*F. elàtior*, Ehrh.). HAUTBOIS. Taller, usually diœcious, more pubescent, the calyx or hull strongly reflexed from the fr.: berry dull red, musky. Eu.—Cult. forms rarely seen in Amer.

mexicàna, Schlecht. Lvs. few and scape solitary: lvs. rather thin, soon becoming smooth above, the slender silky petioles 2–3 in. long; lfts. oblong-obovate or cuneate, coarsely serrate: fls. usually less than ½in. diam., on scapes 2–4 in. high; sepals and bracts silky; petals obovate: fr. nearly hemispheric, small, the achenes superficial. Cent. Mex.—The "everbearing strawberry," frequently advertised, is said to belong here. *F. califórnica*, Cham. & Schlecht., is similar but has much longer petioles and broadly rounded or rhomb-ovate lfts., somewhat larger fls. and fr., and the achenes in shallow pits. Calif., New Mex., Lower Calif.

L. H. B.



1572. A frame.—It accommodates four sashes.

FRAGRANT BALM: *Monarda didyma.*

FRAME. Fig. 1572. A box without permanent top or bottom which is designed, when covered with glass or other transparent material, as a place in which to grow plants. When supplied with artificial bottom heat, the frame is part of a hotbed; when supplied only with sun heat, it is part of a coldframe. The frame may be of any size, but the normal size is 6 by 12 feet, an area which accommodates four 3- by 6-foot sashes; and this 6 by 12 area is understood when one speaks of "a frame." See *Hotbed.*

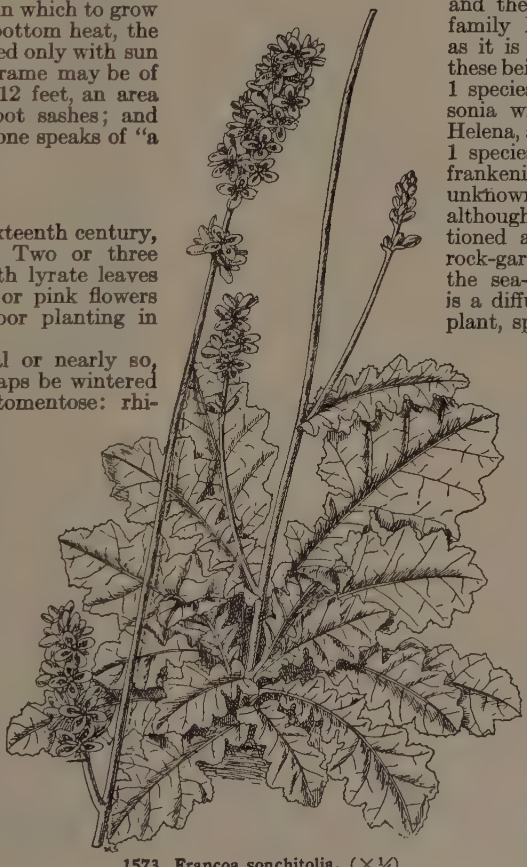
FRANCÍSCEA: *Brunfelsia.*

FRANCÒA (Fr. Franco, Valencia, sixteenth century, promotor of botany). *Saxifragàceæ.* Two or three species of Chilean perennial herbs, with lyrate leaves and terminal dense racemes of white or pink flowers borne in summer, suitable for outdoor planting in mild climates.

Plants erect, scapose, the lvs. basal or nearly so, 2–3 ft. high, and in the N. could perhaps be wintered in a coldframe: glandular-pilose or tomentose: rhizome thick, many-headed: lvs. glandular-dentate: fls. 1 in. across, in racemes 6 in. long; floral parts in 4's rarely 5's; petals obovate, clawed; stamens 4: caps. coriaceous, elongated, 4-angled and 4-celled.

A. *Fls. white.*

ramòsa, D. Don. (*F. glabràta*, DC.). Taller, woodier and more branching than the others, and distinguished by pubescent infl.: lf.-stalks not margined: fls. smaller. Hardy at Washington, D. C., with spikes 2 ft. long and 1 in. thick. Forms are known under the names *F. ramosa hybrida* (G.W. 7:230, a robust plant with pure white fls. larger than the type); and *F. ramosa candida. F. ramosa* is an attractive species. Gt. 60:1590. Gn. 69, pp. 271, 343; 70, p. 283. G.L. 24:177. G. 7: 741; 13:307. G.M. 49:127.



1573. Francoa sonchifolia. (×¼)

AA. *Fls. mostly pink.*

sonchifòlia, Cav. Fig. 1573. Lf.-stalks broadly winged at the base; lower lobes continuous with the broad margin at the base of the lf.-stalk: petals deep rose, dark-spotted. B.M. 3309.—By some considered to be a variety of *F. appendiculata.*

appendiculàta, Cav. Lf.-stalks not winged at the base; lower lobes distant from the base of the stalk: petals pale rose, rarely spotted. B.M. 3178 (shows a white longitudinal band on petals). B.R. 1645. L.B.C. 19:1864, erroneously named *F. sonchifolia.* R.H. 1906, pp. 428, 429. G.W. 12, p. 260.

L. H. B.†

FRANGIPANI: *Plumeria.*

FRANKÈNIA (John Frankenius, Swedish botanist, 1590–1661). *Frankeniàceæ.* Low perennials, evergreen, sometimes woody, mostly in saline soils, more or less heath-like: lvs. opposite or in 4's, thickish, entire, small and numerous on the sts., often fascicled on short branchlets: fls. small, perfect and complete, sessile or nearly so, solitary or in dichotomous clusters; calyx and corolla 4–5-merous, the sepals united, the petals with a crown at the base of the blade; stamens usually same number as petals and alternate with them; style 3–4-cleft; ovary 1-celled, with parietal placentæ, ripening into a caps. inclosed in the calyx.—Probably 30 species in many parts of the world, a very few of them in the S. W. U. S. The family Frankeniaceæ is closly allied to Caryophyllaceæ, from which it differs in the parietal placentæ, and to Hypericaceæ, from which it differs in habit, in the definite stamens and the valvate calyx. The family has 3 other genera, as it is defined by Niedenzu, these being Hypericopsis with 1 species in S. Persia, Beatsonia with 1 species in St. Helena, and Niederleinia with 1 species in Patagonia. The frankenias are practically unknown as cult. plants, although sometimes mentioned as carpeters and for rock-gardens. *F. lævis*, Linn., the sea-heath, is offered. It is a diffusely much-branched plant, spreading 6–8 in., glabrous or nearly so: lvs. revolute and thereby appearing linear, crowded in opposite clusters: fls. few, sessile in terminal leafy clusters, pink. England and the Medit. region. *F. pulverulénta*, Linn., is a closely allied hairy species; it has been reported in ballast at New York.

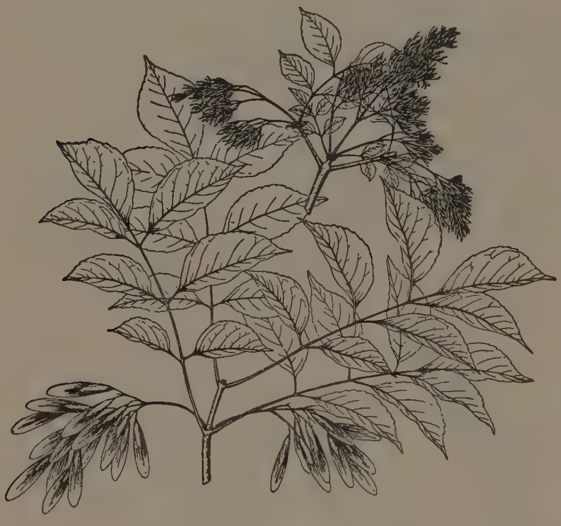
L. H. B.

FRASÈRA (John Fraser, English botanist, collected in Amer. 1785–96 and published Walter's "Flora Caroliniana"). *Gentianàceæ.* COLUMBO.

Large stout glabrous herbs, all N. American, and all but 1 far-western with a single st. from thick bitter mostly biennial roots, opposite or whorled lvs., and cymose panicled clusters of dull white, yellowish or bluish fls. which are commonly dark-spotted; calyx deeply 4-parted; corolla wheel-shaped, 4-parted, persistent, the lobes glandular within; stamens 4, the filaments often united at the base; ovary 1-celled, the stigma entire or 2-lobed.—Species 8, mostly in woods or dry soils. Three of the species have been offered in the trade, but are probably very little planted. *F. carolinénsis*, Walt., of the eastern states and Ont., is a biennial or short-lived perennial, 3–4 ft. tall, with lance-oblong or spatulate veiny lvs. mostly in 4's, and greenish yellow purple-dotted fls.

A. *Lvs. in whorls of 4–6, not white-margined.*

speciòsa, Douglas. Stout, 2–5 ft., very leafy, the lvs. ovate to oblong: fls. greenish white or barely tinged bluish, dark-dotted; 2 glands on each corolla-lobe. Wyo., S. and W.



1574. Fraxinus Bungeana. (×⅓)

AA. *Lvs. in 2's or 3's, white-margined.*

Párryi, Torr. Height 2–3 ft.: lvs. opposite or in 3's: fls. whitish, dark-dotted; 1 notched gland on each corolla-lobe. Ariz., S. Calif.

Cùsickii, Gray. Slender, height 3–8 in.: lvs. opposite: fls. bluish; 1 gland reaching from near the base to near the middle of each corolla-lobe. Ore.

L. H. B.†

FRAXINÉLLA: *Dictamnus.*

FRÁXINUS (ancient Latin name). *Oleàceæ.* Ash. Interesting trees grown chiefly for their handsome pinnate leaves and some species also for the conspicuous panicles of white flowers.

Deciduous: lvs. opposite, odd-pinnate, without stipules: fls. in panicles, diœcious or polygamous, with or without calyx or with calyx and a 2–6-parted corolla with generally linear segms.; stamens generally 2; ovary 2-celled: fr. a 1-seeded, winged samara.—About 50 species in the temperate regions of the northern hemisphere south to Cuba; 16 of them occur in the U. S.

The ashes are ornamental trees, most of them hardy, with rather large leaves and small flowers in panicles, either appearing before the leaves and greenish, or in the subgenus Ornus after or with leaves and whitish in showy panicles: the winged fruit is insignificant. They are valuable as street and park trees, and grow mostly into tall, pyramidal or broad-headed trees, with rather light green foliage, which turns yellow or dark purple in fall or remains green, as in *F. excelsior* and *F. Ornus.* The ash is seldom severely injured, though a number of insects and fungi prey on the leaves and wood, of which two borers, and a fungus attacking the leaves are perhaps the most obnoxious. Most of the species are hardy North except those from the southern states, southern Europe and Himalayas; of the subgenus Ornus, *F. Bungeana* and *F. longicuspis* seem to be the hardiest. The ashes are important forest trees, and the straight-grained and tough wood is much used for handles of tools, in the manufacture of carriages and wagons, for the interior finish of houses, and for furniture, for baskets and also for fuel. From *F. Ornus* manna is obtained as an exudation of the trunk, and some Chinese species, especially *F. chinensis* and *F. Mariesii*, yield the Chinese white wax.

The ashes grow in almost any moderately moist soil, *F. nigra* being somewhat more moisture-loving, while *F. oxycarpa*, *F. Ornus*, *F. syriaca* and *F. cuspidata* grow well even in drier situations. They are usually readily transplanted and grow rapidly when young. Propagation is by seeds gathered in fall and sown immediately, or stratified and sown in spring, covered with about 1 inch of good soil; sometimes they remain dormant until the second year. The varieties and rarer kinds are budded in late summer or grafted in spring on the seedlings of any of the common species.

INDEX.

acuminata, 9.
alba, 9.
albo-marginata, 9, 20.
albo-variegata, 20.
americana, 9.
angustifolia, 1.
anomala, 16.
argentea, 20.
asplenifolia, 20.
atrovirens, 20.
aucubæfolia, 12.
aurea, 20.
aurea-pendula, 20.
Biltmoreana, 10.
Bungeana, 2, 3.
caroliniana, 15.
chinensis, 8.
crispa, 20.
cucullata, 20.
cuspidata, 7.
diversifolia, 20.
elegantissima, 20.
epiptera, 9.
erosa, 20.
excelsior, 20.
floribunda, 1.
glauca, 9.
globosa, 20.
heterophylla, 20.
iodocarpa, 9.
jaspidea, 20.
juglandifolia, 1, 9.
laciniata, 20.
lanceolata, 11.
latifolia, 1.
lentiscifolia.23.
longicuspis, 4.
lutea, 20.
mandschurica, 19.
Mariesii, 5.
monophylla, 20.
nana, 20.
nigra, 18, 19.
novæ-angliæ, 9.
obovata, 3.
oregona, 14.
Ornus, 1.
oxycarpa, 22.
oxyphylla, 22.
parvifolia, 2, 23.
pendula, 20, 23.
pennsylvanica, 11, 12.
pistaciæfolia, 13.
platycarpa, 15.
polemoniifolia, 20.
potamophila, 24.
pubescens, 12.
quadrangulata, 17.
Regelii, 24.
rhynchophylla, 8.
rotundifolia, 1, 23.
rufa, 20.
sambucifolia, 18.
sambucina, 4.
scolopendrifolia, 20.
serratifolia, 6.
Sieboldiana, 4.
simplicifolia, 20.
sogdiana, 21 and suppl. list.
Spaethiana, 6.
syriaca, 21.
tamariscifolia, 22, 23.
Theophrastii, 1 and suppl.
Toumeyi, 13.
triptera, 15.
turkestanica, 21.
velutina, 13.
viridis, 11.

A. *Fls. in terminal panicles on leafy shoots, perfect or polygamous, with or after the lvs. (Ornus.)*

B. *Corolla present, divided nearly to the base; stamens with long filaments.*

C. *Petioles not conspicuously enlarged at the base.*

D. *Lowest pair of lfts. not much smaller than the others.*

E. *Lfts. stalked.*

1. **Órnus,** Linn. (*Órnus europæa*, Pers. *F. floribúnda*, Hort., not Wall.). Small tree, becoming 25 ft.: winter-buds gray or brownish tomentulose: lfts. generally 7, stalked, oblong-ovate or ovate, irregularly serrate, rufously pubescent on the midrib beneath, 2–3½ in. long: fls. whitish, fragrant, in dense, terminal panicles 3–5 in. long: fr. erect, narrow-oblong, truncate or emarginate at the apex, about 1 in. long. May, June. S. Eu., W. Asia. Gn. 22, p. 117; 34, p. 78; 48, p. 286; 31, pp. 354, 355. F.E. 22:61. G. 18:541. G.M. 54:860. H.W. 3:60, p. 120. Var. **juglandifòlia,** Tenore (var. *latifòlia*, Dipp. *F. rotundifòlia*, Hort.). Lfts. ovate or broadly ovate-oblong. Var. **rotundifòlia,** Tenore (*F. rotundifòlia*, Lam.). Low tree: lfts. roundish-elliptic to roundish-obovate. Var. **angustifòlia,** Tenore (*F. Theophrástii*, Hort., partly). Lfts. lanceolate.

2. **Bungeàna,** DC. (*F. parvifòlia,* Lingelsh. *F. Bungeàna* var. *parvifòlia,* Wenzig). Fig. 1574. Small tree, to 15 ft., or shrub: winter-buds nearly black: lfts. generally 5, stalked, ovate, obovate or roundish, obtuse to short-acuminate, serrate, glabrous, 1–1½ in. long: panicles to 2½ in. long, many-fld.; calyx with narrow acute lobes; filaments longer than the linear petals: fr. narrow-oblong, obtuse or emarginate. May. China. G.F. 7:5 (adapted in Fig. 1574).

EE. *Lfts. sessile.*

3. **obovàta,** Blume (*F. Bungeàna* var. *obovàta,* Lingelsh.). Tree: petioles often slightly winged; lfts. 5–7, oval or obovate, short-acuminate to obtusish, cuneate at the base, crenate-serrate, dull green above and slightly pubescent on the veins, grayish green below and pubescent toward the base of the veins, 2–4 in long: infl. small; petals linear, longer than the stamens: fr. with narrow-oblong obtuse wing. Japan.

DD. *Lowest pair of lfts much smaller than the others; lfts. long-acuminate.*

4. **longicúspis,** Sieb. & Zucc. Slender tree, to 30 ft., with rufously pubescent winter-buds: lfts. 5–7, stalked, oblong-lanceolate, long-acuminate, obtusely serrate, almost glabrous, 2–4 in. long: fls. in rather slender, narrow panicles, to 4 in. long; petals linear-oblong, about as long as stamens: fr. oblanceolate, obtuse. May. Japan. S.I.F. 1:81. Var. **Sieboldiàna,** Lingelsh. (*F. Sieboldiàna,* Blume). Lfts. oval to oblong-ovate, short-stalked, usually pubescent below along the midrib. Japan, Korea. Var. **sambúcina,** Lingelsh. (*F. Sieboldiàna* var. *sambúcina,* Blume). Lfts. sessile.

5. **Mariésii,** Hook. f. Shrub or small tree: winter-buds grayish black: petiole minutely glandular-pubescent; lfts. 5–7, nearly sessile, close, touching each other, ovate to ovate-lanceolate, acute or acuminate, entire or finely crenate-serrate, yellowish green below and glandular-puberulous on the midrib toward the base, otherwise glabrous, 1½–3 in. long: panicle upright, 5 in. long; petals linear-spatulate about as long as stamens. Cent. China. B.M. 6678.—Handsome and free-flowering; blooms even as a small shrub.

CC. *Petioles distinctly enlarged at the base: lfts. sessile, the lowest pair smaller.*

6. **Spaethiàna,** Lingelsh. (*F. serratifòlia,* Hort., partly). Tree: young branchlets glabrous: winter-buds dark brown: lvs. 6–12 in. long; petiole grooved, reddish brown at the enlarged base, glabrous; lfts. 5–9, oblong to oblong-obovate, deeply crenate-serrate, dark green above, lighter green below and glabrous except along the midrib toward the base, 3–7 in. long: fls. and frs. unknown. Origin unknown.—Handsome tree with large lvs.

BB. *Corolla with a short tube or wanting.*

C. *The corolla with short tube; anthers almost sessile.*

7. **cuspidàta,** Torr. Shrub or small tree, to 20 ft., with dark, reddish brown buds: lfts. usually 7, slender-stalked, lanceolate or oblong-lanceolate, acuminate, coarsely serrate, almost glabrous, 1½–2 in. long: fls. fragrant, in 3–4-in. long panicles: fr. spatulate-oblong. April. Texas to Ariz. and New Mex. S.S. 6:260.—Handsome flowering tree for temperate regions.

CC. *The corolla wanting, or occasionally present; calyx often irregularly toothed.* (*Ornaster.*)

8. **chinénsis,** Roxbg. Tree, to 40 ft.: branchlets glabrous: winter-buds brownish black, conspicuous with a rufous woolly tomentum when opening: lvs. 5–8 in. long; petiole enlarged at the base, nearly glabrous; lfts. 5–7, short-stalked, elliptic to elliptic-oblong or ovate-oblong, acuminate, cuneate at the base, serrate, dark green above, light green below and hairy along the lower part of the midrib, 2–5 in. long: pistillate panicle 3–6 in. long: fr. oblanceolate, obtuse or emarginate at the apex, 1½ in. long and ¼in. broad. China. May. Var. **rhynchophýlla,** Hemsl. (*F. rhynchophýlla,* Hance). Lfts. entire or irregularly crenate-serrate, on slenderer stalks. Cent. and W. China. G.F. 6:485.

AA. *Fls. from leafless axillary buds, before the lvs.; without corolla; filaments usually shorter than anthers.*

B. *The fls. diœcious, with the calyx persistent on the fr.; anthers linear or linear-oblong: lfts. generally 5–7: buds brown.* (*Leptalix.*)

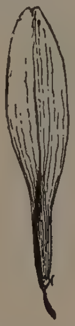
C. *Lvs. always pinnate.*

D. *Fr. oblanceolate or lanceolate; its body terete.*

E. *Lfts. stalked.*

F. *Under side of lfts. glaucous: wing of the fr. not decurrent.*

9. **americàna,** Linn. (*F. nòvæ-ángliæ,* Mill. *F. álba,* Marsh.). White Ash. Fig. 1575. Tall tree, to 120 ft.: branchlets and petioles glabrous: lfts. generally 7, stalked, ovate to ovate-lanceolate, entire or denticulate, dark green above, glaucous beneath, 3–5 in. long: fr. linear-oblong, with terete body, the wing not decurrent, 1½ in. long. From Canada to Fla., west to Minn. and Texas. S.S. 6:268. Em. 377. G.F. 7:405. F.E. 23:427.—Very variable. Var. **acuminàta,** Wesm. (*F. acuminàta,* Lam. *F. epíptera,* Michx. *F. americàna* var. *glaùca,* Hort.). Lfts. dark green and shining above, very glaucous and almost glabrous beneath, usually entire. Var. **juglandifòlia,** Rehd. (*F. juglandifòlia,* Lam.). Lfts. less shining above, usually broader, more or less pubescent beneath, serrate at least above the middle. This is the northern form, while the former is more common in the southern states. Var. **iodocárpa,** Fern. Frs. conspicuous by their reddish purple color. Var. **álbo-marginàta,** Hort. Lfts. edged white.



1575. Fruit or key of Fraxinus americana. (Natural size)

10. **Biltmoreàna,** Beadle. Tree, to 50 ft.: branchlets and petioles pubescent: lfts. 7–9, ovate-oblong to lanceolate, often falcate, acuminate, rounded or broadly cuneate at the base, entire or obscurely toothed, dark green and glabrous above, glaucous below and pubescent, particularly on the veins, 3–6 in. long: panicles pubescent: fr. linear-oblong, with terete body, the wing not decurrent, emarginate at the apex, 1½–1¾ in. long. May. Pa. to Ga., west to Ala., Mo. and Ill. S.S. 14:716.

FF. *Under side of lfts. green or grayish green: wing of the fr. decurrent, hence body margined.*

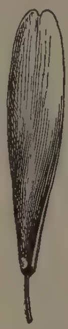
11. **lanceolàta,** Borkh. (*F. víridis,* Michx., in part. *F. pennsylvánica* var. *lanceolàta,* Sarg.). Green Ash. Tree, to 60 ft: branchlets and petioles glabrous: lfts. 5–9, stalked, ovate to oblong-lanceolate, irregularly serrate, green on both sides, almost glabrous, 2–5 in. long: fr. oblanceolate, with decurrent wing, hence body margined, about 1½ in. long. Canada to Fla., west to Rocky Mts. S.S. 6:272.

12. **pennsylvánica,** Marsh. (*F. pubéscens,* Lam.). Red Ash. Tree, to 60 ft.: branchlets and petioles pubescent: lfts. 5–9, stalked, ovate to oblong-lanceolate, acuminate, crenately serrate or entire, pubescent beneath, 3–6 in. long: fr. linear-spatulate, about 2 in. long, with somewhat decurrent wing. Canada to Fla., west to Dakota and Mo. S.S. 6:271.—This species varies considerably in the amount of pubescence and the shape of the lfts., and many forms under different names are grown in European nurseries and gardens. Var. **aucubæfòlia,** Hort., is a form with less pubescent lvs., blotched yellow. There are also variegated forms with the lvs. blotched white or edged white.

EE. *Lfts. sessile or short-stalked: branchlets and petioles pubescent.*

13. **velùtina,** Torr. (*F. pistaciæfòlia,* Torr.). Tree, to 40 ft., with velvety pubescent, rarely glabrous branches: lfts. 5–9, sometimes reduced to 3 or even 1, short-stalked, oblong to lanceolate, usually acuminate, narrowly cuneate at the base, entire or remotely serrate, yellowish green, firm and thick at maturity, pubescent or nearly glabrous beneath, 2–4 in. long: fr. spatulate, with marginless body. Texas to Ariz. and New Mex. S.S. 6:267. G.F. 8:15. —*F. Tòumeyi,* Brit., with narrower more distinctly stalked lfts., is probably only a variety of this species. M.D.G. 1913:556; also S.S. 6:267 represents this variety.—Particularly recommendable for saline and alkaline soil, where but few trees will grow; not hardy N.

14. **oregòna,** Nutt. Tree, to 80 ft.: petioles sometimes glabrous at length; lfts. 7–9, almost sessile or short-stalked, oblong or elliptic, acuminate, entire or obscurely and remotely serrate, light green, 2½–6 in. long, thick and firm at maturity: fr. oblong-obovate, with decurrent wing, about 1½ in. long. Wash. to Calif. S. S. 6:276.



1576. Key of Fraxinus nigra. (Natural size.)

DD. *Fr. elliptic or broadly spatulate, body compressed with the wing all around.*

15. **caroliniàna,** Mill. (*F. platycárpa,* Michx. *F. tríptera,* Nutt.). Water Ash. Tree, to 40 ft., with pubescent or glabrous branches: lfts. 5–7, stalked, ovate or oblong, acuminate, broadly cuneate or sometimes rounded at the base, serrate, rarely entire, pubescent or glabrous beneath, 2–5 in. long: fr. 1–2 in. long, with pinnately veined wing, often 3-winged. Va. to Fla., west to Ark. and Texas. S.S. 6:274, 275.

CC. *Lvs. usually simple, occasionally 3–5-foliolate: branchlets quadrangular.*

16. **anómala,** Wats. Shrub or tree, to 20 ft.: lfts. broadly ovate or roundish at the apex, rounded, acutish or emarginatc, entire or sparingly crenate-serrate, glabrous and dark green above, paler and pubescent below while young, 1½–2 in. long: fls. polygamous: fr. obovate-oblong, rounded or emarginate at the apex, ⅔in. long. Colo., Utah, Nev. and S. Calif. S.S. 6:266.

1577. Fraxinus excelsior. (×⅕)

BB. *The fls. without calyx (only No. 17 has a deciduous minute calyx); anthers cordate, rarely broadly oblong: lfts. generally more than 7, nearly glabrous. (Fraxinaster.)*

C. *Branches 4-angled and usually winged.*

17. **quadrangulàta,** Michx. Blue Ash. Tree, to 80, rarely 120 ft.: lfts. 7–11, short-stalked, ovate to lanceolate, acuminate, sharply serrate, yellowish green on both sides, 3–5 in. long: fls. perfect: fr. oblong, emarginate, winged all around, 1–2 in. long. From Mich. to Ark. and Tenn. S.S. 6:263.

CC. *Branches terete or nearly so.*

D. *Rachis at the base of lfts. with thick rufous tomentum: fls. diœcious.*

18. **nìgra,** Marsh. (*F. sambucifòlia,* Lam.). Black Ash. Fig. 1576. Tree, to 80 ft.: lfts. 9–11, sessile, oblong-lanceolate, rounded at the base, acuminate, sharply serrate, green on both sides, dark above, 3–6 in. long: anthers broadly oblong: fr. narrow-oblong, with decurrent wing. From Canada to Va., west to Mo. S.S. 5:264,265. Em. 382.

19. **mandschùrica,** Rupr. (*F. nìgra,* var. *mandshùrica,* Lingelsh.). Tree, to 100 ft., with obtusely quadrangular branches and dark brown buds: lfts. 9–11, almost sessile, ovate to oblong-lanceolate, sharply serrate, pubescent or hispid on the veins beneath, 3–6 in. long: fr. oblong-lanceolate, 1–1½ in. long. Manchuria, Korea, Saghalin, Japan. S.I.F. 2:62 (as *F. Sieboldiana*).

DD. *Rachis without conspicuous rufous tomentum: fls. perfect or polygamous.*

E. *Buds black.*

20. **excélsior,** Linn. Fig. 1577. Tall tree, to 120 ft.: lfts. 9–13, almost sessile, oblong-ovate or ovate-lanceolate, acute or acuminate, serrate, dark green above, paler beneath, 2–5 in. long: fr. oblong, often emarginate, about 1½ in. long. Eu., W. Asia. H.W. 3:59, pp. 115, 116. Gn. 22, p. 273. F.E. 24:395. Many different varieties are cult., some of the most distinct being the following: Var. **álbo-marginàta,** Hort. Lfts. edged white. Var. **argéntea,** Loud. (var. *álbo-variegàta,* Hort.). Lfts. blotched white. Var. **lùtea,** Loud. Lvs. variegated with yellow. Var. **jaspídea,** Desf. Bark of the young branches striped pinkish white. Var. **aùrea,** Pers. With yellow branches. Var. **aùrea-péndula,** Loud. With pendulous yellow branches, but a somewhat weak grower. Var. **eròsa,** Willd. (Var. *asplenifòlia,* Kirchn. Var. *laciniàta,* Hort. Var. *elegantíssima,* Hort. Var. *scolopendrifòlia,* Hort.). Lfts. very narrow, incisely serrate and often almost linear. Var. **críspa,** Willd. (Var. *atròvirens,* Var. *cucullàta,* Hort.), with very dark green curled and twisted lvs.; of slow growth. Var. **diversifòlia,** Ait. (*F. heterophýlla,* Vahl. *F. simplicifòlia laciniàta,* Hort. *F. rùfa,* Hort., not Bosc). Lvs. simple or 3-parted, usually incisely dentate. Gn. 22, p. 273. Var. **monophýlla,** Kuntze (*F. monophýlla,* Desf. *F. simplicifòlia,* Willd.). Lvs. simple, ovate, serrate, rarely with 1 or 2 small lfts. at the base. Var. **nàna,** Loud. (Var. *polemoniifòlia,* Var. *globòsa,* Hort.). A compact, slow-growing, dwarf form with very small lvs. M.D.G. 1904:380. Var. **péndula,** Ait. With pendulous branches. One of the best pendulous trees

for forming arbors and shady seats. Gn. 39, p, 451; 68, p. 400.

EE. *Buds brown.*

F. *Lfts. sessile or nearly so.*

G. *Number of lfts. 3–5, rarely 7.*

21. **syrìaca,** Boiss. (*F. sogdiàna,* Dipp., not Bunge. *F. turkestànica,* Carr.). In cult. usually small tree, the branches with short internodes and lvs. therefore crowded, often in whorls of 3: lfts. lanceolate, acuminate, cuneate at the base, serrate, bright green and quite glabrous on both sides, 1½–2½ in. long: panicles 1½ in. long: fr. usually obovate-oblong, obtuse. Syria to Kurdistan.

GG. *Number of lfts. 7–13.*

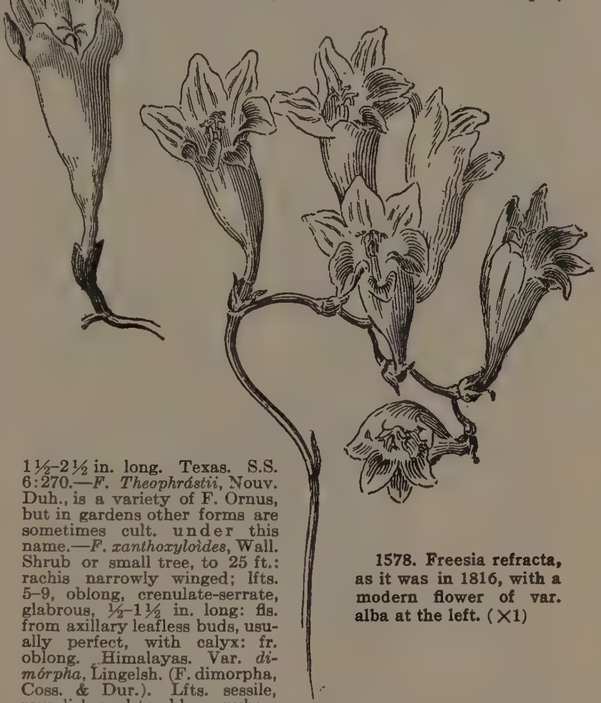
22. **oxycárpa,** Willd. (*F. oxyphýlla,* Bieb. *F. tamariscifòlia,* Hort., partly). Tree: lfts. 7–11, ovate-oblong to oblong-lanceolate, acuminate, cuneate at the base, sharply serrate, light green on both sides and glabrous except along the midrib below, 1½–3 in. long: fr. obovate-oblong, acute or obtusish, narrowed at the base. May. S. Eu. to Persia.

23. **rotundifòlia,** Mill. (*F. parvifòlia,* Lam. *F. lentiscifòlia,* Desf. *F. tamariscifòlia* Hort., partly). Shrub or small tree, to 15 ft., with slender, often purplish branches: lfts. 7–13, sessile, broadly oval to elliptic, rarely obovate, acute, or rounded at the apex, serrate, ½–1½ in. long: fr. oblong, obtuse or acute. W. Asia, S. Eu. Var. **péndula,** Rehd. (*F. parvifòlia* var. *péndula,* Dipp.), with pendulous branches, forming a graceful small weeping tree.

FF. *Lfts. distinctly stalked; stalk ⅕–⅖in. long.*

24. **potamóphila,** Herd. (*F. Règelii,* Dipp.). Small tree, to 30 ft., with rather stout, upright branches: lfts. 7–13, stalked, rhombic-ovate or ovate-lanceolate, serrate, acute or acuminate, glabrous or sparingly pubescent on the midrib below, 1–2½ in. long: fr. oblanceolate-oblong, with decurrent wing, acute, 1 in. long. Turkestan, Songaria.—Handsome tree with round head and dense small foliage.

F. angustifòlia, Vahl. Closely related to F. oxycarpa. Lfts. 7–13, elliptic-lanceolate to lanceolate, serrate, ½–1½ in. long: fr. obtuse at the base. S. Eu., N. Afr., W. Asia. Var. *austràlis,* Schneid. (F. australis, Gay). Lfts. below and rachis hairy.—*F. argéntea,* Loisel., is a variety of F. Ornus, not in cult., but in gardens often other ashes, especially variegated forms, are cult. under this name.—*F. austràlis,* Gay=F. angustifolia var. australis.—*F. Berlandieriàna,* DC. Allied to F. lanceolata. Tree, to 70 ft.: lfts. 3–5, ovate or obovate, serrate, downy along the veins beneath, to 4 in. long. Texas to Mex. S.S. 6:273.—*F. bracteàta,* Hemsl.=F. Griffithii.—*F. coriàcea,* Wats. Allied to F. velutina. Tree, to 30 ft.: lfts. 5, subcoriaceous, ovate to oblong, acute, broadly cuneate or rounded at the base, glabrous or pubescent below. S. Calif. to Utah, Ariz., Nev. S.S. 14:713.—*F. dimórpha,* Coss. & Dur.=F. xanthoxyloides var. dimorpha.—*F. dipétala,* Hook. & Arn. Allied to F. cuspidata. Shrub: lfts. 5–7, elliptic or ovate, serrate or entire, ½–2 in. long: fls. with 2 obovate petals. Calif., Mex. S.S. 6:261. Tender.—*F. floribúnda,* Wall. Allied to F. longicuspis. Tree, to 40 ft.: lfts. 5–7, ovate-lanceolate, serrate, reticulate beneath, 2–4 in. long: panicles large, to 10 in. long; petals oblong. Himalayas. Tender.—*F. floridàna,* Sarg.=F. pauciflora.—*F. Gréggii,* Gray. Allied to F. cuspidata. Small tree: lfts. 3–7, oblong-obovate, crenately serrate, or entire, ½–1 in. long: fr. linear-oblong, emarginate. S.S. 6:262. G.F. 2:451.—*F. Gríffithii,* Clarke (F. bracteata, Hemsl.). Allied to F. Mariesii. Tree, to 40 ft.: lfts. 5–7, subcoriaceous, elliptic to ovate-lanceolate, lustrous above, bright green below and pubescent on the veins, 2–4 in. long: infl. 6–8 in. high, with persistent lanceolate bracts; petals 4: fr. spatulate. Cent. China, Himalayas, Java.—*F. holotrícha,* Koehne. Allied to F. potamophila. Tree: lfts. 9–13, ovate-lanceolate or lanceolate, pubescent on both sides, 1½–3 in. long: fls. in 10-fld. racemes; ovary pubescent. Origin unknown.—*F. hýbrida,* Lingelsh.=F. pauciflora.—*F. pauciflòra,* Nutt. (F. floridana, Sarg. F. hybrida, Lingelsh.). Allied to F. caroliniana. Tree, to 40 ft.: lfts. 3–5, oblong, acuminate, cuneate at the base, tomentose below: fr. oblong-lanceolate, rounded or emarginate at the apex. Ga. to Fla. S.S. 14:717.—*F. Paxiàna,* Lingelsh. Allied to P. longicuspis. Tree, to 40 ft.: lfts. 7–9, sessile, ovate, crenulate, 4–7 in. long: panicle large and dense: fr. 1–1¼ in. long, ⅙in. broad. Cent. China, Himalayas.—*F. platýpoda,* Oliver. Allied to F. americana. Tree: petioles enlarged and winged at the base; lfts. 5–7, ovate-lanceolate, finely serrate, hairy along the midrib below, 2–4 in.: fr. narrow-oblong, acute. Cent. China. H.I. 20:1929.—*F. profúnda,* Bush. Allied to F. pennsylvanica. Lfts. 7–9, oblong-lanceolate, acuminate, entire, 3–6 in. long, tomentose beneath: fr. 2–2½ in., with decurrent wing. Ind., Ark., to Fla. S.S. 14:714–5.—*F. pubinérvis,* Blume. Allied to F. longicuspis. Lfts. usually 9, ovate to oblong-ovate, serrate with incurved teeth, pubescent on the veins below, 3–5 in. long: fr. oblanceolate. Japan.—*F. raibocárpa,* Regel. Shrub: lfts. 3–7, oblong or oblong-obovate, usually entire, obtuse, 1–2 in. long: fr. strongly falcate with obovate not decurrent wing. Turkestan, Bukhar.—*F. retùsa,* Champ. Allied to F. Mariesii. Tree: lfts. about 5, ovate to ovate-lanceolate, glabrous, reticulate, 2–3 in. long. Hongkong. Var. *Henryàna,* Oliver. Shrub or tree, to 35 ft.: lfts. slender-stalked, oblong to lanceolate, serrulate, 3–5 in. long: panicle dense, 4–6 in. long: fr. ¾–1 in. long, emarginate. Cent. China. H.I. 20:1930. Only the variety is in cult.—*F. sogdiàna,* Bunge. Allied to F. potamophila. Lfts. 7–11, ovate-lanceolate, bright green: fr. 1¼ in. long, obtuse or emarginate. Turkestan.—*F. texénsis,* Sarg. Allied to F. americana. Tree, to 40 ft.: lfts. 5, broadly oval or ovate, rounded or acute at the apex, 1½–2½ in. long. Texas. S.S. 6:270.—*F. Theophrástii,* Nouv. Duh., is a variety of F. Ornus, but in gardens other forms are sometimes cult. under this name.—*F. xanthoxyloìdes,* Wall. Shrub or small tree, to 25 ft.: rachis narrowly winged; lfts. 5–9, oblong, crenulate-serrate, glabrous, ½–1½ in. long: fls. from axillary leafless buds, usually perfect, with calyx: fr. oblong. Himalayas. Var. *dimórpha,* Lingelsh. (F. dimorpha, Coss. & Dur.). Lfts. sessile, roundish oval to oblong, pubescent on the midrib below. N. Afr. Var. *dumòsa,* Lingelsh. (F. dimorpha var. dumosa, Carr.). A low shrubby form of the preceding variety, with small lfts.—This species belongs to the section Sciadanthus, having perfect apetalous fls. with calyx.



1578. Freesia refracta, as it was in 1816, with a modern flower of var. alba at the left. (×1)

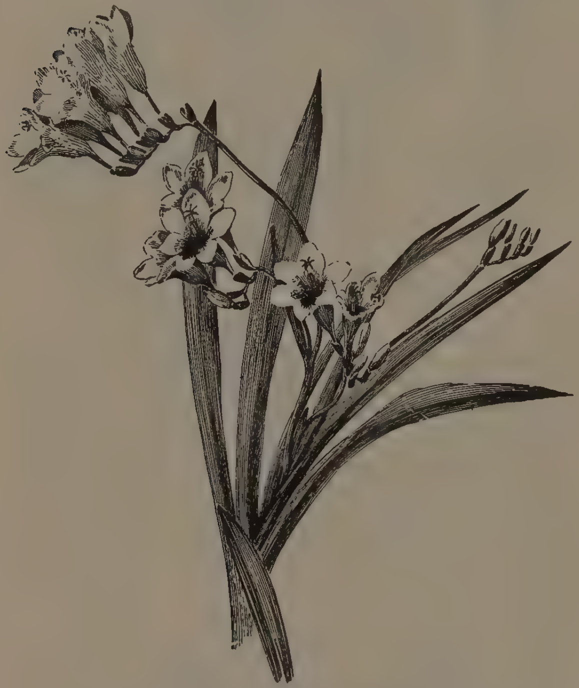
Alfred Rehder.

FREÈSIA (name unexplained, perhaps personal). *Iridàceæ.* Popular "bulbs" for fall planting and winter blooming, and next to the Chinese narcissus, which may be grown in water, they flourish in home windows with less care than most other bulbs; they are also much-prized florists' plants; easily grown, attractive, and fragrant.

Cormous plants, with plane narrow lvs. at the base and somewhat on the sts., and showy fls. in small clusters at the top of the slender st.: perianth tubular and funnel-shaped, the segms. more or less unequal; stamens 3, inserted in the tube, the anthers linear; ovary ovoid or oblong, 3-celled, with crowded ovules, the style filiform and the branches 2-fid (Tritonia, closely allied, has simple style-branches): fr. a loculicidal 3-valved caps., bearing turgid seeds.—S. Afr., probably 2 or 3 original species, but the specific limits difficult of determination.

Freesias have well-shaped tubular flowers, white or pale yellow. The five to seven flowers are upright and attached along a jointed axis which is suddenly bent back almost at right angles to the vertical peduncle. The popularity of freesias is a growth of the last quarter century or more, although they have been in cultivation since 1816 or earlier. Conservative botanists now suppose that the usual garden freesias are all originally of one stock, which species should be called *F.*

refracta. Extremes of variation in form are shown in Figs. 1578 and 1579, from the long and slender tube of var. *alba* to the short and broader tube of var. *Leichtlinii.* One of the earliest pictures of the plant is that in the "Botanical Register" for 1816 (Plate 135, as *Tritonia refracta*), a part of which is reproduced in Fig. 1578 to show the great irregularity of the corolla-lobes at that early period, and the straggling habit of the flowers, some pointing down and others up. The garden evolution of the freesias has proceeded along two lines. The greatest effort has been expended to produce a pure white flower, and in the best strains the white color is mostly associated with a long and slender tube. The ideal of a yellow flower is less popular, and is mostly associated with the shorter and broader tube. In both cases the forms with straggling inflorescence and irregular corolla-lobes have been suppressed. One may readily see how strongly two-lipped and gaping were the flowers of 1816, and how much the tube was bulged on one side. Any tendencies toward such forms in modern bulbs are signs of undesirable characters. In pedigree plants the lobes are rounded and the flowers symmetrical.



1579. Freesia refracta var. Leichtlinii. (×½)

These plants are much forced by florists, chiefly for cut-flowers at Christmas. If cut when only two flowers are out, the others will open. They may be had in flower from Christmas until June by successional plantings from August to February. For the best results the largest and highest-priced bulbs should be planted as early as August. Under good care, the bloom may be secured in ten to twelve weeks after the bulbs are planted; it is not necessary that the bulbs be kept cool or stored for a time after potting, as is the case with hyacinths and tulips, for they root quickly and start rapidly into growth. For holiday bloom, the bulbs are planted in October. One of the strong points of freesias is that planting may be delayed longer than with many other bulbs. Bottoms may be dried off gradually in the pots and then be shaken out and kept dry during summer. Repot; the larger bulbs will bloom, but will not give so good results as medium-sized imported bulbs not previously forced. When the plants are growing, keep them cool and moist. Provide good drainage, and let the potting earth contain a little sand and more or less fibrous material. Usually several bulbs are planted together in pots or boxes (about six bulbs in a 5-inch pot). Offsets are freely produced and these may be used for propagation; or seeds may be employed, giving blooming plants in two or three years, or sometimes the recent hybrid forms are said to give bloom in six to seven months from seeding.

refrácta, Klatt. Fig. 1578. Weakly erect, 1–1½ ft., from an ovoid reticulated corm, the st. more or less distantly branched and bearing a few reduced lvs: the basal lvs. about 6, linear, firm, about 6 in. long: fls. in loose secund spikes on a flexuose rachis, the spathe-valves oblong-lanceolate and acute and not covering the ovary; perianth greenish yellow or bright yellow, to 1½ in. long, the tube abruptly constricted below the middle, the limb distinctly labiate and the segms. unequal. B.R. 135 (as *Tritonia refracta*).—The original type is probably no longer in cult. Var. **álba,** Baker (*F. álba,* Hort.). Lvs. broader: infl. less branched; spathe-valves broader, toothed, covering the ovary; fls. large, clear white, with a gradually narrowing tube, the perianth-limb not bilabiate (or only indistinctly so), the segms. obtuse and nearly equal. G. 5:97; 8:575; 27:88. G.M. 50:927. Gn.W. 15:10. J.H. III. 43:272. The common garden form, much prized. *F. virginalis grandiflora* is a seedling of this, the fls. being much larger, ground-color white and less yellow in throat. G. 31:215. Var. **odoràta,** Baker (*F. odoràta,* Klatt). Lvs. broader than in the type, less rigid, and infl. less branched and fls. fewer: spathe-valves broader and more obtuse, toothed at the apex, covering the ovary; fls. bright yellow, the tube abruptly constricted, the limb not distinctly bilabiate and the segms. obtuse and nearly equal. L.B.C. 19:1820 (as *Tritonia odorata*). Var. **Leíchtlinii,** Hort. (*F. Leíchtlinii,* Klatt), (Fig. 1579), differs in its shorter abruptly constricted tube and large pale yellow fls.; by many considered to be a distinct species.

Ármstrongii, W. Wats. Differs from *F. refracta* in the color of the fls. and absence of purple from the lf.-bases: 16–20 in.: tube white with orange at base, the segms. markedly bordered with rose-purple: about one month later in blooming then *F. refracta alba.* Named for W. Armstrong, of S. Afr. Gn. 59, p. 374. G.M. 48:833.

hýbrida, Hort. Here belong many hybrid forms, some of them known as the "colored freesias," as: *F. Chápmanii,* a cross of the typical *F. refracta* (*F. aurea,* Hort.), with var. *alba,* producing a soft yellow flushed with deeper yellow and with an orange blotch (Gn. 71, p. 165. G.M. 50:164. G. 31:175); *F. Tubérgenii,* being a cross of *F. refracta alba,* and *F. Armstrongii* (G.W. 13, p. 199. G. 28:215. Gn. 69, p. 184. J.H. III. 52:299); *F. kewénsis,* hybrid probably between *F. Armstrongii* and *F. Leichtlinii; F. Màidenii,* being *F. refracta alba* × *F. Armstrongii; F. Ragionièri,* a race resulting from the crossing of *F. refracta, F. Leichtlinii* and their hybrids with *F. Armstrongii,* described as producing scented fls. tinted in shades of pink, rose, purple, blue, brown, orange, and spotted and veined.

L. H. B.†

FREMÓNTIA (after John Charles Fremont, distinguished western explorer, who discovered it in 1846). Syn. *Fremontodéndron. Sterculiàceæ.* Ornamental woody plant, grown chiefly for its showy yellow flowers.

Deciduous shrub or small tree with stellate pubescence: lvs. alternate, slender-petioled, palmately lobed: fls. solitary on short, lateral branchlets, apetalous; calyx large, deeply 5-parted, with 3 small bracts at the base; stamens 5, connate toward the base into a tube; ovary superior, inclosed by the staminal tube; style filiform: fr. a 5-celled, hirsute, dehiscent caps. with many seeds.—One species in Calif., allied to the Mexican Cheiranthodendron. Its bark is sometimes used as a substitute for that of the slippery elm and the plant is therefore locally known under this name.

This is a beautiful free-flowering shrub, with rather small, palmately lobed leaves and large yellow flowers appearing in great profusion in June. It is not hardy North, and in cooler regions it should have a sunny and sheltered position, preferably against a wall of southern aspect; it prefers well-drained, rather dry soil, and dislikes, especially during the winter, an excess of moisture. Propagation is by seeds or by greenwood cuttings under glass in summer.

califórnica, Torr. (*Fremontodéndron califórnicum,* Coville). To 20 ft.: lvs. generally roundish ovate, cordate or rounded at the base, obtuse, 3–5-lobed or almost entire, whitish or ferrugineous pubescent beneath, ¾–1½ in. long: calyx 1½–3 in. across, deep yellow, with stellate hairs outside, villous at the base within; lobes orbicular: caps. densely beset with hispid hairs, 1 in. long. S.S. 1:23. B.M. 5591. Gn. 3, p. 55; 22, p. 115; 29:8; 33, p. 566. G. 5:397; 32:457. G.M. 50:29. F.S. 22:2349. R.H. 1867:90. I.H. 13:496. B.H, 17:13.

Alfred Rehder.

FREYCINÈTIA (Chas. Louis de Freycinet, 1779–1842, French navigator). *Pandanàceæ.* Climbing or straggling shrubs sometimes seen under glass and perhaps planted far S., but apparently not in the American trade. The sts. are often prolonged, rooting: lvs. sheathing at base, the free part long and narrow, carinate, serrate or entire: fls. diœcious, in terminal fascicled spadices surrounded by fleshy leafy often colored bracts; males consisting of several stamens with short filaments; females of many 1-celled many-ovuled densely packed ovaries: fr. an oblong mass of fleshy or hard drupes.—Species above 50, islands of the Pacific, Austral., New Zeal. *F. Bánksii,* Cunn., is a tall climber, sometimes attaining the tops of high trees, with many stout branches, the arching lvs. to 3 ft. long and most abundant toward the ends of the branches: fl.-bracts numerous and leafy, the inner ones with thick succulent bases, sweet, and often eaten in New Zeal., where the plant is native: fr. rather fleshy, brown at maturity, ⅓in. long, edible. B.M. 6028. *F. Cumingiàna,* Gaud., of uncertain nativity, is more slender, lvs. not arching and divaricate. The freycinetias are little grown indoors as they require much room. They may be used as pillar plants. Prop. by offsets. L. H. B.

FRINGE-TREE: *Chionanthus virginica.*

FRITILLÀRIA (Latin *fritillus,* commonly understood to be a checker-board, but may have meant dice-box). *Liliàceæ.* Fritillary. This group includes the crown imperial and the fritillaries, hardy bulbous plants, mostly low-growing and spring-blooming, with drooping or nodding flowers which are often checkered or tessellated with dark purple and green, but some also with brighter colors.

Various leafy-stemmed simple herbs, the st.-lvs. narrow, sessile, alternate or whorled, the bulb mostly of few fleshy scales: perianth deciduous, mostly bell-shaped or sometimes bowl-shaped, the segms. nearly or quite equal, oblong or ovate, all or the inner ones with a nectar-bearing cavity or area at the base; stamens 6, with slender filaments and linear or oblong anthers; ovary 3-celled, nearly or quite sessile: fr. an ovoid or subglobose loculicidal winged or angled caps., with numerous seeds.—Species perhaps 70, widely distributed in the north temperate zone. Fritillaries resemble lilies in having drooping or nodding fls. but their anthers are fixed at the base, while those of the lilies are fastened on the back but are free to swing about. Lilies have funnel-shaped fls., while fritillaries and tulips have bell-shaped fls., and tulip fls. are erect. Nearly all the Old World fritillaries resemble tulips in having coated bulbs, while the American fritillaries resemble lilies in having scaly bulbs.

The most popular kinds are the checkered lily (*F. meleagris*) and crown imperial (*F. Imperialis*). Figs. 1582, 1583. These are hardy, easy to cultivate, and variable. The crown imperial is one of the most characteristic plants of old-fashioned gardens, but it has been banished from many modern gardens because of its strong fetid odor. It is the most robust species, and until lately was supposed to be the only one with its flowers in umbels, all the others being solitary or in racemes. It rejoices the children early in every spring by its pearly drops of nectar, which seem never to fall. *F. meleagris,* the most popular of the purple kinds, is the common snake's-head or checkered lily, so called from the tessellation of purple and green, which is prettiest when as sharply and regularly defined as possible. This plant grows wild in moist English meadows, and can be naturalized in large quantities in such situations. Other ancient inhabitants of European gardens are *F. latifolia, F. lutea* and *F. persica.* Other kinds are apparently less known in gardens. As a rule, the kinds that are chiefly purple or green, or mixtures of both colors, are dull, unattractive and curious compared with the few kinds that have brilliant yellow or red. Of the duller and purple kinds, two of the choicest, next to *F. meleagris,* are *F. tulipifolia* (which is flamed like a tulip and never checkered) and *F. camtschatcensis,* great masses of which in Alaska make one of the "summer sights" remembered by the tourists. The white in fritillaries is perhaps always more or less greenish, and the white color in *F. meleagris* is as good as in any species. A most brilliant species is *F. recurva,* which is also difficult of culture. Next in brilliancy come such species as *F. lutea, F. aurea, F. Moggridgei* and *F. pudica,* all highly individual and all yellow, some checkered, others not.

The culture of fritillaries is rather various, as some species are capable of being naturalized, some cultivated in borders, some in rockeries and others in pots. The crown imperial, being exceptionally vigorous, requires deep planting, rich soil and much room. The earth should be trenched. Well-rotted manure may be worked into the soil 6 inches below the bulbs and the bulbs set on a level 6 inches from the surface of the ground. If possible it should be shaded from the mid-day sun, as southern exposures are said to make the flowers smaller and shorter-lived. In border cultivation of fritillaries the essential peculiarities are a sheltered shady site, early fall planting, division every two or three years, and, as a rule, a warm, deep, sandy loam, which is not too cold or too retentive of moisture. Bulbs of the taller kinds may be planted 3 to 4 inches deep; bulbs of the dwarf kinds may be set at half that depth. As all fritillaries increase rapidly by offsets, it is desirable to lift and divide the plants at least every three years, or the small bulbs will rob the big ones. For the same reason, fritillaries are rarely propagated by seeds. The dwarf and rare sorts require more care and some leaf-mold in their soil, and some kinds require an evergreen carpet through which they may spring, as *Sedum hispanicum* or its var. *glaucum.*

Our native fritillaries, which include the bright-flowered *F. recurva* and *F. pudica,* are confined to the Pacific coast. Of these Carl Purdy makes two cultural groups, based on the character of bulb, the kind of soil and the conditions of shade. The first group contains *F. biflora, F. liliacea, F. pluriflora* and *F. Purdyi;* the second *F. atropurpurea, F. coccinea, F. lanceolata, F. parviflora, F. pudica* and *F. recurva.* The former grow in the sun in open fields in heavy clay soils; the latter in shady woods in well-drained soils, but *F. pudica* does not need so much shade as the others of its group, and must have sandy loam and slight shelter. The bulbs of the first group are composed of thick, heavy scales attached to a thin rhizomatous base, and the stems are 4 to 12 inches high and very leafy at the base; in the second group the bulbs are of one piece, and low-conical in form, their sides thickly covered with small, round, white rice-like offsets, and the slender stems are 1 to 3 feet high and leafy above the base. For the first group Purdy recommends a rich loam, and a slight shade to draw out the stems and prolong the bloom; for the second group a light, loose soil, rich in mold, a sheltered place and considerable shade. At the best these are not profuse in their bloom.

The key to the various subgenera here given is essentially Baker's in his monograph in Jour. Linn. Soc. 14:251 (1875); it rarely happens that the botanical and horticultural interests agree in using such simple and obvious characters as those of the bulb and style. The nectaries or glands are less useful and reliable, but they help to explain the natural groups in this varied genus.

INDEX.

alba, 1.
armena, 16.
atropurpurea, 24.
aurea, 7–9.
biflora, 29.
Burnatii, 3.
camtschatcensis, 30.
chitralensis, 26.
coccinea, 25.
contorta, 1.
delphinensis, 3.
Elwesii, 14.
floribunda, 22.
fusco-lutea, 16.
gracilis, 22.
Imperialis, 26.
kamschatcensis, 30.
lanceolata, 22.
latifolia, 7–9.
leucantha, 4.
libanotica, 20.
liliacea, 28.
longipetala, 26.
lutea, 7–9.
meleagris, 1.
meleagroides, 11.
minor, 11, 19.
Moggridgei, 3.
mutica, 22.
oranensis, 13.
pallidiflora, 10.
parviflora, 23.
persica, 19.
pluriflora, 21.
pudica, 17.
Purdyi, 21.
pyrenaica, 12.
Raddeana, 26.
recurva, 27.
ruthenica, 6.
Sewerzowi, 18.
Thunbergii, 4.
tubæformis, 3.
tulipifolia, 15.
verticillata, 4.
Walujewi, 5.
Whittallii, 2.

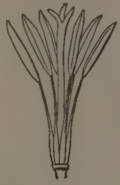
KEY TO THE SUBGENERA.

A. *Bulbs tunicated* (*i.e., coated*).
B. *Style 3-cut.*
C. *Glands distinct and prominent, equal.* Species. Subgenera.
D. *Glands long*............ 1. EUFRITILLARIA
DD. *Glands wide*............ 2–14. MONOCODON
CC. *Glands obscure, equal, long*.. NOTHOLIRION
BB. *Style undivided.*
C. *Glands equal, obscure*..... 15–17. AMBLIRION
CC. *Glands unequal, prominent.*
D. *Glands long*............ 18. KOROLKOWIA
DD. *Glands short*............ RHINOPETALUM
AA. *Bulbs scaly.*
B. *Style undivided*.............19–21. THERESIA
BB. *Style 5-cut.*
C. *Caps. acutely angled.*
D. *Fls. solitary or racemose*..22–25. GONIOCARPA
DD. *Fls. in umbels*.......... 26. PETILIUM
CC. *Caps. obtusely angled*......27–30. LILIORHIZA

1. **meleàgris,** Linn. CHECKERED LILY. SNAKE'S-HEAD. Figs. 1580–1582. St. 1 ft. or more high: lvs. 3 or 4, linear or lanceolate, typically 1-fld.: fl. dull red with the inside checkered and spotted with higher color; segms. oblong, narrowed at both ends, about 1½ in. long, the inner ones bearing an oblong or linear cavity; fls. sometimes white or yellowish, or purplish and more or less checkered. England and Norway, through Cent. Eu. to Caucasus. Gn. 32:536; 47, p. 330; 52, p. 243.—The Dutch bulb-growers keep several kinds distinct. The extremes of color-range are (1) a greenish white, (2) a sufficient degree of purple to make the checkering as distinct as possible, and (3) an approach to yellow. Some kinds bear 2–3 fls.; some are double; some fls. spread so widely as to be almost funnel-shaped. Var. **álba,** Hort. White. G. 29:355. Gn.W. 21·221. Var. **contórta,** an old monstrosity, instead of segms. free all the way, and a shouldered base, has the lower third of the perianth united into a funnel-shaped tube. The yellow of some fls. is conjectured to be the result of a cross with *F. lutea* made before Gerarde's time. In England the species flowers toward the end of April G. 18:182; 35:273. J.H. III. 52:329. Gn.M. 10:117; 12:228. Gn. 61, p. 306 (vars.) G.M. 52:770.

2. **Whíttallii,** Baker. Height 1 ft.: st. 1-fld.: lvs. linear, glaucous: fls. checkered green and brown; nectaries orbicular. Mt. Taurus.

3. **tubæfórmis,** Gren. & Godr. (*F. delphinénsis,* Gren.). St. 6–12 in., often only 1-fld.: lvs. above middle of st. oblanceolate to linear: fls. wine-purple, spotted yellow and somewhat checkered, inodorous; segms. obtuse. Alps.—Distinguished by the glands 3–4 lines long and stigmas very short. Baker gives the same color-range as for *F. meleagris.* The most desirable form is var. **Móggridgei,** Boiss. (*F. Móggridgei,* Hort.), with bright yellow, checkered inside with bright red or reddish brown. This is a dwarfer form from the maritime Alps with wider lvs. (6–9 lines), longer stigmatic cusps, approaching *F. lutea,* and essentially yellow-fld. G.C. II. 13:533. Gn. 18:132. F.M. 1880: 405.—It blooms early. Var. **Burnàtii,** Planch., bright plum-color, checkered greenish yellow: fl. solitary, broadly bell-shaped, smaller, earlier and with smaller glands.



1580. Stamens and pistil of Fritillaria Meleagris.

From Flora Danica, showing the 3-cut stigma, an important character in this genus.

4. **verticillàta,** Willd. (*F. leucántha,* Fisch.). Height 1½ ft.: sts. simple, often 1-, sometimes 2–5-fld.: lvs. near the middle of the st., ovate and tapering toward the apex: fls. white or yellow, with small darker spots at the base. Altai Mts. B.M. 3083.—In the type the lvs. are numerous, 20–40: anthers barely half as long as the filaments: style no longer than the ovary, but in var. **Thúnbergii,** Hort. (*F. Thúnbergii,* Miq.), the upper lvs. are often sparse: anthers as long as the filaments; style 1½–2 times as long as the ovary. G.C. II. 13:532. It is doubtful whether the yellow-fld. form is cult.

5. **Walujèwi,** Regel. Probably belongs here, as its linear lvs. have tendrils: st. 1 ft.: fls. silver-white or lead-colored outside and crimson-brown spotted white or yellow inside. Turkestan. Gn. 52:243.

6. **ruthénica,** Wikst. Height 1–2 ft.: st. 1–3-fld.: lvs. 6–20, linear-lanceolate: fls. livid purple, obscurely checkered. Caucasus.

7–9. **lùtea,** Miller, and its allies **F. latifòlia,** Willd., and **F. aùrea,** Schott. These 3 names may be taken as representing the 3 well-marked types of color: *F. lutea* an intermediate form, essentially yellow, but greenish, and with the purple checker-marks duller in color and not so sharply defined and regular. *F. latifolia* representing the extreme of dark purple and green without yellow; *F. aurea,* at the other extreme, being essentially yellow, the checker marks smaller and more sharply defined, and the colors bright. In this sense the pictures may be referred to the types as follows: B.M. 1538 to *F. lutea;* B.M. 853 and 1207 to *F. latifolia;* B.M. 7374, R.H. 1878, p. 287, Gn. 42: 72, J.H. III. 28:357, to *F. aurea. F. latifolia* represents the extreme width of lvs., and *F. aurea* is said to differ in having the lower lvs. often whorled. All these grow ½–1 ft. high. One of the most anciently cult. of all fritillaries is *F. lutea,* which is found promiscuously mingled with the wider-lvd. form, both wild and cult. At present the most popular of the 3 is probably *F. aurea.* The Dutch bulb-growers advertise several varieties of *F. latifolia.* These 3 species are fom S. W. Asia.—*F. lùtea.* St. often 1-fld.: lvs. alternate, linear-lanceolate: fls. yellow, more or less marked or suffused with purple; segms. oblong-lanceolate. *F. latifòlia* (*F. luteo* var. *latifolia*) has

1581. Strange form of doubling in the checkered lily, pictured as early as 1613.

lanceolate lvs., the upper ones opposite: fls. purple. *F. aurea.* Lvs. 10–12, lower in 3's, linear, somewhat glaucous and fleshy: fls. solitary, bright yellow.

10. **pallidiflòra,** Schrenk. Height 6–15 in.: lvs. many, large and broad, glaucous-blue: fls. 1–6, yellow, handsomely tessellated inside. Siberia. B.M. 6725 (green, with a few dark purple spots). Gt. 6:328. R.H. 1880, p. 215. G.C. II. 19:573. Gn.W. 23:397.

11. **meleagroìdes,** Patrin. (*F. mìnor,* Ledeb.). Height 1–2 ft.: st. very slender, mostly 1-fld.: lvs. 3–6, narrowly linear: fls. dark purple, spotted green; anthers a third the length of the filaments. W. Siberia. B.M. 3280.

12. **pyrenàica,** Linn. Height 1–1½ ft., mostly 1-fld.: lvs. 6–10, linear, glaucous: fls. dark purple, spotted green; anthers two-fifths the length of the filaments. Pyrenees. B.M. 664, not 952 or 1216.

13. **oranénsis,** Baker. Height 1–1½ ft.: lower lvs. lanceolate; upper lvs. linear: fls. dark purple, obscurely checkered green. Mt. Oran. G.C. II. 13:341.

14. **Élwesii,** Boiss. Lvs. 5–6: fls. green, flushed purple on back and tips, not checkered. Lycia. B.M. 6321 (erroneously, as *F. acmopetala*). Gn. 65, p. 307. Gn.W. 21:445.

1582. Common Snake's-Head or Checkered Lily (Fritillaria meleagris).

Faithfully redrawn from Besler's Hortus Eystettensis, published in 1613. (Incorrect as to stamens and some other characters.)

15. **tulipifòlia,** Bieb. Height 2–8 in.: st. 1-fld.: lvs. 3–4, elliptic, concave, nerveless, 1½–2½ in. long: fls. solitary, inside rusty brown-purple, not checkered, outside dark glaucous blue, streaked with the same purple. Caucasus. B.M. 5969.—One of the choicest and daintiest kinds. Very distinct. Foliage glaucous blue: fls. resembling a tulip in shape, and with a chalky look outside.

16. **armèna,** Boiss. Height 6–12 in.: st. 1-fld.: lvs. 4–5, lower lanceolate, upper linear: fls. between funnel- and bell-shaped, dark purple, not checkered. Armenia. B.M. 6365. J.H. III. 35:83. Var. **fúsco-lùtea,** Hort., tawny yellow.

17. **pùdica,** Spreng. St. 2–10 in.: lvs. 3–8, lower ones strap-shaped, often opposite (while in *F. tulipifolia* and *F. armena* they are alternate), upper ones linear: fl. usually solitary, pale or dark yellow, rarely purple, never checkered; segms. oblong-spatulate and obtuse, more or less spreading. N. W. Amer. Gn. 13:598; 61, p. 337. R.H. 1895, p. 229. G.C. III. 19:403. J.H. III. 32:295. Mn. 4:49.—The stamens (as in Nos. 14 and 15) are nearly as long as the perianth. "Deep orange-yellow, fragrant."—Van Tubergen.

18. **Sewérzowi,** Regel. Height 1–1½ ft.: lowest lvs. lorate-lanceolate, 1 in. wide, often opposite, upper lvs. lanceolate, 6–7-nerved, 3–4 in. long: pedicels 3–6 lines long; fls. 6–10, green, not checkered, but with a few purple spots outside; filaments purple; anthers green. Turkestan. Gt. 760. B.M. 6371. J.H. III. 30:319. G.C. III. 1:457. Gn. 69, p. 133.

19. **pérsica,** Linn. Robust, 2–3 ft. high: lvs. 40–60, glaucous, linear, 4–6 in. long, 6–9 lines wide: raceme 10–50-fld.; fls. small bell-shaped, slightly odorous, lilac-purple, sometimes chalky outside and lined with purple but never checkered; stamens a trifle shorter than the perianth. Orient. Fls. end of April or beginning of May. B.M. 1537. Var. **mìnor,** Sims, B.M. 962 (excluding synonymy), has smaller fls. and anthers barely exserted.

20. **libanótica,** Baker. Closely resembling No. 19, but with 6–30 strongly odorous fls., pale lilac, with darker vertical veins; stamens a third shorter than the perianth; anthers purplish. Palestine, rocky and shady parts of Mt. Lebanon.

21. **pluriflòra,** Torr. Pink Fritillary. Height 6–12 in.: lvs. few, mostly at the base, oblong-lanceolate, about 4 in. long: raceme 4–12-fld.; fls. rosy purple, not checkered, the glands not evident; stigma shortly 3-lobed. Calif. G.C. III. 21:231.—Blooms early. **F. Púrdyi,** Eastw., differs in the fl. being white beautifully tinged purple. Humboldt Co., Calif.

22. **lanceolàta,** Pursh. Sts. 1–3 ft.: lvs. 4–10, lanceolate, whorled on the upper part of st. (or sometimes scattered), ovate-lanceolate, 2–4 in. long: fls. 1–4, bowl-shaped, dark purple mottled greenish yellow, somewhat variable in color; segms. ovate to oblong, concave, with large gland. Calif. Var. **grácilis,** Wats. Fls. very small with narrow and more acuminate segms., deep purple or almost black. Var. **floribúnda,** Benth. (*F. mùtica,* Lindl.). Fls. 3 to many, dark purple or greenish and conspicuously spotted or checkered, the segms. crisped or erose.—The bulbs of *F. lanceolata* live one year; the scales are few or none, and the bulb is covered with rice-like bulblets (whence the name "rice-root lily").

1583. The Crown Imperial.—Fritillaria Imperialis.

23. **parviflòra,** Torr. St. 5–20-fld.: lvs. about 9, mostly whorled, linear: fls. purple, suffused green, not checkered, on short and strongly recurved pedicels; segms. with shallow nectaries. Sierra Nevadas in Calif.

24. **atropurpùrea,** Nutt. St. 1–6-fld., lower and more slender than in No. 23: lvs. 12–20, scattered or imperfectly whorled: fls. dark purple obscurely checkered with green, on slender pedicels. Wyo. and Utah, to the Sierras and the Columbia River.

25. **coccínea,** Greene. Scarlet Fritillary. St. 1–4-fld.,

slender, 12–18 in. high: lvs. 3–7, in 2 or 3 whorls at middle of st., narrow-linear: fls. scarlet, slightly mottled within with yellow. Calif.—Said to be very like *F. recurva*, but lower and less leafy and the fls. of different color; it has a smaller bulb and takes more readily to cult.

26. **Imperiàlis,** Linn. (*Imperiàlis coronàta*, Dum. Cours.). Crown Imperial. Fig. 1583. Height 2–3 ft.: lvs. numerous, crowded, ascending, ½–1 in. wide, highest often in whorls of 8–10: fls. end of March. B.M. 194 and 1215. Gn. 46, p. 101; 52, p. 243. A.G. 13:488. R.B. 20:196.—There are single and double forms in yellow and red, and kinds with foliage striped white, and with gold. There are varieties Aurora, Maximus, and William Rex, red; Sulphureus, sulfur-yellow; and Crown upon Crown, Couronne Orange, Red Slagzwaard and others. Var. **longipétala,** Hort. Gn. 56:358, with long segms. Var. **chitralénsis,** Hort., has rich yellow fls.: said to be a common form in Chitral (British India). G.C. III. 47:171. G.M. 54:682. **F. Raddeàna** Regel, from Turkestan, is somewhat dwarfer, blooms earlier, has floral lvs. recurved-spreading, fls. straw-colored or greenish yellow and shorter than the pedicels.

27. **recúrva,** Benth. Height 6–24 in.: st. 2–8-fld., purple, mottled green: lvs. 6–12, lower ones in whorls of 3–4, linear, ascending: fls. narrow, bell-shaped. Calif., Ore. B.M. 6264. Gn. 18:458; 59, p. 415; 61, p. 336. —This has stamens only a little shorter than the perianth, while in the next 3 species they are only half the length of the perianth. Distinct by the color of the fls., which are bright red outside without a trace of purple, and brilliant yellow inside, spotted with red.

28. **liliàcea,** Lindl. White Fritillary. Height 3–12 in.: st. 1–6-fld.: lvs. on st. few, linear-oblong or linear, those of the radical tuft narrowly or broadly oblong: fls. between funnel- and bell-shaped, whitish, veined green, not checkered; gland at base of segms. greenish and purple-dotted. Calif. in Coast Range from San Francisco south. Gt. 1871:715.

29. **biflòra,** Lindl. Black Lily. Chocolate Lily. Height 6–18 in., stout: st. 1–3-fld.: lvs. 2–6, most of them near the base, scattered or whorled, oblong: perianth greenish or dark purple or lined with purple; segms. elliptic-obovate, with a greenish longitudinal band. S. Calif.—Fls. often described as dark chocolate-brown to nearly black.

30. **camtschatcénsis,** Ker-Gawl. Mostly written *kamtschatcensis* and variously misspelled. (*Lílium camtschatcénse*, Linn.). Black Lily. Height 6–18 in.: st. 1–3-fld.: lvs. 10–15, lanceolate, the lower ones whorled: fls. livid wine-purple, not checkered, 1¼ in. or less long. Siberia, Alaska. Gt. 5:290. Gn. 25:232; 52, p. 242. F.S. 12:1232. G. 14:362.

F. agréstis, Greene. Bulbs very deep-seated: sts. 1–1½ ft.: lvs. 8–12, oblong-lanceolate to linear-lanceolate: fls. 3–8, on abruptly recurved pedicels, yellowish green, with prominent midnerve on each segm. Calif.—Said by Purdy to occur in 2 forms, one a dainty plant a few inches high with fls. having light green or yellow base-color and heavily lined with brown (Mendocino Co.); the other a foot or two tall and similarly marked, so fetid as to be called "stink bells" (edge of San Joaquin Valley, Contra Costa Co.). Probably not in cult.—*F. askabadénsis*, Mich. St. about 3 ft.: upper lvs. linear-lanceolate, whorled: fls. 5–8, hanging amongst the uppermost lvs., about 1 in. long, bell-shaped, pale yellow-green. Cent Asia. B.M. 7850. G.C. III. 31:238; 45:184. Gn. 61, p. 256. G.M. 45:745. R.H. 1903:180. J.H. III. 44:293. F. S. R. 1:134.—*F. cònica*, Hort. Lvs. in a rosette: fls. bell-shaped, pale yellow outside and bright yellow inside. Greece.—*F. póntica*, Wahl. St. tall, 1½ ft., leafy at middle, the lvs. broadly lanceolate, lower ones opposite: fls. yellow-green, margined and tipped red, the segms. bearing nearly orbicular nectaries. Asia Minor. Gn.W. 21:407.—*F. tuntàsia*, Heldr. St. 8–10 in.: lvs. long and glaucous: fls. 4–6, bell-shaped, about 1 in. across, intense dark maroon. Greece. Gn.W. 23:435.—*F. Záhnii*, Hort. Fls. bell-shaped, rather large, brown, checkered with green inside and streaked with yellow outside. Greece.

Wilhelm Miller.
L. H. B.†

FRŒLÍCHIA (J. A. Froelich, physician of Ellwangen, Germany, monographed Gentiana in 1796; died 1841). *Amarantàceæ.* About a dozen species of woolly or hairy American annuals, found chiefly in W. Indies, Mex. and Brazil, scarcely planted: lvs. opposite, entire or nearly so: spikes opposite, terminal; fls. perfect, 3-bracted; calyx tubular, 5-cleft, hardened and spiny-crested in fr.; stamens 5, with united filaments: fr. an indehiscent utricle, inclosed in the filament-tube. **F. floridàna,** Moq., has been advertised for sale in Amer. It is cult. abroad. Height 1–4 ft., leafless above: lvs. linear to oblong or lanceolate: spikes 2 in. long or more; fls. white and woolly, set off by small blackish bracts: fr. broadly winged and irregularly toothed. July–Sept. B.M. 2603 (as *Oplotheca floridana*). Dry sandy areas, Del. to Fla., and west. *F. campéstris*, Small, is by some authors considered not to be distinct.

L. H. B.†

FROST. Hoar frost or white frost is ice deposited upon the surface of plants or other objects. Sometimes it consists of frozen dew-drops, sometimes of feathery spinelike ice-crystals, but usually both formations are present. The moisture from which the deposit of ice is formed comes partly from the ground, partly from the air, and in the case of plants, probably partly from the plant itself.

The term "black frost" is used when plants are frozen without the appearance of any deposit of ice upon them. It occurs when the temperature falls below the freezing-point (32° F.), but not low enough to cause the moisture in the air to come out in the form of hoar frost.

The term "frost," when unqualified, means simply temperatures that are injurious to vegetation without regard to any deposit of ice. It is in this sense that the term "frost" is used in this article.

Degrees of frost.

With respect to the effect of frost on vegetation, the Weather Bureau recognizes three degrees of frost—light, heavy, and killing. A light frost is recorded when only the tenderest plants are injured; a heavy frost, when the injury to tender plants is more marked and the hardier plants are damaged; and a killing frost, when the staple products of the region are injured severely or are killed. When no deposit of frost occurs and the temperature of the air as indicated by the thermometer falls during the night to 32°, a killing frost is recorded also. Frost charts and frost tables, published by the Weather Bureau, are based on the records of killing frosts only.

How plants are injured by frost.

When ice appears on the leaves or blossoms of the plant, it is evidence that the temperature of the plant is at or below the freezing-point; but if the temperature does not go below 32° F., or does not remain at that point too long, little injury will result to any temperate-zone plants. In fact, the phenomenon that we usually have in mind when we speak of killing by low temperature occurs only when ice forms within the tissue. Careful observers have found that the ice formed in the tissue is nearly always in the intercellular spaces, the water being withdrawn from the cells to form these crystals. Whether the withdrawal of water from the cell is the cause of death or is merely associated with it, is not certain. In case of winter dormant tissue, that is very resistant to low temperature, the injury at a given temperature is much greater when the temperature-fall is very rapid. In the case of a few tissues, like ripe apples and pears and leaves of *Agave americana* and of lettuce, the rapidity of thawing influences the extent of injury at the highest killing temperature of the tissue. However, it is not a determining factor, since, if the temperature be carried somewhat lower, the tissue will kill regardless of the rate of thawing.

Varieties as well as individual plants differ greatly in their ability to withstand cold, and a temperature that may destroy a plant at one time may cause little injury at any other time. Hence, no general statement can be made with regard to injurious temperatures that will apply in all cases.

The following table indicates the temperatures (Fahr.) that have been found injurious to tree fruits during the blossoming period:

Fruits	Petals closed	In blossom	Setting	Later
Apples	27	29	30	30
Peaches	20	25	28	30
Cherries	22	28	29	29
Pears	27	29	29	30
Plums	30	31	31	29

General atmospheric conditions that cause frost.

The loss of heat that brings the temperature of plants to the freezing-point occurs in two ways,—(1) loss by conduction, and (2) loss by radiation. Loss of heat by conduction occurs when the air in contact with the plant is colder than the plant itself. This allows the heat to flow directly from the plant into the colder air about it. Frosts due to this cause alone result almost invariably from the importation of large masses of cold air, brought down from the upper atmosphere by descending currents, or from higher latitudes by northerly winds, both of which movements usually are active when the weather clears after a storm.

Frosts, particularly in the late spring or early fall, result also from loss of heat by radiation. Plants radiate heat continuously. During the day more heat is received by them from the sun than they give off, and the plant becomes warmer; at night plants pour more heat into the atmosphere than they receive from it, hence they become colder.

Radiation proceeds most rapidly when the sky is clear and the atmosphere is quiet. Clouds check radiation, because the heat given off from the earth does not penetrate them easily. Much of it is reflected back toward the earth, warming the whole stratum of air between the earth and the clouds.

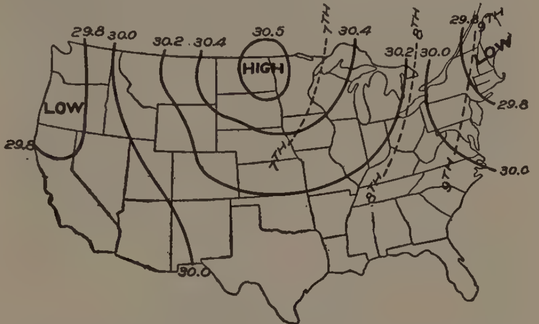
A quiet atmosphere allows the colder, therefore heavier, particles of air to settle to the surface of the earth. Thus, on quiet, clear nights, when frost is likely to occur, the air near the ground may be 10° colder than the air 10 or 15 feet above the ground. The wind, by stirring up the atmosphere, prevents the settling of the cold air, and in this way maintains the stratum of air near the surface at a more nearly uniform temperature.

Frost results seldom from conduction or radiation alone. Both usually are active when frost occurs.

Forecasting frost from weather maps.

Frosts that injure vegetation are a part of the regular weather sequences. The weather comes to us in what may be termed waves that travel with more or less regularity in the middle latitudes from west to east. The weather map is a survey of the atmosphere. It charts the daily progress of these weather waves. By the aid of such a chart it is possible to foresee in a measure the coming of a frost, and to judge its probable extent and severity.

The weather map is based on observations of pressure, temperature, cloudiness, wind, and precipitation, made at many places scattered over a large area. Low atmospheric pressure indicates the trough of the weather wave, and high pressure its crest. The low-pressure area is called the cyclone, because the winds whirl or eddy about its center, the direction of rotation being counter clock-wise in the northern hemisphere. In approaching the center, the winds have an ascending as well as an inward component of motion. The cyclone also is called a storm, because it is attended on its eastern side by southerly or easterly winds, cloudiness, rain or snow, and comparatively high temperature, and on its western side by northerly winds, clearing weather, and a decided fall of temperature.

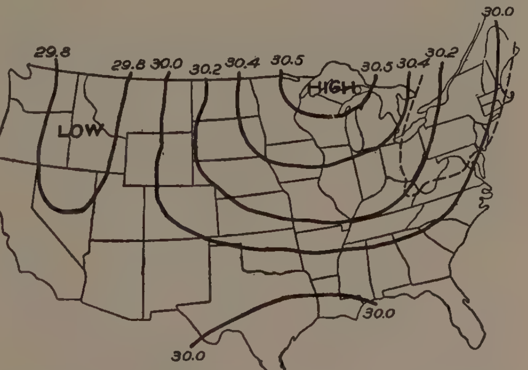


1584. Weather map, 8 a.m., June 7, 1913.

The crest of the wave is indicated by increased pressure, and is called the anti-cyclone. It is so named because its structure is exactly opposite to that of the cyclone. The winds of the anti-cyclone blow outward from its center, and have a downward component of motion; the sky is clear; the precipitation is scanty or absent; and the temperature is comparatively low.

Frosts are most likely to occur in the rear (western side) of the cyclone, and just in front (eastern side) of the crest or center of the anti-cyclone. Here is found the mass of cold air, imported from the north by the northerly winds, and augmented by the cold brought down from above by the gently descending currents; the sky is clear; and as night comes on the air becomes quiet. Thus, the conditions that cause frost are fulfilled.

A weather wave, in which frost was the most pronounced characteristic, moved from North Dakota to the Atlantic coast from June 7 to 10, 1913 (Fig. 1584). The general conditions on the morning of the 7th and 8th (Fig. 1585) are shown by the accompanying weather maps for those dates. The eastward progress of frost from day to day is indicated by the dotted lines on the map of the 7th. The relative position of the cyclone (low) and the anti-cyclone (high), on the 7th, indicates clearly that frosts will occur over the Upper Mississippi Valley and the Upper Lakes on the following morning, while the conditions shown by the map of the 8th make it certain that the frosts will spread eastward over New York and the New England states by the morning of the 9th.



1585. Weather map, 8 a.m., June 8, 1913.

The Weather Bureau issues frost warnings when frosts are indicated for any part of the United States.

The warnings are distributed by mail, telegraph and by telephone. They are telegraphed at Government expense to many telephone companies.

Forecasting frost from local observations.

It is not possible to forecast frost twenty-four or thirty-six hours in advance without the aid of the weather map; but, by observing the local conditions during the late afternoon and early evening, it is possible often to determine whether a frost will occur before morning. Assuming that it is the frost season, the conditions to be considered are: (1) the character of the preceding weather, (2) the state of the sky, whether cloudy or clear, (3) the direction and force of the wind, (4) the trend of the temperature, and (5) the atmospheric pressure.

Preceding weather.—Since the weather comes in waves, an abnormally warm period is likely to be followed by the opposite extreme.

State of the sky.—A clear sky increases loss of heat by radiation, as explained already.

Direction and force of wind.—A southwest to west wind indicates that the cyclone is passing (except perhaps on the Pacific coast, where other conditions may modify the directions), and that the anti-cyclone is approaching, while a northwest to north wind indicates that the anti-cyclone is near. If the wind dies away it will become colder near the ground.

Trend of the temperature.—If the temperature falls steadily during the late afternoon, reaching 40° by 6 or 8 P. M., with a clear sky and a light wind, frost is indicated before morning.

Atmospheric pressure.—The actual stage of the barometer is not important, except if the pressure has been very low during the day it indicates the passage of a deep depression which is likely to be followed by a high crest. If the barometer rises rapidly during the late afternoon or early evening it indicates the rapid approach of the anti-cyclone.

The influence of local conditions on frost.

Everyone who has lived in the open country is familiar with the fact that some places are more subject to frost than other places. Crops in one part of a field may be destroyed by frost, and in another part of the same field remain uninjured. The explanation for this seeming discrimination is found in the influence of local conditions.

There are five factors that determine the frost risk at any place: (1) location, city or country, (2) elevation and topography, (3) proximity to bodies of water, (4) exposure to the sun, (5) soil and soil coverings.

Location.—Frosts are much more likely to occur in the open country than in cities. Many investigations confirm this. The higher night temperatures of cities is attributed to the heat given off from buildings and pavements, and to the smoke from the many city fires that collects over cities on quiet nights.

Elevation and topography.—The average temperature decreases with elevation above sea-level at a rate of 1° for each 300 feet of ascent. From this it might be expected that hilltops would be more frosty than adjacent lower lands. Such is not the case. On clear quiet nights the colder air that settles to the surface drains away from the hilltops and hillsides and accumulates over the low lands, decreasing the temperature of the vegetation and sometimes causing frost. If the valley into which the cold air drains is closed, so that it cannot flow away as rapidly as it accumulates, a "frost pocket" results. Some farms have many such "frost pockets." A walk over a farm on a clear quiet night often will reveal their location and extent. Low hilltops and hillsides, but not too near the valley floor, should be chosen for fruits or other crops that are liable to be injured by frost.

Proximity to bodies of water.—Under similar conditions, land warms and cools about five times as rapidly as water. During the season of spring frosts, the water is relatively cool, although considerably above the freezing-point. Therefore, it tends to cool the air over adjacent lands during the day and to warm it at night. The influence of a body of water on nearby vegetation is twofold: by lowering the day temperature it retards growth, and by increasing the night temperature wards off frost. The fruit-belts along the various lakes are examples of this twofold influence. The cool air from the lake by day retards the blooming period, and also gives immunity from frost at night. The influence of a body of water is more marked in the fall than in the spring, because of the heat stored up by the water during the summer. It also increases the length of the growing season over adjacent lands by warding off frost both in spring and fall. The distance to which the influence of a body of water will extend inland depends upon the volume of water, its temperature relative to that of the land, the area of its free surface, the slope of its shores, and the prevailing winds. The prevailing winds in the middle latitudes are from the west. Thus, the influence of a lake extends farthest on its east side, and farthest also when the land slopes gently away from the water. The influence of Lake Michigan, mainly because of the gentle slope of its eastern shore, extends nearly half way across the state of Michigan, while the influence of Lake Erie, because of the abrupt rise of its eastern shore, extends inland only a few miles.

Exposure.—Hillsides exposed toward the south are warmest; next come those facing east, then west, and finally north. Frost liability follows in the reverse order, being greatest on the north side. In the eastern states many fruit-growers prefer the northern slope for an orchard site, notwithstanding its greater liability to frost. This preference is based partly on the opinion that the colder soil and air of northern slopes tends to retard the blooming time until the period of spring frosts is passed.

Soil and soil coverings.—Dark-colored, sandy soils, because good absorbers of heat, are least liable to frost. Many cranberry-growers cover the surface of the bogs with an inch or two of sand as a means of protecting from frost. The sand stores up heat by day with which to combat frost at night. Well-drained soils are less frosty than poorly drained soils, because, when the soil is wet, the heat from the sun is expended in evaporating the water, and not in warming the soil. Good tillage reduces the frost risk, because a loose, porous soil absorbs more heat than a hard, compact soil.

WILFORD M. WILSON.

The protection of orchards against frost-injury.

Although much interest has been manifested in the prevention of frost-injury to orchards in recent years, it is well known that the protection of plants and fruits from such injury dates back more than 2,000 years. Pliny the Elder, one of the most noted of Roman writers, who lived from 23 to 79 A.D., states that the Romans practised heating and smudging as a protection against frost-injury. We have no doubt that the practice was successful, since it was recommended by Pliny whose one surviving work, his "Natural History," is considered a storehouse of facts. Smudging was also recommended by Olivier de Serres, a French agriculturist, in the sixteenth century. He recommended the use of wet straw and half-rotten manures so as to produce a heavy smoke. In the latter part of the eighteenth century, the practice of smudging was compulsory in parts of Germany, and failure to comply with certain regulations resulted in prosecution before an officer of the law. According to Boussingault, the celebrated

French chemist, smudges have been used for centuries on the plains of Cuzco, Peru, on still clear nights by Indians, to retard the loss of heat from the soil. This practice was inherited by them from the pre-Spanish civilization. From the fragmentary pieces of literature we are able to find concerning the matter of frost-prevention, there is no doubt that the practice has been more or less common from the most remote times to the present day.

It is only in recent years, however, that the matter of frost-prevention has been scientifically investigated. The literature on the subject has been, until very recently, of very little importance, because the methods advocated were very crude and could not be used by the commercial fruit-grower. However, during the 1880's and early 1890's, the French vine-growers did some remarkable work. Even at that time, they used heavy oil and tar as fuels, placing these in flat ironware dishes much the same as the modern practice of using smudge-pots with crude-oil. There had also been devised systems of automatic lighting operated by a mercuric column, not very much unlike some of our more recently patented automatic alarm thermometers and self-lighters. About the same time that the French vine-growers were perfecting their work in frost-prevention, the California and Florida orange-growers were also making experiments along the same line. The first successful attempt to prevent frost-injury by the use of heating devices on a large scale occurred in California about 1896. Edward Copely is credited with inventing the wire coal-basket as well as a machine to make it cheaply. These baskets were filled with kindling and about twenty-five pounds of coal, twenty-five to thirty baskets being provided to the acre. They were suspended by wires to limbs of trees. The first use of oil of which there is a record was by Everett at Arlington, California; and the first use of hot water was by Meacham, at Riverside, California. Later, J. P. Bolton, of the United States Weather Bureau, stationed at Fresno, California, devised an oil-pot for use in the vineyards during the period of spring frosts.

1586. Method of protecting windward side of an orchard by doubling the number of orchard-heaters.

The occasion for considerable activity in the matter of frost-fighting at this time was due to a very severe frost in December, 1895, causing great damage to the orange and lemon groves in the Riverside section. It may be said that the beginning of frost-fighting in a commercial way dates from this time. The Riverside Horticultural Club in the winter of 1897–98 took an active interest, and many experiments were conducted, using all sorts of devices for adding moisture to the air by means of fires of damp straw and stable manure, evaporation of water by means of evaporating-pans, sprayers and sprinklers, and by irrigation of the orchards. Boilers were also used with connecting pipes whereby steam was generated and carried to the different parts of the orchards. Direct heating of the air by means of fires was also tried and proved to be the most successful method of preventing frost-injury.

The deciduous fruit-growers of the Sacramento Valley, California, also practised orchard-heating more or less successfully, adopting the methods employed by the citrus fruit-growers of the South. It is remarkable that some of this work did not bear so good results as it should. Fully ten years passed without any advance having been made in the methods of orchard-heating. About 1906, a renewed interest was taken in the work and since that time orchard-heating has been given scientific study. Within the last four or five years the fruit- and vegetable-growers throughout the United States have taken much interest in the practice of protecting their crops from frost-injury, and it has become a recognized part of orchard work in districts in which frosts regularly occur.

The literature on the subject has now assumed considerable importance since it is the result of scientific investigation of frost-injury and frost-prevention at the hands of scientific men. There are many important articles and bulletins on the subject.

The losses occasioned by frost in the citrus and deciduous fruit districts of the United States often reach enormous proportions. It has been impossible to secure accurate information as to what the average annual loss has been over a period of years; but it is safe to say that the loss would approximate $10,000,000 a year. If one takes into consideration the freezes which occurred in the citrus belt in Florida during 1880, 1884, 1886, 1894, and 1895, where not only the fruit but the trees themselves were killed, the loss would average still greater. It is estimated that the freeze of 1894–95 destroyed 3,000,000 boxes of oranges in the Florida groves. Although the citrus industry in California had not yet reached large proportions, the losses were correspondingly heavy. In January, 1913, the losses in the southern California citrus district reached the enormous sum of $50,000,000, all of which might have been saved by means of the present methods of frost-prevention. Deciduous fruits have suffered quite as heavily from frost-injury. Very often almost the entire crop of fruit throughout the eastern and southern states is a complete failure. In the middle West, especially in Colorado, the one great drawback to fruit-growing has been the danger of damage by frost. This has also been true of the deciduous fruit districts of the inter-mountain and Pacific coast states. However, since the advent of the present methods of protecting against frost-injury, much security has been added to deciduous fruit-growing.

The problem of preventing injury to plants from frost may be classified under the following heads:

1. The prediction of frost, and the issuance of adequate frost-warnings.
2. The construction and use of devices and apparatus to be used in frost-prevention.
3. The cost of orchard heating.
4. The physics of orchard-heating.
5. The use of electricity in frost-prevention.

The prediction of frost and issuance of frost-warnings.

The prediction of frost and issuance of adequate frost-warnings necessarily belong to the United States Weather Bureau. It is wholly impossible accurately to predict frost locally without a knowledge of general weather conditions over a considerable area. However, a local observer with a complete knowledge of the climatology of his district and a knowledge of the air-currents, humidity, maximum and minimum temperatures, and the like, is capable of making very accurate forecasts in coöperation with the United States Weather Service. For careful work, a detailed mapping of the climatological features of each district should be made. It is known that temperatures vary greatly within any district, dependent upon elevation, contour, proximity to large bodies of water, and so on.

Frosts usually occur during periods of high barometric pressure, following a period of low pressure in which there has been some precipitation. Under such conditions the air is very dry and dust-free, producing conditions favorable to intense radiation, and consequently causing rapid cooling of both plants and soil.

1587. Orchard-heating with fifty coal-heaters to the acre. Each heater holds from twenty-five to thirty-five pounds of soft coal.

It has been stated more or less empirically that the temperature of the dew-point is a safe guide in the local forecasting of frosts, but recent investigations have shown that it is not dependable when used alone and in disregard of other important factors, such as the daily maximum temperature, temperature-curve, wind-direction, barometer, and condition of the sky. To this should be added a complete knowledge of general weather conditions as obtained from the nearest District Weather Bureau Office.

In 1882, Lieutenant (now Brigadier General) James Allen published a pamphlet entitled "To Foretell Frost by the Determination of the Dew-point." He said that if the dew-point is above freezing in the early evening the minimum temperature next morning will be above freezing; if the dew-point is below freezing, the minimum temperature next morning will also be below freezing. If the prediction of frosts were so simple, anyone with the aid of the psychrometer, or wet-and-dry bulb thermometer, might easily make independent forecasts. However, it has been found that the dew-point is an aid only when used in combination with a perfect knowledge of the other weather factors and a knowledge of the climatology of the district. The dew-point temperature is used in the Rogue River Valley, Oregon, because it has been found a very safe guide in combination with the above factors which were determined by several years of observation and study. From 1909 to 1913 the average departure of the minimum temperature of the following morning from the previous evening's dew-point temperature during periods of spring frosts has been 0.10 F. It is possible that every district, by a careful study of all the factors governing frost conditions, may be able to predict accurately not only the minimum temperature that will occur, but also the time when the firing in the orchards must begin. This is now done in the Rogue River Valley, Oregon, and has been practised for several years without a single error.

The several ways of preventing fall in temperature.

In order to prevent the fall in temperature, the following methods have been practised: (1) Direct heating of the air. (2) Adding water-vapor. (3) Adding both heat and water-vapor. (4) Ventilation or mixing the air. (5) Irrigation, or use of water. (6) Use of heated water and steam. (7) Use of screens or covers to prevent loss of heat by radiation. (8) Spraying with water.

In the discussion of preventing frost-injury, all the methods excepting that of adding heat will be omitted, as recent experiments have shown that direct heating of the stratum of air in contact with the trees and fruits is the only practicable way of handling frost-prevention on a large scale. All the other methods have been given extensive trials, and, while practicable for small gardens, cannot be used over large areas on account of the large amount of labor necessary, and the further fact that their application cannot be made general. Direct heating is not only simple, but is the least costly, and has, therefore, the advantage of general application.

Methods of direct heating in frost-prevention.—As stated above, it has been demonstrated beyond question that adding heat directly to the air through the agency of fires distributed throughout the orchard is the most successful and practicable way to handle the frost problem in commercial orchards. A multitude of devices and many kinds of fuel have been experimented with, and it is now the opinion among growers who have fought frost that the best heat-producing material so far demonstrated is crude-oil or distillate burned in some form of sheet-iron receptacle or smudge-pot. In the first place, oils are easy to handle, may be readily stored, and, compared with other fuels, produce more heat in proportion to the cost. The cost of handling and igniting such fuels as coal and wood, together with the disadvantage of so much bulky material distributed throughout the orchard which interferes with cultivation, decidedly places these fuels at a disadvantage, excepting in very small tracts. No matter how remote a fruit district may be from an oil-field, there is no question but that oil is the best fuel to be used, especially in large commercial orchards when the labor problem is one of more than ordinary importance. There is very much difference in the oils as secured in different parts of the country. For the most part, eastern crude-oils have a paraffine base, while those on the Pacific slope have an asphaltum base. The crude-oil, or petroleum, as it comes from the wells is very rich in gases and the lighter oils, such as benzene, gasolene, kerosene, and others, and, therefore, is not used as such for orchard-heating. The gases and lighter oils are all removed by fractional distillation, leaving behind the heavier oils and the asphaltum or paraffine base, as the case may be. The fuel-oils on the market are, therefore, residuals, and as such are used for orchard-heating. A residual oil with a paraffine base will burn in the common smudge-pot without leaving behind anything but a little soot; but the oils with an asphaltum base do not. For this reason it is found necessary to remove the asphaltum base in so far as is practicable. Asphaltum does not burn readily in a simple smudge-pot, and, therefore, remains behind after the lighter oil has burned. Upon cooling, it becomes very hard, and reduces the capacity of the pot for future fillings. The best oil for orchard-heating purposes is one of approximately 20° Beaumé test, considering the matter of cost as an item. A lighter oil up to 32° Beaumé may be used, but being lighter, it will burn more rapidly and reduce the effective burning time of the orchard-heater.

The orchard-heater.—During recent years, large numbers of types of orchard-heaters have been placed upon the market. As stated elsewhere in this article, the first smudge-pot devised for orchard-heating was the invention of J. P. Bolton, of Fresno, California, and the object of this invention was to produce a device which would effect fairly complete combustion. In fact, the idea in all of the more recent types of orchard-heaters has been to bring about more perfect combustion of the fuel-oil and a consequent reduction in the amount of soot given off. Also, there has been an effort to increase the burning time of the pot by increasing the capacity for fuel-oil. This has been partially effected by several interesting devices, but the perfect pot producing complete combustion of fuel-oil has yet to be invented. The so-called soot-arrester of some types is a misnomer. Very extensive experiments have been made with all the devices on the market, and it has been shown that the plain sheet-iron pot holding approximately five quarts of fuel-oil is just as effective as the more complicated and expensive types. This pot is inexpensive, and when made of No. 29 or 26 sheet-iron will cost from 5 to 8 cents. In using a heater of such small size, the number to the acre should not be less than 100, and preferably more in districts in which periods of low temperature continue more than four or five hours. Owing to the cheapness of such pots, a very large number may be used in preference to using a few expensive heaters of the reservoir type. Many small fires give better results than a few large ones, as the heat is better distributed and convective air-currents are not produced. It must be understood that any orchard-heating device that is in any way complicated by dampers, cocks, valves, and the like, must be avoided. At best, an orchard-heater is roughly handled and the more expensive and complicated types would find a very short existence in actual orchard-heating practice. Furthermore, the matter of storage must be considered. The simple pot which will nest easily and occupy very little space will be more desirable. There is no objection to the high-priced reservoir heater providing it is not complicated, but the same results may be secured by the more simple lard-pail type, holding about five quarts and having a burning time of four and five hours, depending upon the quality of fuel-oil used.

Equipment for orchard-heating.—The equipment absolutely necessary for effective orchard-heating consists of the following:

1. Storage reservoir.
2. Distributing wagon tank.
3. Orchard-heaters.
4. Lighters for igniting the fuel-oil.
5. Thermometers.
6. Frost alarm thermometers.

(1) The storage reservoir should be built of concrete or steel and should have a capacity sufficient to provide for at least five fillings of the orchard-heaters—that is to say, for five frost-periods. Such a reservoir, if built of concrete, should be constructed in such a way as to make the walls and floor one continuous pouring, so as to provide against leakage of oil. Residual oils have no effect upon the concrete, and all leakage is due to improper pouring of the cement. A rich cement mixture should be used. The reservoir should be so placed that it may be filled and emptied by gravity. At best, it is expensive to handle oil, and there should be no pumping. Oil should be secured in tank-car lots, and, if the proper arrangements are made, all the handling may be done by gravity. The reservoir should have an outlet pipe 2½ to 3 inches in diameter and supplied with a close-fitting valve. A cover to keep out dust and rain should also be provided. (2) The supply-tank should be placed upon a heavy low truck and should hold between 300 and 400 gallons. It should be provided either with two heavy gate valves at the rear or with two lines of hose with valves for the purpose of distributing the oil into the orchard-heaters. This tank may be the ordinary supply-tank used to carry spray material. (3) The number of orchard-heaters to be used to the acre will depend upon a knowledge of the conditions under which they are to be used. If the simple one-gallon type of heater is used, at least 100 to 120 should be provided to the acre. Besides, a double row should be placed around the side from which the prevailing air-movement comes in the periods of frosts. In fact, it is best to reinforce all sides of the orchard. After filling the heaters, they should be covered so as to prevent the entrance of moisture or to provide against evaporation of the oil. In placing the heaters, it is best to arrange them somewhere near the intersections of the diagonals made by the trees; but any arrangement which will not place a pot directly under a tree will suffice. (4) Fuel-oil is rather difficult to ignite, and a small amount of gasolene must be used so as to provide for quick lighting. The best method of lighting is to use a machinist's oil-can filled with gasolene, and a torch made of two pieces of thin iron pipe. The larger piece is fitted with a screw cap and is filled with a mixture of kerosene and lard oil. A section of small pipe through which is drawn a piece of waste is then fitted by a reducer to the other end. The waste is kept saturated with the mixture of lard and kerosene and when lighted provides a very good torch. This iron torch is very useful in taking off lids or caps of heaters when lighting. The machinist's oil-can filled with gasolene is carried in the left hand and about two tablespoonfuls are poured on the surface of the fuel-oil in the pots. The torch is applied and the gasolene ignites, firing the heavy fuel-oil. A simpler and lighter torch is easily made by wiring a piece of waste into a ball and twisting the wire into a handle. The waste is kept saturated by plunging it into the oil of the heater, igniting it from the surface flame as it is removed. (5) A most necessary part of any orchard-heating equipment is a sufficient supply of fairly accurate thermometers. There should be at least one thermometer to the acre. The thermometers should be hung with the bulb about 4 to 5 feet from the ground, depending, of course, upon the relative position of the fruiting area of the tree. In many orchards the thermometers will be placed higher, in others, lower. All thermometers should read correctly to within ½°, and if the correction be greater it should be placed upon a tag attached to the thermometer. In reading the thermometers, a pocket electric flashlight is much better than a lantern. The heat from a lantern will cause the mercury to rise before it can be read and the thermometers will, therefore, not give the true atmospheric temperature. The thermometers should be in the open in order to get the approximate temperature of the plants to be protected. This temperature is always slightly lower than the true atmospheric temperature. Besides the thermometers in the orchard, other thermometers placed at a safe distance from the heated area should be provided. A self-registering thermometer, while not necessary as a part of the equipment, would be very useful in determining the actual minimum as well as the rate at which the tem-

perature is falling. (6) The frost-alarm thermometer is a device for sounding an alarm when a certain temperature is reached. This point is usually a degree or two above the danger point, and serves the purpose of giving notice of approaching danger. The thermometer is placed at a point any distance away and where the lowest temperatures usually occur. Wires are led from the thermometer to the house. When the mercury falls below a certain point, the electric circuit is broken and a relay causes a bell to ring. If a thermograph is at hand, the man on duty may easily note by the character of the temperature curve whether or not it may be necessary to prepare for lighting the fires. There are several types of frost-alarm thermometers on the market, but the simplest and most trustworthy of all is the one in which the mercuric column breaks an electric circuit which in turn operates a relay connected with an electric bell.

Besides the above necessary devices for orchard-heating, there have been invented certain automatic devices for lighting a large number of pots at the same time, either by hand or electrical control. Such devices are always complicated, and, disregarding their cost which is an item of considerable importance, they are impractical in large operations. If the means be electrical or mechanical, an expensive cartridge must be used, the cost of which is greater than the cost of the labor for lighting the pots by hand. Besides, all automatic devices require that a large number of wires be strung through the orchard, which would interfere with other orchard practice. As a rule, the period over which frost-injury may occur may be a month or six weeks, and during this time various orchard work must be in progress.

1588. Using wood for orchard heating—fifty fires to the acre.

Injurious temperatures.—The temperatures at which the principal orchard fruits are liable to be injured cannot be accurately stated, since weather conditions previous to a freeze determine to a very great extent the ability of plants to withstand low temperatures. Not only do the different degrees of cold produce different effects on the same plant, but the same plant will often behave differently when subjected to the same degree of cold. It is well known that plants or parts of plants in active growth are more easily killed by low temperatures than the same plants or parts of plants when dormant. Actively growing plants contain large quantities of water; that is to say, the protoplasm or cell-sap is watery, and, as a rule, the larger the proportion of water contained within the plants the more likely they are to be injured by low temperatures. Injury to plants is due to changes or disturbances produced in the protoplasm by low temperatures and, because of the unlike specific characters of different plants, is not always produced in exactly the same way. Some plants are injured at temperatures above freezing, while others are injured by the formation of ice at temperatures which they can withstand if the formation of ice is prevented. Again, some plants are not injured if the formation of ice does not progress too far, while some are resistant to the lowest temperatures. As yet we do not know the nature of the peculiarities which determine the different powers of resistance of individual plants or of the same plant at different stages of growth. It is well known that the resistance to injury can be increased to a certain extent by raising the concentration of the cell-sap. Cold, in itself, acts as a stimulus, inducing an increased production of sugar in many plants. The presence of an increased amount of sugar in a plant acts in such a way as appreciably to lower the freezing-point. While tables giving injurious temperatures to fruit when in bud, blossom, and so on, have been prepared, it is safe to say that these temperatures are not entirely reliable. This is because conditions are never the same in any frost period. It may be stated that in the practice of orchard-heating the safest plan is to keep the temperature just above the freezing-point no matter what the variety of fruit. No doubt, this will often be 2° to 3°, or even more, higher than necessary, but the practice is on the safe side. In orchard-heating practice the temperature should never be allowed to go much below the danger point, as it is usually difficult to bring it back without some chance of injury to the fruit.

Effect of orchard-heating on pollination.—That pollination and subsequent fertilization of the orchard fruits is in any way affected by orchard-heating is yet to be proved. It has been contended by some that the smoke or soot incident to the use of fuel-oil has a tendency to prevent the normal activities of such insects as visit the blossoms of fruit trees. However, there is no proof that the presence of soot on the trees has any effect in keeping insects, especially the honey-bee, away from the newly opened blossoms. Under normal conditions, the blooms which bees visit open during the early part of the day and, therefore, only such blossoms attract them. These blossoms have been closed during the time when smudging was being done, and, therefore, the nectaries, pistils and stamens have no soot deposited upon them. With citrus fruits, soot may have an injurious effect upon the fruit, but it has been found that such fruit may be freed from soot by a washing process which does not materially increase the cost of handling.

The cost of orchard-heating.—The cost of orchard-heating is such a variable quantity that it is almost impossible to make a general estimate which will be of any value. Equipment, cost of fuel, length and number of firing periods, and so on, will vary in different localities and seasons. Orchard-heaters will cost all the way from 6 cents to 50 cents each, and from fifty to two hundred heaters, depending upon conditions, will have to be used to the acre. The quantity of oil will vary with the season, and the cost will be all the way from 1 to 5 or 6 cents a gallon. Usually, no less than 300 gallons an acre should be provided. At least one wagon-tank will have to be provided for each 10 acres at a cost of $25. Lighters and torches will cost from $1 to $2 an acre; thermometers 75 cents to $1 an acre. The cost of a storage-tank charged to each acre will depend upon its size, but will not be far from $10 an acre for large tracts. It is possible to get at the actual cost of fuel-oil to the acre in the following way: The quantity of fuel-oil necessary to raise the temperature 5° F. above the surrounding air in an orchard in full bearing with wide-spreading trees will be approximately twelve and one-half gallons an hour to the acre. This will be true if the air remains calm or does not move more than 1 or 2 miles an hour. In young orchards with the fruiting area low, practically double the quantity of fuel-oil as given will be necessary. The simple lard-pail type of heater, or, for that matter, any type of orchard-heater providing a burning area of about 44 square inches, will burn about one quart of fuel-oil an hour. Fifty one-gallon heaters will burn approximately twelve and one-half gallons of fuel-oil an hour, and if this oil costs 4 cents a gallon, the cost of an acre-hour will be about 50 cents when all the pots are burning. In other words, under the above conditions, it will cost approximately 1 cent an hour for each heater used, providing this heater does not have a burning surface greater than 44 square inches. It will require less fuel to heat an orchard in the square form than one of any other shape. The more the orchard-heaters are massed in the form of a square, the better the results. In fact, it is almost impossible to protect an orchard of only a few rows because there is no massing of the heat generated on account of the lack of braking effect on air-movement.

The physics of orchard-heating.

By common consent, the one-gallon or ten-pound lard-pail type of orchard-heater has been made the standard. This heater has a top diameter of 7½ inches, a bottom diameter of 6¾ inches, and a depth of 8 inches. It has a top burning surface of about 44 square inches, an average burning surface of 40 square inches, and under actual field conditions will hold five quarts. As will readily be seen, the rate of burning fuel-oil will not remain constant owing to the form of the pot. Since the rate of burning does not remain constant, it is natural to suppose that a corresponding change in the orchard temperature-characteristic takes place. In other words, the difference in temperature between the air outside the heated area and that in the heated area does not remain constant. The characteristic for any orchard-heater having sloping sides will be approximately the same as for the standard lard-pail type.

1589. Smudging used to prevent frost-injury.

By repeated experiment it has been shown that the standard lard-pail type heater will burn about two pounds (two pints) of fuel-oil an hour, providing the oil is neither too heavy nor too light gravity. A very simple rule which will determine the burning time of any fuel-oil in the standard pot is to divide the weight of a gallon (in pounds) by two. This will give the number of hours a gallon will burn under actual conditions in the field.

For any other size heater of the lard-pail type, the burning time will vary in accordance with the following law: $K=T\ (DH)^2$, in which T=the time of burning, D=the mean of the top and bottom diameters, and H=the depth, K=a constant. In other words, it has been found that if the mean diameter times the depth be squared and multiplied by the burning time (in hours) of a unit quantity (one gallon) of fuel-oil, the product will be the constant for the same fuel-oil burned under the same conditions, no matter what the size of the pot may be, providing it is not too much out of proportion.

The calorific power of fuels.—Analyses of various fuel-oils on the market have shown that the heating power averages about 18,000 British thermal units to the pound. A pound of dry pine wood, or, for that matter, the best oak wood, if perfectly dry, will generate about 6,000 B. T. U.'s under perfect combustion; bituminous coal under the same conditions will generate 12,000 B.T.U.'s. It will be seen, therefore, that the ratio of wood, coal and fuel-oil is about as 1:2:3. A cord of well-seasoned pine will weigh about 2,000 pounds and that of oak about 4,000 pounds. These figures are, of course, only approximate, but will serve as a basis for calculation in case anyone should desire to use wood or coal for orchard-heating purposes. Since the calorific power of fuel-oil is about 18,000 B.T.U.'s to the pound, the standard fuel-pot burning two pounds of fuel-oil an hour will generate 36,000 B.T.U.'s. This is largely theoretical as, owing to the character of the heater, combustion is by no means perfect. Nevertheless, the amount of oil, as indicated, is consumed, and will, therefore, be accounted for on the basis of complete combustion. By repeated experiment, it has been shown that the quantity of fuel-oil necessary to raise the temperature 5° F. above the surrounding air in an orchard in full bearing with the trees forming a protective covering and the air calm or moving not more than 1 or 2 miles an hour, is approximately twelve and one-half gallons or 100 pounds an hour to the acre. This quantity of fuel-oil is approximately the amount which would be burned in one hour by fifty standard orchard-heaters. In very young orchards, or with a wind of 10 to 15 miles an hour, fully two or three times as much fuel-oil will be necessary to maintain a temperature 5° F. above that of the surrounding air. Under average orchard conditions, with the trees in good bearing, the maximum height at which the bulk of the fruit crop is borne is usually not more than 12 to 15 feet above the surface of the ground. In many cases frost-injury does not occur above this height, the cold-air stratum being relatively thin. During periods of injurious low temperatures, the atmosphere is very dry and, therefore, calculations may be based upon the heating of the air only, since the small amount of water-vapor present at such times is of little importance. Taking an acre as the unit area, and assuming that the height to which the air must be heated to protect the crop is 12 feet, the total weight of the air inclosed within this space would be 42,000 pounds. As stated above, a pound of fuel-oil has a thermal capacity of 18,000 B. T. U.'s, and since it will require 100 pounds of fuel-oil an hour to the acre to maintain the temperature of the air 5° F. above the surrounding atmosphere, 1,800,000 B. T. U.'s or about 700 mechanical horsepower will be expended an hour to the acre on 42,000 pounds of air. But 1,800,000 B. T. U.'s would raise the temperature of 360,000 pounds of water 5° F., and since the specific heat of air is 0.24, it would raise the temperature of

1,500,000 pounds of air 5° F. However, it is seen that 1,800,000 B. T. U.'s are just capable of maintaining 42,000 pounds of air 5° F. above the surrounding atmosphere when there is no wind-movement. This means that even with large trees having the ability of reflecting back a considerable amount of heat, and with the soot and smoke acting more or less as a blanket, the loss by radiation, convection and absorption is enormous. As a matter of fact, $\frac{35}{36}$ of the heat generated by the orchard-heaters is lost, and the efficiency is, therefore, less than 3 per cent. Though effective and well within the financial possibility of application, the orchard-heater is nevertheless a wasteful appliance.

In the above calculations, the effects of wind-movement have not been taken into consideration. Take the case of a pot placed in an outside tree row heating a space 25 feet square and 12 feet high. This space contains in round numbers 600 pounds of air. The standard pot will generate 600 B. T. U.'s a minute, or sufficient heat to raise the temperature of 600 pounds of air about 4° F. This will be true if there is no wind-movement and if there is very little radiation of heat. However, if the air moved only 100 feet a minute, or a little more than 1 mile an hour, the temperature could never rise more than 1° above the temperature of the incoming cold air. At 4 miles an hour it could rise but ¼° F. This will be true only in the outside tree rows, on the side from which the air-movement comes. This shows why it is often difficult to protect the outside rows from frost-injury. Naturally, with the orchard in the form of a square, all the rows beyond the first, on account of air-movement, would receive a certain amount of heat from the first row. However, with a high wind of 18 to 20 miles an hour and a temperature of 10° F. or more below the danger-point, the problem of frost-prevention becomes a serious one. The number of fuel-pots must be three or four times the number required for ordinary orchard-heating.

The value of smoke.—The discussion so far has considered mainly the value of fuels from the standpoint of heating. There is some value in the smoke which is generated but very much less than there is in the heat. When it is calm there is little difficulty in maintaining a heavy smudge with only fifty orchard heaters, or fires, to the acre, but a very light breeze will quickly drive it away. Experience has shown that the smudge is valuable when the temperature drops somewhat below the danger-point about sunrise. In cases of this kind, the smoke acts as a screen and prevents the too sudden warming up or thawing of the frozen fruit. However, it is unsafe to depend on smudge alone.

The use of electricity in frost-prevention.—During recent years much thought has been given the matter of frost-prevention by electrical engineers. However, let it be said that some other means than that of direct electrical heating must be employed. If we take the above figures indicating the amount of heat energy which must be expended to the acre to raise the temperature 5° F. in an orchard and maintain it above that of the surrounding atmosphere, we find that this is equivalent to approximately 700 H. P. of mechanical energy. In the transmission of electrical energy from the source of power, there is always a heavy loss, so that fully 1,000 H. P. of mechanical energy would have to be generated in order to raise the temperature 5° F. in an acre of orchard. From this it will be seen that, although our large electrical power plants are carrying a very light load during the hours of 1 A.M. to 7 A.M., the amount of reserve power would be so small in comparison with the demands that the largest power plant would cover but a very small area. Of course, this consideration takes into account the conversion of mechanical energy into heat energy. In actual practice, the electrical heater is so inefficient that it is wholly beyond the range of possibility for orchard-heating. The problem of frost-prevention by electrical methods must be attacked from a different side, either by the use of high tension discharges or by the use of large electric fans that will tend to stir the air or produce a chimney effect so as to carry the cold air upward. Even the latter will be useless when very low temperatures are accompanied by high winds.

A simple method of estimating the quantity of fuel necessary to raise the temperature of the air in an acre of orchard any number of degrees Fahrenheit under every condition is as follows: In a full bearing orchard there are approximately 500,000 cubic feet of air to the acre which must be heated continuously, it being considered that the height to which heat must be added is about 12 feet. By experiment, it has been shown that it will require about 0.75 to 1.00 B. T. U. to the cubic foot an hour to maintain the temperature 1° F. above that of the surrounding atmosphere. Therefore, it will require 375,000 to 500,000 B. T. U.'s an hour, under average conditions to maintain the temperature of an acre of orchard 1° F. above that of the surrounding atmosphere. Since one pound of crude-oil or distillate contains approximately 18,000 B. T. U.'s, the number of pounds of fuel-oil required to the acre-hour will be twenty to twenty-eight pounds. Since a pound of oil is approximately one pint, the quantity of oil an acre-hour for 1° F. rise will be two and one-half to three and one-half gallons. As shown above, the ratio of wood, coal and oil is about as 1:2:3, wood having 6,000, coal 12,000, and oil 18,000 B. T. U.'s to the pound.

Bibliography.—Some recent publications on frost protection are: "The Protection of Orchards in the Pacific Northwest from Spring Frosts by Means of Fires and Smudges," P. J. O'Gara, Farmer's Bulletin, No. 401, U. S. Dept. Agric. "The Prevention of Frost Injury in the Orchards of the Rogue River Valley, Oregon," P. J. O'Gara, Bulletin No. 5, Office of the Pathologist and Local United States Weather Bureau Station, Medford, Oregon. "A comparative Test of Fuel Oils and Appliances Used in Orchard-Heating to Prevent Frost Injury," P. J. O'Gara, Bulletin No. 6, Office of the Pathologist and Local United States Weather Bureau Station, Medford, Oregon. "Forecasting Frosts in the North Pacific States," E. A. Beals, Bulletin No. 41, U. S. Weather Bureau.

P. J. O'Gara.

FRUIT-GROWING comprises all the knowledge and practice that are directly concerned in the producing and handling of fruits. Pomology (literally, *science of fruits*) is synonymous with fruit-growing. There has been an effort to divorce the terms pomology and fruit-growing, making the former to comprise the scientific and classificatory subjects and the latter the practical subjects; but such division is arbitrary and is opposed to usage. The word "growing" can no longer be held, when used in such connection, to designate merely the planting and care of fruit-plants, for all good practice is necessarily associated with scientific knowledge and theory. Fruit-growing is a more familiar and homely term than the Latin-Greek word pomology, and for that reason it has seemed to some persons to be less adaptable to the formal presentation of the knowledge connected with fruits. It is significant, however, that with the exception of Prince's "Pomological Manual," the fruit books that have done much to mold public opinion in America have not been known as pomologies, notwithstanding the fact that the greater number of them have given great attention to formal descriptions of varieties. The term pomology is founded on the Latin *pomum*, a word that was used generically for "fruit." In later Latin it came to be associated more particularly with the apple-like fruits. The word is preserved to us in the French *pomme*, meaning "apple," and in other languages of Latin derivation. In English we know it as *pome*, a botanical term used to designate fruits that have the peculiar morphological structure of the apple and pear. This use of the term is explained under the article *Pyrus*. However, the root of the word pomology is derived from the Latin *pomum* rather than from the botanical *pome*.

The limitations of fruit-growing, as art and discussion, depend on the use of the word "fruit." This word, as used by the horticulturist, is impossible of definition. Products that are classed with fruits in one country may be classed with vegetables in another. To the horticulturist a fruit is a product that is closely associated, in its origin, with the flower. As used in this country, it is the product of a bush or tree or woody vine, the most marked exception being the strawberry. Most fruits may be grouped under three general heads, —orchard or tree fruits, vine fruits (of which the grape is the type), and small-fruits or "berries." Of the orchard fruits, the leading groups are the pome-fruits (apple, pear), drupe-fruits (peach, plum, cherry), and the citrus-fruits (orange, lemon). Of the small-fruits, we may distinguish the bush-fruits (raspberry, blackberry, currant, gooseberry, blueberry), cranberry, and the strawberry. There are many fruits, particularly in the tropics, that do not fall within these groups. The species of fruits that are fairly well known in North America are not less than 150, but the important commercial species are not more than forty.

1590. A vineyard of American grapes (New York). Picking-crates are shown in the foreground.

Fruit-growing is the most important and characteristic horticultural interest of North America. It is of high excellence as measured by commercial standards, quantity of product, and the quickness with which scientific theory and discovery are applied to it. Most remarkable examples of the quick assimilation and application of theoretical teachings are afforded by the readiness with which fruit-growers within recent years have adopted the ideas associated with tillage, spraying, pollination, fertilizing, pruning, inter-planting, and the modifications in conditions of marketing. Yet, great as have been the advances, progress has only begun; and in the precise and painstaking application of the best teaching the American fruit-grower has much to acquire.

The American ideals in fruit-growing are quite unlike the European. The American aims at uniformity over large areas. The European gives more attention to special practices, particularly in training of fruit trees. This is well illustrated in American nurseries as contrasted with European nurseries (see *Nursery*). The American merely prunes his fruit trees in the nursery: he does not train them. The American is likely to give most attention to the fruit by the bushel or by the barrel; the European is likely to consider his fruits singly or in small numbers, and often to sell them by the piece or by the dozen.

In many parts of North America, the extension of fruit-growing is the most radical change of base taking place in farming operations. This growth of the fruit business is possible because the consumption of fruit is increasing, the facilities for transportation have been improved, scientific discovery has insured the production of good crops, and also because many other kinds of farming have been relatively unprofitable.

While the phenomenal development of American fruit-growing has been due in great measure to climatic and economic conditions, it also has been hastened by book writings. More than fifty authors have contributed books of greater or less size, either on the general subject or on special fruits, beginning with Coxe's "View of the Cultivation of Fruit Trees" in 1817, and followed by Thacher's "American Orchardist" in 1822. These pioneer writings gave much of their space to orchard management, with little mere compilation of descriptions of varieties. Subsequent volumes, for nearly fifty years, were in large part compilations and collations of accounts of varieties. To this latter class belong the works of Prince, Kenrick, Downing, Thomas, Warder. It is only in the present time that we have come to treat the subject fundamentally, by giving the weight of discussion to principles of orchard management. (For lists of books, see the article *Literature*.) In recent years, the bulletins of the United States Department of Agriculture and of the many experiment stations, and the extensive discussion in the rural press, have greatly spread the knowledge of fruit-growing and have undoubtedly stimulated its practice.

The sources of American fruits—of the species and races that are cultivated on this continent—are chiefly four: (1) Original or early importations of western Asian and European fruits; (2) oriental types, from the China-Japanese region; (3) the introduction within fifty years of fruits from the Russian region; (4) the development of native species. In the first group are included the prevailing types of apples, pears, quinces, cherries, domestica plums, olives, currants, some of the gooseberries. In the second group are citrous fruits, peaches, apricots, Japanese plums, kaki, and others, many of them having come to us by way of Europe. In the third class—the Russian fruits—are types of orchard fruits of such recent introduction that we have only recently ceased disputing violently about their merits and demerits; therefore a special review of the subject is given at the close of this article. The fourth class—the native fruits—includes the grapes of the eastern states, blackberries, dewberries, raspberries, many gooseberries, strawberries (of Chilean origin), many plums, cranberries, blueberries, and a few apples.

Recently, there has been much interest in fruit-growing on the part of persons who desire to establish themselves on the land. The attractiveness of fruit appeals to them, and they think that the raising of it is not laborious and that the business is adaptable to beginners. This is one expression of amateurism. Fruit-growing entails continuous, active and often hard, disagreeable labor, and, in the case of most orchard fruits, it requires long waiting for perfect results. The business demands much special knowledge, quick action, and first-rate salesmanship. The competition is sharp. Persons should enter the business with caution, and only with a full comprehension of the elements of failure and success. The business has additional risk when one must leave the property to be managed and cared for by hired labor. Usually, the most profitable results are secured when part of the farm is devoted to other products than fruit, for one is then able to employ help and equipment more advantageously, to raise produce for the teams and other live-stock, and to have secondary sources of revenue.

In North America, it is chiefly the commercial large-area fruit-growing that is most highly developed. The amateur phase,—for fancy and for home use,—was once relatively more important, as explained in a subsequent paragraph. The "fruit garden" is now little seen. It is very desirable, however, that the growing of the choicest fruits in the most painstaking personal way shall be encouraged amongst us; and with the further development of the country this will take place if writers do not overlook the subject.

In Canada, the total yields of fruits for thirty years have been as follows, in quantities (Canada Yearbook, 1910):

Canada	1871	1881	1891	1901
Apples (bushels).	6,365,315	13,377,655	7,519,913	18,626,186
Peaches (bus.)...	......	......	43,637	545,415
Pears (bushels)...	......	......	229,240	531,837
Plums (bushels).	......	......	266,350	557,875
Cherries(bus.)...	......	......	192,369	336,751
Otherfruits(bus.).	358,963	841,219	320,641	70,396
Grapes (pounds).	1,126,402	3,896,508	12,252,331	24,302,634
Small-fruits (qts.)	......	......	......	21,707,791

The exports of fruits from Canada to all countries has been as follows:

	1906	1908	1909	1910
Apples, green or ripe (barrels)..	1,217,564	1,629,130	1,092,066	1,604,477
Apples, dried (lbs)	3,651,260	6,939,088	4,973,562	8,186,984

Of the green apples, the most part went to Great Britain, but the dried fruit went largely to other countries than Great Britain or the United States. Ontario was far in the lead of any other province in fruit-production in 1901, in grapes, small-fruits and apples exceeding all the other provinces combined.

In the United States, the value of fruits (including small-fruits or berries) and nuts produced in 1909 (as reported in the thirteenth census) amounted to $222,024,000, or 4 per cent of the total value of farm crops. The value reported for 1899 was $133,049,000, the increase for the decade amounting to 66.9 per cent. While it is impossible to reduce the quantity of the product to a single total, the statistics for individual classes show that in general the value increased by a much larger percentage than the production. Of the total value in 1909 of fruits and nuts, $140,867,000 was contributed by orchard fruits, $29,974,000 by small-fruits, $22,711,000 by citrous-fruits, $22,028,000 by grapes, $4,448,000 by nuts, and $1,995,000 by tropical and sub-tropical fruits (other than citrous). In both acreage and quantities, strawberries far exceeded any other class of small-fruits; similarly, apples are far in excess of any other orchard fruit; oranges far exceed in value all other citrous-fruits taken together. In nuts, the production in pounds in 1909 was, Persian or English walnuts 22,026,524; black walnuts 15,628,776; pecans, 9,890,769; almonds, 6,793,539; unclassified, 7,988,402. The values of fruits and nuts in 1909, by states, are displayed in Fig. 1593.

The progress in fruit-growing.

The development of American fruit-growing is well illustrated in the radical change of ideals within recent time. These new points of view may be arranged conveniently under seven general heads:

(1) The most important shift is the fact that there is a horticultural industry as distinguished from a general agricultural industry. At the opening of the nineteenth century American agriculture was more or less homogeneous, largely because the extent of it was limited and because there was little demand for other than the few staple commodities. The horticulture of that time was confined chiefly to a small area about the homestead. A few vegetables, flowers and fruits in a small plantation, with here and there a single greenhouse, represented the horticultural effort of the time. At the present day we conceive of great geographical areas as horticultural regions. Persons now buy farms with the explicit purpose of devoting them to the production of fruits or other horticultural products. Even sixty years ago horticulture was largely an amateur's avocation, but today it is one of the leading commercial occupations of the country, and the most important single factor in it is fruit-growing. With this rise of the horticultural industries came a demand for new knowledge on a host of subjects which were unheard of even as late as a half-century ago. The contemporary progress in pomology is largely a breaking away from the old ideals. Practices that were good enough for amateur purposes, or for the incidental and accidental fruit-growing of our fathers, may be wholly inadequate to the new-time conditions.

1591. Young plum orchard, showing clean tillage and high-heading.

Some growers head-in vigorous young trees like the above; others prefer to let them take their natural course, keeping the heads open rather than thick and close. Neither method is best under all circumstances.

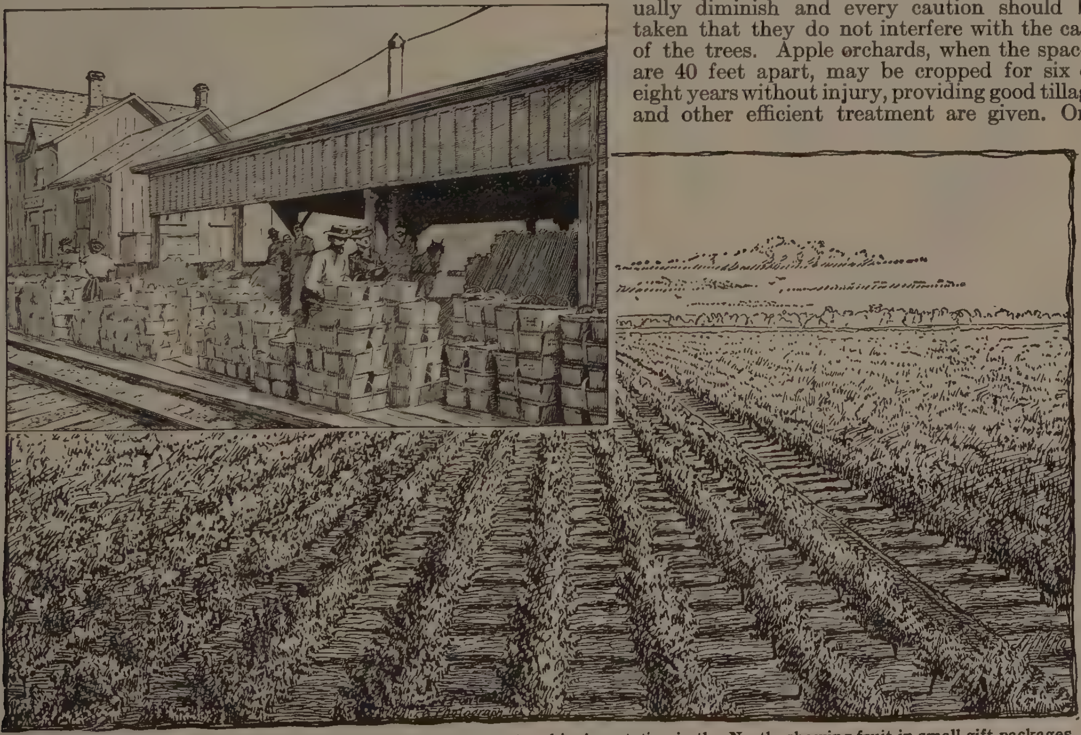
A century ago there was practically no commercial orcharding. The apple was grown somewhat extensively in many parts of the country, particularly in New England, but it was used chiefly for the making of cider. Small-fruit growing, as a business, had not developed. In fact, commercial strawberry-growing (the most readily developed of the fruit-growing industries) may be said to have begun with the introduction of the Hovey in 1836, although previously there were market plantations of small extent about some of the larger towns. The commercial culture of blackberries and raspberries, although it began about the middle of the century, did not acquire distinct importance until after the reaction from the Civil War. The fruit-growing industries now constitute a distinct branch or department of our agricultural condition, in the newer regions as well as in the old. In fact, great areas of virgin lands are now put at once into orchards.

(2) With the rise of commercial fruit-growing, there have developed novel questions related to marketing. The new marketing revolves about three centers: (*a*) The necessity for special products for special uses, (*b*) the growing demand for small packages, and (*c*) the remarkable development of transportation facilities and of pre-cooling, handling, and storage. There has arisen an increased desire for special grades and for particular kinds of fruit. The fruits that were current fifty years ago may not be good enough for the markets of today. Commercial fruit-growing rests on the fact that more persons are consuming fruits. Many of these persons buy only in small lots for present consumption. They go to the market often. They have no facilities for storing the fruit, and they do not buy for the purpose of selling. Therefore, the small package has come to be increasingly more important. There has been a

widespread demand for a package that can be given away with the fruit. This demand for the small and individual package may be expected to increase with all the better kinds of fruits or with those that appeal to the personal customer. This is true in all lines of trade. Not so long ago, boots and shoes were distributed in large board cases, but now each pair is sold in a neat cardboard box. We are still conservative in respect to the handling of apples in barrels. In the general trade and for the staple varieties of apples, the barrel may continue to be the best package, but for the personal customer and particularly with all the finer or dessert varieties, a small package must come into use. In most parts of the world, except in the central and eastern part of the United States, apples are not handled in barrels. The fact that the grower must give attention to his package as well as to the growing of his crop, forces him to adopt a new point of view in his fruit-growing and to visualize his market or even his customer.

(3) Modern commercial orcharding has developed the tillage ideal. Under the old régime, the tree was able to take care of itself and to bear a product good enough to meet the uncritical demands. Nowadays, however, the tree must receive the very best of care, for annual crops of great quantity and of the best quality are desired. Therefore, the plant must be supplied with abundance of plant-food and moisture. Time was when it was thought that the mere application of chemical plant-food to the soil would be sufficient to make a plant productive. It is now understood, however, that plant-food is only one of the requisites of good growth. The soil must be deep and loose and fine, so that it will hold moisture and promote all those chemical and biological activities that make the land to be productive. In former times the best attention in tillage was given to the annual crops. The orchard was usually in neglect. This was because the fruit plantation had small commercial importance. Now that the fruit plantation has risen to first importance, in many cases, it must be given as good care as any farm crop. In recent years there has been great development of special tools and implements for the tillage of orchard lands. Greater attention is given to the original preparation of the land, so that planters no longer ask how large the hole must be to receive a tree, but accept Warder's advice that the hole should be as large as the orchard. The philosophy of orchard tillage, as understood by the best teachers and for most parts of the country, is (*a*) to prepare the land thoroughly at the outset, (*b*) to give frequent light surface tillage in the early part of the season or until the crop is nearly or quite grown, and then (*c*) to cover the land with some crop that will remain on the ground over winter and be plowed under in spring. If the land has been well prepared, it is not necessary to plow it deep after the first two or three years, unless one is turning under a heavy cover-crop. The surface tilth may be secured by breaking the top-soil early in spring with a cutaway harrow, gang-plow or other surface-working tools. This may not be possible, however, on very heavy lands. The cover-crop adds humus and protects the land from puddling and baking in the winter. If it is a leguminous crop it also adds a store of available nitrogen. It is possible, perhaps, to use cover-crops so freely that the land becomes too full of vegetable matter, but all such dangers are easily avoidable. Usually the cover-crop is plowed under in spring at the very earliest opportunity in order to save the soil moisture. It is by no means the universal practice to use cover-crops on fruit lands, but the practice is now accepted, and the grower may adopt it or not as his judgment dictates.

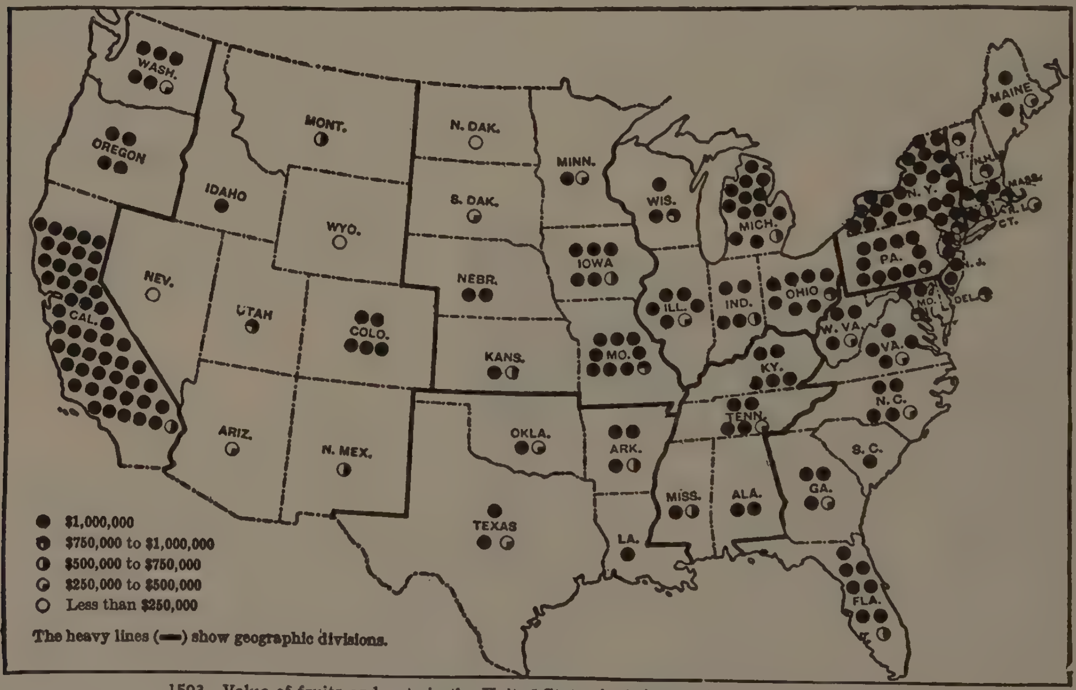
To facilitate the economical and efficient tillage of fruit lands, it is coming to be the practice to devote the land wholly to the fruits. The fertility of the land is not permanently divided between trees and hay, or trees and other crops. With plums and pears and some other orchard fruits, it is often allowable to use the intermediate land for the first two or three years for annual crops, but these crops should gradually diminish and every caution should be taken that they do not interfere with the care of the trees. Apple orchards, when the spaces are 40 feet apart, may be cropped for six or eight years without injury, providing good tillage and other efficient treatment are given. One



1592. Peach-growing on a large scale in Georgia; also a scene at a shipping-station in the North, showing fruit in small gift packages.

reason for allowing orchards to stand in sod in the old times was the difficulty in plowing beneath full-grown trees. Those persons who desired to plow and till their orchards, therefore, advocated very high pruning. The difficulty with these old orchards was the fact that the land was allowed to run into dense sod. Heavy plowing in an old orchard indicates that the plantation has been neglected in previous years. Orchards that have been well tilled from the first do not require much laborious tillage, and the roots are low enough to escape tillage tools. There has been a development of tillage tools which will do the work without necessity of pruning the tops very high. The practice of tilling orchards has increased rapidly. At first it was advised by a few growers and teachers, but the movement is now so well established that it will take care of itself, and in the commercial orchards the man who does not till his orchard is the one who needs to explain. On the Pacific coast, the importance of tillage is universally recognized because of the dry summer climate. The necessity of tilling orchards has forced a new ideal on the pomologist; and when he goes to the expense of tilling he feels the necessity of giving sufficient care in other directions to insure profitable returns from his plantation. It is true, to be sure, that orchards sometimes thrive under sod treatment, but these are special cases.

Of the same purpose with tillage is irrigation,—the purpose to fit the land for its work. Great fruit regions in the western half of the continent are on an irrigation basis and a special literature on fruit-raising under such conditions is now appearing. This irrigation practice for fruit is another expression of the idea that in the future nothing is to be left to chance so far as it is within the power of the grower to prevent it. For certain intensive fruit-culture, particularly of berries, special irrigation practices are appearing in the East, and often they make the difference between failure and success.



1593. Value of fruits and nuts in the United States in 1909, as displayed by the census.

(4) As competition increases, it is necessary to give better attention to pruning. It is unfortunately true that trees will bear without pruning. This, therefore, puts a premium on neglect. The old practice allowed the tree to grow at will for three or four years and to become so full of brush that the fruit could not be well harvested, and then the top was pruned violently. The tree was set into redundant growth and was filled with water-sprouts. This tended also to set the tree into wood-bearing rather than into fruit-bearing. By the time the tree had again begun fruit-bearing, the orchardist went at it with ax and saw and a good part of the top was taken away. It is now understood that the ideal pruning is that which prunes a little every year and keeps the tree in a uniformly healthy and productive condition. The pruning of trees has now come to be a distinct purpose, and this ideal must gain in definiteness and precision so long as fruit trees are grown. The practice proceeds on established principles, and is not of the nature of discipline.

(5) Now that there is demand for the very best products, it is increasingly important that fruits be thinned. The thinning allows the remaining fruits to grow larger and better, it saves the vitality of the tree, and it gives the orchardist an opportunity to remove the diseased specimens and thereby to contribute something toward checking the spread of insects and fungi. Thinning is exceedingly important in all fruits that are essentially luxuries, as peaches, apricots and pears. It is coming also to be important for apples and for others of the cheaper fruits. In the thinning of fruits, there are two rules to be kept in mind: (*a*) Remove the injured, imperfect or diseased specimens; (*b*) remove sufficient fruit so that the remaining specimens stand at a given distance from each other. How far apart the fruit shall be, depends on many conditions. With peaches it is a good rule not to allow them to hang closer than 4 or 5 inches (sometimes 7 or 8 inches), and in years of heavy crops they may be thinned more than this. This extent of thinning often removes two-thirds of the fruits. It nearly always gives a larger bulk of fruit, which brings a higher price. Thinning is

usually performed very early in the season, before the vitality of the tree has been taxed, and after the normal "drop" from non-pollination has occurred.

1594. Various spraying rigs. 1. A tall platform rig, to enable one to spray very high trees. 2. A simple barrel outfit for small orchards and small trees. 3. Compressed air outfit. 4. A low rig, with barrel. For larger machines, and other patterns, see pages 1058–1060 (Vol. II).

(6) Spraying of fruit plantations has now come to be a definite purpose and an established orchard practice; no good orchardist is now without his spraying apparatus any more than he is without his tillage tools. When spraying was first advised, the practice seemed to be so revolutionary that great emphasis had to be laid on its importance to induce people to undertake it. How and when to spray and what materials to use are matters that will always be discussed, because the practices must vary with the season, the kind of fruit, the geographical region, the insects and fungi to be combated. Spraying may not be necessary every year, and certainly not equally necessary in all geographical regions; but the fact that spraying is necessary as a general orchard practice is now completely established. A proof of the firm hold that spraying has taken of the fruit-growing business is afforded by the great numbers and the mechanical excellence of the machinery and devices now on the market; and this fact also attests the vitality of fruit-growing as an occupation. A special literature has developed on fruit diseases and fruit insects and the means of combating them, and the grower must keep fully informed by means of the government, state and provincial publications.

(7) Perhaps the most gratifying modern development in fruit-growing is the demand for instruction in fundamental principles, or in the reasons why. Years ago, the grower was satisfied if he had definite directions as to how to perform certain labor. He was told what to do. At present, the pomologist wants to be told what to think. There seems to be a tendency in horticultural meetings to drop the discussion of the mere details of practice and to give increasingly more attention to the underlying reasons and the results that are to be expected from any line of practice. Knowing why a practice should be undertaken and what the results are likely to be, the grower can work out the details for himself, for every fruit plantation and every farm is, in a certain way, a law unto itself. There must be a rational procedure; the details and the applications are complex: therefore the fruit-growing subjects become effective means of education.

Systematic pomology.

The classifying and describing of the kinds of fruits is a particular kind of pomological knowledge that is left to specialists, who are for the most part writers. With the increase in numbers of varieties, it becomes increasingly more important that the most careful attention be given to describing them and to assembling them into their natural groups in order that similar kinds may be compared and also that it may be possible to determine the name by analyzing the specimen. Necessarily, all classificatory schemes for varieties are imperfect since the varieties often differ by very slight characters, and these characters may vary in different regions and under varying conditions. Theoretically, the most perfect classification is one that considers characters of flowers as well as of fruits, but such schemes are usually impracticable because fruit-growers cannot secure flowers and fruits at the same time. For examples of classificatory schemes the reader may consult the various fruit manuals, but the following examples from the older literature will show something of the range and method connected with the problem:

John J. Thomas' scheme for classifying peaches:

Division I. Freestones or Melters.
 Class I. *Flesh pale or light-colored.*
  Section 1. Leaves serrated, without glands.
  Section 2. Leaves crenate, with globose glands.
  Section 3. Leaves with reniform glands.
 Class II. *Flesh deep yellow.*
  Section 1. Leaves crenated, with globose glands.
  Section 2. Leaves with reniform glands.
Division II. Clingstones or Pavies.
 Class I. *Flesh pale or light-colored.*
  Section 1. Leaves serrated, without glands.
  Section 2. Leaves crenate, with globose glands.
  Section 3. Leaves with reniform glands.
 Class II. *Flesh deep yellow.*
  Section 1. Leaves serrate, without glands.
  Section 2. Leaves with reniform glands.
 Class III. *Flesh purplish crimson.*
  Section 1. Glands reniform.

Following is John A. Warder's scheme for classifying apples, adopted "after a long and careful consideration and study of this subject." See Figs. 1595, 1596.

Class I. *Oblate or flat,* having the axis shorter than the transverse diameter.
 Order I. *Regular.*
 Order II. *Irregular.*
  Section 1. Sweet.
  Section 2. Sour.
   Subsection 1. Pale or blushed, more or less, but self-colored and not striped.
   Subsection 2. Striped or splashed.
   Subsection 3. Russeted.
Class II. *Conical,* tapering decidedly toward the eye, and becoming *ovate* when larger in the middle and tapering to each end, the axial diameter being the shorter.
 Orders I and II, as above.
  Sections 1 and 2. as above.
   Subsections 1, 2 and 3, as above.
Class III. *Round, globular* or nearly so, having the axial and transverse diameters about equal, the former often shorter by less than one-quarter of the latter. The ends are often so flattened as to look truncated, when the fruit appears to be cylindrical or globular-oblate.
 Orders, Sections and Subsections as above.
Class IV. *Oblong,* in which the axis is longer than the transverse diameter, or appears so. These may also be truncate or cylindrical.
 Orders, Sections and Subsections as above.

Robert Hogg's classification of pears ("Fruit Manual," 5th ed., London):

A. The length from the base of the stalk to the base of the cells greater than from the base of the cells to the base of the eye.
 Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
 Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
 Section 3. Length from the base of the stalk of the base of the eye equal to the lateral diameter.
B. The length from the base of the stalk to the base of the cells less than from the base of the cells to the base of the eye.
 Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.
 Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.
 Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.

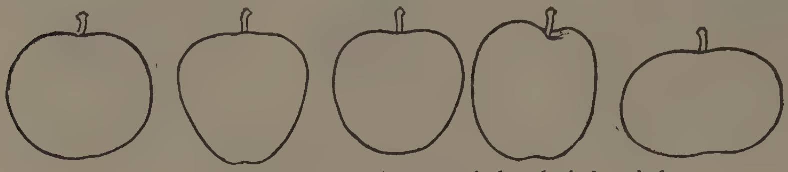
c. The length from the base of the stalk to the base of the cells equal to that from the base of the cells to the base of the eye.

Section 1. Length from the base of the stalk to the base of the eye greater than the lateral diameter.

Section 2. Length from the base of the stalk to the base of the eye less than the lateral diameter.

Section 3. Length from the base of the stalk to the base of the eye equal to the lateral diameter.

A stable and attractive systematic pomology must give careful attention to the names of varieties. In North America much has been done, particularly under the auspices of the American Pomological Society, to simplify and codify the ideas associated with the nomenclature of fruits. The current rules or code of nomenclature of the American Pomological Society are as follows:



1595. The forms of fruits, showing, respectively, spherical, conical, ovate, oblong and oblate forms.

Priority.

Rule 1. No two varieties of the same kind of fruit shall bear the same name. The name first published for a variety shall be the accepted and recognized name, except in cases where it has been applied in violation of this code.

(*a*) The term "kind," as herein used, shall be understood to apply to those general classes of fruits which are grouped together in common usage without regard to their exact botanical relationship; as, apple, cherry, grape, peach, plum, raspberry, etc.

(*b*) The paramount right of the originator, discoverer, or introducer of a new variety to name it, within the limitations of this code, is recognized and emphasized.

(*c*) Where a variety name through long usage has become thoroughly established in American pomological literature for two or more varieties, it should not be displaced nor radically modified for either sort, except in cases where a well-known synonym can be advanced to the position of leading name. The several varieties bearing identical names should be distinguished by adding the name of the author who first described each sort, or by adding some other suitable distinguishing term that will insure their identity in catalogues or discussions.

(*d*) Existing American names of varieties which conflict with earlier published foreign names of the same, or other varieties, but which have become thoroughly established through long usage, shall not be displaced.

Form of names.

Rule 2. The name of a variety of fruit shall consist of a single word, whenever possible, or compatible with the most efficient service to pomology. Under no circumstances shall more than two words be used. When the exigencies of a case make it appear expedient, such words as early, late, white, red, and similar ones may be used as a part of a name.

(*a*) No variety shall be named unless distinctly superior to existing varieties in some important characteristic nor until it has been determined to perpetuate it by bud-propagation.

(*b*) In selecting names for varieties the following points should be emphasized: distinctiveness, simplicity, ease of pronunciation and spelling, indication of origin or parentage.

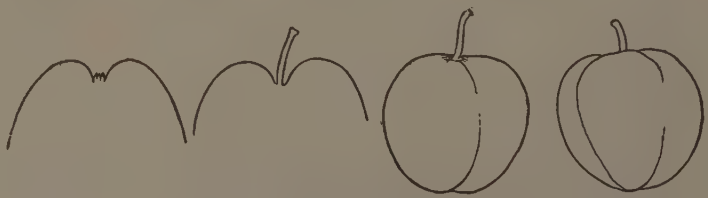
(*c*) The spelling and pronunciation of a varietal name derived from a personal or geographical name should be governed by the rules that control the spelling and pronunication of the name from which it was derived.

There are relatively few special technical terms used in the descriptions of pomological fruits. The greater part of them pertain to the pome fruits. The diagrams (Figs. 1595, 1596) illustrate some of these terms: *Spherical*, nearly or quite globular, the two diameters being approximately equal; *conical*, longitudinal diameter equaling or exceeding the transverse diameter, and the shoulders or apex somewhat narrowed; *ovate*, broad-conical, the base more rounded; *oblong*, longitudinal diameter distinctly the longer, but the fruit not tapering; *oblate*, distinctly flattened on the ends. In the true Japanese or sand pears, the fruit is usually apple-form. In Fig. 1596 are shown special parts of the fruit: *basin*, the depression at the apex, in which is the *calyx* or *eye; cavity*, the depression at the base, in which is the *stem* or *stalk; suture*, or the groove on the side of plums and other fruits; *corrugated* or *furrowed* sides. The outline shape of an apple or pear is best seen by cutting the fruit in halves lengthwise; the flat side may then be used to print the form on paper.

If descriptions are to be accurate and comparable, they should characterize all the leading or designative attributes of the fruit, and to a less extent of the plant as a whole. Many persons who are called on to describe varieties have adopted "forms" or regular outlines, in order that all characterizations in any one fruit shall be comparable. The following forms, adopted by the late John Craig, illustrate the points that a good description should cover:

Name... ....
form.........................*size*.........................
cavity.........................*stem*.........................
suture.........................*apex*.........................
skin.........................*color*.........................
flesh.........................*juice*.........................
stone.........................*quality*.........................
flavor.........................*season*.........................
TREE..
GENERAL NOTES..
....
....
....
....
Specimens received from..........*Described by*........*Date*......
CHERRY......................................*Group*.

Name..
size.........................*form*.........................
color.........................*skin*.........................
cavity.........................*stem*.........................
basin.........................*calyx*.........................
flesh.........................*quality*.........................
texture.........................*core*.........................
seed..
season..
TREE..
GENERAL NOTES..
....
....
....
....
Specimens received from..........*Described by*........*Date*......
APPLE..



1596. Illustrating special terms used in describing fruits, showing, respectively, basin, cavity, suture, corrugation.

At present, the scoring or judging by points is a favorite exercise in classroom and at exhibitions. The score-card with points or attributes totaling 100 indicates the perfect fruit: the judge puts against the perfect score such percentage of perfection as he thinks the specimen in hand may deserve. This judgment of course varies with the person, as the marks are not mathematical; but experienced judges make very similar or uniform returns on given specimens.

Following are examples of score-cards:

SCALE OF POINTS FOR JUDGING FRUITS.

Established by the Massachusetts State Board of Agriculture.

	No. of points	Score
Quality	20	
Form	15	
Color	15	
Size	10	
Uniformity in size	20	
Freedom from imperfections	20	
Perfection	100	

SCORE-CARD FOR A COMMERCIAL VARIETY OF APPLE.

From "Productive Orcharding," by F. C. Sears.

	General market		Special market	
Tree	40		35	
1. Heavy bearer		20		15
2. Early bearer		10		10
3. Health and vigor		10		10
Fruit	60		65	
4. Fair size		10		10
5. Good color		20		15
6. Good quality		12		25
7. Keeps well		10		10
8. Ships well		8		5
Totals	100	100	100	100

SCORE-CARD FOR APPLES.

F. A. Waugh.

	Scale of points.
Form	15
Size	10
Color	15
Uniformity	20
Quality	20
Freedom from blemishes	20
Total	100

SCORE-CARD FOR PEACHES.

F. A. Waugh.

Form	15
Size	10
Color	15
Uniformity	20
Quality	20
Freedom from blemishes	20
Total	100

ONTARIO SCORE-CARD FOR GRAPES.

	Value of points	Score
Flavor	30	
Form of bunch	10	
Size of bunch	15	
Size of berry	15	
Color	10	
Firmness	5	
Bloom	5	
Freedom from blemishes	10	
Perfection	100	

SCORE-CARD FOR STRAWBERRIES.

J. R. Reasoner, Ill.

	Scale of points.
Rootage	5
Stock and foliage	5
Vitality, drought-proof	7
Plant-maker	10
Healthfulness, rust-proof	5
Blossoms	5
Staminate.	
Pistillate.	
Productiveness	25
Size	10
Shape	5
Color	5
Flavor	8
Firmness, shipping quality	10
Total	100

CALIFORNIA SCORE-CARD FOR ORANGES.

	Scale of points.
Size	10
Form	5
Color (bloom, 2; peel, 10; flesh, 3)	15
Weight	10
Peel (finish, 3; protective quality, 7)	10
Fiber	8
Grain	4
Seed	8
Taste	30
Total	100

L. H. B.

Russian fruits.

The Russian apples and their close relatives, the Siberian crabs and their hybrids, constitute the hardiest types of pomaceous fruits in cultivation. It was the demand for hardy varieties for the northwestern states and Canada that led to their introduction.

1597. Longfield, one of the Russian apples. (×⅓)

There are four varieties of Russian apples that may be looked on as American pioneers; these are Alexander, Tetofsky, Duchess (Borovitsky) and Red Astrachan. These varieties were imported by the Massachusetts Horticultural Society from the London (England) Horticultural Society about 1835. They were brought to England from Russia in the early part of the last century by the executive of the latter society. Dr. Hogg is authority for the statement that Alexander was cultivated for 50 years in England prior to 1808. Robert Manning, superintendent of the test garden of the Massachusetts Horticultural Society at Salem, described these varieties from home-grown American specimens in 1839. Their productiveness and the handsome appearance of the fruit attracted attention. Through the efforts of Warder and other western pomologists they were rapidly distributed throughout Ohio, Wisconsin and Minnesota. It would appear that in the last half- or three-fourths-century—which practically covers the pomological history of the West—the periodicity of "hard" or "test" winters has been more or less regular. When the normal or "mild" winter obtains, the apples of the New England states or their descendants do not, as a rule, suffer injury except in the colder parts of Minnesota. These mild winters have followed each other with delusive regularity for periods of ten, fifteen or eighteen years. Under these conditions, fruit-growers have been prone to efface from their memories the effects of the last "test winter" and have planted freely of the American type. With this type have been usually mingled Alexander, Oldenburg and Red Astrachan. It has been invariably noted that after the visitation of an exceptionally cold winter varieties of the Oldenburg or Alexander types were usually unharmed, while Greening, Janet, and Baldwin were killed. "Test winters"—the name has more or less local adaptation in the West—visited the northwestern states in 1855–6, 1872–3, 1885–6, and also in 1898–9. Thus it is that Oldenburg (Duchess) has become a standard of hardiness among apples in the colder parts of the United States and Canada. Importations of cions were made by nurserymen and fruit-growers between 1867 and 1875, but the main introduction was made by the United States Department of Agriculture in 1870 at the urgent request of the State Agricultural Society of Minnesota, which began the agitation as early as 1867. This importation consisted of young trees secured through the coöperation of Edward Regel, director of the Imperial Botanic Gardens at St. Petersburg. The trees were planted on the grounds of the Agricultural Department at Washington. The collection consisted of about 300 varieties. They were taken charge of by William Saunders, superintendent of gardens and grounds. All available cions were cut and distributed annually for five years. They attracted considerable attention in the colder apple-growing regions. Subsequent importations of cions and trees were made by the Iowa Agricultural College between 1875 and 1880. In 1882 Charles Gibb, of Abbotsford, Canada, accompanied by J. L. Budd, of the Iowa Agricultural College, went to Russia and spent the summer in investigating these fruits. Large importations of apples, plums, pears and cherries followed. In these later importations the east-European fruits were collected without discrimination, and in most instances have been erroneously regarded in this country as authentic Russians.

Russian apples: characteristics and nomenclature.

It is now very difficult to say which are Russian apples, which German, Polish or Swedish. If we were to choose the Astrachan variety as a type of the Russian apple, which in all probability would be a correct basis, only a comparatively small number of varieties could be grouped about it. But this is only one of the several apparently authentic groups which might be erected upon certain characteristics of tree. In addition to Astrachan might be cited (1) Hibernal type: trees vigorous growers, with open spreading tops, and very large, leathery leaves. (2) Oldenburg type: moderate growers, with compact, round-topped heads; leaves of medium size. (3) Longfield type: slow growers; branches horizontal or pendulous; leaves whitish and woolly underneath. The Longfield apple, one of the best known of the Russians, is shown in Fig. 1597. (4) Transparent and Tetofsky type: trees pyramidal; bark yellow; spurs numerous; leaves large, light green. (5) Anis type: trees upright, spreading or vase-shaped; leaves medium, veins reddish. It would seem reasonable to suppose that the Anis family was derived from the Astrachan type. The flesh of the fruit of the various types is very similar.

These represent the principal types of Russian apples. The fruit they bear in the prairie climate matures in the summer, autumn or early winter. It does not appear that any of the especially hardy varieties of undoubted north or east Russia origin are winter kinds when grown in the Mississippi Valley. Such late-keeping kinds as give promise of commercial value appear to have originated in the Baltic provinces or to have been transported at an early date from the countries to the west. These types—the Synaps for instance—have characteristically small leaves, slender twigs, and are less hardy than members of the groups cited above.

The "bloom," or glaucous covering, of the Russian apple is characteristic. It does not persist to the same extent, however under all climatic conditions. In eastern Quebec it fails to develop to the same extent that it does under the drier atmospheric conditions of the eastern states. As additional proof that this pruinose bloom is an immediate climatic effect, one has but to compare the Colorado Spy with that grown in New York. The smooth, thin skin and abundant bloom of the Colorado apple is characteristic in a greater or less degree of all varieties produced in the dry regions adjacent to the Rockies, as it is of the Russian apples in the more arid portions of that country.

The names of Russian apples are much confused. There is no pomological society in Russia to assist the fruit-grower in eliminating synonyms; on the other hand, the factors conducive to confusion are strongly in evidence. These are illiteracy on the part of the grower and the practice of propagating fruit trees from the seed instead of by grafting. Gibb says "nomenclature in Russia is hopelessly confused. Different names are given to the same apples in different localities, the same name to different apples growing in adjacent districts."

1598. Vladimir, one of the typical Russian cherries. The fruit is somewhat tapering to the stem. (×⅗)

Fruit-growers of the West, realizing that Americans should have a uniform system, at least in the nomenclature of these varieties, called a meeting made up of interested representatives of the fruit-growers' associations of South Dakota, Minnesota, Iowa and Wisconsin. These delegates, collectively styled the "Russian Apple Nomenclature Commission," met at La Crosse, Wisconsin, August 30, 31, 1898. They decided that it would be wise to attempt a grouping to be based upon "family resemblance." In accordance with this the following statement was adopted: "The varieties here grouped as members of the same families, while in a few cases differing somewhat in characteristics of tree, are so nearly identical in fruit that for exhibition and commercial purposes they are practically the same and should be so considered." It is to be regretted that a commission on nomenclature should take such a radical stand as this, because the characteristics of a variety cannot be changed by voting to call it by the same name as the other member of the group which it most resembles and almost, though not quite, duplicates. The trend of modern pomology is to preserve small differences, to differentiate rather than blend. The work of the future will consist in large part in studying small differences with a view of finding closer adaptations. The propriety of ignoring Russian nomenclature and the rule of priority is questionable, but in a measure is defensible on the grounds of a confused Russian nomenclature and the unpronounceableness of Russian names. The findings of the committee have on the whole met with the approval of those interested in Russian apples.

Russian cherries.

These, next to the apples, constitute the most clearly defined group of Russian fruits; yet many cherries commonly called Russian are in reality Polish, Silesian or German. The typical cherry of northern Russia is represented by the Vladimir type (Fig. 1598). This was first introduced into America as a distinct variety. Later importations and experience demonstrated that Vladimir was a type, not a variety. This type appears to have been grown in Russia for centuries from seeds and sprouts. In this way a special class has been developed. The Vladimir type is characterized by its dwarf stature—5 to 8 feet high—its peculiarly rounded and compact top, its dark red, meaty-fleshed fruit. Koslov-morello is evidently a light-colored juicy variety of Vladimir. The characteristics of the tree are the same as Vladimir, although when grown from seed in this country the seedlings exhibit considerable variation. The amarelles and weichsels of Germany have been grown in Russia for centuries, generally from seed, and have become specialized forms. Cherries of the Vladimir and Koslov-morello types are the hardiest of the cherries. The Vladimirs have not, as a rule, been productive in this country. The fruit-buds appear to be sensitive to cold and as easily injured as some of the recognized tender types of cherries. Although the trees are hardy, the introduction of this type has not extended the area of commercial cherry-growing in this country farther north than the regions already outlined by the profitable cultivation of Early Richmond.

Russian plums.

The plums imported from Russia do not differ materially from those of the domestica type in cultivation in this country. The trees are probably somewhat hardier than Lombard or Green Gage, but the fruit-buds are subject to winter injury wherever Lombard is uncertain. In the main they have been unproductive. Among the most widely tested varieties are Early Red, Moldavka and Merunka, all of the Lombard type.

Russian pears.

These are hardy handsome trees, but none bears fruit of good quality. Where blight is prevalent they are extremely susceptible. Among the hardiest of the class are Bessimianka (meaning seedless, which is only partly true), Gakovsky and Tonko-vietka. These thrive wherever the climate admits of the cultivation of the Oldenburg apple. The fruit ripens in August, and rots at the core if allowed to mature on the tree.

Russian apricots.

Apricots were brought to Nebraska and Kansas by Russian Mennonites about twenty-five years ago. A few of those named and distributed are likely to be retained in the fruit lists of the West.

Russian mulberries.

Russian mulberries have been widely sold as fruit-bearing plants by enterprising agents, but their use to the fruit-grower should be restricted to hedging and the formation of windbreaks. For these purposes they are valuable in the colder and more rigorous regions.

Russian peaches.

So-called hardy Russian peaches are sold, but they really belong to Bokara or Turkestan. The peaches of the Baltic provinces do not differ essentially from the ordinary Persian strain in form or hardiness.

In general.

The introduction of the Russian fruits has given us hardy types from which to breed varieties for northern latitudes. In Iowa, Minnesota and Wisconsin this work is under way. Seedlings and hybrids are appearing each year, which may be considered valuable additions to the fruit lists of these regions

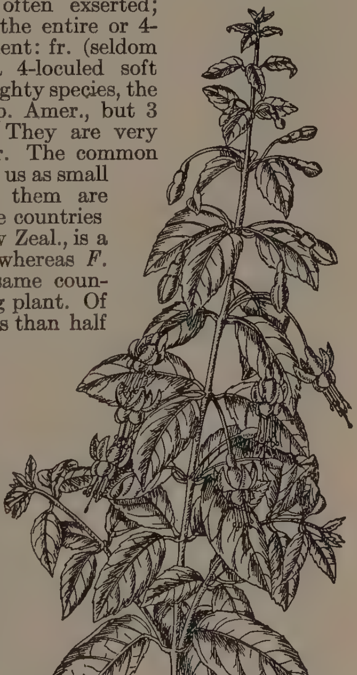
Literature.

But two books appear to have been written on Russian pomology up to 1838, one by Nicolai Krasno Glasov, 1848, the other by Regel, director of the Imperial Botanic Gardens, St. Petersburg, in 1868. The latter is called "Russkaya Pomologaya." It contains a description of 225 varieties of apples, nearly all of Russian origin. A wood-cut of each appears, in addition to 144 colored plates. Gibb calls it "a grand, good fundamental work." American literature on Russian fruits is mainly confined to three sources; the reports of the Montreal Horticultural Society, publications of the Division of Pomology, Department of Agriculture, Washington, and Bulletins of the Horticultural Department of the Iowa Agricultural College. To Charles Gibb, Abbotsford, Canada (Quebec), we are indebted for the faithful and accurate translation of the names given in the collection imported by the Department of Agriculture in 1870. This was adopted by the American Pomological Society in 1885.

John Craig.

FÙCHSIA (Leonard Fuchs, 1501–1565, German professor of medicine, and a botanical author). *Onagràceæ.* Handsome and popular flowering plants of greenhouses, conservatories, window-gardens and open grounds, blooming most freely in spring and summer.

Shrubs and small trees, with opposite, alternate or verticillate simple lvs.: fls. mostly showy, axillary or sometimes racemose and paniculate, usually pendulous, in shades of red and purplish and with some of the parts often white; tube prolonged beyond the ovary and bell-shaped to tubular, with 4 spreading lobes; petals 4, sometimes 5, or in some species wanting; stamens usually 8, often exserted; style long-exserted, the entire or 4-lobed stigma prominent: fr. (seldom seen under glass) a 4-loculed soft berry.—Seventy or eighty species, the greater part in Trop. Amer., but 3 or 4 in New Zeal. They are very variable in character. The common fuchsias are known to us as small herbs, but most of them are shrubs in their native countries *F. excorticata*, of New Zeal., is a tree 30–40 ft. high, whereas *F. procumbens*, of the same country, is a weak, trailing plant. Of the many species, less than half a dozen have entered largely into garden forms. The common garden kinds have come mostly from *F. magellanica.* This species was intro. into Great Britain from Chile in 1788, or about that time. It is variable in a wild state as well as in cult., and plants subsequently intro. from S. Amer. were so distinct as to be regarded for a time as separate species. Even at the present day some of



1599. Fuchsia magellanica var. globosa. (×¼) the forms of *F. magellanica* are commonly spoken of as species, so much do they differ from the type. As early as 1848, 541 species and varieties—mostly mere garden forms—were known and named (Porcher, "La Fuchsia, son Histoire et sa Culture"). The fuchsia reached the height of its popularity about the middle of the past century. At present it is prized mostly for window-gardening and conservatory decoration. The garden forms of the present day are with difficulty referred to specific types. The long-tubed or so-called speciosa forms are probably hybrids of *F. magellanica* and *F. fulgens* (Figs. 1603, 1604). Others are evidently direct varieties from the stem types. There are many full double forms. For the history and the garden botany of the fuchsia, see Hemsley in the Garden 9:284 and 11:70; also Watson, the Garden 55:74.

1600. Fuchsia magellanica var. Riccartonii. (×¼)

In mild climates, fuchsias make excellent outdoor shrubs, some of them withstanding frost. These are of the *F. magellanica* group. They are familiar to travelers in Ireland, and they may be seen as far north as the Shetland Islands. In California, many of the fuchsias are excellent and popular subjects for planting in the open. Under glass, forms of *F. magellanica* may be grown into large rafter shrubs, where they produce great abundance of bloom.

Fuchsias are among the most ornamental and popular of the cool greenhouse flowering plants. They may also be used in summer as bedding plants, and they are among the very few flowering plants that will bloom in the shade. If fair-sized specimen plants in 10- or 12-inch pots are desired, the best time to root them is the end of August. The best cuttings are secured from suckers that start from the base of the plants that are bedded out. The cutting should be 3 inches in length, and if the intention is to grow large specimens, pot them singly in 2-inch pots, in three parts sand, one part loam, and another of leaf-mold. Place the cuttings when potted in a shady position in a temperature of not less than 60° at night. When the very small plants are well rooted, shift them along into a pot 2 inches larger, using this time a compost of equal parts of loam, leaf-mold, and sand and add a third part of well-rotted manure. In this size of pot, the shoot will have made four or five joints, and should now be pinched to encourage side breaks. The plant, where it is stopped, will start into two breaks, and the strongest should be taken for a leader; pinch the weaker one when two leaves are well formed. Strict attention from now on should be paid to keep the plants in good shape. The side shoots must be kept in bounds, so that the symmetry of the plant is preserved, pinching the stronger ones hard and allowing the weaker to grow a little longer so that they gain more vigor. The leader may be allowed to make six pairs of leaves, and then be stopped, always choosing the strongest breaks to increase the height of the plant. Potting should be strictly attended to, never allowing the plant to form a mat of roots around the ball before it gets a shift into a larger pot. The potting material for all future pottings may be composed of two parts good fibrous loam, with an equal amount of well-rotted horse-manure, one part flaky leaves, and one part sharp sand. The whole should be as rough as can be conveniently used when working it equally around the ball of the plant, in the potting operation. It is necessary to have a good straight stake down the center of the plant to support it in an upright position. When the plant is well established in the pot in which it is desired to flower it, manure waterings will be in order, as these plants are gross feeders when in active growth. Green cow-manure, fertilizers, and soot secured from soft coals agree well with fuchsias. The amount to be used is an ordinary handful to two and a half gallons of water. Water twice in between with clean water. Give the last pinch to the plants about six weeks before they are desired to be in full flower.—For bedding-out purposes, cuttings may be rooted in the spring, and grown on into 5- or 6-inch pots. Old plants may be kept through the winter, in a cool light pit, from which frost is kept. Keep them rather dry during October, November, and December, only giving enough water to maintain the wood plump. In January they may be removed to a temperature of 50° by night, allowing a rise of 10° or 15° during the day. This temperature, by the way, is most suitable for fuchsias after they are rooted until they come in flower. After it is seen where all the live eyes are on the old plants, trim them into shape, and remove all the dead wood. Turn them out of the pots, and remove all the loose dirt from the ball with a hose with a gentle pressure of water on it. They may be potted in the same size of pot, and when well rooted in that, give them a shift two sizes larger. Pinch the plants two or three times during the winter, and one will be rewarded with better plants the second year than the first. If well attended to every year, fuchsias may be kept for many years, attaining an enormous size. Fumigate with hydrocyanic gas, during winter, and that, with syringings on all bright days, until they come in flower, will keep down insect pests. (George F. Stewart.)

1601. Fuchsia magellanica var. discolor. (×¼)

INDEX.

alba, 9.
arborescens, 10.
boliviana, 8.
coccinea, 1, 3.
conica, 1.
corallina, 1.
corymbiflora, 9.
decussata, 1.
discolor, 1.
elegans, 1.
exoniensis, 2.
fulgens, 5.
globosa, 1.
gracilis, 1.
hybrida, 2.
Lowei, 1.
macrostema, 1.
macrostemma, 1.
magellanica, 1.
pendulæflora, 5.
procumbens, 11.
Riccartonii, 1.
speciosa, 2.
splendens, 4.
syringæflora, 10.
tenella, 1.
Thompsonii, 1.
triphylla, 6.
variegata, 1.
venusta, 7.

A. *Fls. drooping* (Nos. 1–9).

B. *Tube of fl. mostly shorter than the calyx-lobes (or in F. speciosa sometimes as long again); petals obovate and retuse, convolute in the bud.*—Ladies' Ear-Drops.

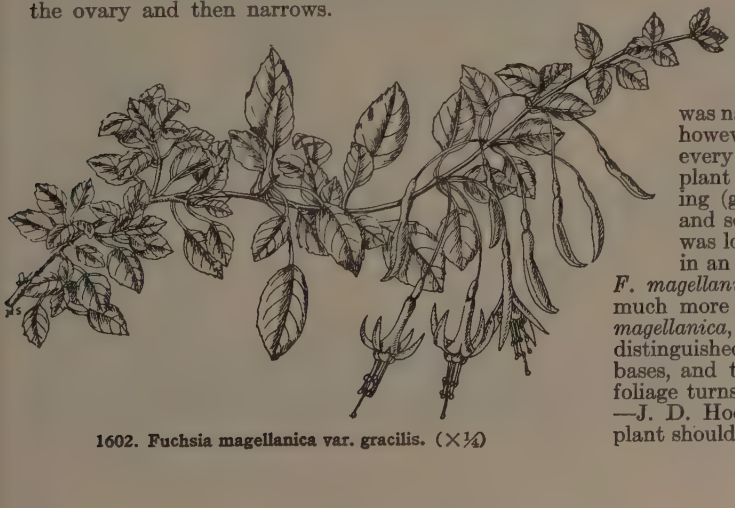
1. **magellánica**, Lam. (*F. macrostèma*, Ruiz & Pav. *F. macrostémma*, Auth. *F. coccinea*, Curtis, not Ait.). Tube little longer than the ovary, oblong or short-cylindrical; petals normally blue, and shorter than the red and oblong-lanceolate calyx-lobes; stamens long-exserted: lvs. opposite or in 3's, lance-ovate, very short-petioled, dentate. Peru and south to Terre del Fuego. B.M. 97 (*F. coccinea*). The leading types are as follows:

Var. **globòsa**, Bailey (*F. globòsa*, Lindl. *F. macrostémma* var. *globòsa*, Nich.). Fig. 1599. Lvs. opposite, short-petiolate, ovate, acute, lightly dentate, glabrous: fls. red-purple, axillary on slender peduncles, small and short, the bud nearly globular and the tips of the sepals cohering even after the fl. begins to burst; tube very short; petals erect, twice shorter than the calyx-lobes. B.R. 1556. Gn. 55, p. 75.—A profuse bloomer, and a common type amongst old-fashioned fuchsias. There is a form with variegated lvs.

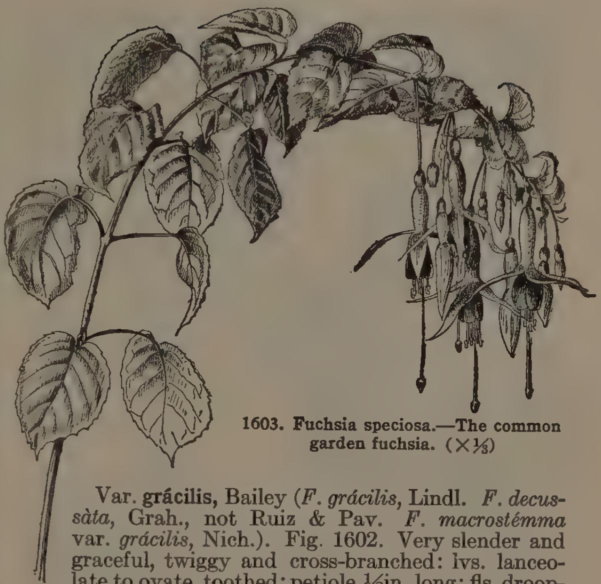
Var. **Ríccartonii** (*F. Ríccartonii*, Hort.). Fig. 1600. Very like var. *globosa* and reported to be a seedling of it, is a very hardy and floriferous form, standing in the open in Scotland, blooming particularly well in autumn: 6–10 ft., making a trunk 3 in. diam., and becoming wide-spreading: shoots slender: fls. red. J.H. III. 58:329.—A handsome and desirable fuchsia, said to have been raised at Riccarton, near Edinburgh, about 1830, but reported as originating in the Falkland Isls. Excellent in Calif.

Var. **díscolor**, Bailey (*F. díscolor*, Lindl. *F. Lòwei*, Hort.). Fig. 1601. Dwarf, compact and hardy: branches deep purple: lvs. rather small undulate-toothed: peduncles axillary, slender, exceeding the lvs.; fls. red, small, with slender, short tube and wide-spreading, rather narrow calyx-lobes, which are somewhat longer than the tube; petals obtuse, shorter than the calyx-lobes. Falkland Isls. B.R. 1805.

Var. **cònica**, Bailey (*F. cònica*, Lindl. *F. macrostémma* var. *cònica*, Nich.). Shrubby, very leafy: lvs. 3–4 together, toothed, ovate, the petiole one-third length of blade, pubescent: fls. axillary, solitary, on peduncles much longer than lvs.; calyx scarlet, the tube conical (or widest at base) and equaling the lobes; petals dark purple, erect and emarginate; small-fld. Raised from seeds brought from Chile. B.R. 1062.—Lindley says that it differs from *F. gracilis* in having broader lvs., being less floriferous, and in the conical tube which widens above the ovary and then narrows.



1602. Fuchsia magellanica var. gracilis. (×¼)



1603. Fuchsia speciosa.—The common garden fuchsia. (×⅛)

Var. **grácilis**, Bailey (*F. grácilis*, Lindl. *F. decussàta*, Grah., not Ruiz & Pav. *F. macrostémma* var. *grácilis*, Nich.). Fig. 1602. Very slender and graceful, twiggy and cross-branched: lvs. lanceolate to ovate, toothed; petiole ½in. long: fls. drooping on very long pedicels which are single or in pairs; tube slender, nearly as long as the narrow spreading lobes; calyx scarlet; petals purple, retuse, shorter than the long acute calyx-lobes. Chile. B.R. 847; 1052 (var. *multiflora*). B.M. 2507. Gn. 55, p. 74. Mn. 2, p. 186.—Perhaps a distinct species. A var. *variegàta* is advertised. *F. Thómpsonii*, Hort., is said to belong here.

With the *F. magellanica* set may be classed *F. corállina*. Hort., *F. élegans*, Paxt., *F. tenélla*, Hort., and others. There are apparently many hybrids. The short-flowered fuchsias are less popular than formerly, but many varieties are now in cult.

2. **speciòsa**, Hort. (*F. hýbrida*, Hort.). Figs. 1603, 1604. The greater part of present-day garden fuchsias are of the longer-tubed type shown in the illustrations. These are probably hybrid derivatives of *F. magellanica* forms and *F. fulgens*. Amongst the named sorts every gradation will be found, from the short-tubed Storm King to the Earl of Beaconsfield with fls. 3 in. long. The old *F. exoniénsis*, Paxt., B.M. 153, is figured as a very showy plant, marked by very long-pointed calyx-lobes and sharp-pointed buds, said to be a hybrid of *F. cordifolia* (a Mexican species) and *F. globosa*. The plant subsequently figured and cult. under that name does not agree, having shorter fls. and much less prominently pointed calyx-lobes.

3. **coccínea**, Ait. Not known to be cult. in Amer., and inserted here for the purpose of clearing up the synonymy of *F. coccinea*. This species appears to have been intro. before *F. magellanica*, and it was named *F. coccinea* by Aiton. *F. magellanica*, however, "usurped its name and spread it to every garden in the kingdom, whilst the true plant lingered in botanic gardens, lastly surviving (greatly to the credit of the Baxters, father and son) in that of Oxford alone." The species was lost from its intro. in 1788 to its rediscovery in an Oxford garden in 1867; meantime forms of *F. magellanica* passed as *F. coccinea*. "*F. coccinea* is much more graceful than any of the varieties of *F. magellanica*, flowers even more freely, and is readily distinguished by the almost sessile leaves with broad bases, and the hairy twigs and petioles; further, its foliage turns of a bright crimson when about to fall." —J. D. Hooker, B.M. 5740. Probably Brazilian. The plant should be looked for in collections.

4. **spléndens,** Zucc. Fig. 1605. Much-branched, shrubby: lvs. ovate-cordate, pale green, serrate: peduncles slender, axillary, solitary and single-fld.; fls. drooping, rather short; fl. 1½ in. long, scarlet tipped pale green, the base swollen and the tube then compressed; petals shorter than calyx-lobes, ovate, greenish; stamens much exserted, the anthers yellow. Mex. B.M. 4082. B.R. 28:67. G.C. III. 45:338. G. 1: 649; 9:693.

1604. The common garden fuchsia—F. speciosa.

BB. *Tube thrice or more the length of the calyx-lobes; petals pointed, nearly or quite as long as the calyx-lobes.*

5. **fúlgens,** Moc. & Sessé. St. somewhat succulent, glabrous, often red-tinged: lvs. large and coarse, cordate-ovate, soft, small-toothed: fls. in terminal leafy clusters or racemes, the red long-tubular calyx-tube 2–3 in. long and very slender at the base; the calyx-lobes short and pointed, greenish at the tip, not very widely spreading; petals deep scarlet, pointed, shorter than calyx-lobes; stamens only short-exserted. Mex. B.M. 3801. B.R. 24:1. Gn. 55, p. 75. R.H. 1881:150 (var. *pumila*).—A brilliant plant, sometimes seen in choice conservatory collections. Evidently one parent of the *F. speciosa* tribes. *F. pendulæflòra*, Hort., is supposed to be a hybrid, but the fls. very long like *F. fulgens:* lvs. ovate, acuminate, with violet midrib: tube of fl. 3–4 in. long, trumpet-shaped; fls. rich crimson shaded maroon. J.H. III. 51:301.

6. **triphýlla,** Linn. Fig. 1606. Low and bushy (18 in. high), pubescent: lvs. often in 3's, small, oblanceolate, petiolate, dentate, green above and purple pubescent beneath: fls. 1½ in. long, in terminal racemes, cinnabar-red, the long tube enlarging towards the top; petals very short; stamens 4, not exserted. St. Domingo, W. Indies. B.M. 6795. Gn. 41:32. I.H. 43, p. 94. G.M. 49:333. Gn.W. 5:389.—Known in botanical collections and sparingly in the trade. The species has a most interesting history, for which see the citations made above. Upon this plant Plumier founded the genus Fuchsia in 1703, giving a rude drawing of it. Upon Plumier's description and picture Linnæus founded his *F. triphylla.* Plumier's figure is so unlike existing fuchsias that there has been much speculation as to the plant he meant to portray. No fuchsia was known to have four stamens or to be native to the W. Indies. In 1877 Hemsley wrote of it: "The figure, however, is so rude that nobody, I believe, has been able to identify it with any living or dried plant. Possibly it is not a fuchsia at all in the sense of the present application of the name, for it is represented as having only four stamens." But in 1873, Thomas Hogg, of New York, secured seeds of a St. Domingo fuchsia which turns out to be Plumier's original, thus bringing into cult. a plant that had been unknown to science for 170 years. It came to the attention of botanists in 1882. For a discussion of further confusion in the history of this plant, see Hemsley, G.C. II. 18, pp. 263–4.

7. **venústa,** HBK. Branches slender, somewhat hairy: lvs. opposite and in 3's, elliptic, acute, entire, glabrous, somewhat shining: peduncles axillary, slender, about the length of the scarlet fls., more or less racemose above; fls. elongated, the tube 2 in. long beyond ovary and narrow-trumpet-shaped, the lobes ovate-lanceolate and acuminate; petals about equaling calyx-lobes, scarlet, the margins undulate. Colombia. F.S. 5:538. J.H. III. 49:243.

8. **boliviàna,** Carr. Compact, branching, 2–4 ft., producing the showy fls. in profuse drooping sometimes branched clusters: lvs. large, elliptic-ovate, acute or acuminate, toothed: fls. 2–3 in. long, trumpet-shaped, rich red. Bolivia. R.H. 1876:150. G.W. 8, p. 316.—Very like *F. corymbiflora*, but said to be more ornamental: fls. brilliant coral-red, the calyx-lobes and petals acuminate and equal or subequal, the former spreading-star-shaped or reflexed, the petals erect or close about the stamens; filaments red, anthers whitish; stigma very large, ovoid: fr. fleshy, violet-black.

9. **corymbiflòra,** Ruiz & Pav. Tall but weak grower, needing support when allowed to attain its full height, therefore excellent for pillars and rafters: lvs. large, ovate-oblong and tapering both ways, serrate, pubescent: fls. deep red, hanging in long brilliant corymbs; calyx-tube 3–4 in. long and nearly uniformly cylindrical, the lobes lance-acuminate and becoming reflexed; petals deep red, lance-acuminate, about the length of the calyx-lobes; stamens length of the petals. Peru. B.M. 4000. Gn. 11:70 (as F. boliviana); 55:74. F. 1841:161. H. U. 2, p. 324. Var. **álba,** Hort., has white or nearly white calyx-tube and -lobes. F.S. 6: 547. Gn. 55:74.—A very handsome plant, but not common

AA. *Fls. erect.*

10. **arboréscens,** Sims (*F. syringæflòra*, Carr.). A shrub: lvs. lance-oblong and entire, laurel-like: fls. lilac-scented, pink-red, small, with a short or almost globular tube, in an erect terminal naked lilac-like panicle; calyx-lobes and petals about equal in length. Mex. B.M. 2620.—Little grown, but excellent for winter-flowering; should not be lost to cult.

1505. Fuchsia splendens. (×¼)

11. **procúmbens,** Cunn. Trailing Fuchsia. Trailing Queen. Trailing, with slender much-branched sts.: lvs. alternate, small (⅓–½in. across), cordate-ovate, long-stalked: fls. solitary and axillary, apetalous, the short tube orange and the reflexing obtuse lobes dark purple, anthers blue: plant diœcious: berry glaucous-

red. N. Zeal. B.M. 6139. G. 35:97.—A very interesting little plant, suitable for baskets.

Species not known to be in the American trade are: *F. amplidta*, Benth. Fls. large, scarlet, long-tubed, drooping. Colombia. B.M. 6839.—*F. bacillàris*, Lindl. Compact, with short-jointed branches: fls. very small, flaring-mouthed, rosy, drooping. Mex. B.R. 1480.—*F. cordifòlia*, Benth. Fls. 2 in. long, slender, drooping, hairy, red, on very long pedicels. Mex. B.R. 27:70.—*F. Dominiàna*, Hort. Garden hybrid with long drooping red fls. of the speciosa type. F.S. 10:1004.—*F. excorticàta*, Linn. f. Shrub or small tree of New Zeal., reaching 40 ft. high and the trunk sometimes 2–3 ft. diam., the bark thin, papery and loose: lvs. alternate, ovate-lanceolate to lanceolate, entire or nearly so: fls. 1¼ in. or less long, solitary and drooping, trimorphic. B.R. 857.—*F. macrántha*, Hook. Largest-fld. fuchsia; 4–6 in. long, pink-red, in large, drooping clusters. Colombia, Peru. B.M. 4233.—*F. microphýlla*, HBK. Dwarf, small-lvd., with deep red, small axillary, drooping fls.: pretty. Mex. B.R. 1269.—*F. serratifòlia*, Ruiz & Pav. Fls. long-tubed, speciosa-like, on drooping pedicels from the axils of the whorled lvs., pink with greenish tinge: handsome. Peru. B.M. 4174.—*F. simplicicaùlis*, Ruiz & Pav. Lvs. usually in 3's, entire: fls. crimson, long and slender-tubed, in drooping clusters: resembles F. corymbifera. Peru. B.M. 5096.—*F. thymifòlia*, H.B.K. To 6 ft.: lvs. small, opposite or nearly so, ovate or roundish, downy above: fls. red, on axillary pedicels, the petals obovate and undulate. Mex. B.R. 1284.

L. H. B.

FUMÀRIA (*fumus*, smoke, the application perhaps to the smoke-like odor of roots or other parts of some species). *Fumariàceæ*, a family by some botanists united with *Papaveràceæ*. This genus includes the common fumitory, *F. officinalis*, formerly held in great repute for various ailments, but now practically banished from medical practice. Seeds are still rarely sold to those who have faith in old physic gardens. The plant has a large literature, which is especially interesting to those who delight in herbals. As an ornamental plant, it is surpassed by Adlumia. There are about 40 species of Fumaria in the Medit. region and Cent. Eu., and S. Afr.: mostly annual herbs, with compound much-dissected lvs., usually diffuse and branching, sometimes climbing, glaucous: corolla 1-spurred at base, and thereby distinguished at once from Adlumia; sepals 2, very small; petals 4; stamens 6, diadelphous: fr. a roundish 1-seeded indehiscent nutlet. *F. officinàlis*, Linn., the common fumitory, of Eu., is sparingly run wild in waste places: 2–3 ft. high: lvs. petioled, the segms. linear, oblong or cuneate and entire or lobed: fls. small, flesh-color with crimson tip, in narrow racemes. Variable.

L. H. B.†

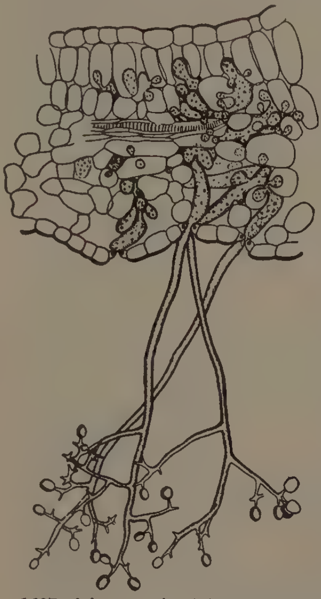
1606. Fuchsia triphylla. (×⅓)

FUMITORY: *Fumaria officinalis.*

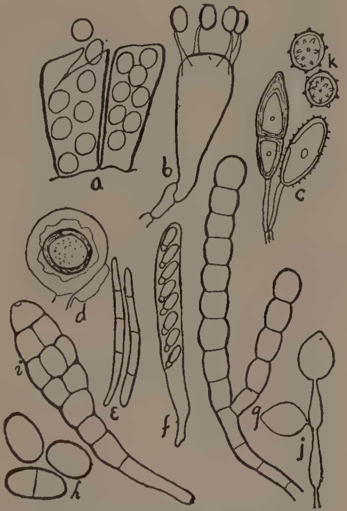
FÚNCKIA, FÚNKIA: *Hosta.*

FUNGI are plants. They differ from other plants chiefly in their lack of chlorophyll, the green coloring matter of green plants, and in the character of the substance of which their cell-walls are composed. This is sometimes spoken of as fungous cellulose, and has characters both of the cellulose of other plants and the chitin of insects. There are thousands of species of fungi, varying greatly in form and structure. Some forms are more or less familiar to everyone; for example, mushrooms, or toadstools, molds, mildews smuts and rusts. Other groups of plants often included under the term fungi are the slime-molds or myxomycetes and bacteria. While they have certain characters in common with fungi, they are sufficiently distinct to be considered separately.

The fungus plant consists of a vegetative feeding portion, the mycelium, which, in a way, corresponds to the roots of higher plants, and the fruiting structure, the sporophore. The latter bears the reproductive bodies, the spores, which, while much simpler in structure, function in the same way as do the seeds of higher plants (Fig. 1607). The sporophore is the part most often observed by the layman. The mushroom or toadstool, the puffball, the smut boil on corn, the white powdery mildew on the grape or rose, or the blue mold on stale bread or cheese, are almost entirely the sporophores and spore masses. The mycelium is usually buried in the substratum from which the food is derived and is thus not often observed. In fact it is often too minute and colorless to be seen with the naked eye. It may be observed as a white branching weft in the dung of mushroom beds or in the leaf-mold in the forest. This form is commonly spoken of as spawn. It may also be seen as a white weft-like growth between the bark and wood of rotting logs or dead trees, or as brown leathery sheets in the cracks of rotting logs. It sometimes appears as brown or black shreds or strands under the bark of dying trees. This form of mycelium strand or rhizomorph is characteristic of the often very destructive mushroom parasite of trees, *Armillaria mellea*. The spores of fungi are minute microscopic bodies cut off from the sporophores for the purpose of reproducing the plant. They are usually one- or two-celled, though often many-celled (Fig. 1608). They are often colorless, though they may be variously tinted or colored, greenish, brown, black, and so on. When placed in



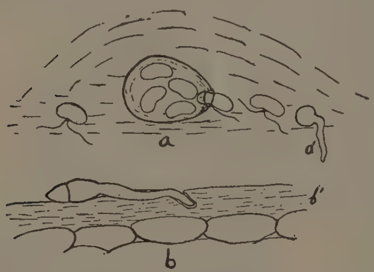
1607. A fungus. A mildew, showing the mycelium in the leaf-tissue and the hanging spore-bearing threads. (Much magnified.)



1608. Different spore forms of fungi.

a, Spore-sacs with spores of the peach leaf-curl fungus; *b*, spore-stalk with spores of a mushroom; *c*, two spore forms of the wheat-rust fungus; *d*, winter-spore of onion-blight parasite; *e*, spores of the beet leaf-spot pathogen; *f*, spore-sac with spores of the black-knot fungus; *g*, the summer-spores of the brown-rot pathogen; *h*, spores of the apple-tree canker fungus; *i*, spore of the alternaria blight fungus of ginseng; *j*, conidia of the late blight fungus of potatoes; *k*, corn-smut spores.

sufficient moisture, and given the proper temperature, they usually will germinate quickly, either sending out a sprout-like germ-tube (Fig. 1609, *b*) which on finding sufficient nourishment grows into mycelium, or the protoplasmic contents of the spore-cell may escape through an opening formed in the cell-wall, as one or more actively swimming and naked protoplasmic masses, called swarm-spores (Fig. 1609, *a*). These swarm-spores swim about in the water for a time, (usually less than an hour), then invest themselves with a cell-wall, and germinate with a germ-tube as above described (Fig. 1609, *a′*). This latter is the method of germination of the potato-blight fungus, *Phytophthora infestans.*—A fungus often produces two kinds of spores, the vegetative spores, conidia (Fig. 1608, *j*), produced usually in great numbers and repeatedly during the season for the purpose of multiplying the form, and the sexual, or resting-spores (Fig. 1608, *a, b, c, d, k*), adapted primarily to carry the fungus through periods unfavorable to growth, as dry seasons, winter and the like. Either form may, however, function as the other. They are disseminated by wind, water, insects, or by man himself.



1609. Germinating spores.
a, Conidium of late blight fungus germinating in a drop of water by swarm-spores; *a′*, swarm-spore germinating by germ-tube; *b*, ascospore of apple-scab fungus sending its germ-tube into the cuticle *b′* of the young apple.

Because of their lack of chlorophyll, fungi cannot assimilate their carbon directly from the carbon-dioxid of the air as can the green plants. They must make use of the food substances already manufactured or elaborated by other plants or animals. With respect to the nature of the substratum from which fungi obtain their food-supply, they are of two general types, saprophytes, those that can feed and develop on non-living organic substances (chiefly dead parts of plants and animals); and parasites, those that may grow upon and take food from living organisms. A true or obligate saprophyte can feed only upon non-living organic substances. There are great numbers of such species, attacking dead and fallen trees, stems and leaves of plants or the dead bodies of animals, infesting dung and other debris, breaking up the complex organic substances into simpler form, and deriving therefrom the food and energy for their development. Most mushrooms, toadstools, molds and the like, are obligate saprophytes, playing the rôle of disintegrators in the ever-changing cycle of nature. An obligate parasite, on the other hand is, in nature at least, compelled to derive its nutrition through direct attack on the living tissues of other plants or of animals. Of such fungi, the rust- and smut-producing parasites, the leaf-curl fungus of the peach, and the potato-blight organism are good examples. Between these extremes are to be found very many forms which, during a part of their active development, live as parasites, and during the remainder as saprophytes. The apple-scab fungus is a good example. It passes the summer as an active parasite upon the leaves and fruit of the apple, but in the autumn and spring continues its growth and development in the fallen leaves, producing the sexually formed ascospores which in the spring infect the next crop. Other forms, which usually lead a saprophytic existence on the dead and fallen parts of plants, may, under special conditions, take on a parasitic habit. A good example is a common saprophyte, a species of Botrytis, common in greenhouses. When there is an excess of moisture or the plants are in any way weakened, this fungus finds it easy to pass from a saprophytic life on the dead leaves, to that of active and destructive parasitism on the living leaves. It is sometimes destructive to lettuce. Fungi are in general favored by abundance of moisture. For this reason in a wet season mushrooms appear in great profusion, and epidemics of plant-disease-producing fungi often occur over wide areas, causing great losses to the agriculturist. The loss from potato-blight in New York state alone often amounts in wet seasons to over $10,000,000. Warm weather is generally favorable to fungus growth, but there are some forms, like the potato-blight fungus, which flourish only during relatively cool periods. This parasite occurs only in temperate regions, being unknown in the hot low lands of tropical and subtropical regions. The peach leaf-curl fungus is apparently favored as much by the low temperature as by the rains of a wet spring. Other forms seem to thrive best in dry climates, as for example the powdery mildew of grapes.

1610. Colonies of the rust fungus on the leaf of a hollyhock.

1611. Colonies of a fungus on a plum leaf. The dead tissue sometimes falls out, leaving a shot-hole effect.

While many fungi are destructive agents of the crops of the agriculturist, causing him heavy losses, most fungi are active co-laborers with him, bringing about, as has been seen, the disintegration of compost, on which the farmer depends so largely for increased crop-production. Other fungi, like the yeasts and certain molds, are necessary agents in the arts and manufactures, as for example, the use of yeast in bread-, beer- and wine-production, molds in cheese-ripening, and so on. The value of these fungi lies chiefly in their ability to produce fermentations of various sorts or to give flavors to the products. Many fungi are edible, as for example the large fruit bodies of mushrooms, puffballs and truffles. While their value as food is perhaps often overestimated, they are valuable and form no unimportant part of the food of many people, especially in Europe. They are to be regarded chiefly as delicacies. The truffles and the cultivated mushroom, *Agaricus campestris*, are perhaps the best known. A delicacy known to relatively few is the large smut boils occurring on *Zizania latifolia*. Some fungi are poisonous, as for example the deadly Amanita, the fly-agaric among mushrooms, and the ergot, a fungous parasite of rye and other grasses.

H. H. Whetzel.

FUNGICIDES: *Diseases and Insects.*

FUNKIA: *Hosta.*

FUNTÙMIA (*Funtum* is one of the vernacular names of *F. elastica*). *Apocynàceæ.* Three trees, sometimes very tall, of Trop. Afr., formerly placed in Kickxia, one of them being a rubber tree. *F. elástica*, Stapf, reaches 100 ft., with a cylindric trunk and pale spotted bark: lvs. oblong or lance-oblong, undulate: fls. white or yellowish in short-peduncled many-fld. dense cymes, the corolla-tube constricted above the base, the lobes oblong and obtuse; stamens inserted well down in the corolla-tube; disk 5-parted: follicles oblong-clavate, woody. Offered in Eu.; yields the Lagos caoutchouc.

FURCRÆA (Ant. François de Fourcroy, 1755–1809, chemist). Syn., *Fourcroya, Fourcræa, Furcroya, Furcræa. Amaryllidàceæ.* Succulent desert plants from tropical America.

Some with spiny foliage like Agave, others with minutely toothed margins like Beschorneria. They occasionally bear immense loose panicles of greenish white fls., suggesting those of *Yucca filamentosa*, which are known to every plant-lover of the N. The perianth of Furcræa is whitish and wheel-shaped; in Agave greenish yellow, funnel-shaped. The filaments in Furcræa have a cushion-like swelling at the base, which is absent from Agave.

Furcræa is cultivated much in the same way as Agave, except that the furcreas are given more heat and water. *F. gigantea* has a very pretty variegated form, which makes a useful pot-plant.

As a rule, furcreas bear fruit not more than once, and then die without producing suckers. However, they produce while in flower an immense number of bulbels, which may be used for propagation. It is impossible to say at what size or age the plants will bloom. Grown in pots, they may take a century. On the other hand, plants from bulbels have been known to flower at three years. Seeding is usually rare.

INDEX.

agavephylla, 5.
altissima, 5, 7.
andina, 5.
Barillettii, 8.
Bedinghausii, 3.
Cabuya, 7.
Cahum, 4.
Commelinii, 8.
cubensis, 4, 5, 6, 7.
Deledevantii, 5.
edentata, 6.
elegans, 5.
fœtida, 8.
geminispina, 9.
gigantea, 8.
hexapetala, 4.
Humboldtiana, 7.
inermis, 7.
interrupta, 9.
Lindenii, 6.
longæva, 1.
macrophylla, 5.
marginata, 6.
medio-picta, 8.
pubescens, 5.
Roezlii, 2.
Selloa, 6.
spinosa, 9.
tuberosa, 9.
variegata, 8.
Watsoniana, 8.
Willemetiana, 8.

A. *Lvs. rough-margined but not toothed, glaucous, striate-roughened beneath: infl. pubescent: pedicels short.* SERRULATÆ.

1. **longæva**, Karw. & Zucc. Slender unbranched tree, up to 50 ft.: lvs. rigidly outcurving, narrowly lanceolate, gradually acute, concave, 3–6 x 60 in.: infl. 15 ft., broadly conical, short-stalked; fls. 1¼–1½ in.; ovary rather longer than segm.: caps. elongated, narrowed below; seeds small (⅙ x ¼in.): bulbels unknown. S. Mex. to Guatemala. Zuccarini, Act. Acad. Leop. Carol. 16, pt. 2:48. M.D.G. 26, p. 10. Bateman, Orchid. of Mex. & Guat. Vignette to pl. 16. B.M. 5519, (habit). Herbert, Amaryll., pl. 34.—A similar if separable species is reported for Bolivia. The most remarkable dracænoid tree, flowering when extremely old, and then dying, like others of its genus.

2. **Roézlii**, André (*Agàve argyrophýlla, A. Tonelìàna, Beschornèria floribúnda, Lília règia, Lílium règium, Roézlia règia, R. regìna, Yúcca argyræa, Y. argyrophýlla, Y. Parmentièri, Y. Tonelìàna*, Hort.). Trunk becoming 6 ft. or more: lvs. rather flaccidly spreading, lanceolate, acute, concave or plicate, 3–5 x 50 in.: infl. 10–15 ft., pubescent, the moderately broad panicle short-stalked; fls. 1¾ in.; ovary and segm. about equal: caps. ellipsoidal, scarcely stipitate: freely bulbiferous, the bulbels elongated. S. Mex. R.H. 1887, p. 353. B.M. 5519 (as to details); 7170 (as *F. Bedinghausii*). G.C. III. 9, p. 489; 36, p. 45; 46, p. 340.—The common plant grown along the Riviera, often as *F. longæva*, but more commonly as *F. Bedinghausii*, with which the synonymy is confused

3. **Bedinghaúsii**, Koch (*Beschornèria multiflòra* Hort. *Yúcca Prínglei*, Greenm. *Roézlia* or *Yúcca bulbífera*, Hort.). Trunk scarcely 3 ft.: lvs. rather rigidly outcurving, lanceolate, acute, rather flat, 2–3 x 18–24 in.: infl. 10–15 ft., the rather narrow panicle little longer than the scape; fls. 1½ in.; ovary and segm. about equal: caps. broadly oblong, abruptly stipitate; seeds moderate (¼–⅓ x ½ in.): freely bulbiferous, the bulbels ovoid. Cent. Mex. B.H. 13, p. 327. Ann. Jard. Buitenzorg. II. Suppl. 3:44. G.W. 7, p. 101.

AA. *Lvs. smooth-margined, typically toothed, usually green, not striate.* EUFURCRÆA.

B. *Prickles rather small and close set: lvs. narrow; margin straight.*

4. **cubénsis**, Vent. (*F. hexapétala*, Urban. *Agàve cubénsis*, Jacq. *A. bulbífera*, Salm? *A. hexapétala*, Jacq. *A. mexicàna*, Lam. *A. odoràta*, Pers). Nearly trunkless: lvs. narrowly lanceolate, spreading, smooth, about 2 x 50 in.; teeth nearly straight, 1/12–⅛in. long, ⅔–1 in. apart: infl. 10–15 ft., long-stalked, nearly glabrous; fls. 2 in.; ovary fusiform, about equaling the segm.: caps. small, broad, stipitate; seeds small (¼–½ in.): bulbels ovoid. Cuba and Haiti. Jacq., Stirp. Amer. :175. Ann. Jard. Buitenzorg. II. Suppl. 3:40.—As badly confused as *Agave americana* and actually rarely seen in gardens: apparently the original henequen of early writers on the W. Indies, its fiber called cabuya. A related Yucatan species, the cahum, with less lanceolate lvs. and ovary exceeding the perianth, is *F. Cahum*, Trel., Ann. Jard. Buitenzorg. II. Suppl. 3:39.

BB. *Prickles large or prominently raised and rather distant, curved,—suppressed in certain forms.*

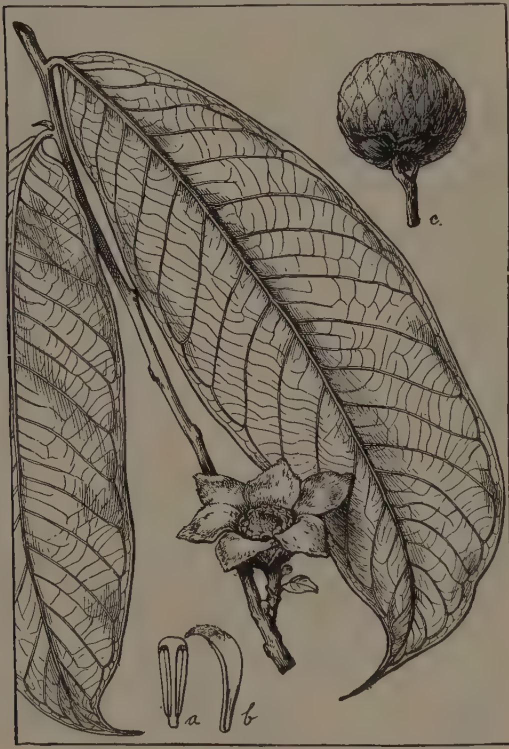
C. *Shape of lvs. oblong-lanceolate, large.*

5. **pubéscens**, Tod. Nearly trunkless: lvs. spreading, concave, smooth, about 3 x 60 in.; teeth ⅕in. long, ⅔–1⅕in. apart: infl. 15–20 ft., rather short-stalked, pubescent; fls. 2¼ in.; ovary 1 in.; segm. 1½ in.: caps. large, broad, variously stipitate: bulbels ovoid. Mex (?). Giorn. Soc. Sci. Palermo 14:5–7. Ann. Jard. Buitenzorg. II. Suppl. 3:43. B.M. 6160(?) (depauperate). Related species are: **F. élegans**, Tod. of Guiana, with lvs. 5 in. wide with hooked blackening teeth ⅕–⅓in. long and 1⅗ in. apart, glabrous long-stalked infl., and leafy-tipped bulbels. Hort. Panorm. 4. **F. macrophýlla**, Hook., established in the Bahamas and Jamaica (probably from the south) with teeth ½in. long and 3⅓ in. apart, broad umbonate caps. and ovoid bulbels. Hook. Icon. 2501. Ann. Jard. Buitenzorg. II. Suppl. 3:37, 45. **F. andìna**, Trel. (*F. Deledevántii*, and *F. altíssima*, Hort.?), of E. Peru, with nearly as large and distant teeth, short-stalked infl., cuboid caps. and conical-ovoid bulbels. Ceara or Pernambuco hemp is ascribed to *F. agavephýlla*, Brot. (*F. cubénsis*, Mart. *Agàve inérmis* and *A. subinérmis*, Roem.), the caraguata assu of N. E. Brazil., Marcgrav. & Piso, Brazil, p. 111, of this same group.

6. **Sellòa**, Koch. Trunk finally 3–5 ft.: lvs. spreading, concave and revolute or plicate, rough-backed, about 3 x 50 in.; teeth ⅕–¼in. long, 1⅓–1⅗ in. apart, variously curved: infl. tall, stalked, glabrous; fls. 1⅗ in.; ovary ⅔in.; segm. 1 in.: caps. not known: freely bulbiferous. Colombia. B.M. 6148.—Frequently meant when the name *F. cubensis* is used. A handsome white- or finally yellow-margined plant, frequent in cult. is **F. Sellòa marginàta**, Trel. (*F. Líndenii*, Jacobi. *F. cubénsis Líndenii*, Hort. *Agàve cubénsis striàta*, etc., Hort.). Wiesner Festschr., p. 350. I.H. 21:186. G.W. 10, p. 212; 11, p 135; 16, p. 162. G.C.

III. 23, p. 227 (as *F. gigantea*). A form of this, rosy tinged and without marginal prickles, **edentàta**, Trel., has been intro. from the Colombian Andes recently by Pittier.

7. **Humboldtiàna**, Trel. (*Yúcca acaùlis*, HBK.). Trunk finally 10 ft.: lvs. spreading, nearly flat, grayish, smooth, 5–6 x 60 in.; teeth ⅛–⅕ in. long, usually divergently twinned from the tops of green prominences, 1–2½ in. apart: infl. 25–40 ft., long-stalked; fls. 2–2½ in.; ovary ⅘–1 in.; segm. 1⅓–1½ in. Venezuela. Ann. Jard. Buitenzorg. II. suppl. 3:38.—Called maguey de cocui by Humboldt; now commonly known as cocuiza brava in contrast with an unarmed cult. form, the cocuiza mansa, which may prove not to differ from *F. inérmis*, Drum. (*F. cubénsis inérmis*, Baker. *F. altíssima*, Hort. Franceschi). B.M. 6543. Intermediate between this and the next is the cabuya of Cent. Amer., *F. Cabùya*, Trel., which likewise presents armed and toothless forms. Ann. Jard. Buitenzorg. III. suppl. 3:36, 37.



1612. **Fusæa longifolia.** (×½)
a, perfect stamen; *b*, petal-like staminode; *c*, fruit.

8. **gigantèa**, Vent. (*F. Barilléttii*, *F. fœtida*, *Agàve fœtida*, Linn. *A. gigantèa*, *Âloe fœtida*, Crantz. *Fùnium pilíferum*, Willem.). Nearly trunkless: lvs. broadly oblanceolate, nearly flat, undulate, somewhat roughened beneath, 5–8 x 60–100 in., entire: infl. 25 ft., long-stalked, rather narrow; fls. 1⅗ in., with ovary and segm. equal: caps. unknown: freely bulbiferous. S. E. Brazil. DC., Pl. Gr. 126, 126*a*. Redouté, Lil. 476. B.M. 2250. Perrine, Senate Doc. 300:5. B.H. 10:34. Indian For. 35:23. Mart., Fl. Bras. 1:44. Ann. Mus. Marseille. II; 8, p. 125. Squier, Fibre Pl., 2. Jacq. Icon. 379. Commelin, Hort. Amst. 2:18.—The Mediterranean hemp, Mauritius hemp, taretra, green aloe, or pita, intro. by way of Madagascar and hence called Malgache aloe. Varies with moderate toothing, var. **Willemetiàna**, Roem. (*F. Commelìnii*, *Agàve Commelìnii*, Auct.), the Creole aloe. Ann. Jard. Buitenzorg. II. Suppl. 3:35. With broad median creamy variegation, the unarmed form is var. **mèdio-pícta**, Trel. (*F. gigantèa variegàta*, Hort. *F. variegàta*, Hort. *F. Watsoniàna*, Hort.). G.C. III. 23, p. 243. Ann. Jard. Buitenzorg. II. Suppl. 3:41, 42, 46–8.

9. **tuberòsa**, Ait. (*F. interrúpta*, *F. spinòsa*, *Agàve spinòsa*, *A. campanulàta*, *A. tuberòsa*, *Yúcca supérba*, Auct.). Nearly trunkless: lvs. broadly lanceolate, nearly flat, 8 x 50–70 in.; teeth usually ⅕in. long and ⅔–1⅓ in. apart, sometimes absent toward the end or below: infl. 25 ft.: caps. unknown: freely bulbiferous, the bulbels elongated. Cuba and Haiti and, in somewhat differing forms, in Porto Rico and through the Lesser Antilles. Rep. Mo. Bot. Gard. 18:1–4 R.H. 1877, p. 233. Cyclo. Amer. Agric., II. p. 290. Gt. 1852:3. Yearbook Dept. Agric. 1904:31. Ann. Mus. Firenze. 1:4. Commelin, Hort. Amts. 2:19. —Commonly called silk-grass, sometimes maguey or cocuiza: apparently the Haitian cabuya of early writers. With the teeth twinned, as they are sometimes in *F. Selloa* and characteristically in *F. Humboldtiana*, it is var. **geminispìna** (*F. geminispìna*, Ait.)

William Trelease.

FURZE: *Ulex*, particularly *U. europæus.*

FUSÆA (probably from Latin *fundo*, signifying melted or fused together, referring to the carpels). *Annonàceæ.* South American trees or shrubs, resembling Annona in the form of fruit, a solid, spheroid syncarpium composed of one-ovuled carpels fused together, but differing from that genus in having its petals imbricate or overlapping and in the outer circles of its stamens which are sterile and petaloid.—A genus of very few species. *Fusæa longifolia* was first described as *Annona longifolia* by Aublet. It was afterwards placed in the genera Duguetia and Aberemoa, from the last-named of which it was set apart by Baillon as the type of a subgenus or section Fusæa. In the genera Duguetia and Aberemoa, however, the carpels are discrete, or separate, and not fused together; in the former the indumentum is usually stellate-pubescent or scurfy, and in the latter the carpels are not only quite distinct but are borne on short pedicels. From the structural features above mentioned, it is evident that it merits generic rank.

longifòlia, Safford (*Duguètia longifòlia*, Baill. *Annòna longifòlia*, Aubl.) Pinacoua. Carib Apple. Fig. 1612. A small tree: lvs. oblong-acuminate, mucronate and smooth: fls. issuing from near the base of small branchlets growing from the axils of the lf.-scars of the preceding year, the 2 series of petals much alike; outer stamens sterile and petaloid: fr. ovate-globose, resembling a solid ball, its surface reticulated with shallow impressed lines, nearly smooth, flesh-colored. Guiana.—According to Aublet, the fr. has a good flavor and is eaten with relish by the Garipon and Galiba (Carib) Indians of French Guiana. Intro. into Fla. as a fr.-plant, but very little known. Closely related to this species and possibly identical with it is the Peruvian *F. rhombipétala*, Safford (*Annòna rhombipétala*, Ruiz. & Pav.) with petals clothed on the outside with appressed sericeous hairs, outer stamens petaloid and connivent as in *F. longifolia*, ⅕in. long, smooth near the base and minutely puberulent on the outside near the apex; and obovate-oblong lvs. with short thick petioles and sharply acuminate apices, the midrib and lateral nerves impressed on the upper surface and prominent beneath, the extremities of the latter connected by a submarginal nerve almost continuous from the base to the apex.

W. E. Safford

XLV. Ferns in a public garden, with springtime bloom.

G

GÀGEA (Sir Thomas Gage, British botanist, died 1820). *Liliàceæ.* Seventy-five or more small herbs of Eu., N. Afr. and east to China and Japan, allied to Ornithogalum, mostly hardy and sometimes grown in the open. Fls. white, yellow or rose, few on the top of the mostly low peduncle or scape: lvs. radical, mostly only 1, and sometimes on the st. and represented by bracts under the umbel: perianth persistent, with distinct segms.; stamens 6; ovary sessile or short-stipitate, 3-loculed: bulbs small. The gageas require the cult. of ornithogalums. They appear not to be in the American trade. **G. Liotárdii,** Schult. f., the gold-star, is from Eu. and eastward; a well-recommended alpine, 4–6 in. high, with yellow fls., making grassy mats: radical lf. usually 1, fistulose; scape-lvs. 2, one of them larger and at base convolute.—**G. lùtea,** Ker (*G. fasciculàris,* Salisb.), the yellow star-of-Bethlehem has yellow fls. with backs of segms. green, opening only in forenoon: radical lf. 1, linear, 6–18 in. long: scape short, with 1–3 bracts. Eu. to Himalayas. B.M. 1200. **G. bracteolàris,** Salisb. (*G. stenopétala,* Reichb.), is pale yellow: lf. 1 at base, linear-lanceolate and glaucous; st.-lvs. opposite, lanceolate, pubescent and fringed. Eu.

L. H. B.

GAILLÁRDIA (named for M. Gaillard, a patron of botany in France). *Compósitæ.* Showy annual and perennial herbs largely cultivated in borders and flower-gardens.

Leaves alternate, more or less toothed, and spotted: fls. in solitary and usually very showy heads, the rays yellow and red and always neutral, the disk-fls. purple and fertile; involucre broad, the bracts in 2 or 3 series, hairy; ligules 3-toothed or 3-cleft, giving a fringed appearance to the fls.—There are 12 species, all American, mostly from the far W.

1613. Gaillardia pulchella var. picta. (×⅖)

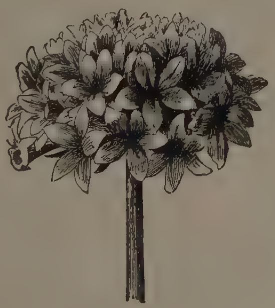
There are two types of gaillardias,—the annual forms, which are derived from *G. pulchella* and *G. amblyodon,* chiefly from the former; and the perennials, which issue from *G. aristata.* The gaillardias are conspicuous for profusion and duration of flowers. A constant succession is produced all summer until very late into the autumn. Besides their use as border or bedding plants they are good for cut-flowers, as they last well in water. They thrive best in light, open, well-drained soil, and should have full sunlight and air. In heavy or wet soils the plants are often winterkilled. The perennial forms are propagated by division, seeds or cuttings in August or September; also by root-cuttings in early spring. They usually do not breed true from seed and as better plants are produced by cuttings it is the most satisfactory method of propagation. *G. grandiflora* and its many varieties are garden forms of *G. aristata* (see Gt. 49, p. 583. G. 7:499). Some of the more recent introductions have highly colored flowers of extraordinary size, at least 4 to 5 inches in diameter. Another kind has quilled florets (*G. fistulosa*) of which Buffalo Bill is an excellent example,—a large, pure yellow with a narrow disk. Vivian Grey is also a remarkable and most distinct form, with clear yellow fringed rays, and disk of the same color. More recent introductions include *G. kermesina splendens* with narrow canary-yellow rays and rich crimson disk, and *G. sulphurea oculata* with pale sulfur, and bright maroon disk-flowers. Other trade names referable to no botanical species are *G. hybrida grandiflora, G. Josephus, G. semiplena,* and *G. Loiselii* (=*picta Loiselii,* H.F. II. 8:329?).

A. *Annual gaillardias: fls. normally mostly red.*

amblỳodon, Gay. One to 2 ft., erect, leafy, hirsute: lvs. oblong or spatulate, sessile and auriculate, entire or nearly so: lobes (or teeth) of disk-corollas short and obtuse; rays numerous, brown-red or maroon throughout their length. Texas. F.S. 21:2149.—Somewhat cult. amongst garden annuals, and worthy.

pulchélla, Foug. Erect, branching, 12–20 in., soft-pubescent: lvs. oblong, lanceolate or spatulate, rather soft, nearly sessile, either entire or the lower ones lyrate-pinnatifid: lobes of disk-fls. acute or awned; heads 2 in. across, the flat rays yellow at top and rose-purple at base. Ark. and La. to Ariz. B.M. 1602; 3551 (as *G. bicolor*).

Var. **pícta,** Gray (*G. pícta,* Hort.). Fig. 1613. The common garden form under cult., having larger heads and of various colors. B.M. 3368. R.H. 1852:20. V. 16:181. In one form (*G. fistulòsa, G. tubulòsa, G. Lorenziàna,* Hort.), the ray-florets and sometimes the disk-florets are enlarged and tubular. Fig. 1614. R.H. 1881, p. 377; 1885:156.


1614. Gaillardia pulchella, the form known as G. Lorenziana. (×⅕)

AA. *Perennial gaillardias: fls. normally yellow.*

aristàta, Pursh (*G. grandiflòra, G. lùtea, G. máxima,* and *G. perénnis,* Hort.). Erect, 2–3 ft.: lvs. rather thick, lanceolate or oblong, sometimes spatulate, varying from entire to sinuate pinnatifid: lobes of disk-corollas acute or awned; heads 3–4 in. across, the flat rays yellow, or in cult. varying to red (particularly at the base). Plains W. B.M. 2940. B.R. 1186. Gng.

2:345. Gn. 45, p. 325. A.F. 5:329.—This is the common perennial gaillardia of gardens (cult. under many names). Blooms the first year from seed. From *G. pulchella* it is distinguished by taller growth, firmer lvs., yellower heads, and less attenuate lobes of the disk-fls.; but it is practically impossible to distinguish the two, except that one is annual and the other perennial.

N. Taylor.†

GALÁCTIA (from the Greek, *milk;* some species said to yield a milky juice, which is improbable). *Leguminòsæ.* Prostrate or twining, perennial herbs or shrubs, mostly of the warm regions of America, only seldom cultivated.

Plants usually with pinnately 3–9-foliate lvs., and axillary, interrupted racemes of perfect, more or less perigynous fls.: calyx short, 4-lobed, bracted; corolla papilionaceous; standard broad; stamens 10, diadelphous; ovary 1, superior, 1-celled, with many ovules; style beardless: fr. a linear, straight or slightly curved legume. Cleistogamous fls. sometimes produced.—There are many species, but of very little horticultural value. The two following have been advertised in the past but are probably not now on the market.

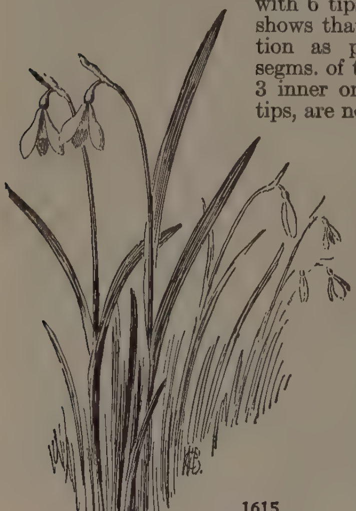
regulàris, BSP. (*G. glabélla,* Michx.). Lvs. with 3 lfts.: panicles mainly shorter than the lvs.: lfts. elliptical, often notched at the tip, 1–2 in. long, glabrous: corolla violet-purple. Dry sandy soil, N. Y. to Fla. and Miss. B.B. 2:335.

Élliottii, Nutt. Lvs. with 7–9 lfts.: panicles longer than the lvs.: lfts. elliptic-oblong, notched, pubescent beneath, ½–1¼ in. long: corolla white tinged with red. Dry sandy soil, S. C. to Fla., along the coast.

K. M. Wiegand.

GALÁNTHUS (Greek, *milk flower*). *Amaryllidàceæ.* Snowdrop. Spring-blooming bulbs (one autumnal), with solid scapes and solitary nodding white flowers.

Bulb tunicated, small: lvs. 2–3, strap-shaped: perianth without tube, outer and inner segms. unlike; stamens 6: fr. a 3-valved caps., more or less fleshy.—Probably a half-dozen species, in Eu. and W. Asia. The flowers of snowdrops (*G. nivalis,* Fig. 1615) are amongst the smallest and daintiest of common hardy cult. spring-blooming bulbs. They often bloom in early March, before all the snow has gone. Their pendulous white fls., with the "heart-shaped seal of green" dear to Rossetti, hold a unique place in the affections of lovers of gardens. At first sight the fls. seem to have 3 large white petals, inclosing a green-and-white tube with 6 tips, but a second glance shows that the parts that function as petals are the outer segms. of the perianth, while the 3 inner ones, with their 2-lobed tips, are not grown together, but overlap slightly, forming a rather crude but stiffish tube. Each plant has a globose coated bulb, 2–3 lvs., grows 6–9 in. high, and bears usually only 1 nodding fl., which emerges from a spathe. Behind the perianth is the globose green ovary.



1615. The snowdrop—Galanthus nivalis. (×½)

In a congenial spot, moist, cool and shady, the plants increase satisfactorily, and sometimes, without any care whatever, form a bed from which thousands of flowers may be picked at what is, perhaps, the most desolate and wearisome moment of the year. The leaves are linear and channeled, and in dark, shining masses make a rich, quiet effect. They come out with the flowers, attain their full growth later, and commonly die down in midsummer or fall. The bulbs are cheap, and should be ordered in liberal quantities. Plant in the autumn, as for other hardy bulbs; set 3 to 4 inches deep in mellow soil, and close together.

An era of new interest in snowdrops began about 1875, with the introduction of the "giant" kind (*G. Elwesii,* Fig. 1616), but those who do not care for "large violets" will be likely to cling to the small snowdrops. Nevertheless, *G. Elwesii* is very distinct, and should be the first choice if any large kinds are desired, and to secure the best forms the connoisseur should buy imported bulbs of its varieties. The only kinds known so far to possess a patch of green at the base of the inner segments are *G. Elwesii* and *G. Fosteri.* Considering that there are only two main types in this genus, *G. nivalis* and *G. Elwesii,* the profusion of Latin names (especially since 1888, the date of Baker's "Handbook of the Amaryllideæ") is rather trying, except to the connoisseur who, unlike the general public, is chiefly interested in the larger-flowered forms and the novelties.

There are several types of minor importance. The autumn-flowering kinds, representing many Latin names, as *G. octobrensis, G. corcyrensis, G. Reginæ-Olgæ,* are usually weak-growing plants. However, much is hoped from *G. cilicicus,* especially by the florists, who have hitherto found no snowdrop that could be profitably forced for Christmas. Doubleness seems to add nothing to the beauty of snowdrops. So far it seems to have affected only the inner segments of *G. nivalis* and *G. Elwesii.* Yellow snowdrops are also practically unknown in America. In these the heart-shaped spot and the ovary are yellow instead of green. Of these, *G. flavescens* is perhaps one of the best.

INDEX.

byzantinus, 12.
Cassaba, 5.
caucasicus, 4.
cilicicus, 2.
corcyrensis, 1.
Elwesii, 5.
Erithræ, 5.
flavescens, 1.
Fosteri, 9.
globosus, 5.
Gotwaldii, 12.
græcus, 6.
grandiflorus, 11.
Ikariæ, 8.
Imperati, 3.
latifolius, 7.
maximus, 4, 11.
nivalis, 1.
ochrospilus, 5.
octobrensis, 1.
octobrinus, 1.
plicatus, 10.
poculiformis, 5.
Redoutei, 4.
reflexus, 1.
robustus, 5.
Sharlockii, 1.
unguiculatus, 5.
Whittallii, 5.

a. *Lvs. merely channeled, not plaited.*

b. *Width of lvs. small, 3–4 lines.*

c. *Base of lvs. not very narrow.*

1. **nivàlis,** Linn. (*G. Shárlockii,* Hort.). Common Snowdrop. Figs. 1615, 1616. Bulb 6–12 lines thick: basal sheath split down one side: lvs. linear, glaucous, finally 6–9 in. long: outer perianth-segms. oblong, 6–12 lines long; inner segms. green only at the sinus. Feb., March. Pyrenees to Caucasus. R.H. 1880, p. 148. G.M. 34:154. G.C. II. 11:237. Gt. 48, p. 232.—There are large-fld. and double forms. Var. **corcyrénsis** and others flower in Nov. G.W. 2, p. 250. At least 2 varieties have yellow instead of green markings. Var. **flavéscens,** S. Arn. The markings on the inner segms. of the perianth and on the ovary are yellow, and the sts. are more yellow than green. Useful for Alpine gardens. G. 31:149. Var. **refléxus** has outer segms. reflexed. G.M. 34:155. Var. **octobrénsis** (var. *octobrìnus,* Voss. *G. octobrénsis,* Hort.). Albania. Known in cult. as a form blooming in England late in Oct.

cc. *Base of lvs. very narrow.*

2. **cilícicus,** Baker. Less robust than *G. Fosteri,* with much narrower lvs., which are narrowed gradually from the middle to a very narrow base. Green color as in *G. nivalis.* Bulb ½in. thick: lvs. whitish beneath:

outer segms. oblong, 9 lines long, 3–4 lines broad; stamens more than half as long as the inner segms. Mt. Taurus, in Cilicia, where it flowers Nov. to March. Intro. 1898. See G.C. III. 21:214. Pictured in G.C. III. 23:79. A.F. 13:1137. Gng. 6:244. F.E. 11:282. Gt. 48, p. 228. Gn. 73, p. 88.

BB. *Width of lvs. medium, 6–9 lines long.*

C. *Foliage moderately glaucous.*

D. *Outer segms. of perianth 12–15 lines long.*

3. **Imperàti,** Bertol. Lvs. broader than in *G. nivalis*, and fls. larger: outer corolla-segms. spatulate, 1–1¼ in. long. Naples and Genoa. This and *G. caucasicus* are regarded by Baker as subspecies of *G. nivalis*. G.C. II. 11:237. G.M. 34:155. Gn. 76, p. 119.

DD. *Outer segms. 9–12 lines long.*

4. **caucásicus,** Baker (*G. Redoùtei*, Rupr.). Lvs. finally 8–9 in. long, mostly 9 lines broad: outer perianth-segms. oblong-spatulate, with a very narrow claw; fls. later than *G. nivalis*. Caucasus. Van Tubergen seems to catalogue var. *máximus* of this species, but consult No. 11.

CC. *Foliage very glaucous.*

D. *Inner segms. with lobes rather spreading or crisped.*

5. **Élwesii,** Hook. GIANT SNOWDROP. Fig. 1616. Bulb larger and fls. more globose than in *G. nivalis:* outer segms. oblong-spatulate, 9–15 lines long, 6–9 lines broad; inner segms. green in the lower half and also around the sinus. Mountains of Asia Minor. B.M. 6166. R.H. 1880, p. 148. G.C. II. 11:236. G.M. 34:154. Gn. M. 2:117; 12:112.—The inner segms. are narrowed suddenly just below the apical lobes, which are square and much larger than in *G. Fosteri*. They also form a narrower tube than in any other species. Dealers have advertised vars. **Cassàba** (A. F. 3:471. C.L.A. 5:135. Gng. 5:180. Gt. 48, p. 225. Gn. 55, p. 206), **ochrospìlus** (has pale yellow coloring on the inner segms.), **unguiculàtus** has a long claw at the tip of each outer segm. (G.C. III. 17:361), and **Erìthræ.** Var. **globòsus** has almost globular fls., larger than in the type, and very broad lvs. Var. *Whíttallii* (Gn. 57, p. 45; 59, p. 262) seems to belong here. Var. **poculifórmis,** a large and robust form with the inner and outer segms. both pure white. Perhaps not in Amer. and rare in England.—*G. robustus*, Hort., seems never to have been accounted for by Baker. It may perhaps be *G. Elwesii* var. *robustus* which is a trade name. It is broad-lvd. and glaucous.

DD. *Inner segms. with lobes not spreading or crisped.*

6. **græcus,** Orph. Very near *G. Elwesii*, but differing as above and in the smaller fls. and narrower outer segms., and the very limited distribution of the wild species. April. Chios.

BBB. *Width of lvs. greatest, 9–12 lines.*

C. *Green color only near the sinus.*

D. *Colored on both sides of the inner segms.*

7. **latifòlius,** Rupr. Bulb. 1 in. thick: lvs. lorate, bright green: outer segms. oblong-spatulate, 6–9 lines long; inner segms. green around the sinus, inside and out; anthers suddenly narrowed to a sharp point, while in *G. nivalis* and *G. Elwesii* they are gradually narrowed. Caucasus, where it flowers in May. G.C. II. 11:237; 15:404. Gt. 48, p. 229.

DD. *Colored on only one side.*

8. **Ikàriæ,** Baker. Resembles *G. Fosteri* in foliage, and *G. Elwesii* not in coloring but in the square, crisp lobes of the inner segms. which tend to recurve: outer segms. nearly 1 in. long; stamens rather shorter than the inner segms.; green color occupying half the outside of the inner segms. Island of Nikaria (the classical Ikaria). See G.C. III. 13:506. Gn. 52, p. 361; 49, p. 330. G. 30:153. G.M. 52:146.—Intro. 1893.

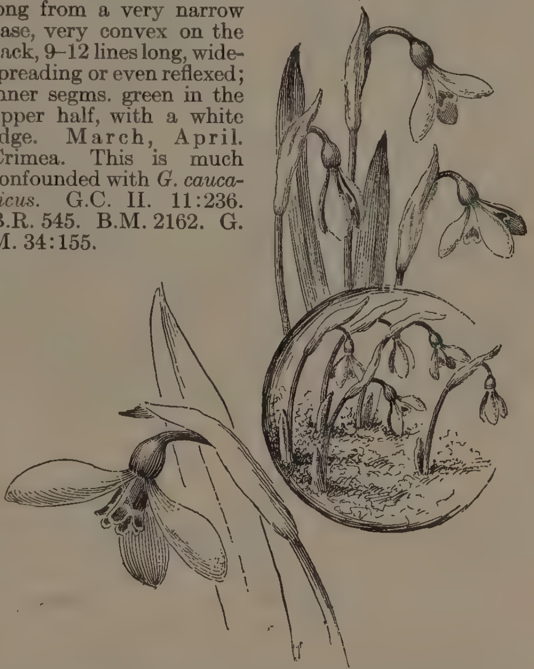
CC. *Green color also on the lower half of the inner segms.*

9. **Fósteri,** Baker. Resembles *G. latifolius* in foliage and *G. Elwesii* in fl., but the apical lobes of the inner segms. are short and erect, and smaller than in *G. Elwesii;* also the stamens are not more than half so long as the inner segms., while in *G. nivalis, G. Elwesii* and *G. latifolius* they are three-fourths as long. Asia Minor. Intro. 1889. G.M. 34:154. G. 35:193.

AA. *Lvs. plaited, the edges permanently rolled back.*

B. *Green color only near the sinus.*

10. **plicàtus,** Bieb. Bulb larger than in *G. nivalis:* lvs. about 12 in. long, and 1 in. wide, very glaucous: outer perianth-segms. oblong from a very narrow base, very convex on the back, 9–12 lines long, wide-spreading or even reflexed; inner segms. green in the upper half, with a white edge. March, April. Crimea. This is much confounded with *G. caucasicus*. G.C. II. 11:236. B.R. 545. B.M. 2162. G. M. 34:155.



1616. Galanthus nivalis and G. Elwesii. The upper flowers are G. nivalis; the lowest one is G. Elwesii; the middle flowers are a variety of G. Elwesii.

11. **grandiflòrus,** Baker (*G. máximus*, Baker, not Velenovsky). Possibly a hybrid between *G. plicatus* and some form of *G. nivalis*, remarkable for its robust habit and green color, extending more than half way down toward the base of the inner segms. Intro. 1893. See G.C. III. 13:354, 656. See also *G. caucasicus* var. *maximus*, No. 4.

BB. *Green color also on the lower half of the inner segms.*

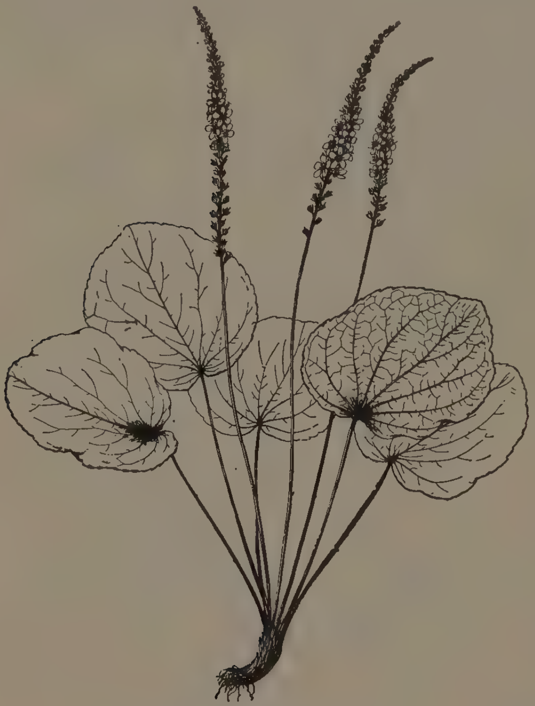
12. **byzantìnus,** Baker (*G. Gótwaldii*, Hort.). Intermediate between *G. plicatus* and *G. Elwesii*. "Lvs. 3 in. broad," which seems hardly possible, glaucous on both sides, especially beneath; margins distinctly and permanently recurved: outer segms. oblong, convex on back, 9 lines long, 4 lines broad, apical lobes somewhat reflexed and crisped; stamens much shorter than inner segms. Intro. 1893. See G. C. III. 13:226.

G. Állenii, Baker, has cone-shaped fls., pure white, but the petals "crimped into a distinctly large, horseshoe-like patch of green just below the wavy fold of the tips." Gn. 67, p. 53.—*G. Átkinsii*, Hort. Two plants seem to be cult. under this name, according to S. Arn., one a pure white one, the other frequently has an additional perianth-segm., also misshapen blooms. Both are scarcely known outside of England. Gn. 74, p. 154. By some supposed to be a form of G. nivalis.—*G. Ólgæ*, Orph. Outer segms. about 1 in. long; inner ones half as long, plain white, with rounded lobes. Blooms in Oct. Greece.—*G. Reginæ-Ólgæ*, Hort.=G. Olgæ.

WILHELM MILLER.
N. TAYLOR.†

GÀLAX (from the Greek meaning *milk;* application obscure). *Diapensiàceæ.* One acaulescent plant, much prized for its stiff bronzy root-leaves.

Calyx imbricated, persistent; petals 5, hypogynous, oblong-spatulate, entire, adnate to the base of the monadelphous stamens; the stamen-tube 10-toothed, the 5 teeth alternating with the petals antheriferous, the others petaloid; anthers transversely dehiscent; pistil 1; ovary superior, 3-celled, many-ovuled; style short: fr. a loculicidal, 3-valved caps.; seeds with a loose cellular testa.—This genus contains but a single species. It belongs to a small family which was much more extensive in past geologic times, but is now on the way to extinction. A large industry has arisen in recent years consisting in the marketing of immense quantities of galax lvs. for decorative purposes, especially at Christmas time; but the lvs. are also used at other times in wreaths and bouquets. The bronzy autumn coloration of the lvs. adds to their attractiveness. They are collected in the mountains of N. C. and Va. The plants are grown also in rockeries. It is recommended to plant in rockeries with northern exposure, shade, and some moisture. Prop. by division.



1617. Galax aphylla. (×½)

aphýlla, Linn. (*Blandfòrdia cordàta,* Andr.). GALAX. Fig. 1617. Evergreen, perennial herbs: rootstock thick, matted, creeping: lvs. basal, tufted, round-heart-shaped, with narrow sinus, crenate, shining, conspicuously palmately netted-veined, 1–3 in. broad, on long slender petioles: scape 1–2½ ft. high; spike-like raceme dense, 2–5 in. long; fls. small, white, 1½–2 lines broad. In dry woods chiefly in the mountains, Va. to Ga., and along the coast, Va. to N. C. B.M. 754. G.F. 5:605 (adapted in Fig. 1617). G.M. 44:223. Gn. 59, p. 187.—Called also colts-foot or beetle-weed.

K. M. WIEGAND.

Galax leaves were used for decorative purposes in a commercial way only as far back as 1890, when they were introduced to the northern florist trade by the writer, who had experimented with them for several years before that date, sending to hospitals and individuals. The reports received fully justified the introducer in advertising the leaf widely as a florist's decorative material for making up wreaths, crosses, and in fact all designs for which ivy leaves up to that time had been employed almost exclusively. Today galax leaves have to a great extent taken the place of ivy leaves, being less expensive, more easily handled and kept, and furnishing long wiry stems. The brilliant bronze leaves supply a color long needed in this class of work. The sizes also of the leaves vary from ½ inch or less to 5 inches diameter, again making their uses very varied. Small green galax leaves are now used extensively for bunching with violets, taking the place of the violet leaves. One of the features of the holiday season in Boston is the fakir with his stand of violets bunched with green galax. They come in again and are used the same way at the first touch of spring, when the early trailing arbutus or "mayflower" appears on the street. They can be arranged to cover much more space than the ivy leaves, and do not have to be wired, as is the case with the latter. The keeping qualities of galax are remarkable, and they are now used the year round from cold storage. Outdoor designs, as in cemeteries, will keep fresh and bright for months if not dried out, but otherwise require no care. A favorite arrangement of galax leaves is to place them loosely in a small vase, where they will retain their bright colors and shape for weeks, even in a close warm room, though most of the leaves are used, commonly with flowers, in designs made up by the florist. As a Christmas decoration they stand preëminent, and their general good qualities mentioned above cause them to be used throughout the year, more, perhaps, than any other decorative green, ferns possibly excepted.

In Philadelphia, some time ago, an enterprising young woman introduced a novel and taking innovation in the shape of potted galax plants for society dinners. Small, brilliantly colored green and bronze leaves were arranged in tiny pots, specially designed by Messrs. Sackett & Company, and placed at each plate, to be carried away by the guests as souvenirs. They were also sold through one of Philadelphia's leading merchants by thousands.

The larger cities, Boston, New York, Philadelphia and Chicago, use the largest quantities, though many of these are retailed again to smaller cities and towns all over the United States and Canada, and there is a large export trade now established in them, mostly to Germany and the Netherlands.

The area over which galax is collected extends from Virginia to Georgia, and is so vast that there is no danger of exterminating the plant by collecting the leaves, even if they were injured thereby, which does not seem to be the case. It is not practicable to grow the plants for the harvest of leaves, at least in America, the process being too expensive. Under cultivation they would perhaps not average one perfect salable leaf to a plant, as a speck or wormhole renders the leaf unfit for decorative purposes. In Europe galax has been tried with varying success under glass, the leaves bringing a very high price.

Galax aphylla is a beautiful ground-covering plant, specially adapted to the rhododendron border, where the soil and situation alike are suitable to its growth; it delights in shade and a cool, moist, peaty loam. Its charms are far better known in England, however, than at home. The leaves, when full grown, are always bright green, the brilliant bronze shades appearing later when the plant ripens and the frosts begin. Then when they are exposed to the direct rays of the sun the alternating freezing and sun action cause the leaves to turn in a short time, though sometimes this occurs to an extent before any freezing weather, when the sap starts downward. In dense shade they always remain green. In spring, when the sap begins to start, the leaves often turn green or dingy again, and eventually die down the second season.

HARLAN P. KELSEY.

GÁLBANUM: *Gums and Resins.*

GALEÁNDRA (Greek for *helmet* and *stamen*). *Orchidàceæ*, tribe *Vándeæ*. Deciduous epiphytes, to be grown under warmhouse conditions.

Plants with jointed thickened sts.: lvs. distichous, membranaceous: labellum infundibuliform; sepals and petals equal, spreading; column erect, winged; pollinia 2.—Six species in Trop. Amer. Cult. as for Eulophia.

Devoniàna, Lindl. St. erect: lvs. linear-lanceolate, sheathing at base: sepals and petals lanceolate, reddish brown, with green margins; labellum whitish, veined in front with crimson. From the banks of the Rio Negro. B.M. 4610. I.H. 21:176. A.F. 6:609. J.F. 2:195. V.O. 9:8.

Baùeri, Lindl. Sts. subcylindric, nearly fusiform: lvs. lanceolate: racemes terminal, drooping; fls. large; sepals and petals similar, lanceolate, yellowish; labellum pale yellow in the throat, interior portion purplish. Mex., S. B.R. 26:49. P.M. 14:49.

D'Escagnolleàna, Reichb. f. Sts. terete, tapering both ways: lvs. lanceolate, pointed: racemes terminal and drooping; sepals and petals similar, ascending, narrow, yellowish; lip funnelform or nearly bell-form, fluted, with a rose-purple blotch on the lower limb. Brazil. I.H. 34:22 (1887).

G. nivàlis, Mast. Racemes short, few-fld., fls. about 2 in. across; sepals and petals light olive-green, the funnel-like lip white with a purple blotch. Trop. Amer. V.O. 9:9. G.W. 14, p. 307.

Oakes Ames.
George V. Nash.†

GALEDÙPA: *Pongamia.*

GALÈGA (Greek, *gala*, milk: supposed to increase the flow of milk). *Leguminòsæ.* Bushy perennials not very commonly cultivated in America.

Of 120 names of species in this genus, only 6 are now retained, most of the others being referred to Tephrosia. The plants mentioned below are hardy herbaceous perennials of the easiest cult., about 3 ft. high, with odd-pinnate lvs. and pea-shaped fls. of purplish blue or white. They do not require frequent division, make bushy plants, and bear in July and Aug. many dense, axillary and terminal racemes of fls., which are useful for cutting. Seeds of goat's rue are still offered abroad among miscellaneous agricultural seeds, but the plants are little known in this country. They are native in S. Eu. and W. Asia.

A. *Lfts. lanceolate: stipules broadly lanceolate.*

officinàlis, Linn. Goat's Rue. Fig. 1618. Height 2–3 ft.: lfts. mucronate: fls. purplish blue. Eu., W. Asia. G.M. 49:57. Var. **álba** or **albiflòra** is commoner in cult. Gn. 50, p. 269. G.L. 22:294. J.H. III. 48:557. Var. **Hártlandii,** Hort., has large spikes of lilac fls. and the young foliage variegated. A.F. 22:695.—A rose-colored variety is sold as var. **cárnea,** Hort., which is also known in a double-fld. form; a dwarf, compact, lilac-fld. variety sold under the name var. **compácta,** is also known.

AA. *Lfts. lanceolate: stipules broadly ovate.*

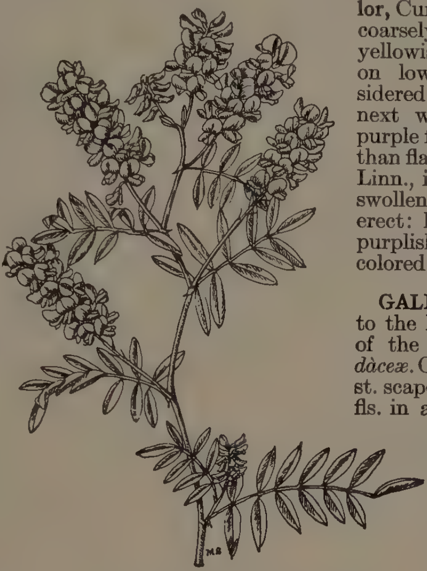
orientàlis, Lam. Foliage and stipules larger: fls. purplish blue, nodding: pods pendulous. Caucasus. B.M. 2192. Gn. W. 23:147. B.R. 326.—Height 2½–4 ft.: rootstock creeping: st. simple.

N. Taylor.†

GALEÓBDOLON: *Lamium.*

GALEÓPSIS (*weasel-like*, from some fancied resemblance). *Labiàtæ.* Hemp Nettle. Several weedy European plants, some of them naturalized in this country, rarely cult. in gardens. Annuals, of spreading habit, opposite lvs. that are dentate or entire, and red, yellowish or variegated fls. in whorls toward the top of the st.: calyx with 5 nearly equal teeth; corolla widened in the throat, bearing an entire arched upper lip and a palate with 2 teeth. **G. Ládanum,** Linn., is canescent, with very narrow, nearly or quite entire lvs.: fls. rose-red or red, sometimes spotted yellow: 8–12 in.: there are forms with broader lvs. and also narrow lvs., and otherwise variable. **G. versícolor,** Curt., has hispid sts., ovate coarsely toothed lvs., and large yellowish fls. with purple spot on lower lip: by some considered to be a form of the next with larger yellow-and-purple fls. and an arched rather than flat upper lip. **G. Tetràhit,** Linn., is bristly-hairy with st. swollen beneath the joints, erect: lvs. ovate, toothed: fls. purplish or white or particolored.

L. H. B.



1618. Galega officinalis. (×¼)

GALEÓRCHIS (in reference to the hood-like organ formed of the united sepals). *Orchidàceæ.* Orchids with fleshy roots: st. scape-like, with 2 basal lvs.: fls. in a short, loose spike, exceeded by the large bracts; sepals united, forming a hood; petals connivent; lip entire, spurred; column short; pollinia granulose, 1 mas in each sac, tailed.

spectábilis, Rydb. (*Órchis spectábilis*, Linn.). Showy Orchis. St. up to 1 ft. tall, 5-angled: spike 3–6-fld.; fls. violet-purple, variegated with lighter purple and white. N.E. N. Amer.

George V. Nash.

GALÌUM (Galion was the name of a plant mentioned by Dioscorides as used in curdling milk. *G. verum* is locally used abroad for this purpose). *Rubiàceæ.* Bedstraw or Ladies' Bedstraw, so-called because of the legend that one of these plants was in the hay on which the mother of Christ rested. Mostly weak or slender herbaceous plants with square, often barbed stems, and whorled leaves.

Flowers very small, perfect, epigynous; calyx almost or quite obsolete; corolla gamopetalous, rotate, deeply 4-parted; divisions in our species acute or acuminate; stamens 4; ovary inferior, 2-celled, forming a 2-lobed, 2-seeded, dry, indehiscent fr.; the lobes nearly globular.—About 220 species in various parts of the world. Noted for the recurved-scabrous sts. of many species, mathematical habit due to the whorled lvs., and the fine fluffy fls. The profuse-flowering species noted below are often used in rockeries and flower-beds for the regular but soft and filmy effect, which is similar to that of gypsophila. As cut-fls., they are used to lighten the effect of heavier fls.

A. *Fls. yellow.*

vèrum, Linn. Yellow Bedstraw. Perennial from a somewhat woody base: sts. erect, smooth, tufted, 1–3 ft. high: lvs. in 8's or 6's, linear, ½–1 in. long; apex bristle-tipped: panicle ample, its lower branches exceeding the lvs. Eu., now also a weed in fields in the E. U. S.—A very good plant for rockeries and banks.

AA. *Fls. white.*

B. *Lvs. in 4's, lanceolate, several-nerved.*

boreàle, Linn. Northern Bedstraw. Perennial, stoloniferous, forming patches: sts. smooth, 1–3 ft.

high, erect, strict: lvs. ¾–1½ in. long; apex not bristle-tipped: panicle ample: fr. usually minutely bristly. Rocky soil, Que. to Alaska and south to Pa. and Colo.—Useful in rockeries and flower-beds.

BB. *Lvs. in 8's or 6's, oblanceolate to linear.*

Mollùgo, Linn. Wild Madder. White or Great Hedge Bedstraw. Perennial, smooth: sts. erect or diffuse, 1–3 ft. high, mostly in clumps: lvs. ½–1 in. long, bristle-tipped, 1-nerved: panicle ample: fr. smooth. Eu., but a weed in fields in the eastern states.—This plant is known in some places as "baby's breath," but this name is properly given to gypsophila.

K. M. Wiegand.

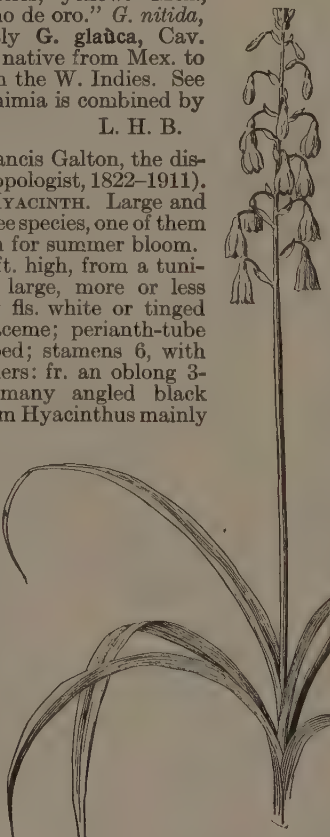
GALPHÌMIA (anagram of Malpighia). *Malpighiàceæ.* Woody plants, sparingly introduced in Florida and southern California.

Shrubs or subshrubs: lvs. opposite, small, slightly glaucous on both sides or beneath, entire or obscurely toothed, glandular at the margin or base of blade or at the tip of the lf.-stalk: clusters terminal; fls. yellow or reddish; calyx without glands; petals toothed, clawed, spreading: fr. a 3-parted caps., not winged.—Species 15 or more, from S. Texas to Brazil, largely Mexican. Little known as cult. plants, although a few species have been mentioned in hort. literature abroad, and the two following are listed in Calif. **G. brasiliénsis,** A. Juss. Shrub: lvs. ovate or lanceolate, about 1 in. long, reddish, glabrous, glaucous beneath: fls. small, yellow, in short lax panicles, said to be bright in winter in Calif.; pedicels jointed at base; petals ovate-lanceolate, obtuse, scarcely twice longer than calyx. Brazil. **G. hirsùta,** Cav. Shrub: lvs. bright green, ovate, acute, twice larger than in preceding, hairy both sides: fls. larger, in longer panicles, yellow. Mex., where it is known as "ramo de oro." *G. nitida,* cult. in Fla., is apparently **G. glaùca,** Cav. (*Thryállis glaùca,* Kuntze), native from Mex. to Panama and naturalized in the W. Indies. See *Thryallis,* with which Galphimia is combined by recent students.

L. H. B.

GALTÒNIA (after Sir Francis Galton, the distinguished author and anthropologist, 1822–1911). *Liliàceæ.* Giant Summer Hyacinth. Large and handsome Cape bulbs, of three species, one of them being cultivated in the open for summer bloom.

Scape or peduncle, 2–4 ft. high, from a tunicated bulb: lvs. long and large, more or less fleshy, all from the crown: fls. white or tinged green, large, in an open raceme; perianth-tube short, oblong or club-shaped; stamens 6, with linear-oblong versatile anthers: fr. an oblong 3-valved caps., containing many angled black seeds.—The genus differs from Hyacinthus mainly by its more numerous and flattened crowded seeds. The other 2 species are inferior to the following, which was intro. by Leichtlin in the early seventies of last century, and now holds a permanent place in horticulture. The plants prefer a rich, open, moist soil.



1619. Summer hyacinth, Galtonia candicans.

cándicans, Decne. (*Hyacinthus cándicans,* Baker). Fig. 1619. Bulb large, round, coated: lvs. 4–6, lorate-lanceolate, 2½ ft. long: scape often 4 ft. high; racemes 20–30-fld.; fls. fragrant, pure white, 1–1½ in. long, the tube oblong; stamens about ½in. long, inserted high in the tube. F.S. 21:2173. G.C. 1871:380, desc.; 1872:1099; II. 15:273. G. 28:687. Gn. 62, p. 361; 64, p. 158; 69, p. 163. J.H. III. 45:262; 47:583. R.H. 1882, p. 32. P.G. 3:101. A.G. 17:281. —The plants should be heavily mulched if left outdoors where winters are severe. In favored localities the bulbs may be left for several years with increasingly better results. Large clumps are desirable.

G. clavàta, Baker. Bulb ovoid, 3–4 in. diam.: lvs. 6–8, soft, 2–2½ ft. long, with whitish margin: scape 2 ft., bearing a lax raceme; fls. with a clavate tube which is 1 in. long and which is twice as long as the segms. B.M. 6885.—*G. princeps,* Decne. Much like G. candicans, but fls. fewer and raceme shorter: stamens inserted below middle of tube.

L. H. B.†

GAMÓGYNE (name refers to the united ovaries). *Aràceæ.* Two erect small herbs from the Malaysian region, bearing attractive colored inclined spathes: lvs. narrow, thickish, tapering into petiole: spadix included in the spathe: fls. apetalous; anthers truncate; ovaries united. *G. púlchra,* N. E. Br. Peduncles erect, terete, reddish brown, about 6 in. long: spathe bright crimson, about 1¾ in. long, spreading or almost nodding, closed except at top: stigmas red: spadix with neuter organs at base. B.M. 8330. *G. Búrbidgei,* N. E. Br. Spathe less brightly colored: stigmas greenish yellow: spadix with neuter organs between the male and female parts.

GAMÓLEPIS (Greek for *united scales;* referring to the involucre). *Compósitæ.* Flower-garden plants.

Leaves alternate and mostly pinnatisect: peduncles 1-headed, the heads bearing 1 series of yellow, pistillate rays, the disk-fls. perfect: achenes without pappus, wingless and glabrous.—About a dozen S. African herbs or small shrubs, somewhat allied botanically to Chrysanthemum.

Tagètes, DC. (*G. ánnua,* Less.). Fig. 1620. Annual, of wiry growth, a foot or less high, much branched and very floriferous: lvs. pinnate or pinnately parted, 5–7 lobes or lfts. on either side of the rachis and lfts. entire or lobed: involucre nearly or quite urn-shaped, the scales joined more than half their length; fls.-heads bright yellow or orange, ¾in. across. R.H. 1896, p. 412. Gn. 25, p. 407 (both as *G. Tagetes*).—Hardy or half-hardy. Of easiest cult. from seeds in sunny places, and most excellent for ribbon borders and for low mass effects. Continuous bloomer.

L. H. B.

GARCÌNIA (Laurence Garcin, who lived and collected in India, and wrote in the eighteenth century). *Guttiferæ.* This genus includes the mangosteen, which is declared by some connoisseurs to be one of the most luscious of all tropical fruits; also the gamboge tree, whose resinous juice yields a well-known pigment and purgative.

Garcinia is a polymorphous genus of upward of 150 species in the tropics of Asia, Africa and Polynesia. The species are glabrous trees, usually with a yellow juice: lvs. evergreen, opposite or ternate, simple, often thick: fls. solitary or fascicled, polygamous or diœcious; sepals and petals 4; stamens in male fl. many, 2- or 3-delphous; female fls. with staminodia; ovary 2- to many-celled, with sessile stigma and solitary ovule in each cell.—The mangosteen is cultivated in the West Indies; the gamboge tree is also cult. in S. Fla.; it is a broad-leaved tree of slow growth. The mangosteen is about the size and shape of an orange, with a rind of similar thickness and edible segments of form and arrangement like those of an orange. It is brilliantly colored outside with rich purple. The flavor is said to suggest something between a grape and a peach. Numberless efforts are said to have been made to naturalize this tree in the tropics without success. The successful ripening of this fruit under glass may be regarded as an achievement. See *Mangosteen.*

Mangostàna, Linn. MANGOSTEEN. Height 20–30 ft.: lvs. 7–10 in. long, elliptic-oblong, acuminate, leathery, nerves horizontal and very numerous: fls. (male) 1½ in. diam., purple or yellow-red, in few-fld. terminal fascicles; sepals orbicular, and petals broad-ovate and fleshy: fr. about 2½ in. diam., dark purple with large flat seeds. Malay region. B.M. 4847. L. B.C. 9:845. F.S. 22:2359. G.C. II. 4:657. G.W. 3, p. 8.

Morélla, Desr. GAMBOGE TREE. Height 30–50 ft.: lvs. more tapering at both ends, 4–6 in. long, the veins indistinct: fls. yellowish, male fls. about 3 in the axils, the sepals very small; female fls. larger, solitary, the staminodes about 12: fr. resembling a Morello cherry in size, slightly 4-lobed. Bengal to Siam.

L. H. B.†

1620. Gamolepis Tagetes. A good yellow-fld. composite for edgings. (×⅔)

GARDEN and GARDENING. The word garden etymologically means an inclosed space, and gardening is historically distinguished from agriculture by being within an inclosure of some kind instead of in the open fields. Gardening operations are usually conducted on a smaller scale than those of agriculture and by more intensive methods. Gardening and horticulture are really synonymous terms, but, by usage, a horticulturist is supposed to have a more extended training and wider range of activities than a gardener. Moreover, the word gardening now suggests more of the private, homelike and personal point of view, whereas the most distinctive feature of American horticulture is the immense commercial importance of fruit-growing on a large scale, and a marked emphasis of the professional side of a fruit-grower's work; and in later years, it is marked also by the very extensive vegetable-gardening and floricultural development. The history and discussion of gardening are, therefore, set forth in this book under *Horticulture.* Large private places are often divided into fruit-garden, kitchen-garden and flower-garden. Fruit-growing (which see) is the same as pomology. Kitchen-gardening, in its widest sense, is the same as vegetable-gardening (which see), or the more learned word, olericulture; but the expression kitchen-gardening is now less common, and usually indicates the private and uncommercial point of view, whereas market-gardening and truck-gardening (which are practically the same) are now the chief words used for the wholesale and commercial side of vegetable-gardening in the United States. Flower-gardening, a third primary division of gardening, is the same as floriculture (which see). Under ornamental gardening and landscape gardening are explained the two different points of view in the use of plants and flowers for their own separate values or when grouped for artistic effects, the nature-like or picturesque conception being set forth under landscape gardening, and the artificial or merely decorative styles under ornamental gardening.

It is customary to speak of gardening as the amateur and personal practice of horticulture. One makes a garden. One derives from the garden not only the plants and products that may be harvested, but also the satisfactions in plant-growing, the reaction to forms, fragrances and colors, and the gain of close contact with the out-of-doors. The first garden that one may have should be personal, for his own growth and development. Naturally, this will be in some personal or retired part of the grounds. In recent years, however, there has been a marked socialization of gardening, making it a contribution to public cleanliness and beauty and a means of educating the people. In America, this application of the gardening spirit to civic improvement has been very marked, as evidenced in the taking away of fences between adjoining properties and the development of a street as a unit. This is a great gain to public spirit and to social feeling; but this in no way interferes with the personal garden for the sheer love of it, to be grown in a place all one's own.

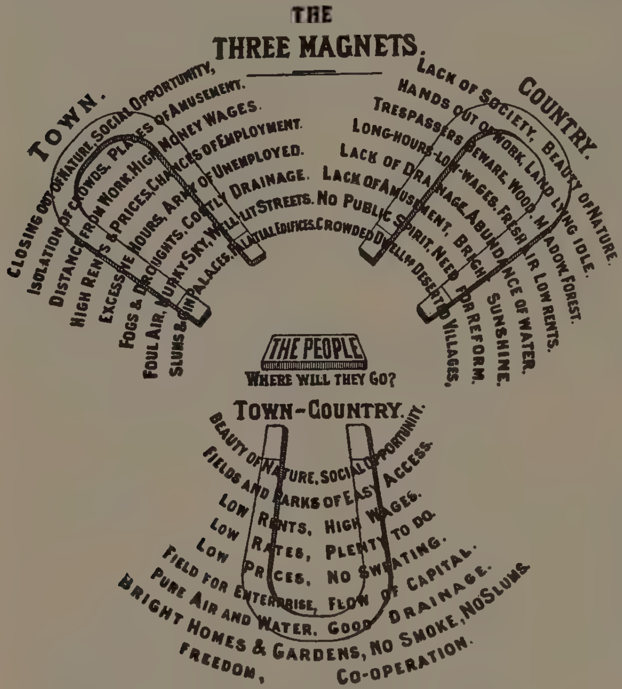
Persons desiring to find advice on specific gardening matters, should refer to the different genera under their respective heads; also to the articles under *Landscape Gardening,* and to such cultural entries as *Alpine Plants, Annuals, Arboriculture, Autumn Gardening, Banks, Bedding, Biennials, Border, Bulbs, Evergreens, Ferns, Herbary, House-plants, Orchids, Palms, Perennials, Rock-Gardening, Shrubbery, Spring-Gardening, Subtropical Gardening, Succulents, Vegetable-Gardening, Wall-Gardening, Water-Gardening, Kitchen-Garden, Wild-Garden,* and others.

L. H. B.

GARDEN CITIES. Instead of being a community in which gardens are the dominant feature, the garden-city form of urban dwelling-place implies primarily an industrial town of limited size and of definitely advanced economic ideals. While there were in England, where the idea originated, several prior developments, the example which has best typified the aims and practicability of the garden city is that sometimes known as Letchworth, but actually named Garden City, in Hertfordshire, about thirty-five miles from London. The genesis of this enterprise appears to have been in the reception given to a little book entitled "To-morrow: A Peaceful Path to Real Reform," issued in 1898, and written by Ebenezer Howard, then a London stenographer. The stated purpose was "to organize a migratory movement of population from our over-crowded centers to sparsely settled rural communities." In detail, Howard proposed "to find for our industrial population work at wages of higher purchasing power, and to secure healthier surroundings and more regular employment. To enterprising manufacturies, coöperative societies, architects, engineers, builders and mechanicians of all kinds, as well as to many engaged in various professions, it is intended to offer a means of securing new and better employment for their capital and talents, while to agriculturists it is designed to open a new market for their produce close to their doors. Its object is, in short, to raise the standard of health and comfort of all true workers of whatever grade, the means by which these objects are to be achieved being a healthy, natural and economic combination of town and country life, and this on land owned by the municipality." It will be observed that this is not a proprietary enterprise.

Howard considered that people aggregated themselves into the cities because of the "attractions" there, of various kinds. In the nature of the case, certain magnets attract to the town or city, and certain other magnets attract to the country. He would combine these magnets into a town-country habitation. He expressed the idea in a chart, Fig. 1621.

The reception given to this idea was so favorable that in 1902 a corporation was organized "to promote and further the distribution of the industrial population upon the land upon the lines suggested in Ebenezer Howard's book," which in 1904 began operations. It is interesting to note that among the subscribers to this company's stock were George Cadbury and Sir W. H. Lever, both of whom had previously established with success industrial villages upon a proprietary plan—Bournville and Port Sunlight.


THE
THREE MAGNETS.
TOWN.
Closing out of Nature, Social Opportunity,
Isolation of Crowds, Places of Amusement.
Distance from Work. High Money Wages.
High Rents & Prices, Chances of Employment.
Excessive Hours, Army of Unemployed.
Fogs & Droughts, Costly Drainage.
Foul Air, Murky Sky, Well-lit Streets.
Slums & Gin Palaces. Palatial Edifices.
COUNTRY.
Lack of Society, Beauty of Nature.
Hands out of Work, Land lying idle.
Trespassers beware, Wood, Meadow, Forest.
Long-hours-low-wages. Fresh Air. Low Rents.
Lack of Drainage. Abundance of Water.
Lack of Amusement, Bright Sunshine.
No Public Spirit, Need for Reform.
Crowded Dwellings, Deserted Villages,
THE PEOPLE
Where will they go?
TOWN-COUNTRY.
Beauty of Nature, Social Opportunity.
Fields and Parks of Easy Access.
Low Rents, High Wages.
Low Rates, Plenty to do.
Low Prices, No Sweating.
Field for Enterprise, Flow of Capital.
Pure Air and Water, Good Drainage.
Bright Homes & Gardens, No Smoke, No Slums.
Freedom, Co-operation.

1621. The three magnets that Mr. Howard considers to be the attractions for the people.

While it is not the province of this sketch to discuss in detail the sociological features either of Garden City in England, or of its German prototype at Hellerau, near to and dependent upon the great German enterprise of the Krupps at Essen, it is proper to report the steady growth of the Letchworth scheme (so called because of the name of the largest estate purchased for establishing the Garden City), and to note the removal thither of several large industries, of which it is said that "printing, book-binding and various branches of engineering are the chief industries, and there are at least a dozen others." Garden City had, in 1912, eight years from its beginning, a population of 7,912, scattered comfortably and working happily in 1,761 buildings in the developed part of its 4,500 acres, and the effect of living eight years in its designed wholesomeness had been to give it a death rate of eight in the thousand, as compared with 14.1 for the larger English communities from which it drew its inhabitants and its industries. It is quite within the scope of this book to register the sober conclusion of the Royal Commission on Canals and Inland Navigation (England), in 1909, that "If industries are widely distributed, workers can have better houses at lower rents, can breathe less vitiated air, and they and their families can in many cases combine with factory work the healthy and profitable work of small agricultural production."

"The gardens of Garden City are . . . the small individual gardens of its houses and cottages. . . . The garden is inevitable in Garden City. . . . You will not find a house without one—a real practical garden. . . . The majority keep their gardens well. . . . Most of the residences are detached, with gardens all around them." Such are comments on this feature of the successful Garden City found in a book on the enterprise, itself an evidence of the quality of the printing product of the community. (The Garden City, by C. B. Purdom; "printed in the Garden City at the Temple Press and published by J. M. Dent & Sons, Ltd., London, 1913.")

In addition to the prevalence of gardens, this industrial community enjoys other features not usual in hit-or-miss development. The houses in Garden City are not in blocks or "rows," are not monotonously similar, include careful provision for health and cleanliness, and range in cost from $1,000 to more than $10,000. There are many outdoor recreational facilities, and a strong community spirit helps to provide entertainment and amusement. The town plan takes account of the contour of the land, and the houses of whatever character are touched or approached by the green of vine or tree or plant.

In the United States there are as yet no garden cities so thoughtfully designed and so capably worked out. There is a "Garden City" near New York, but it is merely a well-handled real estate promotion enterprise. Pullman near Chicago, was an attempt at mitigating the rigors of the congested city, and Gary, in Indiana, is a later and slightly more advanced industrial town. Neither approximates the efficiency of the English example. There are building in northern Michigan several industrial towns in which there is both planting and the retention of some native growth, but these are proprietary enterprises, and not coöperative as is the Letchworth Garden City.

It is certain that there will come into existence many more communities of the type of Garden City, because it is coming to be generally known that the influences of the garden and of wider living areas upon an industrial population are economically favorable and tend to contentment, permanence and prosperity, especially if intoxicating liquors are either kept out or are made available only under sharp restraint.

J. Horace McFarland.

GARDÈNIA (after Alexander Garden, M.D., of Charleston, S. C., a correspondent of Linnæus). *Rubiàceæ.* Shrubs or rarely small trees, sometimes nearly or quite evergreen, some of which are planted South and one yields popular flowers for cutting.

Plants glabrous or pubescent or even tomentose: lvs. opposite or in 3's, with interpetiolar stipules: fls. large, axillary and solitary or sometimes corymbose, yellow or white; calyx-tube ovoid or obconic; corolla salver-shaped or tubular, the tube much exceeding the calyx, the limb with 5–9 spreading or recurved contorted lobes; stamens 5–9, on the corolla-throat.—Species about 60, in subtropical regions of the eastern hemisphere. See *Randia* for related plants.

Gardenia includes the Cape jasmine, a tender shrub 2 to 6 feet high, with thick, evergreen foliage and large double, waxy camellia-like, fragrant flowers. It

XLVI. Type of an old-time formal garden.—Washington's garden at Mt. Vernon.

blooms from May to September in the South, where it is often used for hedges, and is hardy as far north as Virginia. In the middle of last century the Cape jasmine was considered one of the finest stove shrubs in cultivation, but with the waning popularity of camellias the doom of the Cape jasmine as a conservatory plant was sealed. The camellia has a greater range of color, and has had hundreds of varieties, while its scented rival has had barely a dozen. The flowers of the Cape jasmine have never been so perfectly regular as those of a camellia, and the plants are very subject to insect enemies. Their bloom is successional rather than close, and large plants are therefore not so showy as camellias. They are considerably grown abroad for cut-flowers in early spring, young plants a season or two old being used for best results. The variety with variegated foliage is dwarfer and weaker-growing. The true botanical name of the Cape jasmine is *G. jasminoides*, a name almost never used in the trade. "Cape jasmine" itself is one of the most remarkable cases of the vitality of an erroneous popular name. The single-flowered form was introduced much later than the double, and has always been less popular. The earliest picture of a living plant with single flowers was published in 1820 in B. R. 449. Cape jasmines are also handled by importers of Japanese plants, who sometimes offer seeds also. *G. lucida* was probably introduced by Reasoner, and *G. Rothmannia* by Franceschi, who reports that it is probably not now (1914) in cultivation. For the true jasmines (which belong to the olive family, and are often trailing plants), see *Jasminum.*

Culture.—The Cape jasmine of today, *Gardenia Veitchii*, was introduced by the well-known English firm of Jas. Veitch & Son. This new variety has fulfilled the long-desired want, because it is really a winter-flowering variety, while the old species *Gardenia jasminoides* or *G. florida* could not be made to flower during the early and midwinter when actually most valuable, hence the almost total abandonment of that old variety for cut-flower purposes. This new type has become one of the most popular florist flowers, although it is one of the most difficult plants to handle. The young plants are raised from cuttings in the early winter. Care must be taken to propagate only from thoroughly healthy plants. Three- to four-eye cuttings should be put into clean, sharp sand with a minimum bottom heat of 70° and a maximum of 85°. The atmosphere should be rather close in the propagating-house until after the cuttings begin to root, then some air should be admitted. The cutting-bench must be kept shaded from the sun and frequent syringing is absolutely necessary. When fully rooted in the sand, they are potted into 2-inch pots in well-prepared soil of four parts decomposed sod loam, one part of well-rotted old cow-manure and one part sand. The soil should be well screened. Potting firmly is essential, and not too much room should be left for water. A gentle bottom heat for these young plants is highly beneficial. When the sun begins to get higher and the days lengthen, a little fresh air during the middle of the day is invigorating for the young plants, but the night temperature should never go below 65°. The plants must be kept growing constantly and should be repotted as soon as they have filled their pots with roots. The months of May and June are the best time to plant gardenias into benches or solid beds. The best soil has been found to be well-rotted turf or sod, a pliable loam and well-rotted cow-manure well mixed, three parts of loam to one of manure. Should the soil be rather stiff or of a heavy texture, a portion of sand may be added. The benches should be 4 to 5 inches deep and have sufficient openings or cracks for drainage. Where very thin turf or sod can be had, the bench should be lined with this, or if not practicable, then a layer of sphagnum moss so as to cover the bottom of the bench. On top of this, a liberal sprinkling of pieces of charcoal will tend to keep the soil sweet. A small quantity of ground bone may be sprinkled over the soil after it is all spread on the benches ready for planting. Care must be taken that all balls are well softened and dissolved when planting so that there will be an amalgamation of the new soil and the soil of the ball. Firm planting and immediate watering are of the highest importance and frequent syringing after planting. Shading is not necessary, providing frequent syringing is given. Keep the soil moist but never wet. It is well to keep the house rather close for a few days, after which air can be given freely. *Gardenia Veitchii* can stand any amount of heat, and there is no danger of burning or scorching until the foliage begins to get warm. When thermometer goes above 90° to 95° more air must be given. The plants must now make their growth and if buds appear they must be pinched out. Keep pinching out buds and small side shoots until the latter part of September when buds may be allowed to set upon the stronger shoots. A strong healthy plant can carry four to six such flowering shoots. After buds begin to set and sometimes even before, bottom shoots begin to come. These are the second growth and make for a second crop of flowers as well as for propagating the young plants for the next season. Plants are seldom kept over the second year although it can be done successfully. Young plants are decidedly the most profitable. When the plants are well set with buds, in October and November, and the roots appear on the surface, a very light mulch of cow-manure is beneficial as it will assist to develop the flowers. A night temperature of 65° to 68° is best, while during the day it may range from 70° to 90°. Good hard syringing will keep down the pests which are fond of this plant, especially the mealy-bug. The flowers should be cut before the center petals have fully expanded and the longer the stem the more valuable the flower. (H. A. Siebrecht.)

A. *Corolla-tube cylindrical.*

B. *Calyx with 5 long teeth.*

C. *Ribs on the calyx.*

jasminoìdes, Ellis (*G. flórida,* Linn. *G. radìcans,* Thunb.). CAPE JASMINE. Variable, very small shrub, unarmed, the st. sometimes rooting: lvs. lanceolate, sometimes variegated: fls. white, solitary, very fragrant, waxy. For pictures of double forms, see B.M. 1842 and 2627, and B.R. 73; single, B.R. 449 and B.M. 3349; normal and variegated foliage, R.H. 1864, p. 30. China. Var. **Fortuniàna,** Lindl. (*G. Fórtunei,* Hort.). B.R. 32:43. F.S. 2:177. R.B. 23:241. In 1893 was advertised *G. camelliæflòra* in addition to *G. radìcans*, *G. flórida* and vars. *màjor* and *majéstica. G. sinénsis grandiflòra* of Berger's catalogue perhaps belongs here. Presumably the *G. Veitchii* of the gardens belongs here.

CC. *Ribs not present.*

lùcida, Roxbg. Buds resinous: lvs. oblong; stipules annular, variously divided at the mouth, unequally lobed: fls. stalked, fragrant, white but ultimately turning yellow, 1–2½ in. across. India, Burma, Luzon. —The calyx-teeth are not decurrent, as in the Cape jasmine, and thus the calyx does not have the ribbed look.

BB. *Calyx tubular, with 5 very short teeth.*

amœna, Sims. Differs from all here described in having numerous strong spines nearly ½in. long, which are axillary: lvs. oval, acute, short-stalked: fls. subterminal; corolla-tube 1 in. long, longer than the lobes, which are 6, obovate, white, with margins incurved enough to show the rosy back. India or China.

BBB. *Calyx spathe-like.*

Thunbérgia, Linn. f. Lvs. broadly elliptic, acute, with pairs of glands along the midribs: fls. 3 in. across, pure white; corolla-lobes 8, overlapping. S. Afr. B.M. 1004.—Dwarf-growing, and perhaps not now in cult. in this country.

AA. *Corolla-tube short and wide-throated.*

B. *Fls. 3 in. long and broad.*

Rothmánnia, Linn. f. Very distinct in foliage and fl.: lvs. with pairs of hairy glands along the midrib: calyx ribbed, with 5 long teeth, equaling the short, cylindrical portion of the corolla-tube; corolla-tube rather suddenly swelled, ribbed; lobes 5, long-acuminate, whitish, spotted purple in the mouth. S. Afr. B.M. 690. L.B.C. 11:1053.—Fls. pale yellow, but it does not bloom in Calif. according to Franceschi.

BB. *Fls. 1½ in. long and broad.*

globòsa, Hochst. Lvs. oblong, short-acuminate; lf.-stalk nearly 3–5 lines long: fls. white, inside hairy and lined pale yellow; calyx small, with 5 very short teeth; corolla-tube wide at the base and gradually swelled; lobes 5, short-acuminate. S. Afr. B.M. 4791. F.S. 9:951.

G. citriodòra, Hook.=Mitriostigma axillare.—*G. intermèdia,* Hort., is a name unknown in botanical literature and the plant's affinities are unknown.—*G. Stanleyàna,* Hook.=Randia maculata.

Wilhelm Miller.
N. Taylor.†

GARDEN LEMON: *Cucumis Melo.*

GARDÒQUIA BETONICOÌDES: *Cedronella mexicana.*

GARGET: *Phytolacca decandra.*

GARLAND FLOWER in the South sometimes means *Hedychium coronarium.* Often means *Daphne Cneorum.*

GARLIC (*Állium satìvum,* Linn.). Hardy perennial bulbous plant, closely allied to the onion. It is native of southern Europe. It has flat leaves, and the bulb is composed of several separable parts or bulbels, called cloves. These cloves are planted, as are onion sets, in spring or in fall in the South. They mature in summer and early autumn, being ready to gather when the leaves die away. If the soil is rich, it may be necessary to break over the tops to prevent too much top growth and to make the bulbs better, as is sometimes done with onions. This is done when the top growth has reached normal full size. The cloves are usually set 4 to 6 inches apart in drills or rows, in ordinary garden soil. The bulbs are used in cookery, but mostly amongst the foreign population. Strings of bulbs braided together by their tops are common in metropolitan markets (Fig. 1622). The bulbs are white-skinned or sometimes rose-tinged.

L. H. B.

1622. Garlic, as strung for market.

GARLIC PEAR: *Cratæva.*

GÁRRYA (after Nicholas Garry, secretary of the Hudson Bay Company). Including *Fadyénia. Garryàceæ,* formerly included under *Cornàceæ.* Ornamental shrubs chiefly grown for foliage and showy catkins.

Evergreen: lvs. opposite, short-petioled, entire or denticulate, without stipules: fls. diœcious, apetalous, 1–3 in the axils of opposite bracts on elongated, often drooping, axillary spikes; staminate fls. with 4 sepals and 4 stamens; pistillate with 2 sepals and 2 styles and a 1-celled ovary: berry 1–2-seeded, rather dry.—About 10 species in W. N. Amer. from S. Ore. to S. Mex., east to W. Texas.

The garryas generally have elliptic to oblong leaves, and small greenish white or yellowish flowers in catkin-like, often pendulous spikes, and dark purple or dark blue berries. None of the species is hardy North but *G. flavescens, G. Wrightii,* and also *G. Fremontii,* which are the hardiest, can probably be grown north to New York in sheltered positions, while the others are hardy in warmer regions only. They are well adapted for evergreen shrubberies, and the staminate plants are especially decorative in early spring with the showy, pendulous catkins, which in *G. elliptica* attain to 1 foot in length and often bloom in midwinter. The garryas thrive well in a well-drained soil and in sunny, sheltered position; in England they are often grown on walls. Propagation is by seeds or by cuttings of half-ripened wood under glass; also by layers.

ellíptica, Douglas. Shrub, to 8 ft.: lvs. elliptic to oval-oblong, obtuse or acute, usually undulate, glabrous above, densely tomentose beneath, 1½–3 in. long: 3 fls. in the axils of short and broad, pointed bracts; spikes rather dense, staminate 2–12 in. long often branched, pistillate 1–3 in. long: fr. globose, silky tomentose. Calif. to New Mex. B.R. 1686. Gn. 33, p. 562; 37, p. 501; 39, p. 261; 51, p. 257; 53, p. 449; 55, p. 258; 57, p. 122; 63, p. 181; 67, p. 149; 76, p. 639. G.C. II. 22:425; III. 35:42, 43. Gn. W. 22:115. G. 20:30; 35:21. H.U. 2, p. 35. H.F. 1865: 198. G.L. 24:190.—This is the handsomest species, and stands about 10° of frost (sometimes more) in a sheltered position.

G. Fadyénii, Hook. (Fadyenia Hookeri, Griseb.). Shrub, to 15 ft.: lvs. elliptic to oblong, acute or mucronulate, glossy above, tomentose beneath or almost glabrous at length, 2–4 in. long: bracts oblong-lanceolate, remote: fr. tomentose. Jamaica, Cuba.—*G. flavéscens,* Wats. (G. Veatchii var. flavescens, Coult. & Evans). Shrub, to 8 ft.: lvs. elliptic, silky pubescent below, 1–2 in. long: spikes dense, about 1 in. long. Ariz., Utah, N. Mex.—*G. Fremóntii,* Torr. Shrub, to 10 ft.: lvs. ovate to oblong, acute, glabrous on both sides, yellowish green, 1–3 in. long: spikes dense, 2–5 in. long: with short bracts: fr. pedicelled, glabrous. Ore. to Calif. G.C. II. 15:431; III. 35:44.—*G. macrophýlla,* Benth. Shrub, to 6 ft.: lvs. ovate to oblong-ovate, glabrous above, villous-pubescent beneath, 2–5 in. long: spikes dense and short: fr. sessile. Mex.—*G. Thurétii,* Carr. (G. elliptica × G. Fadyenii). Shrub, to 15 ft.: lvs. elliptic to elliptic-oblong, whitish tomentose beneath, 2–5 in. long: bracts remote, with usually 1 fl. in each axil; spikes shorter than those of G. elliptica. Originated in France. R.H. 1869, p. 17; 1879, pp. 154, 155.—*G. Vèatchii,* Kellogg. Spreading shrub, to 8 ft.: lvs. elliptic-ovate to ovate-oblong, acute, yellowish green, tomentose beneath, 1½–2½ in. long: spikes dense, 1–2 in. long: fr. sessile, usually silky tomentose. Nev. to Calif. and N. Mex. Named for J. A. Veatch, botanical explorer of Cedros Isl., Lower Calif.—*G. Wrìghtii,* Torr. Shrub, to 10 ft.: lvs. elliptic or elliptic-ovate, acutish and mucronate, glabrous or nearly so below, 1–2 in. long: spikes slender, about 2 in. long: fr. glabrous, nearly sessile. Ariz., Mex.

Alfred Rehder.

GARÙGA (native East Indian name). *Burseràceæ.* This includes a deciduous East Indian tree, reaching 60 feet, and cultivated in southern Florida and California for its fruits, which are the size of a gooseberry, and are eaten raw, but chiefly pickled.

Tomentose or hairy plants: lvs. crowded at tips of branches, alternate, odd-pinnate; lfts. opposite, subsessile, serrate: fls. polygamous, large, panicled; calyx bell-shaped, 5-cut; petals 5, inserted on the tube of the calyx above the middle; stamens 10; ovary 4–5-celled; ovules in pairs: drupe with 5, or by abortion 1–3, stones, which are wrinkled and finally 1-seeded.—Species perhaps a dozen in India and Pacific islands to Austral.

pinnàta, Roxbg. Tree, 30–40 ft., with lvs. 1 ft. or more long; lfts. obtusely crenate: fls. small, in a very large panicle: fr. a black drupe. India and Malaya to the Philippines.—Also cult. abroad under glass.

L. H. B.

GAS PLANT: *Dictamnus.*

GASTÈRIA (Greek, *gaster*, belly; referring to the usually swollen base of the flowers). *Liliàceæ*, tribe *Aloíneæ.* Mostly acaulescent and small succulents of similar decorative uses and treatment as Aloe.

Leaves usually elongated, crowded in rosettes or on short sts., usually 2-ranked: fls. with a red or rosy typically ventricose curved tube and short equal suberect greenish segms. about as long as the stamens and pistil. S. Afr. Species 43. Monog. by Berger in Engler, Das Pflanzenreich, hft. 33 (1908).

INDEX.

acinacifolia, 18.
angulata, 3, 4.
canaliculata, 7.
carinata, 15.
conspurcata, 2.
crassifolia, 6.
denticulata, 5.
dísticha, 2, 3, 5.
Dregeana, 10.
ensifolia, 18.
excavata, 13.
falcata, 15.
fallax, 10.
formosa, 9.
glabra, 16.
glabrior, 7.
grandipunctata, 17.
intermedia, 1.
latifolia, 1, 15.
lingua, 5.
longifolia, 3.
maculata, 10.
major, 16.
marmorata, 6, 12.
minor, 16.
nigricans, 6, 7, 10.
nitens, 18.
nitida, 17.
obliqua, 10.
parvifolia, 14.
parvipunctata, 17.
picta, 9.
planifolia, 8.
pulchra, 11.
scaberrima, 1.
strigata, 15.
subnigricans, 7.
sulcata, 4.
truncata, 3.
venusta, 18.
verrucosa, 1.

A. *Fls. scarcely 1 in. long, mostly ventricose.*

B. *Lvs. radical, in 2 nearly straight ranks, not keeled.*

C. *The lvs. with pale raised warts.*

1. **verrucòsa,** Haw. (*Alòe verrucòsa,* Mill. *A. dísticha,* Linn. *A. verrùcula,* Medikus. *A. acuminàta* and *A. racemòsa,* Lam.). Cespitose: lvs. acute, somewhat concavely 3-sided, spreading, ½ x 4–6 in., dull gray, very rough with white crowded tubercles: infl. 2 ft. high, typically simple. Cape. B.M. 837. DC., Pl. Gr. 63. Berger 42, 43.—Varies in a form with lvs. 1 ft. long and branched infl., var. **latifòlia,** Salm (*Alòe lingua* var., Ker), B.M. 1322, f. 2, 3. Salm, Aloe § 29, f. 25; a form with large greener more mucronate lvs. with less crowded warts, var. **intermèdia,** Baker (*G. intermèdia,* Haw. *Alòe intermèdia,* Haw.), Salm, Aloe § 29, f. 24. B.M. 1322, f. 1; and a form with scarcely concave greener lvs. with the greenish warts somewhat in lines on the back, var. **scabérrima,** Baker (*G. intermèdia scabérrima,* Haw. *Alòe scabérrima* Salm), Salm, Aloe § 29, f. 26. Hybrids are reported between *G. verrucosa* and *G. pulchra; G. verrucosa intermedia* and *G. carinata* as well as *Haworthia radula;* and *G. verrucosa latifolia* and *G. brevifolia.*

CC. *The lvs. not white-warty.*

2. **conspurcàta,** Haw. (*G. dísticha conspurcàta,* Baker. *Alòe conspurcàta,* Salm). Lvs. obtuse, mucronate, little concave, 1½ x 10–12 in., green, smooth except on the margin, with small often confluent white spots: infl. 2½–3 ft. high, simple. Cape. Salm, Aloe § 29, f. 31.

3. **angulàta,** Haw. (*G. dísticha angulàta,* Baker. *G. longifòlia,* Haw. *Alòe angulàta,* Willd. *A. lingua longifòlia,* Haw.). Lvs. abruptly short-mucronate, a little concave on one or both faces, 2 x 8–10 in., one or both edges angularly doubled, dark green with small often confluent white spots: infl. 3 ft. high, exceptionally branching. Cape(?). Salm, Aloe § 29, f. 29.—A form with gutter-like lvs. is var. **truncàta,** Berger (*A. angulàta truncàta,* Willd.).

4. **sulcàta,** Haw. (*G. angulàta,* Haw. *Alòe sulcàta,* Salm. *A. lingua angulàta,* Haw.). Lvs. concavely strap-shaped, 4-angled, 1 x 4 in., dull green with small greenish little-raised dots: infl. 2 ft. high, simple; fls. little inflated. Cape. Salm, Aloe § 29, f. 32.

5. **língua,** Berger (*G. dísticha,* Haw. *G. denticulàta,* Haw. *Alòe lingua,* Thunb. *A. dísticha,* R. & S.). Lvs. obtusely mucronate, oblong, somewhat concave, 2-edged, denticulate above, 2 x 8–10 in., green or grayish with more or less banded and pale greenish spots: infl. 3 ft. high, simple. Cape. Salm, Aloe § 29, f. 33. Berger 44.

6. **nígricans,** Haw. (*Alòe nígricans,* Haw. *A. oblìqua,* Jacq.). Lvs. oblong, abruptly mucronate, 2-edged, 2 x 5–8 in., glossy dark green or purplish with more or less banded pale greenish spots: infl. 3 ft. high, sometimes branched. Cape. Salm, Aloe § 29, f. 7.—Varies into a less mottled form with shorter fleshier lvs., var. **crassifòlia,** Haw. (*A. lingua crassifòlia,* Ait. *A. crassifòlia,* R. & S.), B.M. 838. J.H. III. 60, p. 98; and a white- and rosy-marbled form with smaller lvs., var. **marmoràta,** Baker (*A. marmoràta,* Salm. *A. formòsa,* R. & S.).

7. **subnígricans,** Haw. (*G. nígricans subnígricans,* Baker. *Alòe subnígricans,* Spreng. *A. pseudonígricans,* Salm). Lvs. scarcely 1 in. wide, acute, green with small separate rather transversely arranged pale spots: infl. 3 ft. high, simple; fls. ventricose. Cape. Salm, Aloe § 29, f. 10.—Varies into a form with more concave lvs., var. **canaliculàta,** Salm; and a form with sword-like darker lvs., var. **glàbrior,** Haw. (*Alòe guttàta,* Salm. *A. nígricans denticulàta,* Salm. *G. nígricans guttàta,* Baker). Salm, Aloe § 29, f. 9.

BB. *Lvs. crowded along an evident if short st.*

C. *The lvs. in 2 straight or twisted ranks.*

8. **planifòlia,** Baker (*Alòe planifòlia,* Baker) Lvs. in straight ranks, narrow, abruptly mucronate, 2-edged, ¾ x 6–10 in., glossy green with more or less confluent oblong white spots, the minutely rough margin often rosy: infl. 6 ft. high, or more, simple; perianth very abruptly inflated below. Cape. Ref. Bot. 162.

9. **pícta,** Haw. (*Alòe Boureàna,* R. &. S., *A. Bowieàna,* Salm). Lvs. in twisted ranks, tongue-shaped, abruptly mucronate, somewhat concave and 3-sided, 1½–2 x 10–14 in., glossy dark green mottled with round white spots confluent below, the thickened margin subentire: infl. 3 ft. high, branched. Cape. Salm, Aloe § 29, f. 3.—Varies into the smaller var. **formòsa,** Berger (*Alòe Bowieàna formòsa,* Salm. *G. formòsa,* Haw.).

10. **maculàta,** Haw. (*G. oblìqua,* Haw. *G. nígricans platyphýlla,* Baker. *Alòe maculàta,* Thunb. *A. oblìqua,* Haw. *A. maculàta oblìqua,* Ait.). Lvs. in somewhat twisted ranks, tongue-shaped, blunt or abruptly mucronate, 2-edged or with one margin doubled, 1¾–2 x 6–8 in., glossy dark green with more or less confluent large oblong spots or entirely white at base below, rough-margined: infl. 3–4 ft. high, branched. Cape. Salm Aloe § 29, f. 1. B.M. 979. Berger 47.—Two varieties are distinguished: var. **fállax,** Haw. (*A. maculàta angústior,* Salm), with smaller whiter smooth lvs., and var. **Dregeàna,** Berger, with rough-margined lvs.

11. **púlchra,** Haw. (*Alòe maculàta púlchra,* Ait. *A. púlchra,* Jacq). Lvs. in spiral ranks, falcate, narrowed from the base, acute, scarcely 1 x 8–10 in., glossy dark green with oblong white spots transversely or reticulately confluent, slightly rough-margined: infl. 3 ft. high, branched. Cape. Jacq., Schoenbr. 4:19. Salm, Aloe § 29, f. 2. DC., Pl. Gr. 91. B.M. 765. Miller, Icon. 292. Berger 47.—It is said to have been crossed with *G. verrucosa.*

CC. *The lvs. not 2-ranked.*

12. **marmoràta,** Baker. Lvs. smooth, lorate-lanceolate, rounded and cuspidate at tip, 1–1½ x 5–6 in., with one margin doubled, dark green with large greenish more or less confluent spots: infl. 2–2½ ft. high. branched. Cape.

BBB. *Lvs. nearly radical, typically keeled or triquetrous.*

c. *The lvs. in 2 spiral ranks.*

13. **excavàta,** Haw. (*Alòe excavàta,* Willd. *A. obscùra,* Willd.). Lvs. smooth, rather thin, spreading, lanceolate, mucronately acute, denticulate, 1–1½ x 4–5 in., dull pale green with small greenish white spots: infl. 2 ft. high, simple. Cape. Salm, Aloe § 29, f. 22. B.M. 1322, f. 4.

cc. *The lvs. not 2-ranked.*

14. **parvifòlia,** Baker. Lvs. thick, deltoid-oblong, submucronate, somewhat roughened on keel and margin, 1 x 2–3 in., purplish green with small whitish spots: infl. 1½ ft. high, simple. Cape. Berger 49.

15. **carinàta,** Haw. (*Alòe carinàta,* Mill. *A. tristicha,* Medikus). Lvs. thick, spreading, triangular-lanceolate, somewhat falcate, acute from the 2-in. base, 5–6 in. long, grooved above, dull green with coarse whitish warts sometimes in irregular lines: infl. 2½–3 ft., sometimes branched. Cape. B.M. 1331*a*. Salm, Aloe § 29, f. 20. Berger 50.—Varies into a larger smoother form, var. **strigàta,** Baker (*G. strigàta,* Haw. *A. carinàta lævior,* Salm); a form with narrower more falcate lvs. with smaller pale points, var. **falcàta,** Berger; and a form with short broad still finer-punctate lvs., var. **latifòlia,** Berger. It is said to have been crossed with *G. verrucosa intermedia.*

16. **glàbra,** Haw. (*Alòe glàbra,* Salm. *A. carinàta subglàbra,* Haw.). Lvs. triangular-lanceolate, acute or mucronate from the 2-in. base, 6–8 in. long, dull green with small scarcely raised whitish points: infl. 2½–3 ft. high. Cape. Salm, Aloe § 29, f. 19. B.M. 1331, lf. at left.—Respectively larger and smaller forms are sometimes designated as vars. **màjor** and **mìnor.**

17. **nítida,** Haw. (*Alòe nítida,* Salm). Lvs. triangular-lanceolate, acute from the 2-in. base, 6–9 in. long, smooth, light glossy green with white often banded spots, the margin roughish: infl. 3 ft. high, simple. Cape. Salm, Aloe § 29, f. 17.—Varies in a form with more numerous smaller pale dots, var. **parvipunctàta,** Salm (*A. nítida màjor,* Salm). B.M. 2304; and one with fewer, larger and more confluent spots, var. **grandipunctàta,** Salm (*A. nítida mìnor,* Salm).

AA. *Fls. 1½–2 in., little inflated, long-stalked: large for the genus.*

18. **acinacifòlia,** Haw. (*Alòe acinacifòlia,* Jacq.). Lvs. acute, 3-edged, spreading in a large 2-ranked rosette, 2 x 14 in., rather glossy dark green with scattered low pale dots: infl. about 4 ft. high, branched below. Cape. B.M. 2369. Berger 52.—Varies in a more erect-lvd. form, var. **ensifòlia,** Baker (*G. ensifòlia,* Haw.), Salm, Aloe § 29, f. 12; a form with more confluent low mottling, var. **nìtens,** Baker (*G. nìtens,* Haw. *Alòe nìtens,* R. & S.); and a narrower-lvd. form with somewhat seriate slightly raised whiter spots, var. **venústa,** Baker (*G. venústa,* Haw. *Alòe venústa,* R. & S. *A. acinacifòlia venústa,* Salm). It has been crossed with *Aloe striata.*

G. brevifòlia, Haw. Lvs. 3–4 in. long, lingulate, close together: fls. red, about 1 in. long. Afr.—*G. Húttoniæ,* N. E. Br. Lvs. in a loose rosette, 16–18 in. long, broad at base, narrowed above, obliquely keeled: fls. pendulous, nearly 1 in. long, rose with green-keeled lobes. S. Afr.—*G. obtusifòlia,* Haw. Lvs. thinner than in G. sulcata and shorter than in G. lingua.

William Trelease.

GASTÒNIA PALMÀTA: *Trevesia.*

GASTROCHÌLUS (Greek-made name, alluding to the swollen lip). *Zingiberàceæ.* A very few Indian and Malayan herbs, perennial or annual, that may sometimes be found in choice collections of hothouse plants. Allied to Hedychium and Kaempferia, differing from the former in the character of the connective and from the latter in the sac-form lip: sometimes provided with a creeping rootstock: st. very short or none, or reaching 12 in. high: lvs. oblong and acute: fls. mostly white with lip yellow or pink, solitary or in spikes; corolla-tube slender and the segms. connivent; staminodia present and petal-like; lip oblong and entire but the margin sinuate, exceeding the corolla; ovary 3-celled, each cell many-ovuled. *G. pulchérrima,* Wall., is leafy-stemmed, to 12 in., from a creeping rootstock: fls. white in a spike 2–3 in. long, the lip tinged pink. H. U. 4, p. 100. *G. longiflòra,* Wall., is acaulescent, with lvs. to 12 in. long: fls. 1 or 2 from the crown, long-tubed, white, the lip tinged red. The Gastrochilus of Don is orchidaceous, and is now referred to Saccolabium.

L. H. B.

GASTROLÒBIUM (Greek-made name, referring to the swollen pods). *Leguminòsæ.* More than 30 shrubs of W. Austral., little known in cult. Lvs. simple and entire, mostly stiff: fls. yellow or in part purple-red, racemose in corymbs or whorls; calyx 5-lobed; petals clawed, the standard orbicular or kidney-shaped, and emarginate, the wings oblong, and the keel broad and short; stamens free; style filiform, incurved: pod turgid, ovoid or nearly globular. *G. velùtinum,* Lindl. A handsome shrub: lvs. in 3's or 4's, varying from obovate to linear-cuneate, very obtuse, emarginate, ¾in. or less long: fls. orange-red, on villous pedicels, in terminal clusters to 1½ in. long: pod ovoid, about ¼in. long. *G. cuneàtum,* Henfr., may be the same as the foregoing, perhaps with longer racemes. J.F. 3:258. *G. villòsum,* Benth. Decumbent with ascending sts.: lvs. opposite, ovate to almost lanceolate, very obtuse, 1–2 in. long: fls. in terminal pedunculate racemes 3–4 in. long; standard orange-red, shorter lower petals purple-red: pod broadly ovoid, about ⅓in. long. B.R. 33:45. J.F. 4:341. *G. ovalifòlium,* Henfr. Diffuse shrub: lvs. mostly opposite, ovate or oblong or orbicular, 1 in. or less long, often emarginate: fls. nearly sessile in racemes 1–3 in. long, orange or orange-red, the lower petals deeply colored. J.F. 3:247, 324.

L. H. B.

GASTRONÈMA: A section of *Cyrtanthus.*

GAULTHÈRIA (named by Kalm after Dr. "Gaulthier," a physician in Quebec, whose name was really written Gaultier). *Ericàceæ.* Ornamental woody plants grown for the attractive flowers and fruits and also for their handsome evergreen foliage.

Evergreen erect or procumbent shrubs, rarely small trees, usually hairy and glandular: lvs. petioled, roundish to lanceolate, mostly serrate: fls. in terminal panicles or axillary racemes or solitary; calyx 5-parted; corolla urceolate, 5-lobed; stamens 10; ovary superior: fr. a 5-celled, dehiscent caps., usually inclosed by the fleshy and berry-like calyx.—About 90 species in the warmer and subtropical regions of Asia, Austral., and in Amer. from Canada to Chile. Some have edible fruits, and an aromatic oil used in perfumery and medicine is obtained from *G. procumbens* and several Asiatic species.

This genus includes the wintergreen and some other ornamental low aromatic plants with alternate, evergreen leaves, white, pink or scarlet, often fragrant flowers in terminal or axillary racemes or solitary, and with decorative, berry-like red or blackish fruit. *G. procumbens* is fully hardy North, while the other North American species are somewhat tenderer and need protection during the winter; *G. Veitchiana* promises to be hardy as far north as Massachusetts. They are well adapted for borders of evergreen shrubberies as well as for rockeries, and in suitable soil they are apt to form a handsome evergreen ground-cover. Most of the foreign species can be grown only South or as greenhouse shrubs. They grow best in sandy or peaty, somewhat moist soil and partly shaded situations. Propagation is by seeds, layers or suckers, division of older plants, and also by cuttings of half-ripened wood under glass.

A. *Fls. solitary.*

procúmbens, Linn. Wintergreen. Checkerberry. Boxberry. Partridge Berry. St. creeping, sending up erect branches to 5 in. high, bearing toward the end 3–8 dark green, oval or obovate, almost glabrous lvs., 1–2 in. long, with ciliate teeth: fls. solitary, nodding; corolla ovate, white, about ¼in. long; anthers with 4 awns; filaments pubescent: fr. scarlet. July–Sept. Canada to Ga., west to Mich. B.M. 1966. L.B.C. 1:82. Gn. 31, p. 379.

AA. *Fls. in racemes.*

Shállon, Pursh. Low shrub, to 2 ft., with spreading, glandular-hairy branches: lvs. roundish-ovate or ovate, cordate or rounded at the base, serrulate, 2–4 in. long: fls. nodding, in terminal and axillary racemes; corolla ovate, white or pinkish: fr. purplish black, glandular, hairy. May, June; fr. Sept., Oct. Brit. Col. to Calif. Called "shallon" or "salal" by Indians. B.M. 2843. B.R. 1411. L.B.C. 14:1372. Gn. 31, p. 379.

Veitchiàna, Craib. Shrub, to 3 ft., sometimes decumbent: branchlets setose: lvs. elliptic to oblong or obovate-oblong, short-apiculate, broadly cuneate or nearly rounded at the base, setose-serrulate, glabrous and lustrous above, paler below and setose on the veins while young, 1½–3½ in. long: fls. in axillary and terminal villous racemes 1–2 in. long, densely bracteate, the bracts as long or longer than the pedicels; corolla ovate, white, ¼in. long: fr. indigo-blue. May, June; fr. Aug., Sept. W. China.

G. antípoda, Forst. Shrub, to 5 ft., sometimes procumbent, hairy: lvs. orbicular to oblong, ¼–⅛in.: fl. solitary, white or pink, campanulate. New Zeal., Tasmania.—*G. coccínea,* HBK. Shrub, to 2 ft., hairy: lvs. roundish ovate, about 1 in.: fls. slender-pedicelled, in elongated, secund racemes; corolla ovate, pink. Venezuela. R.H. 1849:181.—*G. ferrugínea,* Cham. & Schlecht. (G. ignescens, Lem.). Small shrub, rufously hairy: lvs. ovate or oblong, 1–2 in.: fls. almost like those of the preceding species. Brazil. B.M. 4697. J.F. 3:265; 4:371.—*G. fragrantíssima,* Wall. Shrub or small tree, glabrous: lvs. elliptic to lanceolate, 2½–3½ in. long: racemes axillary, erect, shorter than the lvs.; corolla white or pinkish, globular-ovate. Himalayas, Ceylon. B.M. 5984.—*G. myrsinìtes,* Hook. Allied to G. procumbens. Lvs. orbicular or broadly ovate, ½–1 in. long: corolla broadly campanulate; filaments glabrous; anthers without awns. Wash. to Calif. and Colo.—*G. nummularioìdes,* D. Don (G. Nummularia, DC.). Procumbent: branches densely rufously hairy: lvs. orbicular to ovate, ½–1 in. long: fls. solitary, ovate, white. Himalayas. G.C. II. 22:457.—*G. oppositifòlia,* Hook. f. Shrub, to 8 ft.: lvs. mostly opposite, ovate, cordate, bluntly toothed, 1½–2½ in. long: fls. white, urceolate, ⅙in. long, in terminal panicles 3–4 in. long. New Zeal. G.C. III. 52:109. Gn. 75, p. 412.—*G. ovatifòlia,* Gray. Procumbent, with ascending and sparingly hairy branches: lvs. ovate, acute, 1–1½ in. long: fls. solitary, campanulate: fr. scarlet. Brit. Col. to Ore.—*G. pyroloìdes,* Hook. f. & Thom. (G. pyrolæfolia, Hook. f.). Low shrub, sometimes procumbent, almost glabrous: lvs elliptic-obovate, about 1½ in. long: racemes few-fld., axillary. Himalayas, Japan. Var. *cuneàta,* Rehd. & Wilson. Branchlets minutely villous: lvs. narrow, oblong-obovate, cuneate: ovary and fr. villous. W. China.—*G. trichophýlla,* Royle. Dwarf: lvs. elliptic, ciliate, ⅙–½ in. long: fls. axillary, pinkish: fr. blue. Himalayas, W. China. B.M. 7635.

Alfred Rehder.

GAÙRA (Greek, *superb*). *Onagràceæ.* This includes several herbs which are distinct in appearance, but scarcely possess general garden value, although they are pleasant incidents in the hardy border for those who like native plants.

Annual, biennial or perennial plants confined to the warmer regions of N. Amer.: lvs. alternate, sessile or stalked, entire, dentate, or sinuate: fls. white or rose, in spikes or racemes; calyx-tube deciduous, obconical, much prolonged beyond the ovary, with 4 reflexed lobes; petals clawed, unequal; stamens mostly 8, with a small scale-like appendage before the base of each filament; stigma 4-lobed, surrounded by a ring or cup-like border: fr. nut-like, 3–4-ribbed, finally 1-celled, and 1–4-seeded.—Species 20–25. The bloom ascends the slender racemes too slowly to make the plants as showy as possible. The best kind is *G. Lindheimeri,* which has white fls. of singular appearance, with rosy calyx-tubes. Gauras are easily prop. by seed. They prefer light soils, and the seedlings can be transplanted directly into permanent quarters.

A. *Height 3 ft.: fls. white.*

Líndheimeri, Engelm. & Gray. St. hairy and more or less branched above: lvs. lanceolate or more often spatulate with a few wavy teeth and recurved margins: fls. in a loose spike. Texas and La. R.H. 1851:41; 1857, p. 262. H.F. 8:145. G.W. 14, p. 100.

AA. *Height 1 ft.: fls. rosy, turning to scarlet.*

coccínea, Nutt. An erect or ascending, usually much-branched perennial: lvs. numerous, lanceolate to linear or oblong, repand-denticulate or entire: fls. in spikes, very showy, except that the whole spike does not come into flower at one time: fr. 4-sided. Manitoba to Mont. and Texas.

Wilhelm Miller.
N. Taylor.†

GAÙSSIA (probably from a personal name). *Palmàceæ.* One slender pinnate-leaved palm, reaching about 20 ft., from Cuba, recently intro. in S. Calif. It is allied to Hyophorbe and Pseudophœnix. **G. prínceps,** Wendl., is a spineless species, the st. thickened below but very slender above: lvs. pinnatisect, the pinnæ crowded and narrow-linear and entire or 2-cut: fls. very small, on filiform branches, monœcious; spadix long-stalked: fr. small, purple or red.

L. H. B.

GAỲA (for Jacques and perhaps Claude Gay, writers on the plants of W. S. Amer.). *Malvàceæ.* About a dozen herbs, shrubs or small trees of S. Amer. except the one described below: mostly tomentose: lvs. usually undivided: fls. yellow or white, axillary or terminal, pedunculate, with no bracteoles; calyx 5-parted; staminal column split at apex into many parts; ovary many-celled and style-branches as many as the cells, the ovules 1 in each cell. *G. Lỳallii,* Baker (*Plagiánthus Lỳallii,* Gray), the lacebark, endemic in the southern island of New Zeal., is recorded in horticultural literature abroad. It is said by Cheeseman to be one of the most beautiful trees of the New Zealand flora, often forming a broad fringe to the subalpine beech forests. It is partly deciduous at high elevations, but is evergreen in certain river valleys. It is a small spreading tree 15–30 ft. high: lvs. ovate, acuminate, usually double-crenate, sometimes somewhat lobed: fls. to 1 in. diam., white, in axillary fascicles or rarely solitary; petals obliquely obovate, retuse. G.C. III. 50:56, and Suppl. Sept. 23, 1911. B.M. 5935.—Hardy in the south of England, where it blooms profusely.

L. H. B.

GAYLUSSÀCIA (after J. L. Gaylussac, eminent French chemist; died 1850). Syn., *Adnària.* *Ericàceæ,* tribe *Vaccínieæ.* Huckleberry. Small shrubs, some grown for their handsome flowers, others valued for their edible fruits.

Evergreen or deciduous: lvs. alternate, short-petioled, usually entire: fls. in axillary, usually few-fld. racemes; calyx 5-lobed, persistent; corolla tubular-campanulate or urceolate; stamens 10; anthers acute; ovary inferior, 10-celled, each cell with 1 ovule: fr. a berry-like drupe with 10 nutlets.—About 50 species in E. N. Amer. and S. Amer. Closely allied to Vaccinium, distinguished by the 10-celled ovary, each cell with 1 ovule.

The huckleberries are low shrubs with white, red, or reddish green flowers, and blue or black mostly edible fruits. The deciduous species are hardy North, but are of little decorative value, the handsomest being *G. dumosa,* while the evergreen species, all inhabitants of the South American mountains, except the half-hardy *G. brachycera,* are often very ornamental in foliage and flowers, but tender and hardly cultivated in this country. They grow best in peaty or sandy soil and in shaded situations; but *G. baccata* thrives well also in drier localities and exposed to the full sun; like other Ericaceæ, they are all impatient of limestone. Propagated by seeds, layers or division; the evergreen species by cuttings of half-ripened wood under glass. See also *Vaccinium* for cultivation.

A. *Lvs. evergreen, obtusely serrate.*

brachýcera, Gray. Low shrub, with creeping and ascending st. and spreading angled glabrous branches: lvs. oval, glabrous, ½–1 in. long: racemes short, with few white or pinkish fls.: fr. blue. May, June; fr. July, Aug. Pa. to Va. B.M. 928. L.B.C. 7:648 (as *Vaccinium buxifolium*).

AA. *Lvs. deciduous, entire.*

B. *Fls. in loose racemes; corolla campanulate.*

C. *Plant glandular-pubescent.*

dumòsa, Torr. & Gray. Shrub, to 2 ft., with creeping st. and almost erect, somewhat hairy and glandular branches: lvs. obovate-oblong to oblanceolate, mucronate, shining above, leathery, 1–2 in. long: fls. white or pinkish; bracts foliaceous and persistent: fr. black, usually pubescent, rather insipid. May, June; fr. Aug., Sept. Newfoundland to Fla. and La. in moist sandy or swampy soil. B.M. 1106 (as *Vaccinium*).

1623. Gazania splendens. (×½)

CC. *Plant slightly pubescent or glabrous.*

frondòsa, Torr. & Gray. Blue Huckleberry. Dangleberry. Tangleberry. Shrub, to 6 ft., with spreading, usually glabrous branches: lvs. oblong or oval-obovate, obtuse or emarginate, pale green above, whitish beneath, membranaceous, 1–2 in. long: fls. slender-pedicelled; corolla broadly campanulate, greenish purple: fr. blue, with glaucous bloom, sweet. May, June; fr. July. N. H. to Fla., west to Ky., preferring moist, peaty soil. Em. 2:451. G.C. III. 7:580.

ursìna, Torr. & Gray. Shrub, to 6 ft., with somewhat pubescent, spreading branches: lvs. obovate to oblong, acute, membranaceous, 2–4 in. long: fls. white or pinkish: fr. black, shining, sweet. May, June; fr. July, Aug. N. and S. C.—Harlan P. Kelsey writes of this species: "Shrub 2 to 6 feet high; very local in a few counties in southwestern North Carolina, though common in these stations. Locally it is known as 'buckberry,' a name given by the native mountaineers from the fact that deer feed on the very abundant clustered fruit in late summer. The berries are much used for pies and jams, and have a most peculiar and pleasant acid flavor, unlike any other Vaccinium. It promises to be a valuable addition to our garden fruits."

BB. *Fls. in short, sessile racemes; corolla ovate.*

baccàta, Koch (*G. resinòsa*, Torr. & Gray). Black Huckleberry. Erect shrub, to 3 ft., resinous when young: lvs. oval or oblong-lanceolate, mucronulate, yellowish green above, pale beneath, 1–1½ in. long: fls. short-pedicelled, nodding, reddish: fr. black, rarely white, sweet. May, June; fr. July, Aug. Newfoundland to Ga., west to Wis. and Ky., preferring sandy or rocky soil. Em. 451. B.M. 1288 (as Vaccinium). I.T. 4:152. Var. **glaucocárpa,** Rob. Frs. larger, blue with glaucous bloom.

G. Pseùdo-Vaccìnium, Cham. & Schlecht. Evergreen, usually glabrous shrub, to 3 ft., with elliptic, entire lvs. and red fls. in secund, many-fld. racemes. Brazil. B.R. 30:62. R.H. 1845:285

Alfred Rehder.

GAZÀNIA (after Theodore of Gaza, 1393–1478, translator of Aristotle and Theophrastus; by some considered to be derived from Greek, *riches*, owing to the splendid floral coloring). *Compósitæ.* Showy plants grown in a cool greenhouse or in the open border in summer.

Herbaceous, mostly perennial, rarely annual, with short sts. or none: lvs. crowded at the crown of the root, or scattered along the st.: involucral scales in 2 or several rows, cup-like at the base, toothed at the apex: achenes wingless, villous; pappus in 2 series of very delicate, scarious, toothed scales, often hidden in the wool of the achene.—Species 24–30. This group contains some of the finest of the sub-shrubby composites from the Cape of Good Hope. They have a wide range of color,—pure white, yellow, orange, scarlet, and the backs of the rays are in some cases rich purple, and even azure-blue. Their foliage is often densely woolly beneath, and the range of form is unusual. The group is also notable for the spots near the base of the rays of *G. Pavonia* and some others. These markings suggest the eyes of a peacock's tail. The plants are also remarkable for their behavior at night, when they close their fls. and turn their foliage enough to make the woolly under sides of the lvs. more conspicuous.

Gazanias are now rarely met with in some of the oldest-fashioned florists' establishments. Few of the more prominent firms keep them now, and they may be said to be practically out of the trade in America. All the kinds described below are old garden favorites abroad, particularly *G. rigens*, a common bedding plant, cultivated for nearly a century and a half, but whose precise habitat has never been ascertained. They are of easy culture in the cool greenhouse, and are commended for summer use in the borders of those who can keep them under glass in winter. They can be rapidly propagated in midsummer by cuttings made from the side shoots near the base and placed in a close frame.

A. *Color of heads yellow.*

B. *Rays not spotted: heads 2 in. across.*

unifiòra, Sims. Sts. woody at the base, spreading 6–12 in. or more from a center: lvs. varying as mentioned above. The woolliness also varies greatly: sometimes the whole plant is snowy white; sometimes the whiteness is confined to the under sides of the lvs. B.M. 2270. L.B.C. 8:795.—The involucre is woolly, according to Harvey, but the pictures cited do not show it. This and *G. rigens* have short sts. with branches alternately leafy, while *G. pinnata*, *G. Pavonia* and *G. pygmæa* have little or no st. and the lvs. radical or tufted at the ends of the short branches.

BB. *Rays spotted at base: heads 3 in. or more across.*

pinnàta, Less. Rootstock perennial, fibrous: lvs. commonly pinnate (some simple); lobes oblong or linear in several pairs; white on both surfaces and stiff-hairy: peduncle not much longer than lvs.; involucral scales acuminate, particularly the inner ones. Harvey names 6 botanical varieties.

AA. *Color of heads orange: rays spotted at base: heads 3 in. or more across.*

B. *Lvs. mostly entire and spatulate.*

C. *Basal markings containing brown.*

rìgens, R. Br. Sts. short and densely leafy or diffuse, laxly leafy, with ascending branches: lvs. sometimes sparingly pinnatifid, i. e., with only 1 or 2 side lobes, white beneath except on the midrib: heads large and showy, 1½ in. wide, the rays orange, disk purplish black. B.M. 90 (as *Gorteria rigens*) shows a head of scarlet rays, with basal markings of brown, black and white.

CC. *Basal markings without brown.*

spléndens, Hort. Fig. 1623. Hybrid, said to resemble *G. uniflora* in habit but dwarfer and more compact. Of the kinds in common cult. it is nearest to *G. Pavonia* in coloring of fls. H.F. II. 4:240.

BB. *Lvs. mostly pinnate.*

Pavònia, R. Br. PEACOCK GAZANIA. Involucral scales short, the inner broad, acute or subacute. B.R. 35 shows markings of brown, white, yellow and blue, which are marvelous in design and precision of execution.

AAA. *Color of heads white above.*

pygmæ̀a, Sond. Crown woody and much divided: lvs. spatulate, entire: rays white, striped purple beneath. Gn. 47:288. I.H. 43:53. B.M. 7455. G. 30:101. Var. **maculàta,** N. E. Br. Rays pale creamy white, with a blackish spot at the base, reverse striped dull purple. Var. **supérba,** N. E. Br. Rays white, unspotted, reverse striped bluish. Var. **lùtea,** Hort. Fl.-heads very large, chrome-yellow.—This species is very variable in its involucral scales, which may be short or long, sometimes cup-shaped at the base, and again almost free. This upsets one of the most important features of Harvey's key.

A hybrid between G. nivea, Less., and G. longiscapa, DC., known as *G. hýbrida*, has been described as a very profuse bloomer, flowering continuously from June to late autumn. R.H. 1900:209. Gt. 47:134.—*G. longiscàpa*, DC. (G. stenophylla, Hort.), is a white-woolly perennial with a glabrous peduncle which is shorter than the lvs.: involucre glabrous.—*G. nívea*, DC. Very dwarf, almost woody: lvs. crowded, hoary-tomentose on both sides: peduncle not exceeding the lvs.: involucre tomentose. Last two probably not cult. in Amer.

WILHELM MILLER.
N. TAYLOR.†

GEISSORHÌZA (Greek words alluding to the coats of the bulb, which cover it somewhat like overlapping tiles). *Iridàceæ.* Ixia-like half-hardy Cape bulbs, which are dormant from August to November and are usually flowered under glass in spring and early summer.

Cormous: lvs. few, distichous: fls. in different colors, in open, simple or forked spikes; perianth nearly regular, rotate, with a cylindrical tube; stamens 6, inserted in the throat; ovary 3-celled, becoming a small oblong caps.—Species about 30, 1 in Madagascar and the others in S. Afr. The genus has a wide range in habit and in color of fls., but these plants are presumably inferior to ixias for general culture. The following species are advertised.

rochénsis, Ker. Corm ¼in. diam., globular: lvs. 3, one of them on the st., glabrous, basal ones narrow, few-ribbed: st. 3–6 in., simple or forked, with 1 fl. at the top; st.-sheath loose and swelling: fls. violet-purple, 1–2 in. across; perianth-tube shorter than the spathe; segms. with a blotch at the base. B.M. 598, where the whole plant is a trifle over 3 in. high and the fls. purple, with a dark red eye, the latter surrounded by a pale blue circle.

hírta, Ker. Lvs. hairy: fls. 2–6 in a loose spike, bright red, the tube very short, segms. not blotched: corm ½in. diam., globular.—Offered in S. Calif. L. H. B.

GEITONOPLÈSIUM (Greek-made name, *near neighbor*, in allusion to its kinship to another genus). *Liliàceæ.* Woody stemmed twiners of Austral. and Pacific islands of probably 2 species; one is offered in S. Calif. Fls. small, in loose terminal clusters: lvs. alternate, linear to ovate, very short-stalked, lightly nerved; perianth with 6 oblong distinct segms., the 3 outer ones more or less hood-shaped at times, the inner ones flat and obtuse; stamens 6, included: fr. a nearly globular berry with thin pulp and becoming dry; seeds irregular, black. **G. cymòsum,** Cunn. Tall-climbing, with wiry sts.: fls. purplish green, the perianth ⅛in. or less long, the pedicels very short and jointed under the fl.: berry dark blue, ½in. or less diam.; seeds few. Queensland to Victoria. B.M. 3131. L. H. B.

GELSÈMIUM (from the word *Gelsemino*, the Italian name of the true jessamine). *Loganiàceæ.* Climbing shrubs, with evergreen foliage and yellow flowers.

Glabrous, twining, shrubby plants, with opposite, rarely whorled lvs., and showy, hypogynous, perfect, regular, yellow and very fragrant fls., in axillary and terminal cymes, the pedicels scaly-bracted: calyx imbricated, deeply 5-parted; corolla funnelform, 5-lobed, imbricated in the bud; stamens 5, epipetalous; ovary solitary, superior, 2-celled; ovules numerous, on narrow placentæ; style slender, 4-cleft: fr. an elliptic, septicidal caps., flattened contrary to the partition; valves boat-shaped, 2-cleft at the apex; seeds flattened and winged.—There are 2 species in the genus, one American the other Chinese. The American or Carolina yellow jessamine is a well-known woody twiner of the S., bearing evergreen foliage and a profusion of bright yellow, very fragrant fls. The cymes of the Chinese species are terminal and trichotomous. Our species is very desirable for covering banks and fences in any soil. It is also grown occasionally in conservatories. The rhizomes and roots are used medicinally as a nervine, antispasmodic and sedative. The true jessamine is *Jasminum officinale* (*Oleaceæ*) of Eu.

sempérvirens, Ait. f. CAROLINA YELLOW JESSAMINE. St. high-climbing: lvs. ovate, or lanceolate, shining, entire, short-petioled, 1–3 in. long: cymes terminal, 1–6-fld.; the fls. dimorphous; corolla 1–1½ in. long. Low woods and thickets, Va. to Fla., Texas and Guatemala; early flowering. B.M. 7851. G.W. 9, p. 494. K. M. WIEGAND.

GENÉTYLLIS: *Darwinia.*

GENÌPA (Brazilian name). *Rubiàceæ.* This includes a West Indian shrub allied to the Cape jasmine and barely known to American horticulture. Genipa and Gardenia are difficult to separate.

Small trees or shrubs: lvs. with short or no stalks, opposite, large, leathery, obovate or lanceolate, shining: cymes axillary, few-fld.; fls. white to yellowish; calyx-limb bell-shaped, truncated, or 5-toothed; corolla salver-shaped, limb twisted to the left, 5-parted; stigma club-shaped or bifid; ovary 1-celled; placentas 2, almost touching each other in the axis: berries edible.

clusiifòlia, Griseb. A shrub 4–10 ft. in the wild, not so large in cult.: lvs. 4 in. or less long, black when dried, obovate, glabrous: corymbs short-peduncled; calyx-limb 5-cut, the pedicels as long as the calyx; corolla glabrous, the tube nearly as long as the lobes: berry ovoid. W. Indies.

americàna, Linn. A small tree: lvs. 5–10 in. long, lanceolate-oblong, glabrous: pedicels shorter than the calyx; corolla silky, white, about 1 in. across: berry similar to last, but is "highly commended in cookery" according to Reasoner, by whom the plant was intro. (1914). W. Indies.—The fr. is largely used in Trop. Amer. as a preserve under the name "genipop." It is often used as a kind of marmalade and has been called "marmalade-box" in Surinam. N. TAYLOR.†

GENÍSTA (ancient Latin name). *Leguminòsæ.* Ornamental woody plants chiefly grown for their handsome yellow, rarely white, flowers.

Deciduous or half-evergreen, sometimes nearly leafless shrubs, unarmed or spiny: branches usually striped and green: lvs. alternate, rarely opposite, entire, simple or sometimes 3-foliolate: fls. papilionaceous, in terminal racemes or heads, rarely axillary, yellow, rarely white; calyx 2-lipped, with the upper lip deeply 2-parted; style incurved: pod globular to narrow-oblong, 1- to many-seeded, dehiscent, rarely indehiscent.—About 100 species in Eu., Canary Isls., N. Afr. and W. Asia. Allied to Cytisus, but without callose appendage at the base of the seeds. The Genista of florists is Cytisus.

The genistas are ornamental, usually low shrubs with showy flowers, appearing profusely in spring or summer, and followed by small, insignificant pods. None of the species is quite hardy North, but *G. tinctoria, G. pilosa, G. germanica* and some other European species will do well in a sheltered position or if somewhat protected during the winter, while the others are more suited for cultivation in southern regions. They are essentially plants suited to drier climates and most of them do well in California. They are adapted for covering dry, sandy banks and rocky slopes, and for borders and rockeries. They grow in any well-drained soil, and like a sunny position. Propagate by seeds, sown in spring, also by layers and by greenwood cuttings under glass.

INDEX.

ætnensis, 9.
cinerea, 10.
elata, 14.
ephedroides, 8.
ferox, 3.
florida, 12.
germanica, 5.
hispanica, 6.
humilior, 14.
mantica, 14.
Martinii, 4.
monosperma, 1.
pilosa, 15.
plena, 14.
polygalæfolia, 13, 14.
sagittalis, 16.
sibirica, 14.
sphærocarpa, 2.
tinctoria, 14.
umbellata, 7.
virgata, 11, 14.

A. *Color of fls. white.*

1. **monospérma,** Lam. (*Retàma monospérma,* Boiss.). Shrub, to 10 ft. or more with slender grayish branches, almost leafless: lvs. small, simple or rarely 3-foliolate, generally linear or linear-spatulate, silky: fls. white, fragrant, in short lateral racemes; corolla silky; calyx purple: pod broadly oval, 1–2-seeded. Feb.–April. Spain, N. Afr. B.M. 683. B.R. 1918. Gn. 55, p. 213; 62, p. 15. G.W. 15, p. 412.

AA. *Color of fls. yellow.*

B. *Twigs striped, not winged.* (Nos. 2–15.)

C. *Pod globular, indehiscent, 1-seeded.*

2. **sphærocárpa,** Lam. Similar to the preceding, but lower and more upright, leafless: fls. yellow, very small, in numerous panicled racemes; corolla glabrous. May, June. Spain, N. Afr.

CC. *Pod oval to linear, dehiscent.*

D. *Shrubs spiny.*

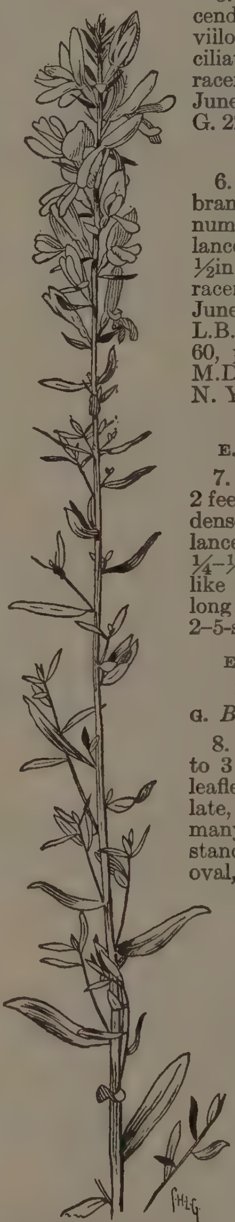
E. *Infl. racemose.*

F. *Spines stout: habit upright, to 6 ft.*

3. **fèrox,** Poir. Erect shrub, to 6 ft., with many stout spines: lvs. simple, rarely 3-foliolate, oblong to obovate, almost glabrous: fls. in numerous terminal racemes along the branches; corolla glabrous, over ½in. long, fragrant: pod linear, densely silky, many-seeded. Spring, in Calif. in autumn and winter. N. Afr. B.R. 368.

FF. *Spines slender: habit decumbent to upright, to 2 ft.*

4. **Martínii,** Verguin & Soulié (*G. Scorpius × G. Villarsii*). Decumbent shrub: branchlets tomentose: lvs. linear-lanceolate, simple, whitish pubescent on both sides, small: fls. axillary, forming terminal slender racemes; calyx pubescent; standard and keel silky. S. France; natural hybrid. Cult. in Calif.



1624. Dyer's Greenweed, Genista tinctoria. (×⅓)

5. **germánica,** Linn. Erect or ascending spiny shrub, to 2 ft., with villous branches: lvs. elliptic-oblong, ciliate: fls. small, in 1–2-in. long racemes: pod oval, villous, few-seeded. June, July. Cent. and S. Eu. R.F. G. 22:2085.

EE. *Infl. head-like.*

6. **hispánica,** Linn. Densely branched shrub, about 1 ft. high, with numerous thin spines: lvs. ovate-lanceolate, pubescent, not exceeding ½in.: fls. in 3–12-fld. short head-like racemes: pod rhombic, hirsute. May, June. Spain, S. France, N. W. Italy. L.B.C. 18:1738. R.H. 1888:36. Gn. 60, p. 395; 62, p. 95. G.M. 45:69. M.D.G. 1907:388.—Hardy in W. N. Y.

DD. *Shrubs unarmed.*

E. *Fls. in terminal heads, sessile.*

7. **umbellàta,** Poir. Erect shrub, to 2 feet, with rigid branches, forming a dense bush: lvs. simple or 3-foliolate, lanceolate or linear-lanceolate, silky, ¼–½in. long: fls. in 10–30-fld. umbel-like heads; corolla silky, over ⅓in. long: pod linear-oblong, tomentose, 2–5-seeded. April, May. Spain.

EE. *Fls. in racemes, or axillary.*

F. *Habit upright.* Nos. 8–14.

G. *Branches rigid: pod 1-seeded, silky.*

8. **ephedroìdes,** DC. Erect shrub, to 3 ft., with rigid branches, almost leafless: lvs. sessile, simple or 3-foliolate, linear, almost glabrous: fls. in many-fld. terminal racemes, small; standard much shorter than keel: pod oval, 1-seeded, silky. April, May. Sardinia, Corsica, Sicily.

GG. *Branches slender: pod 1–10-seeded.*

H. *The fls. axillary on last year's branchlets.*

9. **ætnénsis,** DC. Shrub, to 6 ft., with slender branches, nearly leafless: lvs. simple, small, linear, silky: fls. axillary, forming loose, terminal racemes, fragrant; keel shorter than the standard: pod glabrous at maturity, oblique-oval, 1–3-seeded. June, July. Sicily, Sardinia. B.M. 2674.

10. **cinèrea,** DC. Shrub, to 3 ft.: branches grooved, pubescent while young, sparsely leafy: lvs. simple, lanceolate, pubescent on both sides, ⅓–½in. long: fls. 1–3, axillary, forming terminal racemes to 8 in. long; calyx pubescent; keel pubescent outside: pod 2–5-seeded, silky. April–June. S. Eu., N. Afr. B.M. 8086. G.M. 52:511; 53:507.—This species does not seem to be in the trade at present, but it deserves attention on account of its copious, brilliant yellow fls.

HH. *The fls. in terminal racemes on the young growth.*

I. *Pod pubescent, 1–4-seeded.*

11. **virgàta,** Link (*Spártium virgàtum,* L'Her.). Shrub, to 8 ft., with slender branches: lvs. lanceolate to elliptic, silky-villous, ¼–½in. long: fls. in numerous short 3–6-fld. racemes; standard and keel silky: pod oblong, 1–3-seeded, villous. May–July. Madeira. B.M. 2265. F. 1875:169.

12. **flórida,** Linn. Erect shrub, to 5 ft., with glabrous striped branches: lvs. spatulate-oblong or lanceolate, silky beneath, ⅓–⅔ in. long: fls. in dense, many-fld. racemes; corolla glabrous: pod oblong or narrow-oblong, silky, 2–4-seeded. April–July. Spain.

II. *Pod glabrous or slightly pubescent, rarely densely so, 3–10-seeded.*

13. **polygalæfòlia,** DC. Erect shrub, to 6 ft., with somewhat silky branches: lvs. spatulate-oblong, glabrous above, sparingly silky beneath, ½–⅔in. long: fls. in many-fld. slender racemes; standard and wings glabrous, keel silky: pod oblong or narrow-oblong, almost glabrous, 3–6-seeded. May–July. Spain, Portugal.

14. **tinctòria,** Linn. (*G. sibírica,* Hort. *G. polygalæfòlia,* Hort., not DC.). DYER'S GREENWEED. Fig. 1624. Erect shrub, to 3 ft., with striped, glabrous or slightly pubescent branches: lvs. oblong-elliptic or oblong-lanceolate, almost glabrous, ciliate, ½–1 in. long: racemes many-fld., panicled at the ends of branches; corolla glabrous: pod narrow-oblong, glabrous or slightly pubescent, 6–10-seeded. June–Aug. Eu., W. Asia; naturalized in some places E. B.B. (ed. 2) 2:350. S.E.B. 3:328. R.F.G. 22:2088. Var. **plèna,** Hort. With double fls. R.H. 1899, p. 573. G.W. 16, p. 137. Var. **virgàta,** Mert. & Koch (*G. virgàta,* Willd., not Link, not Lam. *G. elàta,* Wender.). Of more vigorous growth, to 6 ft. high: pod 3–6-seeded. S.E. Eu. Var. **humílior,** Schneid. (*G. mántica,* Poll.). Dwarf and compact, more pubescent: pods silky-villous. Italy.

FF. *Habit procumbent: fls. axillary.*

15. **pilòsa,** Linn. Dwarf, procumbent or ascending: lvs. cuneate, oblong or obovate, dark green and almost glabrous above, silky beneath: fls. axillary, 1–2, often racemose toward the end of branches: pod linear, silky, 5–8-seeded. May, June. Cent. and S. Eu., W. Asia. S.E.B. 3:327. R.F.G. 22:2093.

BB. *Twigs broadly 2-winged.*

16. **sagittàlis,** Linn. (*Cýtisus sagittàlis,* Mert. & Koch). Dwarf, procumbent, with ascending or erect, mostly simple branches: lvs. ovate to oblong, villous: fls. in terminal, short racemes; corolla glabrous: pod linear-oblong, silky. May, June. Eu., W. Asia. R.F.G. 27:2081.

G. álba, Lam.=Cytisus multiflorus.—*G. Andreàna,* Puissant=Cytisus scoparius var. Andreanus.—*G. ánglica,* Linn. Spiny shrub, to 3 ft., sometimes procumbent, glabrous: lvs. oval to linear-oblong, bluish green: racemes few-fld. Cent. Eu. S.E.B. 3:326. R.F.G. 22:2086.—*G. anxántica,* Tenore (G. tinctoria var. anxantica, Fiori). Allied to G. tinctoria. Dwarf, diffuse: lvs. elliptic, obtuse, glabrous: fls. in racemes. Italy.—*G. aspalathoìdes,* Lam. Low, spiny shrub: lvs. simple or 3-foliolate: fls. 1–3, axillary, forming loose, terminal racemes: pod many-seeded. N. Afr.—*G. canariénsis,* Linn.=Cytisus canariensis.—*G. cándicans,* Linn.=Cytisus monspeliensis.—*G. dalmática,* Bartl. Allied to G. germanica. Spiny shrub with appressed or spreading silky pubescence: lvs. linear-lanceolate, simple: fls. in terminal racemes, 1–1½ in. long: pod globose-ovoid, 1-seeded. Dalmatia, Herzegovina. B.M. 8075.—*G. formòsa,* Hort.=Cytisus racemosus.—*G. glabréscens,* Briquet=Cytisus emeriflorus.—*G. hórrida,* DC. Spiny rigid shrub, to 1 ft.: lvs. opposite, usually 3-foliolate, pubescent: fls. 1–3, in terminal heads: pods rhombic-lanceolate, pubescent. S. France, Spain. G.C. III. 53:140.—*G. júncea,* Lam.=Spartium junceum.—*G. lusitánica,* Linn. Spiny shrub, 1–3 ft.: lvs. 3-foliolate; lfts. linear-lanceolate, silky, very small: fls. in peduncled heads. Spain, Portugal.—*G. nyssàna,* Petrovich. Shrub, to 3 ft., silky-villous: lvs. 3-foliolate: fls. in terminal leafy racemes to 8 in. long: pod rhombic, villous, 2-seeded. Servia, Albania. I.T. 5:197.—*G. ovàta,* Waldst. & Kit. Allied to G. tinctoria. To 1 ft., with ascending or erect branches: lvs. ovate to lanceolate, villous: pod villous. S. E. Eu. L.B.C. 5:482.—*G. prostràta,* Lam.=Cytisus decumbens.—*G. racemòsa,* Hort.=Cytisus racemosus.—*G. radiàta,* Scop. Erect shrub, with opposite rigid branches: lvs. simple or 3-foliolate: fls. in 3–6-fld. heads: pod oval, silky. S. E. Eu. B.M. 2260.—*G. Retàma,* Nichols.=G. monosperma.—*G. scariòsa,* Viv.=G. triangularis.—*G. scopària,* Lam.=Cytisus scoparius.—*G. triangulàris,* Willd. Dwarf, with ascending or procumbent triangular branches, glabrous: lvs. obovate to lanceolate, with transparent margin: fls. in short racemes. Italy. S. E. Eu. L.B.C. 12:1135 (as G. scariosa).

ALFRED REHDER.

GENTIÀNA (after Gentius, King of Illyria, who is said to have discovered the tonic value of these plants). *Gentianàceæ.* Choice herbs, mostly blue-flowered, grown in the open, many of them in alpine gardening.

Chiefly perennial herbs, only rarely biennial or annual, often dwarf, diffuse or frequently tufted, sometimes erect and slender or even tall and stout: lvs. opposite, rarely verticillate, mostly sessile: fls. blue, violet, purple, rarely dull yellow or white; floral parts typically 5, rarely 4–7: fr. a caps.—There are about 300 species, widely scattered in temperate and mountainous regions. Many botanists now consider the genus in a highly restricted sense, taking up various names for gentians, such as Amarella, Dasystephana, and so on, but they are here all considered as of the genus Gentiana.

Gentians are amongst the most desirable of alpine plants, and of blue flowers in general, but they are usually considered difficult to establish. The genus is the largest in the family, and from the horticultural standpoint, the most important.

The blue gentian, celebrated by tourists in the Alps, is mostly the stemless *G. acaulis.* This was brought to English gardens so long ago that all record of its introduction is lost. It is by far the most popular kind in cultivation. This species is by some split into five distinct forms, of which *G. angustifolia,* Vill. (not Michx.), is nearest to the Gentianella of English gardens. It has been so much modified in cultivation that it now has stems 4 to 6 inches high and the rootstock is so stoloniferous that the plant has to be cut back every year when used for edgings in English gardens. In France it is easily grown in a compost of one-half humus or leaf-soil and one-half good vegetable mold, to which may be added a little sand. Correvon writes: "It can be multiplied by means of offsets, but it is infinitely better to raise it from seed, and, in doing this, it should not be forgotten that the seeds of this group of gentians are very tedious, and, more especially, very capricious in germinating. I have sown seeds of *G. acaulis,* some of which did not germinate for twelve months, while others (which I must say were more recently gathered) germinated in a few weeks. The seedlings should be potted as soon as possible and while they are very young. They will begin to flower in about three years from the time of sowing, rarely sooner." Except *G. Andrewsii, G. Saponaria* and *G. puberula,* and perhaps a few others, gentians do not thrive so well in America as in England. Our seasons are too hot and dry. Whenever possible, choose a damp atmosphere.

It is rash to generalize on gentian-culture, because some plants are tall, others dwarf, some found on mountains, others in lowlands, some in moist soil, others in dry lands, while some like limestone and others cannot endure it. The annual kinds are of interest only to the expert. Alpine plants in general are singular in requiring an extremely large water-supply, combined with extremely good drainage. Another difficult problem is to keep the plants as cool as they are on the mountains without shading them more than nature does. Gentian seeds are small, and in germination slow and uncertain. They should be sown as soon as gathered, for the thorough drying out of small seeds is, as a rule, soon fatal. Gentians are difficult to establish, and dislike division of the root, but are well worth patient years of trial, for they are very permanent when once established. Nature-like alpine gardens are one of the latest and most refined departments of gardening, and gentians are one of the most inviting groups of plants to the skilled amateur. Consult *Alpine Plants.*

There are several fringed gentians, but ours (*G. crinita,* Fig. 1625) is perhaps the most beautiful of gentians, and one of the choicest and most delicate of American wild flowers. It has been proposed as our national flower, and, while sought after less than the trailing arbutus, it is in even greater danger of extermination in certain states because it is a biennial, and because it has never been successfully cultivated. Seeds of *G. crinita* have long been advertised, but they are difficult to germinate and the plant is not seen in American gardens. The fringed gentian is, however, firmly rooted in American literature, and from the time of Bryant's ode many tributes in verse have been paid to its unique beauty. The daily unfolding of its square-ridged and twisted buds has been watched in thousands of homes. By the artists its blue is often considered the nearest approach to the color of the sky, but it must be confessed that a shade of purple often appears in the older flowers.

1625. Gentiana crinita. (×⅜)

Correvon makes four cultural groups of gentians:

1. *Tall gentians for general culture:* species whose roots are more or less stout, which are of relatively easy culture, and therefore suitable for borders, rockwork and landscape gardening. Typical plant, *G. lutea;* others are *G. affinis, G. alba, G. Andrewsii, G. asclepiadea, G. Bigelovii, G. Burseri, G. Cruciata, G. decumbens, G. Fetisowii, G. gelida, G. Kesselringii, G. macrophylla, G. Olivieri, G. Pneumonanthe, G. Porphyrio, G. Saponaria, G. sceptrum, G. septemfida* and *G. Walujewi.*
2. *Low-growing gentians:* species whose roots being less stout are adapted to rockwork, and for the open ground only when a special compost is provided. Includes *G. acaulis* and the species into which it is sometimes divided.
3. *Tufted gentians:* species with sessile flowers growing little above the level of the ground, and suited to the same positions as Group II. Typical plant, *G. verna:* others are *G. bavarica, G. imbricata, G. oregana, G. ornata, G. pyrenaica,* and *G. pumila.*
4. *Rare gentians:* species which cannot be grown without some special knowledge and practical experience. Typical plant, *G. purpurea;* others are *G. ciliata, G. Froelichii, G. punctata,* and presumably all the rest.

The two most popular gentians in American cultivation seem to be *G. acaulis* and *G. Andrewsii.* These are perhaps, followed by *G. Cruciata, G. puberula* and *G. Saponaria.* The plant which King Gentius knew is probably *G. lutea,* the root of which furnishes the gentian of drugstores. From the same sources comes the liqueur or cordial called "gentiane."

In the index, those marked with an asterisk (*) appear in American trade catalogues; the others are cultivated abroad. (See also Suppl. list, p. 1328). The plants are perennials and mountain-loving, unless otherwise stated.

INDEX.

*acaulis, 51.
adscendens, 3.
affinis, 29.
alata, 48.
*alba, 7, 19, 51.
algida, 10, 11.
alpina, 55.
*Andrewsii, 22.
angulosa, 48.
*angustifolia, 31, 52.
*asclepiadea, 19.
barbata, 16.
bavarica, 49.
*Bigelovii, 39.
brevidens, 37.
Buergeri, 26.
Burseri, 2.
*calycosa, 35.
campestris, 12.
carpatica, 46.
Catesbæi, 21, 22.
ciliata, 15.
*Clusii, 54.
cordifolia, 28.
*crinita, 14.
*Cruciata, 45.
dahurica, 30.
*decumbens, 3.
detonsa, 16.
dinarica, 56.
excisa, 51.
Favratii, 48.
Fortunei, 27.
Freyniana, 28.
frigida, 9, 10.
Froelichii, 18.
Gaudiniana, 43.
gelida, 11.
guttata, 20.
imbricata, 47.
incarnata, 8.
intermedia, 8.
Kochiana, 53.
Kochii, 51.
Kurroo, 37.
*linearis, 23.
*lutea, 1.
*macrophylla, 44.
Moorcroftiana, 13.
*Newberryi, 38.
nivalis, 46.
occidentalis, 17.
ochroleuca, 8.
Olivieri, 30.
*oregana, 40.
ornata, 32.
pannonica, 42.
*Parryi, 36.
Pneumonanthe, 20
Porphyrio, 31.
prostrata, 25.
pseudo-Pneumonanthe, 23.
*puberula, 41.
pumila, 50.
*punctata, 6.
*purpurea, 4.
pyrenaica, 24.
quinqueflora, 17.
*quinquefolia, 17.
rubra, 5.
*Saponaria, 21.
*scabra, 26.
*sceptrum, 34.
*septemfida, 28.
serrata, 16.
Thomasii, 4.
triflora, 35.
Veitchiorum, 32.
verna, 48.
villosa, 8.

KEY TO THE SPECIES.

A. *Calyx spathe-like, split in two.*
B. *Color of fls. yellowish.*
C. *Form of corolla wheel-shaped*..... 1. **lutea**
CC. *Form of corolla club-shaped, at least in bud*.................. 2. **Burseri**
BB. *Color of fls. blue or purple, at least above.*
C. *Corolla plaited*................. 3. **decumbens**
CC. *Corolla not plaited.*
D. *Anthers grown together*......... 4. **purpurea**
DD. *Anthers free*.................. 5. **rubra**
AA. *Calyx with a tubular portion, and usually 5 lobes.*
B. *Color of fls. yellowish, or greenish white.*
C. *Style distinct: caps. not stalked*.... 6. **punctata**
CC. *Style none or very short: caps. stalked.*
D. *Height 2 ft*.................... 7. **alba**
DD. *Height 9–12 in*................ 8. **villosa**
DDD. *Height 6 in. or less.*
E. *Lobes of calyx longer than the calyx-tube*................ 9. **frigida**
EE. *Lobes of calyx shorter than the calyx-tube.*
F. *Lvs. lanceolate-linear*........10. **algida**
FF. *Lvs. ovate-lanceolate*.........11. **gelida**
BB. *Color of fls. blue or purple.*
C. *Corolla not plaited.*
D. *Glands found at the base of the filaments.*
E. *Calyx 4-cut*.................12. **campestris**
EE. *Calyx 5-cut*.................13. **Moorcroftiana**
DD. *Glands not found at the base of the filaments.*
E. *Fringed gentians: calyx 4-cut.*
F. *Caps. raised on a distinct stalk.*
G. *Apex of lobes fringed, the sides less so*.............14. **crinita**
GG. *Apex of lobes not fringed, base fringed*.............15. **ciliata**
FF. *Caps. on a very short stalk*...16. **serrata**
EE. *Not fringed: calyx 5-cut; corolla-lobes tipped with a sharp point*....................17. **quinquefolia**
CC. *Corolla plaited.*
D. *Stigmas 2, always distinct.*
E. *Caps. finally raised on a distinct stalk.*
F. *Anthers permanently grown together.*
G. *Calyx as long as the corolla.*18. **Froelichii**
GG. *Calyx one-half or one-third as long as the corolla.*
H. *Seeds not at all winged*...19. **asclepiadea**
HH. *Seeds slightly winged.*
I. *Fls. open*..............20. **Pneumonanthe**
II. *Fls. closed, blue*.........21. **Saponaria**

HHH. *Seeds strongly winged.*
I. *Fls. closed, purple*.......22. **Andrewsii**
II. *Fls. open*..............23. **linearis**
FF. *Anthers free, at least finally.*
G. *Number of corolla-lobes 10*.24. **pyrenaica**
GG. *Number of corolla-lobes 5 (rarely 4).*
H. *Calyx 4-lobed*...........25. **prostrata**
HH. *Calyx 5-lobed.*
I. *Lvs. distinctly rough above (hispid-scabrous)*......26. **scabra**
II. *Lvs. distinctly rough at the margins (scabrous).*
J. *Lobes of calyx shorter than the calyx-tube*...27. **Fortunei**
JJ. *Lobes of calyx as long as the calyx-tube.*
K. *Corolla-lobes ovate, acute, a little longer than the much-cut appendages*........28. **septemfida**
KK. *Corolla-lobes oblong-lanceolate, obtuse, thrice as long as the much-cut appendages*............29. **affinis**
III. *Lvs. not distinctly rough above or at margins.*
J. *Seeds not at all winged.*
K. *Form of corolla-lobes linear-oblong*.......30. **Olivieri**
KK. *Form of corolla-lobes ovate, often broadly so.*
L. *Fls. solitary.*
M. *Peduncled*.......31. **Porphyrio**
MM. *Not peduncled*....32. **ornata**
LL. *Fls. in clusters of 3–5 or more.*
M. *Lvs. lanceolate-linear*.........33. **triflora**
MM. *Lvs. ovate to oblong-lanceolate.*
N. *Height 2–4 ft*.....34. **sceptrum**
NN. *Height 9–12 in.*
O. *Calyx-lobes ovate, about as long as the calyx-tube*....35. **calycosa**
OO. *Calyx-lobes linear, moderately or much shorter than the calyx-tube*.36. **Parryi**
JJ. *Seeds winged (at the base in G. Kurroo, in G. Bigelovii wings narrow, thickish).*
K. *Height 2–8 in.: fls. spotted.*
L. *Pedicel ½in. long or more*............37. **Kurroo**
LL. *Pedicel very short, practically absent*..38. **Newberryi**
KK. *Height 1–2 ft.*
L. *Fls. in a dense spike*.39. **Bigelovii**
LL. *Fls. 1 to few or several.*
M. *Appendages conspicuous, sometimes nearly as long as the corolla-lobes*..........40. **oregana**
MM. *Appendages only half as long as the corolla-lobes*..41. **puberula**
EE. *Caps. sessile.*
F. *Anthers grown together; style distinct: seeds winged.*
G. *Calyx 5-cut, the lobes longer than the calyx-tube*.......42. **pannonica**
GG. *Calyx entire, truncate, indistinctly 5-lobed*..........43. **Gaudiniana**
FF. *Anthers free; style usually not distinct: seeds not winged.*
G. *Lvs. 6-12 in. long: calyx 5–6-lobed*..................44. **macrophylla**
GG. *Lvs. much shorter: calyx 4-lobed*...................45. **Cruciata**
DD. *Stigmas contiguous, rather funnel-shaped, the margin crenate-fimbriate.*
E. *Anthers free; style distinct.*
F. *Calyx pellucid, veiny*........46. **carpatica**
FF. *Calyx leafy.*
G. *Seeds winged*.............47. **imbricata**
GG. *Seeds not winged.*
H. *Lvs. ovate*..............48. **verna**
HH. *Lvs. obovate*............49. **bavarica**
HHH. *Lvs. linear*.............50. **pumila**
EE. *Anthers connate; style short.*
F. *Fls. spotted.*
G. *Color deep blue*..........51. **acaulis**
GG. *Color sky-blue*...........52. **angustifolia**
GGG. *Color violet-blue*..........53. **Kochiana**
FF. *Fls. not spotted.*
G. *Corolla broadly bell-shaped.*
H. *Size of fls. large*.........54. **Clusii**
HH. *Size of fls. small*........55. **alpina**
GG. *Corolla almost cylindrical*..56. **dinarica**

1. **lùtea,** Linn. Fls. in dense, umbel-like cymes; corolla 5–6-parted; lobes oblong-linear, acuminate; anthers free; style none. July–Sept. Eu., Asia Minor. Gn. 64, p. 59. G.W. 3, p. 290.—Prop. only by seed. Sow seed in Nov. in coldframe. Seedlings appear the following March and April. In May and June prick them out under a coldframe, and in Aug. transfer young plants to pots, where they should be kept until needed for permanent outdoor use. Be very careful never to break the roots. Sometimes cult. abroad for medicine.

2. **Búrseri,** Lapeyr. A low perennial, less than 1 ft., with a simple st.: lvs. elliptic-ovate, 7-nerved: corolla mostly 6-cut; the tube much longer than the limb; lobes ovate-oblong, acute; anthers connate; style distinct. June, July. Pyrenees.—Cult. like preceding.

3. **decúmbens,** Linn. f. (*G. adscéndens,* Pall.). A stout, erect herb with fl.-sts. 2–10 in. tall: lvs. mostly radical, oblong or elliptic, margins scabrous: fls. blue; calyx-tube ⅓in. long, often split nearly to the base; corolla narrowly obconical, toothed between the lobes; lobes 5, ovate; anthers connate, finally free. Himalayas, Tibet. June–Aug. B.M. 705, 723.—Cult. like *G. lutea.*

4. **purpùrea,** Linn. Lvs. ovate-oblong, 5-nerved: fls. purple above; corolla-tube yellowish, club-shaped; lobes mostly 6, obovate-subrotund, one-third the length of the tube. Aug., Sept. Eu. L.B.C. 6:583 shows a rich, dull purple, with no trace of blue.—Compost of sphagnum and heath soil. Be careful not to break the roots.

5. **rùbra,** Clairv. (*G. Thómasii,* Gillaboz). One of 5 or more natural hybrids between *G. lutea* and some species of the section Cœlanthe, which includes *G. punctata, G. purpurea, G. Pannonica,* and *G. Burseri:* fls. purplish outside. Swiss Alps.

6. **punctàta,** Linn. Lvs. 5-nerved: calyx 5–7-cut; corolla-tube bell-shaped; lobes ovate, muticous, one-third the length of the tube; anthers finally free. Cent. Eu.—The spots are not arranged in any definite order. This belongs to the section Cœlanthe, in which the seed has a wing of the same color, while the next 5 species belong to the section Pneumonanthe, in which there is no wing, or it is of a different color. Cult. like *G. Froelichii.*

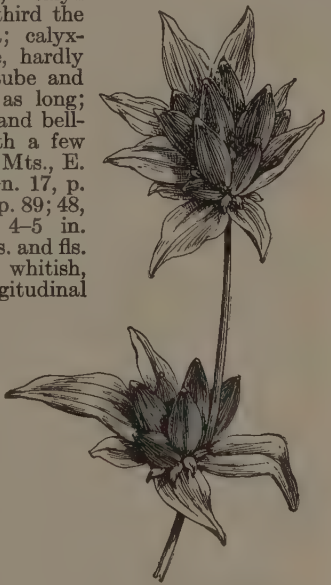
7. **álba,** Muhl. St. stout: lvs. acuminate, with a clasping base: fls. in a terminal head, with single or clustered ones in the upper axils; dull white, commonly tinged yellowish or greenish; corolla resembling *G. Saponaria,* but more bell-shaped and open; lobes ovate, short, little if at all spreading. Low grounds and mountain meadows, N. Amer. B.M. 1551 (as *G. ochroleuca*).—This species now takes the name **G. flávida,** Gray.

8. **villòsa,** Linn. (*G. ochroleùca,* Froel.). St. smooth scending, simple or nearly so, slender, 6–18 in. tall: lvs. ovate-lanceolate and obovate: fls. in crowded terminal, nearly sessile, leafy clusters, or sometimes axillary; corolla yellowish white or greenish, club-shaped, connivent at the apex. E. N. Amer. Not B.M. 1551. Var. **intermèdia,** Griseb. (*G. intermèdia,* Sims, not L.B.C. 3:218), may be a hybrid between this and *G. Andrewsii.* It resembles *G. ochroleuca* in having calyx-lobes of unequal lengths, but as long as or longer than the calyx-tube, and free anthers: it resembles *G. Andrewsii* in the tinge of purplish blue. B.M. 2303. Var. **incarnàta,** Griseb. (*G. incarnàta,* Sims), B.M. 1856, from Carolina is not cult. These forms are not considered worthy of varietal rank in Gray's Syn. Fl.

9. **frígida,** Hænke. Lvs. spatulate-linear, obtuse: fls. 1 or 2 at the top, sometimes a few in the upper axils; calyx not laterally cut, and half as long as the corolla or more; calyx-teeth lanceolate, a little longer than the calyx-tube; corolla club-shaped, plaits not cut. Carpathian Mts.; also N. Amer.—This is the true type of *G. frigida,* which is not in cult., but is inserted to make clear the differences between *G. algida* of Pallas and of Steven.

10. **álgida,** Pall., not Stev. (*G. frígida* var. *álgida,* Griseb.). Lvs. lanceolate-linear: fls. 2–5 at the top and distinctly pedicelled; calyx laterally cut and one-third the length of the corolla; calyx-teeth linear-lanceolate, hardly as long as the calyx-tube and sometimes only half as long; corolla between club- and bell-shaped; plaits cut with a few crenate teeth. Altai Mts., E. Siberia, N. Amer. Gn. 17, p. 343, same as Gn. 27, p. 89; 48, p. 146.—This grows 4–5 in. high, has numerous sts. and fls. nearly 2½ in. long, whitish, with blue spots in longitudinal lines.

11. **gélida,** Bieb. (*G. álgida,* Stev., not Pall.). Lvs. ovate-lanceolate, 3-nerved: fls. few and terminal, or many in the upper axils, peduncled; calyx-teeth linear-oblong, acute, nearly as long as the calyx-tube or shorter than it; corolla rather bell-shaped, yellowish white, its lobes broadly ovate, twice as long as the calyx and twice as long as the lacerated plaits. June, July. Caucasus. Not P.M. 7:5, which is *G. septemfida* var. *cordifolia.*—"Light, deep, cool soil and full sunlight."—Correvon.



1626. Gentiana Andrewsii.

12. **campéstris,** Linn. A low slender annual with erect st. 2–6 in. tall: lvs. sessile, ovate-lanceolate, 3–5-nerved: fls. dark purplish blue, short-pedicelled, but in various kinds of clusters; calyx 4-cut; corolla nearly bowl-shaped, crowned; anthers free; style none. Eu.

13. **Moorcroftiàna,** Wall. A stiff annual 8–16 in. high: fls. pale blue in nearly terminal cymes which are racemosely clustered; calyx 5-cut; corolla funnel-shaped, about 1½ in. wide. Himalayas. B.M. 6727, where fls. are shown as pale purple.

14. **crinìta,** Froel. Fig. 1625. FRINGED GENTIAN. Biennial or often annual: erect, branched, 1–2 ft. high: lvs. lanceolate or ovate-lanceolate, acutish, from a rounded or subcordate partly clasping base: corolla-lobes wedge-obovate: seeds roughened by scales or needle-like projections. Moist woods and meadows. N. Amer. B.M. 2031. Mn. 4:161. B.B. 2:613.—The ribs of the calyx (made by the decurrent lobes) are one of the minor beauties of this plant, and are probably more pronounced than in the other fringed gentians here described. Almost impossible to grow in cult.

15. **ciliàta,** Linn. Perennial: st. flexuose, scarcely branched: lvs. linear, obtuse: corolla-lobes obovate-oblong: seeds smooth. Dry limestone soils. Eu. Not B.M. 639, which is *G. serrata.*—Hardly 3 per cent of Correvon's seedlings have flowered. He recommends a heavy, compact soil which is almost clayey, and full sunlight.

16. **serràta,** Gunner (*G. barbàta,* Froel. *G. detónsa,* Griseb. *G. detónsa* var. *barbàta,* Griseb.). Annual: st. erect, branching, 3–18 in. high: lvs. linear or lance-linear: corolla-lobes oblong or spatulate-obovate, fringed around the apex and sides or sometimes either part nearly bare. Wet lands, Ural and Altai Mts., Caucasus, N. Amer. B.B. 2:614. B.M. 639 (erroneously as *G. ciliata*).—No plants appear to be advertised as *G. serrata. G. barbata* is a trade name abroad.

17. **quinquefòlia,** Linn. (*G. quinqueflòra,* Hill, Lam. and others). Annual: height 1–2 ft., the larger plants branched: lvs. 3–7-nerved: infl. thyrsoid-paniculate; clusters 3–5-fld.; fls. bright blue; calyx one-fifth or one-fourth as long as the narrowly funnel-shaped corolla. N. Amer. Probably the form in cult. is var. **occidentàlis,** Gray. Height 2–3 ft., paniculately much branched: infl. more open; calyx half the length of the broader corolla. B.B. 2:615. B.M. 3496.—Very pretty.

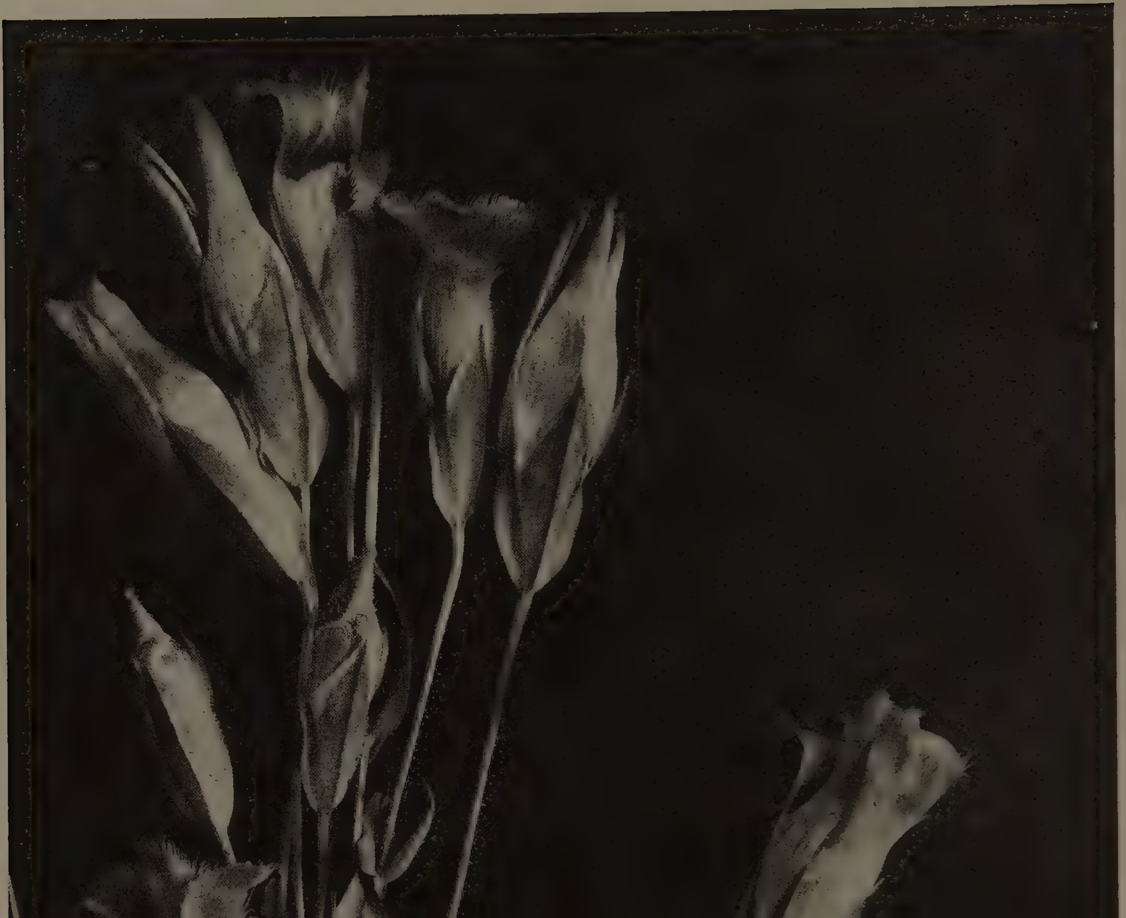
18. **Froèlichii,** Jan. Sts. short, almost tufted: fls. blue, solitary, peduncled, nearly as long as the st.; corolla not spotted. Very rare in Alps, limestone rocks.—Easily grown on rockwork in compost of equal parts of sphagnum, heath soil and vegetable-mold. Half-exposure to sunlight.

19. **asclepiádea,** Linn. St. strict, about 1–1½ ft. tall: lvs. sessile, ovate-lanceolate: calyx-teeth very short: fls. in spike-like racemes, dark blue, very showy; corolla club-shaped; calyx one-third as long as the corolla: seeds not winged. July–Sept. S. Eu., Caucasus. B.M. 1078. Gn. 48, p. 143, and 54, p. 39. G.M. 47:544. Gt. 54, p. 345. G. 3:59; 8:481; 13:403; 21:233. Var. **álba,** a white-fld. form is excellent but perhaps not known outside of English trade. Shade or half-shade, and moist, deep soil rich in humus.

20. **Pneumonánthe,** Linn. St. erect: fls. dark blue in a cyme-like raceme (the top fls. opening first); corolla club-shaped; lobes ovate, acute, mucronate, much longer than the appendages. Aug.–Oct. Mountain marshes, Eu., N. Asia. Var. **guttàta,** Sims, is dotted white. B.M. 1101.—"Requires a cool, deep, spongy soil, rich in humus. Dislikes lime, and prefers sandy soil. Does remarkably well when planted on margins of ponds or brooks. Prop. by seed or division."—Correvon.

21. **Saponària,** Linn. (*G. Catésbæi,* Walt., not Andr.). BARREL OR SOAPWORT GENTIAN. St. ascending: fls. light blue, club-shaped; calyx-lobes linear or oblong, mostly as long as the calyx-tube; corolla-lobes short, broad, roundish, erect, little, and often not at all longer than the 2-cleft and many-toothed intervening appendages. N. Amer. B.M. 1039. (Hooker is probably wrong in referring this picture to *G. Andrewsii,* although the calyx-lobes in the plate are not narrow enough.)—Cult. like preceding.

22. **Ándrewsii,** Griseb. (*G. Catésbæi,* Andr., not Walt.). CLOSED, BLIND OR BOTTLE GENTIAN. Fig. 1626. St. ascending: fls. purplish blue; calyx-lobes lanceolate to ovate, usually spreading or recurved, shorter than the calyx-tube; corolla-lobes entirely obliterated, the teeth at the top being supposed to be the remains of the



XLVII. Gentiana crinita.

appendages often found between the corolla-lobes in other species. July, Aug. Moist places. E. N. Amer. B.M. 6421. B.B. 2:616. Gn. 27:86. G.W. 4, p. 549. F.W. 1879:33. L.B.C. 9:815 (erroneously as *G. Saponaria*).—A white-fld. form is cult. but very rare. For cult., see *G. Pneumonanthe*.

23. **lineàris,** Froel. (*G. pseùdo-Pneumonánthe*, Schult.). St. strict, 1–2 ft. high: fls. blue, 1–5 in the terminal cluster; corolla narrowly funnel-shaped; lobes erect, roundish ovate, obtuse, a little longer than the triangular, acute, entire or 1–2-toothed appendages. Bogs, N. Amer. B.B. 2:617.

24. **pyrenàica,** Linn. St. tufted, about as long as the fl., often forming mats: lvs. with a cartilaginous, scabrous margin: fls. solitary, dark blue; corolla funnel- or nearly bowl-shaped, as long as or exceeding the corolla which is about 1 in. long. May, June. Eu., Asia Minor. B.M. 5742.—Very distinct and dainty. Cult. like *G. verna*.

25. **prostràta,** Hænke (*Chondrophýlla americàna*, Nelson). Annual, dwarf: lvs. white-margined: fls. azure-blue, solitary and terminal, the parts in 4's; corolla salver-form, in fruit inclosing the long-stalked caps. W. N. Amer. Alpine.

26. **scàbra,** Bunge. St. erect, leafy, rough-hairy above: basal lvs. almost perfoliate, ovate, acute, faintly 3-nerved, the margins rough toothed: fls. dark blue, clustered; corolla bell-shaped. E. Asia. *G. Fortunei* is considered a variety by recent authorities. (G.C. III. 47:136). Var. **Buérgeri** (*G. Buérgeri*, Miq.) is advertised by Yokohama Nursery Co. It differs in having a narrower corolla with shorter and more triangular lobes. Probably not in Amer. except in botanic gardens.

27. **Fórtunei,** Hook. Lvs. rather distant, 3-nerved: terminal fls. rather clustered; corolla-lobes blue, spotted white; outside of tube green; plaits blue, terminated by 3-toothed appendages, much shorter than the corolla-lobes. China. B.M. 4776. F.S. 9:947. I.H. 1:36.—Now thought to be a variety of *G. scabra*, but not so considered by Miquel.

28. **septémfida,** Pall. Lvs. lanceolate ("ovate," according to Grisebach), 3–5-nerved: fls. dark blue, in head-like cymes; calyx-lobes linear; corolla club-shaped. July–Oct. N. Asia, Orient. B.M. 1229 and 1410 (both purple outside and dotted brown within; the lobes of the latter spotted white). G. 34:773. L.B.C. 1:89. Gn. 54, p. 37. P.M. 8:51. Not F.S. 8:765. *G. Freyniàna*, Hort., is said to differ from the type in having larger fls. which are less prominently fringed between the segms. of the corolla. G.C. III. 46:202. Gn. 75, p. 421; 77, p. 168. Var. **cordifòlia,** Boiss. (*G. cordifòlia*, C. Koch), has heart-shaped lvs.: corolla-tube greenish white outside, unspotted within; lobes narrower, unspotted. B.M. 6497. P.M. 7:5 (erroneously as *G. gelida*).—The name septemfida is misleading, as 7-lobed corollas are very rare. Cult. like *G. lutea*.

29. **affìnis,** Griseb. Sts. clustered, 3–9 in. high: lower lvs. obovate-oblong; upper lvs. lanceolate, acutish: fls. dark blue, in thyrsoid-racemose clusters, a few or sometimes solitary; calyx-lobes oblong-linear and sharp-pointed; corolla narrowly obconical, open, the lobes spreading. N. W. Amer. Gn. 46, p. 77 and 48, p. 139. B.B. 2:615 (where corolla-lobes are pictured erect, but said to be spreading).—Cult. like *G. Pneumonanthe*.

30. **Olivièri,** Griseb. (*G. dahùrica*, Fisch., which is probably the oldest name). Fls. dark blue, in umbel-like cymes; corolla narrowly obconical; plaits triangular, nearly entire. June–Aug. Mountain pastures, Asia.—By recent authority referred to *G. decumbens*, but differing from that species only in having equal calyx-lobes. Cult. like *G. lutea*.—Useful in the rockery, but will not grow well in the hot dry summer of E. U. S.

31. **Porphýrio,** J. F. Gmel. (*G. angustifòlia*, Michx., not Vill.). Lvs. narrowly linear: fls. blue, somewhat brown-dotted (also a snow-white variety with a greenish hue outside); corolla funnel-shaped; anthers connivent but never connected. July, Aug. Moist pine-barrens, N. Amer. B.B. 2:618.—Cult. like *G. Pneumonanthe*.

32. **ornàta,** Wall. Branches many from the same root: lvs. broadly linear: fls. solitary, blue, streaked; calyx-lobes spreading; corolla ventricose, about 1–1¾ in. long; lobes very short, spreading. Himalayas. B.M. 6514 and 8140. G.C. II. 20:396; III. 46:179. Gn. 59, p. 249.—A form that differs from the type in being more robust, with larger fls. and broader corolla-lobes which are "intense blue," is offered as *G. Veitchiòrum*, Hemsl. It is a native of W. China, "where it covers large areas," according to E. H. Wilson (Naturalist in Western China, 1:139), its discoverer. Intro. into England in 1904. Alpine. Gn. 73, p. 479. G.C. III. 46:178.

33. **triflòra,** Pall. St. erect: lvs. oblong-linear, blunt: fls. solitary, dark blue, the calyx 5-toothed, acute, and elongate; corolla club-shaped or bell-shaped, the anthers free. E. Siberia.—Probably not now in cult. in Amer. outside of botanic gardens.

34. **scéptrum,** Griseb. An erect, leafy perennial, from 2–4 ft. high: lvs. oblong-lanceolate: fls. dark blue; corolla bell-shaped, about 1 in. long: seeds winged on one side according to Grisebach, but Gray says not winged. Aug., Sept. N. W. Amer.—Cult. like *G. lutea*, except that it requires half shade and a rather peaty soil.

35. **calycòsa,** Griseb. About 1 ft. high: lvs. ovate, about ¾in. long, the 2 upper commonly involucrate around the fl.: fls. dark blue, commonly solitary, according to Gray; corolla oblong-funnel-shaped; appendages triangular-awl-shaped, laciniate or 2-cleft at the tip. N. W. Amer. G.M. 47:541.

36. **Párryi,** Engelm. Sts. many, from a rather woody root, about 9 in. tall: lvs. somewhat glaucous, ovate to oblong-lanceolate, the upper pairs involucrate around the 1–5 purple-blue fls.: appendages narrow, deeply 2-cleft. N. W. Amer.

37. **Kurroò,** Royle. St. tufted, as high as 7 in.: lower lvs. lanceolate, upper linear: fls. blue, spotted white inside, 1–3 on a st.; corolla bell-shaped. Himalayas. Gn. 17:264. B.M. 6470. Var. **brévidens** has shorter calyx-lobes. J.H. III. 30:3.

38. **Néwberryi,** Gray. St. 2–4 in. high: lower lvs. obovate or spatulate: fls. pale blue, white inside, greenish dotted; calyx-lobes oblong or lanceolate, nearly as long as the tube; corolla broadly funnel-shaped, its lobes ovate and sharp-pointed. N.W. Amer. Alpine.

39. **Bígelovii,** Gray. St. 6–16 in. high, equally leafy to the summit: fls. purple; corolla more narrowly funnelform and smaller than in *G. affinis*. July, Aug. New Mex., Colo. B.M. 6874.—"Soon forms large clumps, often with 40–50 sts. from a single plant, each bearing 10–20 bright blue fls."—D. M. Andrews.

40. **oregàna,** Engelm. Height 1–2 ft.: lvs. ovate or ovate-oblong, 1–1½ in. long: fls. blue, a few at the summit or several and loosely racemose; corolla broadly funnel-shaped, over 1 in. long; lobes short, roundish. July, Aug. N. W. Amer.

41. **pubérula,** Michx. Perennial, usually solitary-stemmed herb from 8–18 in. tall: lvs. oblong-lanceolate to lanceolate-linear: fls. blue, sessile or nearly so in the upper axils; corolla open-funnel-shaped, 1½–2 in. long; lobes ovate. E. N. Amer. B.B. 2:615.

42. **pannónica,** Scop. A tall stout perennial: lower lvs. broadly elliptical, 5-nerved, margin scabrous; upper ones ovate-lanceolate, also 5-nerved: fls. purple above; calyx 5–7-cut; corolla leathery, distinctly spotted; anthers connate at first, finally free. Eu.

43. **Gaudiniàna,** Thom. Natural hybrid with the habit of *G. purpurea,* but the membranous corolla of *G. punctata:* fls. rosy violet. Eu., but not widely cult.

44. **macrophýlla,** Pall. Perennial, with erect or ascending st.: lvs. lanceolate, distant, very spreading, 3-nerved, the upper often connate-perfoliate; internodes unequal: fls. dark blue. July, Aug. B.M. 1414, not L.B.C. 3:218. N. Eu. and Asia.—Cult. like *G. lutea.*

45. **Cruciàta,** Linn. (*Cruciàta verticillàta,* Gilib.). An erect and leafy perennial: lvs. ovate-lanceolate, crowded, erect-spreading, the upper connate-perfoliate; internodes equal: fls. axillary, in sparse clusters, dark blue. June–Aug. Eu., N. Asia.—Cult. like *G. lutea.* Prefers limestone and full sunlight.

46. **carpática,** Kit. (Probably *G. nivàlis,* Linn.). A slender perennial with small obovate lvs.: fls. solitary, axillary or terminal, dark blue (as are the next 4 species); corolla funnel-shaped, scarcely exceeding ¾in. long. Carpathian Mts.—Little known.

47. **imbricàta,** Froel. Lvs. acute, margins scabrous, (the next 3 species with smooth margins): corolla-lobes subrotund. June, July. Limestone rocks, Alps.—In this and the next 3 species, the corolla-lobes are usually crenate, half the length of the tube, and 6 times the length of the plaits. "Eastern and granitic Alps."—Correvon. Cult. like *G. bavarica.*

48. **vérna,** Linn. Fig. 1627. Tufted: st. angled: lvs. ovate or ovate-lanceolate: fls. solitary; calyx membranaceous; corolla nearly bowl-shaped; lobes ovate, obtuse. Apr.–June. Eu., Caucasus. B.M. 491. L.B.C. 1:62. R.H. 1859, p. 250. Gn. 48, p. 139; 75, p. 284. G.C. II. 24:373. J.H. III. 52:58. G.W. 23:431. Var. **alàta,** Griseb. (*G. angulòsa,* Bieb.), is taller and has the nerves of the ventricose calyx produced into wings.—Rockwork, in a compost of heath-soil, finely crushed granite, and vegetable-mold, with full sunlight. A supposed hybrid between this and the following has been described as *G. Favràtii,* Hort. The plant is practically unknown in Amer.

49. **bavárica,** Linn. Calyx-lobes lanceolate; corolla funnel- or nearly bowl-shaped; lobes obovate, obtuse; ovary sessile: seeds not winged. May–Aug. Cent. Eu. F.S. 7:651. L.B.C. 13:1256. J.H. III. 35:585. Gn. 15:278 (poor).—The pictures cited all show a salver-shaped corolla. "Requires a soil that is peaty, or at the very least porous and cool, well drained, and capable of retaining an abundant supply of moisture, although it may be fully exposed to the sun. In the alpine garden here we grow them in pure sphagnum moss on a wall facing due south, but the plants which we raise for sale are grown in pots in a compost of sphagnum, heath-soil and sand. Finest of Group III."—Correvon.

1627. Gentiana verna. (×2/5)

50. **pùmila,** Jacq. A tiny almost moss-like gentian with a 3–4-angled st.: lvs. clustered, scarcely more than ½in. long: fls. solitary terminal; calyx-lobes linear; corolla deep blue, the lobes ovate, acute. June, July. Tyrolese and Carinthian Alps.

51. **acaùlis,** Linn. (*G. excìsa,* Presl.). GENTIANELLA. STEMLESS GENTIAN. Fig. 1628. By the botanists of continental Eu. this is often split up into the 4 or 5 following species. The plants that Linnæus had in mind were probably mostly *G. Clusii* and *G. Kochiana.* For pictures of *G. acaulis* in its widest sense, see B. M. 52. G.C. III. 15:236. G.W. 3, p. 289. J.H. III. 52:59. R.B. 28:204. Gn. 48, p. 146; 54, p. 39. F.S. 23:2421, where a more detailed account of the 4 following species is given. A var. **Kòchii,** Hort., is known but it may well be *G. Kochiana.* A white-fld. form, var. **álba,** is advertised.

1628. Gentiana acaulis.

52. **angustifòlia,** Vill., not Michx. Stoloniferous: lvs. linear-oblong, narrowing toward the base, glistening above: fls. spotted with sprightly green; calyx-lobes more or less spreading, oval, abruptly contracted at the base. May, June. Limestone rocks, Alps.—Considered by Correvon the handsomest species of the whole genus.

53. **Kochiàna,** Perr. & Song. Lvs. large, flat, thin, spreading, oval or broadly oblong, light green: calyx-lobes oblong, limp, more or less contracted at the base and separated by truncate sinuses; corolla with 5 blackish green spots on the throat. May, June. Common in pastures on granitic Alps.—Dislikes lime. It seems almost certain that this is the *G. acaulis* var. *Kochii* of many gardeners.

54. **Clùsii,** Perr. & Song. A low acaulescent perennial perhaps not different from *G. acaulis* and so considered in "Index Kewensis:" lvs. lanceolate-acute, leathery: fls. dark blue; calyx-lobes pressed close against corolla, not contracted at base, and separated by acute sinuses. May, June. Limestone rocks, Alps.

55. **alpìna,** Vill. St. almost wanting: lvs. small, glistening, curving inward and imbricated, forming rosettes which incurve at about the middle: fls. dark blue. May, June. Granitic Alps.—This and *G. Kochiana* "require a compost of one-third crushed granite, one-third heath soil, and one-third vegetable loam, and should be planted on rockwork half exposed to the sun."

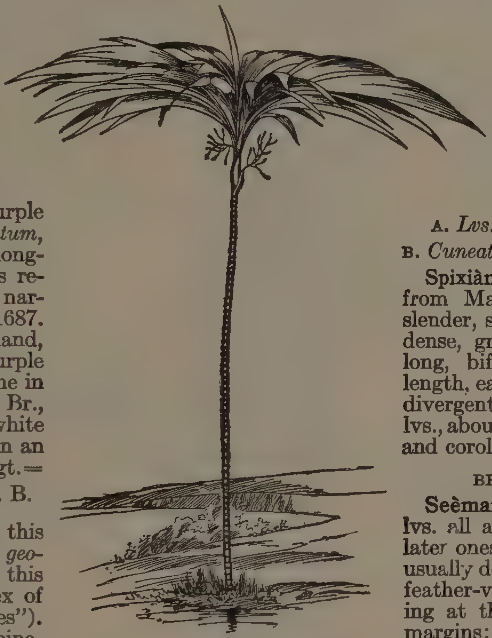
56. **dinárica,** Beck. Lvs. broad, thick, erect: fls. dark blue. Certainly a mere form of *G. acaulis,* but described as differing from that species in having no spots on the corolla. Alps of S. and E. Austria.

The following are names of gentians not sufficiently described for insertion above or as yet scarcely known in cult.: *G. arvernénsis,* Hort. Perhaps a var. of G. Pneumonanthe. Fls. Napoleon blue. See G.C. II. 20:40, desc. G. 29:7.—*G. Charpentièri,* Thom. Natural hybrid, intermediate between G. lutea and G. punctata: corolla spotted red; calyx 5-cut. Grisebach does not say whether the corolla is not plaited, anthers always free, and style none. Alps, above Engadine.—*G. corymbífera,* Hort., is described as 12–18 in. high, with usually simple sts. branching toward the top: fls. white, about 1 in. diam. New Zeal. G.C. III. 46:203.—*G. Fetisòwii,* Regel. St. erect, tall: fls. deep blue. China. Gt. 31:1069.—*C. Hǽngsiii,* Hausm.=G. Kummeriana.—*G. Késselringii,* Regel. Height about 8 in.: fls. whitish, dotted violet outside. Turkestan. Gt. 31:1087.—*G. Kummeriàna,* Sendt. Hybrid between G. lutea and G. Pannonica. Fls. yellowish.—*G. Láwrencei,* Burkill. Allied to G. ornata but distinguished by the much longer linear lvs.: corolla about 1¾ in. long, blue above, the tube paler with dark blue lines. Mongolia. G.C. III. 38:307.—*G. Wallichiàna.*—Height 8–12 in.: fls. clear blue.—*G. Walujéwi,* Regel & Schmalh. Fls. whitish, dotted pale blue. Turkestan. Gt. 33:1140.

WILHELM MILLER.
N. TAYLOR.†

GENUS, pl. **GENERA** (i. e., *kind*), is a term used in natural history to designate a group of species. As with species, so the genus is an indefinite conception, varying with the author. The chief value of the conception is its use in aiding us conveniently to arrange and name plants and animals. The name of the genus is the first of the two words in the name of the plant: thus, in *Brassica oleracea*, Brassica designates the genus, and oleracea the particular Brassica of which we are speaking. It is difficult to trace the origin of the genus-conception in natural history, but it is usually ascribed to Konrad Gesner (Zurich, 1516–1565). L. H. B.

GEODÒRUM (*gift of the earth*). *Orchidàceæ.* Orchids of minor importance, E. Indies to Austral., with radical lanceolate or elliptical lvs., tuberous bulb-like rootstocks, and vari-colored fls. in a nodding spike on the top of the scape; sepals and petals similar, lip upright: terrestrial. Belongs in the same sub-group or tribe as Cyrtopodium and Eulophia. In habit, they somewhat resemble Phaius and Eulophia, and require similar treatment, with potting in fibrous loam and peat. Apparently not offered in this country, but sometimes grown abroad in collections. *G. purpùreum*, R. Br., from India: like a Bletia in habit: lvs. large: scape erect, bearing a densely-fld. drooping raceme; fls. small, white with purple markings on the lip. *G. fucàtum*, Lindl., of Ceylon: 1 ft.: lvs. oblong-lanceolate and plicate, the scapes recurved at the apex: fl. with pink narrow sepals and ovate lip. B.R. 1687. *G. pictum*, Lindl., from New Holland, grows 1–2 ft., with dull rose-purple fls. shaded brown and white, borne in dense racemes. *G. dilatàtum*, R. Br., of India, 6–12 in. high, fls. white marked pink and yellow, borne on an erect scape.—*G. plicàtum*, Voigt.=Phaius. L. H. B.



1629. Geonoma Spixiana.

GEÒNOMA (Wittstein gives this interesting explanation: "Greek, *geonomos*, skilled in agriculture: for this tree puts forth buds at the apex of its stem which become new trees"). *Palmàceæ*, tribe *Arèceæ*. Slender spineless palms with ringed, reed-like stems much cultivated for their excellent decorative possibilities.

Leaves terminal or alternate, usually crowded in showy clusters; blade entire, 2-lobed at the apex, or more or less pinnatisect; segms. acuminate, 1-nerved, with the margins broadly recurved at the base; rachis acute above, convex on the back; petiole nearly cylindrical, concave at the base above; sheath tubular: spadices ascending or recurved, simple, forked or paniculately branched, slender or stout, often colored; spathes 2, often deciduous before flowering, or obsolete, the lower one partial, truncate, concave, the upper compressed or fusiform; fls. monœcious in each spadix, borne in the furrows of the spadix, at length partially exserted, when in 3's the upper one pistillate; cells of the anthers twisted: fr. small, globose, black.—Species about 100. Trop. Amer. G.C. II. 24:586. A.G. 16: 345. For *G. Ghiesbreghtiana*, see *Calyptrogyne*.

Several of the members of this extensive genus of small-growing palms are useful for the greenhouse, though most attractive while in a small state, from the fact that geonomas soon begin to form a stem, and when aged become rather scantily furnished specimens. These palms are by no means difficult to grow, and do not require a very high temperature, their natural habitat being the mountains of Central and South America, some of the species being found at an altitude of over 4,000 feet above sea-level. Geonomas form part of the undergrowth on their native mountains, and are said never to appear in the open country unsheltered by trees of larger growth; therefore, shade is necessary for them when cultivated under glass. The old practice of growing geonomas in a very light peaty soil does not seem to be the only method, for excellent results have been secured by growing them in a good loam, well manured and well drained, giving an abundance of water and a night temperature of 60.° Red spiders and thrips are the most troublesome insects to which these plants are subject, and both of these pests multiply much more rapidly if the plants are kept too warm and dry. (W. H. Taplin.)

The most useful species from a commercial point of view is *G. Riedeliana* (*G. gracilis*), which reminds one of *Cocos Weddelliana*, but has longer leaflets. The species are undoubtedly confused under cultivation, and often unidentified. They are said not to be grown in the open in southern California, at least, not to any extent. The species here listed appear to be those of most horticultural importance here.

A. *Lvs. simple, 2-lobed at the apex.*

B. *Cuneate-oblanceolate, rusty, tomentose.*

Spixiàna, Mart. Fig. 1629 (adapted from Martius' work on palms). St. slender, solitary, 6–9 ft. high: lvs. in a dense, graceful cluster; blades 3–5 ft. long, bifurcate one-fourth of their length, each lobe lanceolate-acuminate, divergent: spadix from between the lvs., about 3 ft. long; fls. small, the calyx and corolla equal. W. Brazil.

BB. *Cuneate-ovate, plicate.*

Seèmannii, Hort. Low, 1–3 ft. high: lvs. all alike, the first 2 in. long, the later ones 10 in. long, entire, or 2-lobed, usually deeply cleft at the apex, plaited, feather-veined; stalk triangular, sheathing at the base, with broad, scarious margins: fls. unknown. F.M. 1869:428. Cent. Amer.

AA. *Lvs. pinnate.*

B. *Basal lf.-segms. narrow; the upper ones the broadest.*

acaùlis, Mart. Acaulescent: lvs. in a congested, rosette-like cluster, long-petioled, 3–4 ft. high; blade unequally pinnatisect, with usually 6 segms. on both sides of the rachis; 22–25-nerved, basal segms. 4 lines wide, spreading, the middle and upper erect-spreading at an acute angle, ¾–4 in. wide, the apical very wide: spadix stiff, usually about 18 in. long, the stalk very thick; fls. numerous: fr. unknown. Cent. Brazil.

BB. *Broad and narrow segms. irregularly intermingled.*

C. *Blade of lf. 6 ft. long; petiole 1 ft. long.*

Pohliàna, Mart. St. 12–15 ft. high, slender, densely ringed, columnar or reedy: lvs. very numerous, erect or spreading, forming a much congested, showy cluster, in adult specimens; segms. very unequal, linear-lanceolate, falcate-acuminate, few-nerved and many-nerved intermixed, 16–20 in. long; petioles very short: spadix scarcely showing among the dense cluster of lvs. Trop. Brazil.—Cult. most advantageously in a warm moist house. The young specimens are attractive for potted plants.

cc. *Blade 2–2½ ft.: petiole 4 in. long.*

élegans, Mart., var. **robústa**, Drude. St. 6–10 ft. high, 3–4 lines diam.: segms. rarely 3, usually 5–7, 1-nerved, 10–14 in. long, some 4 lines wide, intermixed with broader, many-nerved ones, all long, falcate-acuminate: spadix about 10 in. long, the fls. very small, inserted in deep pits. Cent. Brazil.

bbb. *Lf.-segms. all alike (except the connivent apical ones).*

c. *Alternate, remote, linear, scurfy.*

Riedeliàna, Wendl. (*G. grácilis*, Lind. & André, the oldest and perhaps the correct name). Habit of *Cocos Weddelliana*, the whole plant sparsely covered with caducous, brown, shining scales: petiole slender, 1½ ft. or more long, terete below, flattened above; rachis triangular, bisulcate above: lvs. spreading, drooping at the apex; segms. 10–12 in. long, about 9 lines wide, linear-acute, elegantly recurved, the 2 terminal ones connivent: fls. showy, yellow, in long drooping spadices. Brazil. I.H. 21:169. B.M. 7963.

cc. *Equidistant: petiole half as long as the blade.*

Schottiàna, Mart. St. 9–15 ft. high, 1–1¼ in. thick: lvs. long-stalked, gracefully recurving; petiole half or more than half as long as the blade; segms. about 35 on each side, 10–12 in. long, ⅖in. wide, equidistant, linear or linear-lanceolate, very long-acuminate, recurved at the tip: spadix about 10 in. long, the stalk about 1 ft. long. E. Brazil.—A very variable species.

The following are imperfectly described, but are in the trade: *G imperiàlis*, Lind. G.W 2, p. 37.—*G. prínceps*, Lind.—*G. Pynærtiàna*, Hort. Belongs under A. One of the smallest lvs. measures 28 in. long by 10 in. at the broadest. Has not flowered yet, and the genus is therefore uncertain. R.H. 1898, p. 262. G.C. III. 23:258. F.E. 10:886. G.W. 2, p. 445.—*G. speciòsa*, Barb.-Rodr. G.W. 2, p. 431.—*G. Swártzii*, Griseb. (Calyptrogyne Swartzii, Hook. Calyptronoma Swartzii, Griseb.). Trunk 50–60 ft. high, smooth: lf.-segms. linear-acuminate, green, glabrous. Cuba.

N. Taylor.†

GEORGÌNA. A synonym of Dahlia, which still survives in the form of "Georginen," the popular name of dahlias in Germany.

GERÀNIUM (Greek, *crane;* from the resemblance of the fruit to a crane's bill). *Geraniàceæ.* Cranesbill. Generally herbaceous plants, annual, biennial, and perennial. Widely cultivated in borders, and some species in the rockery, usually caulescent.

Leaves simple, alternate or opposite and much-lobed, sometimes almost radical: fls. regular; sepals 5, imbricated, often 3-nerved and mucronate; petals 5, often hairy or ciliate; stamens 10, in 2 rows; anthers 10; seeds when ripened separated from the ovary and with its awn bent sinuously. The genus Erodium, its nearest ally, has but the inner row of stamens furnished with anthers and the awn of the seed is bent spirally. The geraniums of common speech are classed in the genus Pelargonium, having at the side of the pedicel a distinct narrow tube and zygomorphic fls.—The genus Geranium has over 250 species, found in the temperate zones particularly of the northern hemispheres, very few in the tropics. The roots of some, as *G. maculatum*, find use in medicine on account of their astringency. Thrive well in ordinary garden soil, and are propagated by seeds and divisions of roots. The best botanical account is that of R. Knuth in Engler's Das Pflanzenreich, hft. 53 (1912), and by Small and Hanks in N. Amer. Flora, Vol. 25, 1907, for the N. American species. A beautifully illustrated account of the genus is by Sweet (1820–30) in which special stress is laid on cultivation. There are 500 colored plates, and, where possible, these are cited in the following account, thus, S. 197.=Sweet, Geraniaceæ, plate 197.

Large masses of native species such as *G. maculatum* and *G. Robertianum* can be effectively naturalized under bushes and trees. They spread very rapidly and in the case of *G. Robertianum* will be profuse bloomers nearly all summer.

INDEX.

aconitifolium, 10.
album, 13, 15, 16.
anemonifolium, 3.
argenteum, 6.
armenum, 14.
Backhousianum, 14.
canariense, 3.
cinereum, 7.
collinum, 24
Endressii, 22.
erianthum, 17.
eriostemon, 18.
flore-pleno, 15
Fremontii, 12.
grandiflorum, 20.
Grevilleanum, 25.
ibericum, 13.
incisum, 17.
lancastriense, 11.
Londesii, 24.
macrorrhizum, 5.
maculatum, 16.
malvæflorum, 4.
nepalense, 21.
phæum, 8.
platyanthum, 18.
platypetalum, 13.
plenum, 16.
pratense, 15.
prostratum, 11
Richardsonii, 9.
Robertianum, 1.
sanguineum, 11.
sibiricum, 19.
subargenteum, 7.
Traversii, 2.
Wallichianum, 23.

KEY TO THE SPECIES.

A. *Plants annual, more or less prostrate: lvs. finely dissected*................ 1. **Robertianum**
AA. *Plants perennial.*
B. *Species tender, to be grown only in greenhouse northward.*
C. *Foliage silvery canescent*.......... 2. **Traversii**
CC. *Foliage glabrous, at least never canescent*...................... 3. **anemonifolium**
BB. *Species hardy.*
C. *Tuberous-rooted*................. 4. **malvæflorum**
CC. *Not tuberous-rooted.*
D. *Plant with a thickened woody base*........................ 5. **macrorrhizum**
DD. *Plants without thickened woody base.*
E. *Foliage silvery-canescent.*
F. *Usually 1-fld*.............. 6. **argenteum**
FF. *Usually 2-fld*.............. 7. **cinereum**
EE. *Foliage or whole plant glabrous or pubescent, but not silvery.*
F. *Sts. erect.*
G. *Fls. dark blue, almost black.* 8. **phæum**
GG. *Fls. not dark blue, sometimes light blue.*
H. *Color of fls. white (see also white-fld. forms of Nos. 13, 15, and 16).*
I. *Lvs. 3–5-parted*....... 9. **Richardsonii**
II. *Lvs. 7-parted*.........10. **aconitifolium**
HH. *Color of fls. not white.*
I. *Mostly 1-fld*..........11. **sanguineum**
II. *Mostly more than 1-fld.*
J. *The st. branched.*
K. *Fls. rose-purple*....12. **Fremontii**
KK. *Fls. violet*.........13. **ibericum**
JJ. *The sts. essentially simple.*
K. *Lobes of the lvs. more or less rounded*..........14. **armenum**
KK. *Lobes of the lvs. ovate or lanceolate.*
L. *Pedicels recurved in fr*...........15. **pratense**
LL. *Pedicels erect in fr.*
M. *The pedicels not glandular*.....16. **maculatum**
MM. *The pedicels glandular.*
N. *Lvs. finely cut.*17. **incisum**
NN. *Lvs. 5-lobed*...18. **eriostemon**
FF. *Sts. decumbent or creeping, scarcely erect.*
G. *Peduncles 1-fld*...........19. **sibiricum**
GG. *Peduncles 2- or more-fld.*
H. *Petals about as long as the sepals.*
I. *Fls. pale lilac*.........20. **grandiflorum**
II. *Fls. rose-purple*.......21. **nepalense**
HH. *Petals 1–2 times the length of the sepals.*
I. *Upper lvs. 3-lobed*.....22. **Endressii**
II. *All the lvs. 5-lobed.*
J. *The petals striped*....23. **Wallichianum**
JJ. *The petals not striped, sometimes spotted.*
K. *Base of petals ciliate.*24. **collinum**
KK. *Base of petals pilose or glabrous*.......25. **Grevilleanum**

1. **Robertiànum,** Linn. Herb Robert. Red Robin. About 9 in. high: lvs. thin, ovate-orbicular, 3–5-parted, with 3-fid. pinnatifid lobes: peduncles slender, 2-fld.; fls. small, bright crimson. June to Oct. Amer., Eu., Asia and N. Afr. B.B. 2:341.—For the rockery, in a moist soil and some shade, and will carpet the ground in a few seasons, from seed. Annual; or possibly biennial.

2. **Tràversii,** Hook. A silvery canescant herb 3–15 in. tall with a stout st.: lvs. beautiful silver-color, nearly round, 7-parted, the lobes wedge-shaped, and 3-parted: fls. large, often 1½ in. across; sepals broadly ovate, cuspidate, silvery; petals ovate or nearly round, pale rose, or sometimes white, much longer than the sepals. Chatham Isl.—Not hardy north of Washington and to be grown in temperate house. Little known in Amer. but a desirable greenhouse plant.

1630. Geranium maculatum. (×⅛)

3. **anemonifòlium,** L'Her. (*G. canariénse,* Reut.). A stiff single-stemmed perennial from a thickened rootstock or tube: lvs. glabrous, round-ovate, 5-parted, the lobes finely dissected: fls. corymbose, the pedicels and calyx densely hairy; sepals oblong, mucronate, the mucro almost ½in. long; petals 2–3 times as long as the sepals, obovate, pale purple. Canary Isls. and Madeira. S. 244.—Must be grown in the temperate house, but doubtless hardy south of Washington.

4. **malvæflòrum,** Boiss. A usually 1-stemmed perennial, from a thickened tuber, not over 18 in. tall: lvs. long-petioled, 5–9-parted, the lobes finely dissected, hairy: fls. showy, the pedicels and peduncles densely hairy; sepals ovate-oblong, hairy; petals rose-purple, obcordate, the apex often emarginate, about twice as long as the sepals. Medit. Region.—Very doubtfully hardy north of Philadelphia.

5. **macrorrhìzum,** Linn. A large-rooted species, about 1½ ft. high, with a st. suffruticose at base: lvs. smooth, round, basal ones 5-lobed, cauline 3-lobed, toothed and often colored red: fls. in bunches at the end of the st.; calyx inflated; the sepals ovate and 3-nerved; petals spatulate and blood-red in color. May to July. S. Eu. B.M. 2420. S. 271.

6. **argénteum,** Linn. Silver-leaved Crane's-bill. About 3 in. high: lvs. almost radical, on long petioles, 5–7-parted, with 3-fid linear lobes, both surfaces hoary: peduncles almost radical, 1- or 2-fld.; fls. large, pink, with darker veins; petals emarginate. Middle of June to Aug. Carnic Alps. B.M. 504. L.B.C. 10:948. S. 59.—One of the best for the rockery. Often acts as a biennial in New England.

7. **cinèreum,** Cav. (*G. subargénteum,* Lange). Gray Crane's-bill. Like *G. argenteum,* but 2-fld. and paler in color: lvs. not so hoary in appearance. June, July. Pyrenees.

8. **phæum,** Linn. About 2 ft. high, with upright, short-haired st., glandular above: lvs. 5–7-lobed and deeply toothed: peduncles 1–2-fld.; petals spreading, obovate, unequally notched and often with a small spur, very dark blue, almost black, with white spot at base of each petal. May, June. Cent. and W. Eu.

9. **Ríchardsonii,** Fisch. & Trautv. About 1½ ft. high: lvs. thin and terminal, lobe of the uppermost lvs. longer than the often greatly reduced lateral lobes: pedicels conspicuously glandular pubescent; fls. large, white or sometimes streaked with pink; petals with long white hairs on inner surface. Colo. and west.—Sts. and young growth tinged with red.

10. **aconitifòlium,** L'Her. St. usually simple, grooved, 10–20 in. tall, few-lvd.: lvs. more or less hairy, deeply 7-parted, kidney-shaped or orbicular, the lobes broadly ovate, deeply pinnatifid, the segms. mucronulate: fls. fragrant, loosely corymbose, the pedicels 2-fld.; sepals oblong or oblong-ovate, 3-nerved; petals white, obovate, the margins slightly wavy. Alpine or sub-alpine region of Eu. June.—Useful chiefly as rock-garden species.

11. **sanguíneum,** Linn. About 1½ ft. high, with st. occasionally forked, erect: lvs. all petiolate, mostly 7-parted, with 3–5-lobed linear lobules: peduncles long, mostly 1-fld.; fls. very large, blood-red. June to Aug. Eu.—One of the best species in cult.

Var. **lancastriénse,** With. (*G. prostràtum,* Cav.). A dwarfer form, smaller and with less deeply lobed foliage: fls. lighter in color and conspicuously veined purple.

12. **Frèmontii,** Torr. & Gray. A 1- or many-stemmed perennial: lvs. nearly round, palmately 5–7-parted, the lobes 3-toothed or sometimes crenate, slightly hairy: fls. large and showy, frequently 1–1½ in. across; sepals oblong, 3-nerved; petals pale rose-purple, obovate, toward the base densely ciliate. Rocky Mts. G. 29:191.—A handsome garden species. Not as yet much known in cult. in Amer. but a fine showy geranium for the hardy border. Blooms all summer.

13. **ibéricum,** Cav. Iberian Crane's-bill. From 1–1½ ft. high: st. erect and leafless below, above dichotomously branched, villous: lvs. opposite, 5–7-parted, with deeply cut lobes and toothed lobules: fls. 1 in. across, in showy, open panicles, violet. July, Aug. Iberia. Gn. 71, p. 167. B.M. 1386. S. 84. Var. **álbum,** with white fls., is rare but known by some dealers.

Var. **platypétalum** (*G. platypétalum,* Fisch. & Mey.). Slightly shorter than the parent, with lvs. less deeply lobed and lobes less pointed: fls. deeper and richer in color, and also larger. G.M. 52:61. Gn. 76, p. 108. G. 3:293; 9:686.

14. **armènum,** Boiss. (*G. Backhousiànum,* Regel?). About 2½ ft. high, the lower part of the st. thickened and almost woody: lvs. radical, upright, orbicular, with 5 deep lobes: fls. about 1½ in. across, inclining to a dark crimson; petals dark spotted near the base, obovate, often with the tips a little recurved. All season at irregular intervals. Armenia. R.H. 1891: 350.—A very vigorous and floriferous species. Sometimes growing 4 ft. high.

15. **praténse,** Linn. Meadow Crane's-bill. About 2½ ft. high, with an upright round st.: lvs. mostly hand-shaped, with 7 lobes, each deeply cut: peduncles mostly 2-fld., drooping after flowering; fls. large, blue;

petals entire. June, through Aug. Eu. G. 18:649. G.L. 18:208. Gn.W. 24:367. Var. **flòre-plèno,** Not so tall as parent. Very numerous deep blue fls. in clusters. June and July, and often again in fall. J.H. III. 48:305. Var. **álbum,** a white-fld. form is known.

16. **maculàtum,** Linn. Wild or Spotted Crane's-bill. Fig. 1630. The common American species, about 1½ ft. high: st. angular: basal lvs. long-petioled, deeply 3–5-parted; st.-lvs. opposite, shorter-petioled: peduncles 1–5, infl. often umbellate; fls. 1–1½ in. broad, rose-purple; petals woolly at base. June, July. N. Amer. B.B. 2:341. S. 332.—Showy native species; should be more in cult. Grows best in somewhat wet places. Var. **plènum,** a double-fld. variety of deeper color. Var. **álbum,** a pale-fld. or pure white form is known.

17. **incìsum,** Nutt. (*G. eriánthum,* Lind.). About 1 ft. high, leafy branched, the st. thickened below, solitary: lvs. finely cut, long hairy, the hairs fine and silky: pedicels conspicuously glandular-pubescent; sepals oblong-lanceolate, mucronate; petals with stiff white hairs, inner surface purple, about 1 in. wide. Ore.—A hardy species well worth growing. Not perfectly hardy near Boston.

18. **eriostèmon,** Fisch. (*G. platyánthum,* Duthie). St. erect, slender, grooved, from an almost woody base: lvs. kidney-shaped, 5-lobed, sometimes palmately so, the lobes ovate, toothed, the teeth slightly mucronate: fls. corymbose, the sepals ovate, obtuse, very hairy; petals violet-purple, broadly obovate, entire. Native of Siberia and temp. China.—A showy and useful garden plant.

19. **sibíricum,** Linn. Siberian Crane's-bill. A slender, somewhat forked plant, brown-villous, 1–2 ft. high: lvs. deeply 3–5-parted: peduncles slender, usually 1-fld.; fls. very small, dingy white, the obovate petals scarcely exceeding the oblong-lanceolate 3-nerved sepals. June through Aug. Siberia, and naturalized near New York. B.B. 2:341. Jacq. Hort. Widd. pl. 19.—Another form under same name, with brick-red fls., appears to be in cult.

20. **grandiflòrum,** Edgew. A thick-stemmed perennial about 10–16 in. tall, usually somewhat glandular, branched: lvs. long-petioled, the blade 5-parted and rotund in outline, the lobes irregularly toothed: fls. bunched at the apex of the branches, showy; petals spreading, pale lilac, the veins dark purple, about as long as the sepals. N. Asia. F.S.R. 1:54. Gn. 64, p. 184.—Suitable mostly for rockeries.

21. **nepalénse,** Sweet. St. spreading or ascending, thin, not more than 18 in. long: lvs. ovate-rhomboid, deeply 5-lobed, hairy, the lobes dentate, the teeth almost spinose: fls. numerous, on hairy pedicels; sepals lanceolate, acuminate, often mucronate; petals usually about equaling the sepals, rose-purple, broadly obovate, not emarginate at apex. Mountains of Asia. June–Aug. S. 12.—Useful only in the rockery.

22. **Éndressii,** J. Gay. About 18 in. high, the st. covered with pale brown hairs: lvs. opposite, palmate, 5-lobed, upper ones 3-lobed, serrated, densely hairy, with spreading hairs: peduncles axillary, 2-fld.; petals entire, fringed at base, light rose, darker veined, 2–3 times the length of the 3-nerved, oblong-ovate sepals. Summer. Pyrenees.—Among the best for the border, and useful for cutting.

23. **Wallichiànum,** D. Don. Of prostrate trailing habit: st. and lvs. covered with silky hairs, the st. deeply grooved: lvs. light green, 3–5-parted, with deeply toothed lobes: fls. large, purple, borne sparingly all summer; sepals 3-nerved, the lateral nerves stiff-hairy; petals about twice as long as the sepals, smooth, emarginate. Himalayas. B.M. 2377. S. 90.—For the rockery and must not be grown in the open exposed parts of it. The hot dry winds of midsummer in E. U. S. are not favorable.

24. **collìnum,** Steph. (*G. Lóndesii,* Fisch.). St. angular and usually decumbent, grooved and hairy: lvs. palmately 5-parted, deeply divided and cut: sepals lanceolate-ovate, 3-nerved, densely hairy; petals entire, purple, with a tinge of violet. June, July. E. Eu.—One of the showiest in its season. Should be cut back before seeding, to induce second bloom.

25. **Grevilleànum,** Wall. St. creeping, rarely a little erect: lvs. long-petioled, the blades usually 5-lobed, kidney-shaped, hairy, the lobes deeply serrate, but not usually divided: flowering stalk thick, more or less glandular, the fls. large and showy, frequently 2 in. across; sepals oblong-ovate; petals obovate, sometimes hairy at their bases, pale rose or in some forms with large purple spots, at least as to the wild plant, 1–2 times the length of the sepals. Himalayas.—Useful for the rockery.

The following are unknown as to botanical affinities or are insufficiently known in Amer.

G. Balkànum, Hort. A hardy plant, with fragrant foliage: fls. on radical sts., 1 in. across, dark magenta. June.—*G. Heldreìchii,* Hort. Orange-colored fls.=(?).—*G. Lòwii,* Hort. 2–2½ ft.: fls. bright rose with violet center. Name unknown in botanical literature.—*G. prostràtum,* Hort. Fls. purple. Advertised as "good rockery subject."=(?).—*G. sylváticum,* Linn. About 2 ft. high, with a soft-haired, upright, round st.: lvs. 5–7-parted, lobes oblong, deeply toothed: fls. purple or violet. June, July. The common wood geranium of Eu. A white-fld. form *G. sylváticum álbum,* Hort., is known. Gn. 72, p. 178.—*G. tuberòsum,* Linn. Tuberous-rooted, 9–15 in. high, with st. at base naked: lvs. many-lobed, linear and serrate: pedicels 1–2-fld., fls. large, violet. May. S. Eu.

N. Taylor.†

GERANIUM, FEATHER: *Chenopodium Botrys.*

GERÁRDIA (after John Gerarde, 1545–1607, perhaps the most popular of the herbalists). *Scrophulariàceæ.* Hardy annual and perennial herbs, all American, and mostly of the Atlantic states, with yellow or rosy purple flowers, in late summer and autumn, the later color rarely varying to white.

Leaves mainly opposite: calyx 5-toothed or cleft; corolla bell- to funnel-shaped, broad-throated, 5-parted, the 2 posterior lobes often smaller and more united; stamens commonly more or less hairy; anthers more or less approximate in pairs: caps. globose, 2-grooved; seeds usually angled, loose-coated. The first 3 species described below belong to a section in which the roots are more or less saprophytic; by some, and probably correctly, they are considered as belonging to the genus Dasystoma. These plants are therefore rather difficult to cultivate, and are offered only by collectors. *G. tenuifolia* is offered by one dealer, the seeds presumably gathered in European gardens.

A. *Fls. yellow.*

B. *Corolla pubescent outside: biennial or annual.*

Pediculària, Linn. St. much branched: pubescence partly glandular and viscid, especially on the pedicels and calyx, while in the next 2 species there is no glandular pubescence: lvs. 1-2 in. long, all pinnatifid: fls. in loose panicles or solitary, the calyx-lobes oblong and herbaceous, usually incised. E. N. Amer.

BB. *Corolla glabrous outside: perennial.*

C. *Height 3–6 ft.*

virgínica, Linn. (*G. quercifòlia,* Pursh). St. at first glaucous, sparingly branched: lower lvs. 3–5 in. long, 1–2-pinnatifid; upper lvs. rarely entire: calyx-lobes ovate, entire. Dry woods, E. U. S.

CC. *Height 1–2 ft.*

lævigàta, Raf. Not glaucous but glabrous, the st. simple or slightly branched: lvs. 1½–4 in. long, entire, or the lowest somewhat incised, all petioled, lanceolate or ovate-lanceolate: calyx-lobes ovate-lanceolate, equaling or shorter than the tube and caps. glabrous, about twice as long as the calyx. Oak barrens, etc. S. E. U. S.

AA. *Fls. rosy purple rarely varying to white.*

B. *Height 1 ft.*

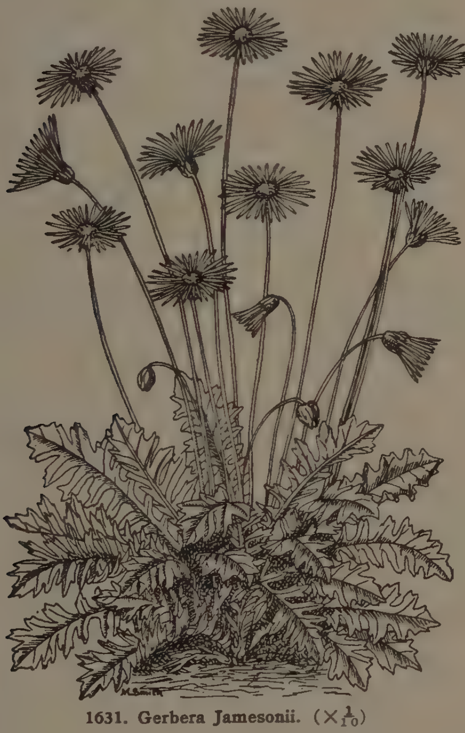
tenuifòlia, Vahl. Height 1 ft.; branching, paniculate: lvs. mostly narrowly linear: infl. racemose; corolla ½in. long, light purple, spotted, sometimes white. Low or dry ground, E. N. Amer.

BB. *Height 2–3 ft.*

linifòlia, Nutt. Perennial: lvs. erect, very narrowly linear, 1 line wide: calyx-teeth minute; corolla 1 in. long. Low pine-barrens, N. Amer. Not cult., but said to be a parent with *Pentstemon pulchellus* of **G. hýbrida,** Hort. Intro. by Haage & Schmidt, 1899. The poor cut in S. H. 2:485 seems nearer Pentstemon than Gerardia.

Wilhelm Miller.
N. Taylor.†

GERBÈRA (named in honor of Traug. Gerber, a German naturalist who traveled in Russia). *Compósitæ.* A small group of temperate and tropical Asiatic and African perennial herbs grown for their yellow or pink or orange flower-heads.



1631. Gerbera Jamesonii. ($\times\frac{1}{10}$)

Stemless herbs with radical, petioled lvs. which are entire or sometimes lobed: fl.-heads solitary, many-fld., the conspicuous rays in 1 or 2 rows, those of the inner row, when present, very short and sometimes tubular and 2-lipped, as are the disk-fls.: achenes beaked.—There are 40 species, only one of which (*G. Jamesonii*) is well known in Amer. and is sometimes found outside the collections of botanic gardens and fanciers. They should be grown in the temperate house, in a rich compost of sandy loam and peat. Prop. by seeds or by cuttings of side shoots.

Jàmesonii, Hook. Fig. 1631. Hairy throughout, the mature lvs. very woolly beneath: lvs. numerous, the petiole 6–8 in. long, the blade 5–10 in., a little pinnatifid: heads solitary, the showy orange-flame-colored rays strap-shaped. Transvaal. B.M. 7087. G.C. III. 5:773. Gn. 36:340. A.G. 22:345. Gt. 54:1545. G.W. 2, p. 2. R.H. 1903:36.—Could be grown outdoors in the S. A brilliant summer-blooming composite, more or less planted in the open. Var. **transvaalénsis,** Hort. Has larger fl.-heads than type, of somewhat lighter color. Var. **illústris,** Hort. A robust variety.

G. aurantìaca, Sch. A handsome plant with fls. 2½ in. diam.: florets red, with bright yellow anthers. Natal and the Transvaal. B.M. 8079. Has been listed under name of G. Elsæ.—*G. cantabrigiénsis,* Hort. A garden hybrid between G. Jamesonii and G. viridifolia G.M. 47:366, desc.—*G. viridifòlia,* Sch., is a little-known green-lvd. plant with showy fls. that are white on the upper side, yellow beneath. S. Afr.—Well worth growing in temperate house.

N. Taylor.

GESNÈRIA (Conrad Gesner, Zurich, 1516–1565, celebrated naturalist, and considered to be the originator of the idea of genus in taxonomy). *Gesneriàceæ.* Greenhouse and hothouse plants with showy tubular flowers. Sometimes written *Gesnera.*

Low perennials, sometimes shrubs, with simple, opposite lvs. and showy tubular fls. in terminal short panicles or fascicles: calyx campanulate, 5-parted; corolla long, straight or curved, more or less ventricose, the base often distinctly swollen or gibbous, the limb mostly shallow-toothed and nearly regular or bilabiate; stamens 4, didynamous (in pairs under the upper lip); style 1, long; glands on the disk in the fl.—Species upward of 40, in the American tropics. Often tuberous plants; allied to Achimenes, Gloxinia, Isoloma and Streptocarpus. Some of the gesnerias of the trade belong to Nægelia, which differs, amongst other things, in having an annular or ringed disk rather than a disk of distinct glands. There is considerable variation of opinion as to the limits of Gesneria. In this account, the genus is held to include Pentarhaphia, Duchartrea, Codonoraphia, Conradia, Ophianthe, Synanthera. The plants of this group are probably considerably modified by crossing and breeding. The catalogue name *G. hybrida* probably covers some of these forms.

A. *Lvs. green.*

cardinàlis, Lehm. (*Dircæa cardinàlis,* Regel. *G. macrántha,* Hort.). St. 6–12 in. high, stout, and hairy: lvs. large, cordate-ovate, crenate-dentate, petioled: fls. red, tubular, hairy, slender (2–3 in. long), the upper lip projecting and the lower one almost wanting, borne in a terminal, more or less flat cluster. Nativity unknown. B.M. 8167. Gn. 42:232. A good species for the stove.—*G. Duvàlii,* Hort., is evidently only a slender form of this species.

Héndersonii, Hort. Lvs. velvety green: fls. 3 in. long, brilliant scarlet, in a large truss. Probably of garden origin.

longiflòra, Hort., is a small-lvd. species, with drooping, long-tubed nicotiana-like white fls. Gn. 33:340.—The botanical position of this plant is in doubt. It is not the *G. longiflora,* HBK., which is purple-fld., nor *G. longiflora,* DC., which is *Achimenes longiflora.* By some it has been confounded with *Isoloma longifolium,* Decne. *Pentarhaphia longiflora,* Lindl. (*Gesneria ventricosa,* Swartz), is a small somewhat branched shrub: lvs. ovate-lanceolate or oblong-lanceolate, acuminate and serrulate, pale green beneath: fls. bright scarlet, 1½ in. long, in long-peduncled cymes; corolla-tube somewhat curved, narrowed toward the base; stamens red, much exserted. W. Indies. B.M. 7339.—A good summer- and autumn-blooming stove shrub.

AA. *Lvs. richly colored, at least beneath.*

libanénsis, Morr. (*Pentarháphia libanénsis,* Hanst. *Rhytidophýllum floribúndum,* Van Houtte. *Ophiánthe libanénsis,* Hanst.). Subshrub, but only a few inches high, simple or slightly branched: lvs. more or less rosulate toward top of st., 3–4 in. long, obovate-lanceolate, more or less blistered, toothed: fls. bright red, half as long as lvs., tubular, puffed or swollen in the middle, hairy, the mouth oblique and the limb of 5 small ciliated lobes; stamens equaling the tube; calyx very short, the segms. leafy. Cuba. B.M. 4380.

craniolària, Swartz (*Pentarhàphia craniolària,* Decne.). Three to 4 ft. somewhat shrubby: lvs. glabrous above and hispid beneath, obovate-cuneiform, runcinate or more or less lobed: fls. greenish yellow with black dots, in long-peduncled clusters of 5 or 6, the corolla-lobes fringed. St. Domingo.

Lèopoldii, Scheidw. Compact: st. erect from the large, depressed tuber, thinly hairy: lvs. verticillate in 4's, broadly ovate-acuminate, more or less unequal at base, dentate, green above and purple beneath: fls. long-tubular, thinly hairy, the lobes nearly equal; light scarlet, in a rather loose, umbel-like cluster. Nativity not recorded. F.S. 7:704, 705. Gn. 53:542.

exoniénsis, Hort. Hybrid: lvs. velvety, with red and purple hairs: fls. bright orange-red, yellow in the throat, in close clusters: 1 ft.

1632. Geum rivale.

refúlgens, Hort. Probably a hybrid: lvs. cordate-ovate, red-hairy: fls. deep red or vermilion: 1½ ft.—One of the best.

Donkelæriàna, Lem. (*G. Dónklarii,* Hort.). St. often 2 ft. tall: lvs. large, cordate-ovate, crenate, hairy, green and purple-tinged above and purple beneath: fls. tubular-campanulate, the rounded lobes nearly equal, dull red, 2 in. long, hanging from long pedicels in a large panicle. Variable. Colombia. B.M. 5070. R.B. 21:97. F. 1853:241.

G. amábilis, Hort.=Nægelia.—*G. cinnabarìna,* Lind.=Nægelia.—*G. guatemalénsis,* Hort., "a free grower and bloomer, fls. orange," was once offered.—*G. jasminiflòra,* Hort., "fls. of the purest white, freely produced, beautiful," once offered.—*G. oblònga,* Hort., fls. orange.—*G. oblongàta,* Hort., is probably the same and is very likely an Isoloma.—*G. Regìnæ,* Hort. Exhibited abroad: lvs. green and velvety, the midrib and main veins white: fls. bluish purple.—*G. robústa,* Hort., "vermilion, beautifully spotted and tigered."—*G. Seèmannii,* Hook.=Isoloma.—*G. zebrìna,* Paxt.=Nægelia.

L. H. B.

GETHÝLLIS (old Greek name, of no particular application). *Amaryllidàceæ.* Nine or 10 stemless herbs, with the look of crocus, allied to Sternbergia, from the Cape region, seldom cult. under glass; apparently not in the trade: lvs. usually appearing after the fls., linear, sometimes filiform and twisted: fls. appearing through the ground, of delicate texture and of short duration, fragrant, whitish, salverform, with a long slender tube and 6 similar acute spreading segms.; stamens 6 or more, attached in the throat; ovary 3-celled, concealed in the bulb-neck: bulbous. Prop. by offsets or seeds. *G. áfra,* Linn. Bulb 1½–2 in. diam.: lvs. 12–20, linear and twisted: fl. with whitish limb 2 in. or less long and tube 3–4 in. long; stamens 9–12: fr. yellowish, clavate, recorded as edible. B.R. 1016. *G. spiràlis,* Linn. Bulb 1–1¼ in. diam.: lvs. 4–6, linear-subulate, very much twisted, 4–6 in. long; perianth-tube 2–3 in. long, limb 1–1½ in. long, whitish and tinted red on the outside; stamens 6: fr. clavate, 2–3 in. long. B.M. 1088. *G. ciliàris,* Linn. Bulb 1½ in. diam.: lvs. 20 or more, linear, twisted, prominently ciliate: perianth-tube 2–3 in. long, the whitish limb ½in. long: fr. yellow, clavate, 2–3 in. long.

L. H. B.

GÈUM (probably originally from Greek, *geuo,* to have a taste; referring to the roots). *Rosàceæ.* Hardy border and rock plants, some of which are valued for their bright red flowers, some for their pure yellow flowers, others for their long plumy fruits.

Herbs, with a perennial rhizome, sometimes stoloniferous: root-lvs. crowded, odd-pinnate, the alternate lobes often smaller, terminal ones largest; st.-lvs. few, mostly of 3 lfts. or bract-like: fls. 1–2 in. across, solitary or corymbose or cymose; calyx persistent, its tube nearly hemispheric, usually 5-lobed; petals 5, nearly or quite round, longer than the calyx: fr. bunched on a short receptacle, frequently plumed.—More than 50 species, mostly in temperate and frigid regions.

The plumy kinds are all contained in the subgenus Sieversia. *G. chiloense* is the best species, and in the gardens is commonly seen in double forms. A gardener writes that "inferior forms show scarcely any duplicity." Geums are of easy culture, and are propagated by division or seed. It is said that they hybridize freely if grown together. The dwarf kinds are suited only to the rockery. Correvon, of Geneva, Switzerland, writes that *G. reptans* is one of the best of the rockery kinds, and needs full sunlight. For *G. triflorum* he advises half exposure to sun and a light, moist soil. *G. rivale* grows naturally in marshy places.

A. *Plumy geums: style in fr. long and plumose*

B. *Fls. yellow.*

C. *Plants spreading by runners.*

réptans, Linn. Root-lvs. interruptedly pinnatifid; upper lvs. 3-lobed, deeply crenate-serrate: fls. erect; petals obcordate, not much longer than the sepals. Eu. Gn. 45:284.—The purple styles are pretty.

CC. *Plants not spreading by runners.*

D. *Root-lvs. pinnatifid.*

montànum, Linn. An erect and single-fld. perennial with lower lvs. lyrate pinnatifid; terminal lft. broadly ovate-rounded: calyx-lobes entire, while those of *G. reptans* are often 3-cut at apex; petals 1–2 times the length of the sepals. S. Eu. G.C. II. 13:425. Gn. 45, p. 285.—Under the name of *G. Heldreichii* and *G. Heldreichii superbum* are advertised what appear to be forms of this with orange-colored fls. which often produce more than 1 fl. The name Heldreichii is of no botanical significance. G.M. 46:371.

DD. *Root-lvs. kidney-shaped.*

radiàtum, Michx. (*Sievérsia Péckii,* Rydb.) Very hirsute: root-lvs. 2–5 in. broad: st. 1–8-fld.: bractlets minute. Mountains of N. C. and Tenn.

BB. *Fls. bright red, unmixed with yellow.*

C. *Lateral lobes of lvs. minute.*

coccíneum, Sibth. & Smith, not Hort. "St.-lvs. 3-lobed; root-lvs. lyrate, the terminal lobe largest, cordate-reniform: fls. erect. Mt. Olympus in Bithynia." The above is an exact translation of the entire description given by Sibthorp and Smith, Flora Græca, t. 485.—The chances are that all the plants in the trade under this name are really *G. chiloense.* The true *G. coccineum* is known in the botanic gardens.

CC. *Lateral lobes of lvs. 1 in. long.*

chiloénse, Balb. (*G. coccineum,* Hort., not Balb.). "St.-lvs. 3-parted, laciniate; root-lvs. interruptedly lyrate, pilose: terminal lobe rotund, somewhat 3-lobed, crenate: fls. panicled: carpels villous." The above is a literal translation of B. R. 1348, where the terminal lobe is shown to be 2½ in. each way. Chile. B.R.

1088, and under 1099. L.B.C. 16:1527. Gn. 14:562; 45, p. 284. R.H. 1890, p. 305; 1881, p. 309. G. 4:487. All erroneously as *G. coccineum.*

Var. **miniàtum,** Hort. (*G. miniàtum*, Robt. Parker), has fls. about two shades lighter in color. A robust form growing 2–3 ft. high, easily prop., and fls. from April to end of July. Gn. 38:298, where it is supposed to be a hybrid of *G. chiloense* var. *grandiflorum* × *G. aureum*, which is a robust many-fld. form of *G. montanum* or else of *G. chiloense* × *G. urbanum.*

Var. **grandiflòrum,** Hort., is an improved form. "The double-fld. form of this seems to be a more general favorite, the blooms lasting longer, though I think they lack the elegance of those of the simple form. They begin to expand soon after May and are produced until Oct."—D. K., in Gn. 38, p. 299. Var. **plènum,** Hort., a semi-double form, is known. It has bright scarlet fls. and is a good border plant. G. 10:495.

BBB. *Fls. chiefly dull red, mixed with yellow.*

triflòrum, Pursh (*Sievérsia ciliàta*, Pursh). Low, softly hairy: lfts. very numerous and crowded, deeply cut: fls. 3 or more on long peduncles; calyx purple, as long as the petals. Coulter says the petals are erect. Arctic Amer. L.B.C. 17:1609. Fruit showy and interesting all summer.

AA. *Not long and plumy in fr.*

B. *Style jointed and bent in the middle.*

C. *Fls. purplish orange.*

rivàle, Linn. Fig. 1632. St. erect and nearly simple: root-lvs. lyrate; st.-lvs. few, with 3 lobes or lfts.: calyx brownish purple; petals purplish orange, obovate and emarginate, narrowed into a claw. North temperate regions. Var. **álbum,** is also sold.

CC. *Fls. golden yellow.*

macrophýllum, Willd. St. erect and hairy: lower lvs. pinnatifid, 3–7-lobed, often with small lfts. irregularly placed on the rachis: fls. several, short-peduncled. E. N. Amer. B.B. 2:221.

BB. *Style not jointed, straight.*

Róssii, Seringe. Slightly pubescent above: scape 1–3-fld.; styles glabrous. Colo., arctic regions.—Fls. large, bright yellow.

G. atrococcíneum, Hort., may be a typographical error for G. atrosanguineum.—*G. atrosanguíneum*, Hort., is presumably a form of G. chiloense, with darker fls. than the type, and sold mostly if not entirely, in its double condition.—*G. bulgáricum*, Hort.=(?). *G. Éwenii*, Hort. has light orange fls. and is said to be a good border plant.—*G. japónicum*, Thunb., is sold, but little known. St. flexuose, hirsute: lvs. 3–5-lobed, hirsute: fls. erect, yellow; petals as long as the calyx: fr. hirsute, awned, recurved. Japan.

WILHELM MILLER.
N. TAYLOR.†

GEVUÌNA (from the Chilean name). Also written *Guevina. Proteàceæ.* One species, **G. Avellàna,** Molina (Syn., *Quádria heterophýlla*, Ruiz & Pav.), sparingly planted in Calif. CHILEAN NUT. CHILE HAZEL. An evergreen tree, with large, alternate odd-pinnate, dark green, glossy lvs. and white, hermaphrodite fls. in long, axillary racemes: sepals 4, deciduous; stamens 4; ovary nearly sessile, 1-celled and 2-ovuled, the style filiform: fr. a somewhat fleshy drupe, about the size of a cherry, coral-red when ripe, the seed having a pleasant-flavored kernel, resembling the hazel in taste and largely used by the Chileans. G.C. III. 40:174. Prop. by seeds or by green cuttings under glass. No trees of bearing age recorded in U. S., although a tree approximately 50 years old is recorded as bearing in Devonshire, England.

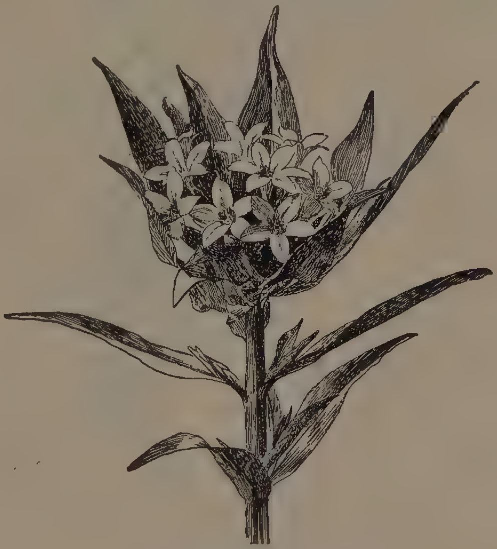
W. A. TAYLOR.

GHERKIN: A small cucumber. The Burr or West Indian gherkin is *Cucumis Anguria.*

GÍFOLA (anagram of *Filago*). *Compósitæ.* About 10 species of small woolly composites, of no horticultural significance, in warm and temperate countries. *G. germánica*, Dum. (*Fílago germánica*, Linn.), the COTTON-ROSE, is a cottony annual plant somewhat like leontopodium, which latter is now and then collected by tourists and dyed like immortelles. It was called *Herba impia* by the old herbalists, because a new generation of clustered heads rises out of the parent cluster as if undutifully exalting itself. It is native in Eu., and has become naturalized in E. N. Amer. in dry fields. St. erect, 6–18 in.: lvs. lanceolate, upright, crowded: heads small, rayless.

GÍLIA (Philipp Salvador Gil, Spanish botanist of the latter half of the eighteenth century, collaborator with Xaurez). *Polemoniàceæ.* Annual, biennial or perennial herbs, mostly of western North America.

Flowers small, of many colors, the corolla funnelform to bell-shape or sometimes salverform, 5-lobed; stamens 5, inserted near the base of the corolla-tube, the filaments usually naked; ovary 3-loculed, with axile placentæ, the stigmas 3 (or sometimes 2).—Nearly 100 species, as the genus is now understood by most botanists. Gilia is a very polymorphic genus, into which Gray now (Syn. Fl. 2, pt. 1, suppl.) throws Collomia, Linanthus, Leptosiphon, Leptodactylon, Navarretia, Hugelia, Ipomopsis, Fenzlia. In this conception, Gilia is defined as follows: "Fls. naked, not involucellate; calyx partly herbaceous, scarious below the sinuses; lobes narrow and acute; corolla salverform or funnelform to campanulate or almost rotate; filaments not bearded at base: seeds wingless: herbs, or a few suffruticose." In cult. only *G. californica* is woody. It is not certainly hardy in the E.


1633. Gilia grandiflora. (×¾)

Several of the gilias are popular garden annuals or biennials (a few perennial). They are of the easiest culture, being vigorous, hardy and floriferous. They are mostly dwarfish, and are excellent for low masses, edgings or rockeries. Seeds may be sown where the plants are to grow. Any good soil will suit them.

INDEX.

achilleæfolia, 8.
aggregata, 12.
alba, 6. 8, 10, 14.
androsacea, 15.
aureus, 16.
californica, 18.
capitata, 6.
carmineus, 16.
coccinea, 2.
compacta, 10.
congesta, 4.
coronopifolia, 11.
debilis, 5.
densiflora, 14.
dianthoides, 17.
grandiflora, 1.
hybridus, 16.
laciniata, 7.
liniflora, 13.
linifolia, 13.
major, 6, 8.
micrantha, 16.
minima, 3.
multicaulis, 9.
nana, 10.
nivalis, 10.
rosea, 8, 10, 16.
speciosa, 17.
splendens, 10.
tricolor, 10.

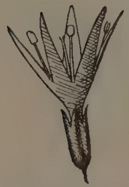
A. *Plants not shrubby.* (Nos. 1–17.)

B. *Lvs. normally alternate, entire or pinnately cut or divided (lower lvs. sometimes opposite).*

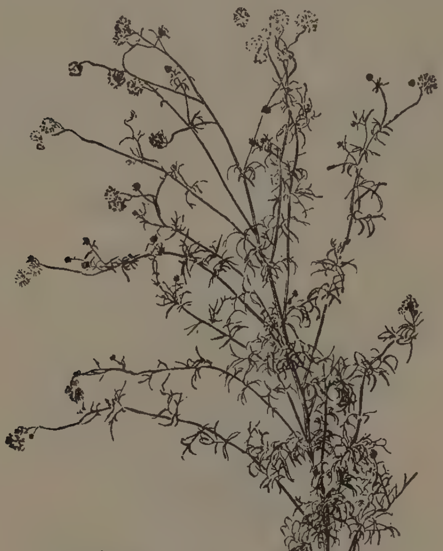
C. *Fls. in dense heads, which are subtended by leafy involucres.*

D. *Foliage entire or at least not much parted.*

1. **grandiflòra,** Gray (*Collòmia grandiflòra,* Douglas). Fig. 1633. Erect, with minutely pubescent reddish sts. 1–2 ft. high: lvs. linear-lanceolate or oblong, narrowed below but scarcely petioled, entire, acute: fls. many, in dense terminal heads, buff or salmon-color, redder inside, 1 in. long. Plains, west of Rocky Mts. B.M. 2894. B.R. 1174.—This and the next are interesting annuals. Useful as bee plants.



1634. Flower of Gilia capitata. (×2)



1635. Gilia achilleæfolia. (×¼)

2. **coccínea,** Gray (*Collòmia coccínea,* Lehm.). More slender: sts. not red: lvs. narrower (mostly linear), somewhat cut at the ends: fls. smaller, slender-tubed, yellow or buff outside and brick-red inside. Chile. B.R. 1622.

DD. *Foliage pinnately parted or compound.*

3. **mínima,** Gray (*Navarrètia mínima,* Nutt.). Dwarf and tufted (3 in. or less high) often forming broad tufts, nearly glabrous: lvs. needle-like, pinnately parted: fls. white, the corolla scarcely exceeding the white-hairy calyx. In arid districts. Dak. to Ore. and Colo.

4. **congésta,** Hook. A foot or less high, erect or spreading, tufted: lvs. mostly 3–7-divided into linear divisions: fls. corymbose or in close head-like cymes; corolla white, the oval lobes nearly as long as the tube; calyx-teeth long-pointed, nearly equaling the corolla. A small-fld. species growing from Rocky Mts. to the Pacific.

CC. *Fls. not in close heads, but more or less scattered, or if capitate, the heads not leafy-subtended.*

D. *Plant perennial: seed only 1 in a locule: fls. small.*

5. **débilis,** Wats. Two in. or less high: lvs. oblong, entire or 2–3-lobed, petioled: fls. solitary and nearly sessile, the purple corolla ⅔in. long, the tube exceeding the calyx. S. Utah.—Offered by collectors, but little known in cult.

DD. *Plant annual: seeds more than 1 to the locule: corolla distinctly tubular, but relatively small.*

E. *Infl. capitate.*

6. **capitàta,** Douglas. Fig. 1634. Plant 18 in. to 2½ ft. tall, the sts. long and nearly straight between joints: fls. about ½in. long, in dense, nearly globular heads, which terminate long, naked sts.; corolla-lobes lance-linear, acute: lvs. cut into very unequal linear lobes. Calif. and Ore. B.M. 2698. B.R. 1170. G.W. 15, p. 214.—An old favorite. There is a white form (var. **álba**). There is also a var. **màjor.**

7. **laciniàta,** Ruiz & Pav. Much like the last in botanical characters, and possibly a form of it: lower and much more slender, the lf.-divisions mostly very narrow (usually almost thread-like), the heads smaller or the fls. sometimes even scattered. Chile.—The fine foliage and compact habit make this species an excellent garden plant.

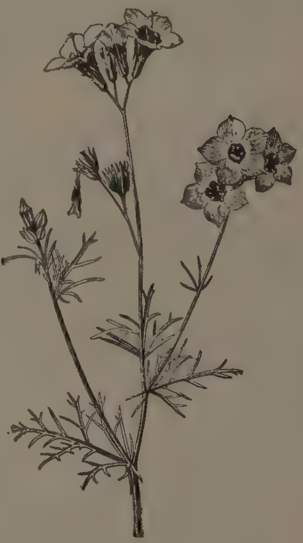
EE. *Infl. mixed, capitate on the main branches, scattered on the others.*

8. **achilleǽfolia,** Benth. Fig. 1635. Stout (2–3 ft.) and very branchy and bushy, the early main branches terminating in large, dense heads, but the later, finer growth bearing scattered fls.: lvs. small, with short, linear lobes or teeth: fls. large, violet or purple-blue, the corolla-lobes oblong or obovate: caps. large. W. Calif. B.M. 5939 (showing only capitate infl.).—An old garden plant. Fls. vary to white and rose, and there is a large-fld. form. Various horticultural names are in use for these forms, such as *álba, ròsea, màjor,* etc.

9. **multicaùlis,** Benth. Not unlike the preceding, from which it differs only in its smaller fls. and more distinctive habit. Calif. B.M. 3440 and B.R. 1682, both as *G. achilleæfolia* from which this may not really differ.

EEE. *Infl. scattered or loosely cymulose.*

10. **trícolor,** Benth. Fig. 1636. A very diffuse, twiggy grower, 2–2½ ft. high, sparsely pubescent: lvs. few on the full-grown plant, small, with many short, very narrow or needle-shaped divisions: fls. comparatively large (¾in. long or nearly so), nearly or quite bell-shaped, the corolla 2–3 times the length of the calyx; color of the roundish lobes violet and passing to whitish at the base, of the throat brown-purple and of the tube yellow. W. Calif. B.M. 3463. B.R. 1704.—One of the commonest of garden annuals. There is a white form (*G. nivàlis,* Hort. *G. álba,* Hort.), Gn. 72, p. 201, and a rose-colored form (*G. ròsea,* Hort.), and a red-violet form (var. *rùbro-violàcea,* Hort.) Besides these a small form has been called *G. nàna,* a large one *G. spléndens,* and a dense, stiff one *G. compácta.* None of these names appears to be in anything but trade catalogues. Thrives with the least care, and is always a profuse bloomer. It requires an open warm situation.



1636. Gilia tricolor. (×½)

DDD. *Plant biennial: seeds few or many in each locule: fls. large and long-tubular, red (running into white forms), the corolla very much surpassing the subulate calyx-lobes. (Ipomopsis.)*

11. **coronopifòlia,** Pers. (*Ipomópsis élegans,* Poir. *I. auranttaca* and *I. sanguínea,* Hort.). Standing Cypress. St. strict and unbranched, sometimes 6 ft. high, very leafy: lvs. pinnate, the divisions needle-like and about 1 in. long: fls. many, 1½ in. long, long-trumpet-shape, borne along the sides of the summit of the st., the calyx inconspicuous amongst the short bract-lvs., the corolla scarlet or pink-red and dotted and yellowish within, varying to orange, its lobes obtuse or nearly so and flaring. In dry soil, S. C., south and west. B.R. 1691. G.C. III. 40:277. G.M. 49:598. Gn. 70, p. 165.—Common old garden plant, and worthy. Fls. scentless. Name should probably be *G. rubra,* Heller.

1637. Gilia liniflora. (×⅜)

1638. Gilia micrantha. (×½)

12. **aggregàta,** Spreng. (*Ipomópsis élegans,* Lindl.). Differs in mostly shorter stature, pubescent st., and more slender habit, with redder (sometimes white) fragrant fls., with acute and reflexing corolla-lobes. Neb., south and west. B.R. 1281.—The fls. are fiery scarlet or sometimes nearly white. A very showy biennial.

BB. *Lvs. opposite, entire, or, if alternate (as in No. 13) palmately parted.*

C. *Foliage very fine, the lvs. cut into thread-like or linear divisions.*

D. *Corolla rotate-bell-shape, with a short, flaring tube.*

13. **liniflòra,** Benth. (*G. linifòlia,* Hort.). Fig. 1637. Ten to 20 in. high, diffuse and branchy: lower lvs. mostly opposite, but the upper alternate, all palmately divided to the base in needle-like or spurrey-like divisions: fls. rather large for the size of the plant, the corolla white or blush, nearly rotate, the thin lobes obtuse. Calif. B.M. 5895.—A useful tufty garden annual. The name *liniflora* is meant to designate the resemblance of the fls. to those of *Linum tenuifolium;* but some catalogue-maker, evidently thinking that the name meant *linear-flowered,* and was therefore inappropriate or an error, has changed the name to *G. linifolia,* under which name it is known in the trade.

1639. Gilia dianthoides, the Fenzlia of gardens.

DD. *Corolla salverform, with a filiform and elongated tube. (Leptosiphon.)*

14. **densiflòra,** Benth. (*Leptosìphon densiflòrus,* Benth.). Erect or even strict, 1–2 ft., hairy: lvs. with many filiform somewhat rigid divisions: fls. in rather close heads, lilac or white, ½–¾ in. long; tube of the corolla scarcely longer than the lvs.; lobes of the corolla spreading, obtuse, often dentate, nearly or quite as long as the tube. Calif. B.M. 3578. B.R. 1725.—Common garden annual. The white-fld. form is known as var. **álba,** Hort.

15. **androsàcea,** Steud. (*Leptosìphon androsàceus,* Benth.). Much like the last, but the tube very slender and much exserted beyond the calyx and lvs.: fls. 1 in. long, pink, lilac or white, in rather close heads, the corolla-lobes ovate-acute and entire, much shorter than the tube, 12–18 in. Calif. B.M. 3491. B.R. 1710.

16. **micrántha,** Steud. Fig. 1638. Tufted, 8 in. or less high, the sts. most leafy near the top: lvs. short, fascicled: fls. with an exceedingly slender thread-like tube which is 1–1½ in. long, and projecting prominently above the upper fascicles of lvs., the corolla-lobes spreading and obtuse; color range very wide,—from purple to lilac, red, yellow and white. Calif.—A popular bedding plant. Forms of it are known as *Leptosiphon aureus, L. carmineus, L. hybridus,* and *L. roseus.*

CC. *Foliage of entire (but narrow) lvs.*

17. **dianthoìdes,** Endl. (*Fénzlia dianthiflòra,* Benth.). Fig. 1639. Tufted, 6 in. or less high: lvs. narrowly linear, opposite: fls. 1–1½ in. long, lilac or purple, with yellowish throat, the flat-spreading lobes denticulate or nearly fringed. S. Calif. B.M. 4876. R.H. 1865:11.—A choice little annual, excellent for edgings and rock-work, bearing a profusion of pink-like fls. The fls. sometimes vary to white (*Fénzlia álba,* Hort.). A large-fld. form is called *G. speciòsa.*

AA. *Plants shrubby.*

18. **califórnica,** Benth. A low, procumbent and much-branched shrub: lvs. alternate, deeply digitately parted into 5–7 stiff and hairy segms: fls. showy, very free; sepals subulate, mucronate; petals cuneate, sometimes toothed, rose-colored. Calif. B.M. 4872.—A fine showy species, perhaps not hardy in the E.

G. abrotanifòlia, Nutt., occurs in mountains back of Santa Barbara, and has been listed in collections of native plants for sale: 1–2 ft., simple or somewhat branched: lvs. ample, all tripinnately dissected, the ultimate segms. very narrow and acute and curved backward: fl. without markings (blue?), large, the lobes spreading, obovate and obtuse; stamens scarcely protruding.—*G. Chamissònis,* Greene, is a segregate from G. achillæfolia: annual, but sometimes persisting over winter, 1 ft.: lvs. mostly twice pinnately dissected into linear segms.: branches few and peduncle-like, bearing large and dense heads of blue fls. Calif.

L. H. B.
N. Taylor.†

GILIBÉRTIA (J. E. Gilibert, 1741–1814, France, physician and botanist). *Araliàceæ.* A genus of very few Trop. American shrubs (if Dendropanax is separated) that are not known in cult. The name is one frequently but incorrectly used by gardeners for Trevesia, and *G. palmata* is described under that genus. *G. paniculata* and one or two others are referred to Polyscias. Gilibertia differs from Trevesia in having parts of the fl. in 6–8's instead of 8–12's, and in its simple entire lvs. From Dendropanax it differs mostly in its 6–8-merous rather than 5-merous fls. N. Taylor.

GILLÈNIA (dedicated to an obscure German botanist or physician of the seventeenth century, A. Gille or Gillenius). Syn. *Porteránthus. Rosàceæ.* Excellent graceful plants for the mixed border, rockeries, or other hardy gardens.

Erect, perennial herbs, 2–4 ft. high, with nearly sessile, 3-foliate, or 3-parted, stipulate lvs.: fls. white or pinkish, loosely panicled, perfect, perigynous; cup-shaped receptacle narrow, somewhat contracted at the mouth, 5-toothed; petals strap-shaped, unequal, 4–8 lines long; stamens 10–20, very short; pistils 5, superior, lightly coherent, later distinct, pubescent: fr. consisting of 5 2–4-seeded follicles.—Two species. They are hardy and of easy cult. in any good soil. Prop. by seeds or division.

trifoliàta, Moench. Bowman's Root. Lfts. serrate; stipules small, awl-shaped, mainly entire. Cent. and S. U. S. B.M. 489 (as Spiræa). Mn. 8:129. J.H. III. 43:188.

1640. Ginkgo biloba.

stipulàta, Trel. (*G. stipulàcea*, Nutt.). American Ipecac. Lfts. incised; stipules large, broad, and leaf-like, doubly incised. Cent. and S. U. S.

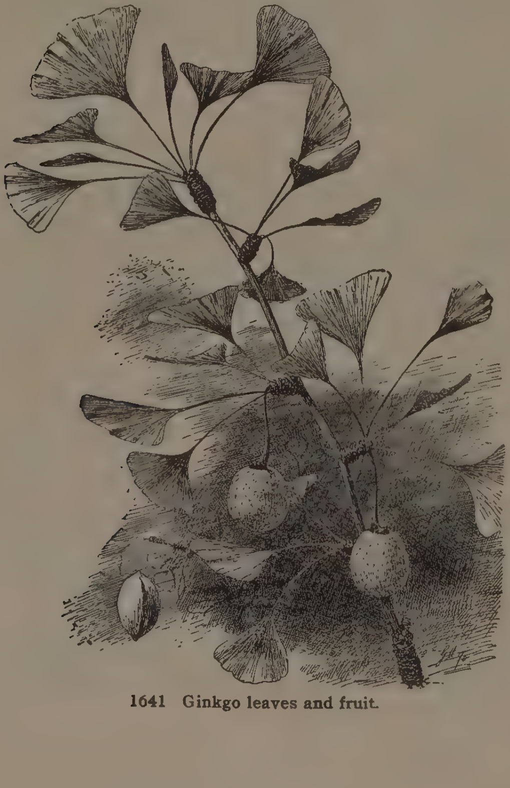
K. M. Wiegand.

GILLYFLOWER. Down to Shakespeare's time usually referred to what we now call the carnation, *Dianthus Caryophyllus*, also known as clove pink. Since Shakespeare's time gilliflower has usually meant either wall-flowers or stocks, as explained under Cheiranthus and Matthiola.

GINGER: *Zingiber officinale.* **Wild Ginger:** *Asarum canadense.*

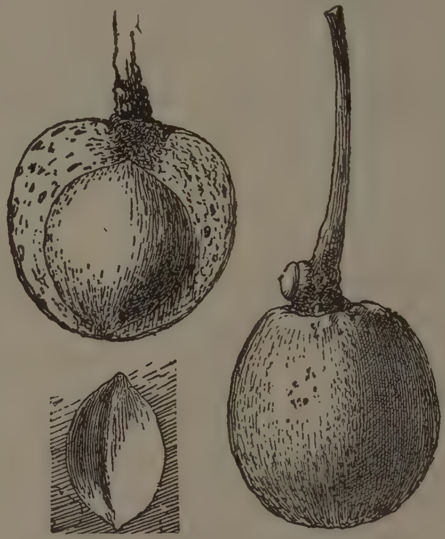
GÍNKGO (Chinese name). Syn., *Salisbùria. Ginkgoàceæ*, one of the segregates from the *Coniferæ*. One species in northern China and Japan, the sole remainder of a more numerous tribe in geologic time; now widespread as a street and park tree and also prized for the edible seeds.

Tall tree, with wedge-shaped deciduous lvs.: fls. small and mostly diœcious; pistillate fl. solitary, the single naked ovule ripening into a drupe; staminate fls. in slender, loose catkins: fr. a drupe about 1 in. diam., containing a very large lenticular seed or kernel.



1641 Ginkgo leaves and fruit.

bìloba, Linn. (*Salisbùria adiantifòlia*, Smith). Ginkgo. Maidenhair Tree. Kew Tree. Figs. 1640–1642. A straight, sparsely branched, usually slender tree, attaining a height of 60–80 ft.: lvs. 3–5, 1-clustered, fan-shaped, divided at summit, with thickened margin, striated on both sides with numerous parallel veins: fls. diœcious; male catkins slender, stalked; females on long footstalks, in pairs, of which one usually aborts: fr. a drupe, consisting of an acrid, foul-smelling pulp surrounding a smooth, angular oval, cream-colored, thin-shelled, sweet-kerneled nut. F.S. 10, p. 119. G.C. III. 5:265, 269. G.F. 1:175 (adapted in Fig. 1640). A.G. 12:268. Gng. 6:194. G.M. 52:1011. Gn. 66, p. 345. Gn.M. 2:11. G.W. 3, p. 542; 10, p. 285; 15, pp. 589–593. J.H. III. 64:148.—The ginkgo was intro. to Amer. early in the last century; it is generally successful on good soil in the eastern states as far north as E. Mass. and Cent. Mich., and along the St. Lawrence River in parts of Canada. It is of special value for solitary planting to secure picturesque effects. It is considerably planted in Washington, D. C., where it is growing in esteem as a street tree because of its upright habit and freedom from insect injury. Easily prop. from seed, stratified in autumn; varieties by budding and grafting. Several horticultural forms are recognized, including *laciniata*, *pendula* and *variegata*. The foul odor of the ripe frs., which continue to mature and drop during a period of some weeks, constitutes the chief objection to the species as a street tree, or near dwellings, and suggests the advisability of prop. from staminate trees by grafting or budding, for planting in such locations. The kernels, which have a sweetish, slightly resinous flavor, are highly esteemed for food in China and Japan, and are gathered from fruiting trees in Washington for such use by Chinese laundrymen.

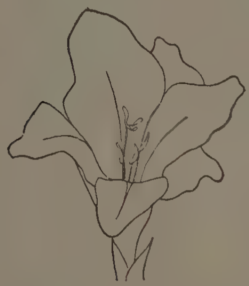


1642. Ginkgo fruit. (Natural size)

The word Ginkgo seems to be pronounced with a hard initial G in the orient, but in English a soft G should be used. The name is often spelled Gingko, but the other spelling is that used by Linnæus.

W. A. Taylor.

GINSENG (*Pànax quinquefòlium*, Linn. *P. Gínseng*, Meyer. *Aràlia quinquefòlia*, Decne. & Planch.) is to the Chinese more than quinine or any other drug is to Americans. As its name Panax implies, it is a panacea, being employed for all the ills that flesh is heir to. Though credited with stimulating, aromatic, alterative, carminative and tonic properties, the root is with us seldom used except as a demulcent. The reverence in which it is held, and the high price that it commands in China, led to extensive search for a substitute, which resulted in the discovery in 1716 of American ginseng, *Panax quinquefolium*, near Montreal, Canada. This root was favorably received by the Chinese, and soon became an important article of export. During the past fifty years the price of American ginseng has advanced nearly 700 per cent, but owing to the energetic hunt for the root, to the destruction of forests and to the gathering of plants at improper times, the wild supply has greatly decreased. With the advancing prices and the diminishing supply came experiments in ginseng cultivation, most of which failed through ignorance of the plant's peculiarities. The seed ripens in September. If dry it will not germinate until the second year, but if fresh and properly kept nearly all the seeds will germinate the first season. The soil must be a light, friable loam, free from stones, rich in humus and well drained; the plants must be well supplied with shade and moisture. Cultivated ginseng already commands a considerably higher price than the wild root, and, though no returns can be expected from a plantation under three or four years, the industry is profitable to the men that have given it careful attention.



1643. Parts of a gladiolus flower. Showing the three stigmas, three stamens, six segments of the perianth, and the tips of the spathe-valves.

Ginseng beds can be located in orchards, gardens, or woods, where the roots may remain without danger of deterioration for several years after they first attain marketable size. The roots are so valuable that they are likely to be stolen, and beds should, therefore, be placed where they can be guarded.

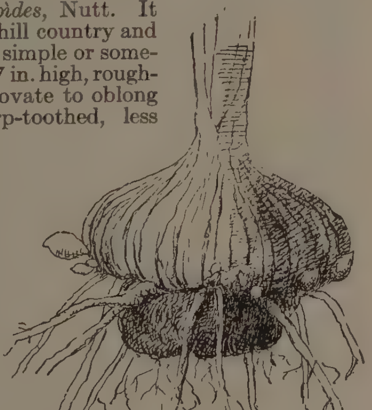
For further information on ginseng, send to Division of Publications, Department of Agriculture, Washington, D. C., for Bulletin No. 16 of the Division of Botany, revised by M. G. Kains in 1898, or consult Kains' Ginseng, its culture, etc., Orange Judd Company 1899; second edition, 1902. For diseases, consult Cornell bulletins.

M. G. Kains.

GITHÀGO: *Lychnis.*

GITHÓPSIS (*like Githago*, from the calyx). *Campanulàceæ.* One blue-fld. annual in Calif., sometimes recorded in horticultural literature, *G. specularioìdes*, Nutt. It grows in the open hill country and the mountains: st. simple or somewhat branched, 4–7 in. high, rough-pubescent: lvs. obovate to oblong or narrower, sharp-toothed, less than ½in. long: corolla tubular-bell-shaped, the lobes shorter than the tube; calyx 10-ribbed, adnate to the ovary: fr. a coriaceous caps., bearing the rigid calyx-lobes, dehiscing at apex. Var. *diffùsa*, Jepson, is nearly glabrous, but sinuses of calyx somewhat hispid.

L. H. B.



1644. Gladiolus corm growing above the old one; and the cormels from the bottom.

GLADÌOLUS (diminutive of Latin *gladius* a sword, from the shape of the leaves). *Iridàceæ.* Popular summer-flowering and autumn-flowering bulbs, and now somewhat grown under glass.

Corm-bearing herbs with fls. in simple or branched spikes; lvs. radical and cauline: fl. more or less tubular, the tube usually funnel-shaped (enlarging upward); segms. 6, more or less unequal, strongly narrowed or even clawed at the base, the upper ones often hooded or roofed over the opening or mouth of the fl.; stamens 3, inserted on the tube; stigmas 3, on a long style; ovary 3-loculed, becoming an oblong 3-valved caps., with flattened and winged or sometimes globose seeds: each fl. is borne in a sessile spathe (like a calyx) with linear or lanceolate valves or lf.-like parts: the lvs. are mostly equitant on the st., all firm and prominently several-ribbed, varying from linear to sword-shaped (sometimes almost terete): the old corm dies and a new one grows on top, and cormels or offsets (sometimes called "spawn") form from the underpart (Fig. 1644).—The species of Gladiolus are 160 or more, perhaps 100 being in S. Afr. (Cape), many in Trop. Afr. in both the E. and the W., and others in the Medit. and W. Asian regions. The greater part of highly improved garden forms are derived more or less directly from the S. African species. The Eurasian species are little grown, although some of them are hardy. Gladioli have been much modified by variation, hybridizing and selection.

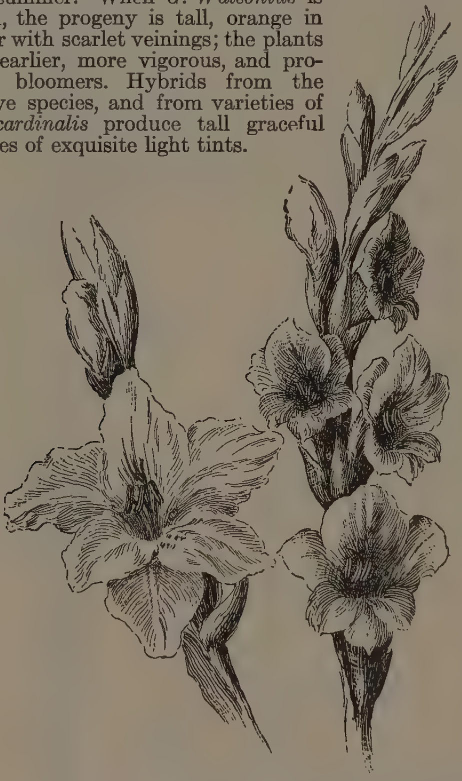
The gladiolus is propagated readily by seeds, as explained farther on; by the use of the new corm growing above the old one, and which is separated either when cleaning in autumn or before planting in spring; by the young corms, or cormels. Increasing stock by the small corms or cormels is the most common method, and the one by which a variety is perpetuated. The small corms are stored in bags, boxes or other suitable receptacles and kept from frost. It is a help to sprouting if the cormels are not allowed to dry out during the period of rest. They should be planted like one-year seedlings, and they give blooming plants the first and second year.

Great progress has been made in recent years in the improvement of the gladiolus, until in floriferousness, form, color, substance and keeping qualities it has become one of the important summer flowers, both for amateurs and florists. It is to be expected, however, that many other forms and qualities are yet to appear, considering the great number of wild species of much beauty that have not been combined in the cultivated strains. It may be possible, also, that closely related genera can be used to some extent in hybridizing. The lines of division between Gladiolus, Antholyza, Acidanthera, and some others, are more or less arbitrary.

1645. Gladiolus gandavensis. (×⅓)

The early departures were of the gandavensis (Fig. 1645) and similar types, founded probably on *G.*

psittacinus and *G. cardinalis.* Forms of *G. tristis* early entered into the cultivated strains, as well as *G. oppositiflorus,* and later *G. purpureo-auratus* and *G. Saundersii.* The Lemoinei and nanceianus races (Fig. 1646) have afforded foundations for much subsequent breeding. Recently, *G. primulinus* has entered into the combinations. It seems to be particularly valuable as a parent; it is said to be dominant in color over even the deepest reds, subduing them to excellent shades of orange, salmon, and terra-cotta; when crossed with the lighter colors it transforms them to buff, lemon and ecru; combined with yellow the color is deepened. The hooded character is commonly inherited. W. W. Van Fleet has succeeded in crossing this species with many of the other wild forms. With *G. Quartinianus* the color is said to be toned down to terra-cotta and the season for blooming is changed from autumn to midsummer. When *G. Watsonius* is used, the progeny is tall, orange in color with scarlet veinings; the plants are earlier, more vigorous, and profuse bloomers. Hybrids from the above species, and from varieties of *G. cardinalis* produce tall graceful spikes of exquisite light tints.



1646. Gladiolus Lemoinei (on the right), and G. nanceianus. (× ⅓)

The ruffled strains of gladioli have appeared in recent years, adding a pleasing variety and much merit to the flower. This type has been specially developed in the recent breeding work of A. E. Kunderd, of Goshen, Indiana (Fig. 1647). Nearly twenty years ago he began his selections for the production of a frilled or wavy flower, that should have something of the petal-edge exhibited so well in azalea. Early- and late-flowering strains have been produced. It is said that one strain has the blood of *G. Quartinianus* and is producing many good shades of red with fluted or ruffled petals and suitable for late-flowering purposes. *G. primulinus* has also given good tints in yellows, with flowers very much frilled. It now seems possible to introduce the ruffling into many of the standard types, much as has been done with the sweet pea.

The recent Burbank strains have been developed from the variety America as the seed-parent. These are said to comprise many very large-flowered forms, with brilliant coloring.

The *G. præcox* group or strain was introduced by Frederick Roemer, of Quedlinburgh, Germany, said to be the result of intercrossing the earliest-flowering plants of *G. gandavensis, G. Lemoinei, G. Childsii* and *G. nanceianus.* In color, markings, or size, the race compares favorably with the parents, and at the same time the plants bloom the first year from seed, especially when the seed is started in a moderate hotbed in March. As growth advances, they are given ventilation gradually. There is a decided improvement the second year, when two or more spikes of normal size are usually produced. Other strains of gladiolus may also give bloom the first year from seed.

Some of the earlier history of American gladiolus-breeding was written for the "Cyclopedia of American Horticulture" by H. H. Groff, of Canada, one of the prominent contributors to the improvement of the flower (extracts): Some twenty-five years ago "when the writer, under the inspiration of Luther Burbank, began his own work in hybridization, the best American-grown stock available was the Hallock collection of some 400 named varieties of gandavensis and about 100 of the earlier Lemoine hybrids, all of European origin. After trial, the writer placed them all in mixtures. About this time Luther Burbank began to offer a few named varieties, but shortly afterward sold his whole stock, the collection being now in the writer's hands. This collection, in the opinion of the writer, is the best strain of gandavensis. The varieties were largely of variegated types, with many of unique markings and peculiar form. Burbank had given particular attention to varieties calculated to withstand the hot, dry winds of California, and had originated several with specially stiff petals, quite distinct from the ordinary types. The peculiarity of the flowers blooming around the spike like the hyacinth was also his contribution. All of his varieties are now grown in mixture by the writer with the exception of a white variety, which promises to be distinct and valuable for some time to come. The work of Van Fleet, of New Jersey, was carried on more for scientific than commercial results, and reaped a deserved success. However, the writer has found that the offspring of a pure species is less stable than that of well-balanced cross-bred varieties, the former system handing down few varieties of permanent commercial value, though they are in themselves valuable as parents for the foundation of new strains. The best work of a semi-professional character, in the opinion of the writer, has been done by T. S. Moore, of Indiana, who has spared no trouble or expense in procuring choice material upon which to build, and with satisfactory results." Writing in 1914, Groff speaks of the fluted, ruffled and crimped forms being frequent in the progeny of every improved species; of the development of iris-form flowers; and of innumerable influences, under breeding, on the character of the stalk, fiber, capsule, shape and size of foliage, disposition of flowers to droop or to grow erect, on the corm and its husk and the facility of producing cormels, and other interesting departures.

The interest in the gladiolus has been much stimulated in North America by the work of the American Gladiolus Society. It was organized at Boston, May 27, 1910, for the purpose of "stimulating interest in, and promoting the culture and development of the gladiolus; to establish a standard nomenclature; to test out new varieties, and to give them such recognition as they deserve; to study the diseases of the gladiolus, and find remedies for same; to disseminate information relating to this flower; to secure uniformity in awarding prizes at flower shows, and to give one exhibition each year." The society holds exhibitions, publishes a bulletin, and in many ways aids in the popularizing of the gladiolus and in establishing standards of excellence. It has a trial-ground at the New York

State College of Agriculture at Cornell University, where gladioli are now being carefully studied.

Following is a score-card prepared by direction of Gladiolus Society of Ohio:

	Points
1. Spike (long, 5; straight, 5; many blooms, 5; facing together, 5)	20
2. Flower (large, 5; widely opened, 5; broad, round petals, 5; substance and texture, 5; beauty of bud, 5)	25
3. Color (attractive, 10; either self-color, or strikingly marked, 5; adapted to cut-flower trade or florists' use, 5)	20
4. Foliage (dark, healthy green, 5; broad, 5; abundant, 5)	15
5. Durability (continuance of bloom on spike, 5; lasting qualities as cut-flower, 5)	10
6. General effect (in mass bed or field, 5; in vase or cut display, 5)	10
Total	100

Culture of the gladiolus. (Isaac S. Hendrickson, except when otherwise stated.)

The Gladiolus has several good points combined to make it interesting, popular, and promising, as: The low cost; ease of culture; freedom from insects; variation in color; ease of carrying over from year to year; length of blooming season; rapid increase; ease with which new varieties are produced.

Figures recently compiled from information given by the growers in the United States are as follows:

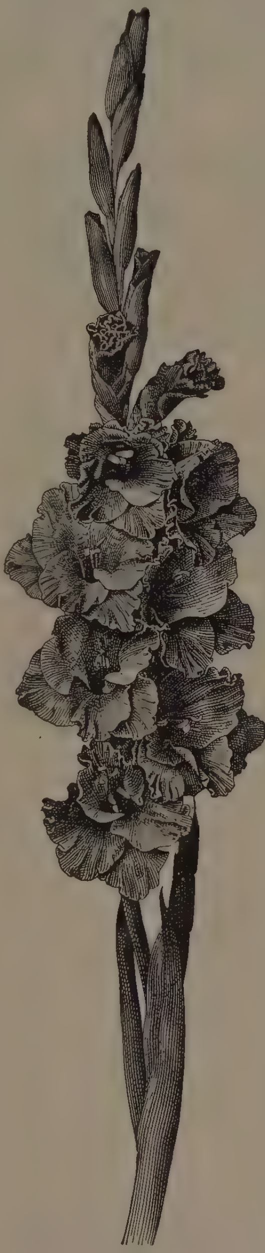
Number of acres devoted to gladioli	400 to 500.
Estimated number of bulbs produced annually	14,000,000 to 15,000,000
Estimated value of crop	$250,000

Raising new varieties.

It is the contention of some growers that certain definite results can be secured by hand-crossing of different varieties, while other growers assert that they cannot trace a single valuable result to that method. The writer's observation has led him to the opinion that some of the best and most useful sorts on the market today are the results of careful selection of seed from the varieties showing best form, growth, color, vigor, size, and other qualities. It is well for the general gardener to purchase a collection of the best-named kinds now on sale, plant them together and let the insects transfer the pollen naturally; and if the weather is favorable, one is almost sure to have a crop of seed. This seed must be carried over until the following spring, when it can be planted in shallow drills, covering about one-eighth to one-fourth inch with soil; they will make only a slight grass-like growth the first year, and must be taken up in the fall, and housed away from frost. The following spring they can be planted as one would sow garden peas, and covered about 1½ inches deep; they will make a little more growth and perhaps a small percentage will flower, but the bulbs will have to be lifted and planted once more before a good showing of flowers can be expected. The commercial grower expects to wait three or four years after planting the seed before he has salable bulbs, which of course, can be sold only as seedlings or mixtures as all forms and colors will be present. In looking for new varieties to name, the greatest care must be taken to choose only those of real merit, something that is distinct from previous selections, new in color, good in substance, excellent in form, and in all ways meritorious. When the selection is finally made from perhaps thousands of seedlings, it is labeled out and lifted separately in the fall, and jealously guarded until the next planting-time; then it is watched with eagerness to see whether it will prove constant and worth taking the trouble to "bring up," for as it requires at least ten years to secure enough bulbs to offer for sale, one can easily waste much time if the selection does not prove to be a wise one. It is often said that there are too many varieties now under name, and this is true; but as it is so very easy and so fascinating to grow seedlings, one should not discourage the amateur in securing this satisfaction.

Of course the professional or expert breeder will exercise the most careful choice of the parent stocks; and he is able to make many interesting and valuable combinations of special qualities.

Culture.



1647. The ruffled gladiolus. (×¼)

While nearly any good garden soil is adapted to the culture of the gladiolus, the plant seems partial to a sandy loam. In field culture, gladioli are usually planted in rows similar to potatoes; that is to say, the furrows are made 3 feet apart to allow tillage with horse. The bulbs are placed in the row by hand, usually about 2 to 4 inches apart each way according to size, and covered about 4 or 5 inches deep. Deep planting prevents them blowing over. Frequent tillage must be given in spring and summer.

For garden culture, they may be planted promiscuously in the border if wanted for garden decoration; or if wanted for cut-flowers principally, the straight-row method is best, as it enables better tillage to be given and makes it much easier to cut the blooms. The gladiolus is essentially a cut-flower. If one has a goodly number of bulbs, it is an excellent plan to make successive plantings about fifteen days apart, beginning as early as the ground can be worked and continued until July. This will insure continuous bloom from July until October, or until the plants are cut down by frost. As the old bulb or corm produces its flower, it dies and a new one forms in its place, and develops until harvest time, when it is lifted and stored in a warm dry place; some time during the winter the roots and old bulb should be taken off, so that the bulb will present a clean appearance and be ready for planting.

As a cut-flower, the gladiolus will rival most other flowers in keeping qualities. The blooms can be kept fresh and beautiful for a period of five to ten days after cutting by changing the water daily and removing each day the withered blooms; it also helps if the ends of the spike are nipped off when changing the water. If the spikes are cut when the first two or three flowers have opened, the entire stalk will open out after it has been put in water. They may be sent to a distance; they will arrive in excellent condition if a little care is taken when shipping. The spikes should be cut when the first flower opens, and put in water in the cellar or cool place for two or three hours, after which they will stand a journey of two or three days; and then when placed in water they will quickly respond and unfold their petals.

The uses of gladioli are varied; great quantities are used for decorating dining tables in the great hotels and steamboats; florists have long recognized their value in making funeral designs; at the exhibition of the American Gladiolus Society, at Rochester, it was demonstrated that they can be used for fancy table decoration, wedding bouquets, and other purposes.

Varieties.

No two persons will agree on varieties, but the following represent some of the good types at present (given here as a matter of record):

White.—Europa, Blanche, Peace, LaLuna. *Pink.*—Wild Rose, America, Mrs. Frank Pendleton, Myrtle, Taconic, Panama. *Scarlet.*—Mrs. Francis King, Princeps, Brenchleyensis, Contrast (scarlet and white). *Yellow.*—Golden King, Sulphur King, Niagara, Kunderdi Glory. *Maroon.*—Empress of India, Mrs. Millins. *Violet.*—Baron Joseph Hulot.

Variation in size of bulbs.

There is great variation in size of bulb or corm. It is a varietal characteristic. Some kinds never make a large bulb, yet they may be superior kinds. This ought to give a hint in buying mixtures at the flower-shop. Nine times out of ten, when a customer has the opportunity to pick out the bulbs personally, the very largest ones are taken, with the result that perhaps not more than one or two kinds are received, as very often the very best and choicest flowers are concealed in the small or medium-sized corms. Some of the large-bulb sorts are very inferior, and it is easy to increase the stock, while others, perhaps producing smaller bottoms, bear only a few offsets.

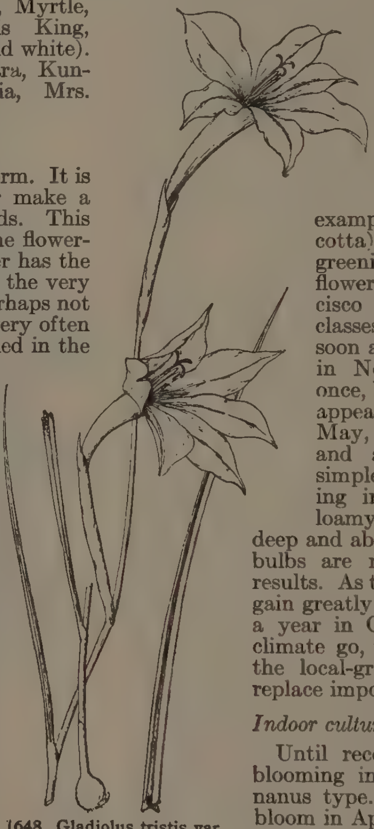
Commercial cultivation for stock or bulbs.

(E. H. Cushman.)

For successful commercial culture it is essential that sandy soil conditions are obtainable. Such preparation of the soil as puts it in a loose, friable condition will answer. Probably the ideal soil is a sod, fall-plowed and then most thoroughly worked in the spring. Strong, fresh stable manure should be avoided. If soil is not sufficiently rich in plant-food it is best to use all strong manures on a previous season's crop of some other kind. Any complete fertilizer is beneficial when thoroughly worked through the soil, at the rate of 600 to 1,000 pounds to the acre. Planting should be begun as early in the spring as the proper working of the soil will permit. The ground being prepared, it should be furrowed 4 inches deep and from 24 to 36 inches apart, according to method of cultivation. If fine, round bulbs are to be grown, and the stock for planting exceeds 1½ inches in diameter, it will be necessary to place the bulbs right side up in the furrow by hand, either in single or double rows 2 inches apart. Bulbs of lesser size may be scattered as evenly as possible along the furrow, with an average of ten or twelve to the foot of furrow. Clean culture throughout the growing season is essential. Cutting the spike of flowers is a help to increasing the size of the bulbs. Four months is sufficient for the growth and maturity of the bulb. To harvest, loosen the soil and lift the bulbs by their tops, and lay on the ground to dry off and ripen. Should weather permit, they can be entirely ripened out-of-doors Cut the tops off close to the bulbs, pulling off the old bulbs and roots, and place in thin layers in crates and store in a cool, dry place. If circumstances require, the tops may be trimmed off at once on lifting, and the bulbs taken under cover for cleaning and drying.

Culture in California. (Sydney B. Mitchell.)

Gladioli, like all South African bulbs, do very well in California; indeed near Santa Cruz, some of the popular large-flowering varieties are grown in commercial quantities for their bulbs. These summer-flowering kinds may be planted in the fall to bloom in the following May and June, but in private gardens additional corms should be put in at intervals from April to July so that a succession of flowers may be available until October, right through the season when California gardens are barest. It should be noted that the early-flowering class of the nanus and Colvillei types are also quite hardy here and so do not require the glass protection given in the East. The favorite varieties of the nanus or dwarfs are Peach Blossom and Blushing Bride, while The Bride easily leads in the Colvillei section. A few of the less-known early species are also grown occasionally, as for example *G. tristis* (yellow and terra-cotta) and its variety *concolor* (pale greenish yellow), both of which flower in March around San Francisco Bay. The earlier-flowering classes should all be planted just as soon as available in late October or in November. Growth starts at once, but the flowers usually do not appear much before the following May, when they make a brave show and are fine for cutting. Their simple requirements are fall-planting in a well-drained, preferably loamy soil, put about 3 inches deep and about the same apart. Separate bulbs are reset each autumn for best results. As they increase quite rapidly and gain greatly in vigor after they have had a year in California, as far as soil and climate go, there is no good reason why the local-grown bulbs should not quite replace imported ones.



1648. Gladiolus tristis var. concolor. (×½)

Indoor culture. (A. C. Hottes.)

Until recently, the gladiolus used for blooming indoors was principally of the nanus type. Planted in November, they bloom in April and May. They may first be started in 5-inch pots and later benched. They require a cool temperature, about 45° at night, if one expects the foliage to develop nicely. This is a temperature near that of the carnation optimum; they are therefore, often planted around the margins of the carnation benches. Their growth at first is slow, making little growth till the sun gets higher in the spring.

The flowers of the nanus type appear two or three weeks earlier than the standard varieties of gandavensis, Lemoinei or nanceianus. Varieties of the latter groups, however, are being developed with the desirable qualities for forcing, that of earliness and of a pleasing commercial color, and are becoming of considerable importance as a spring flower for the florist.

If the stems are not cut too short, the corms will renew themselves as well as in outdoor culture and they can be forced again or given a year's growth in the field.

XLVIII. The garden gladiolus, variety "Peace."

The kinds of gladiolus.

The following account includes those species that appear to have any particular horticultural history; also some of the prominent Latin-named hybrids, although not all these hybrids may now be in commerce.

INDEX.

Adlami, 20.
alatus, 2.
albidus, 24.
albus, 28.
angustus, 5.
atroviolaceus, 7.
biflorus, 8.
blandus, 24.
brenchleyensis, 29.
Brinerii, 33.
byzantinus, 11.
cardinalis, 15.
carneus, 10, 24.
Childsii, 32.
citrinus, 29.
Colvillei, 28.
communis, 10.
concolor, 4, 19.
cordatus, 5.
crispiflorus, 6.
cruentus, 16.
delicatissimus, 28.
dracocephalus, 21.
Engesseri, 33.
erectus, 19.
excelsus, 24.
fasciatus, 9.
floribundus, 25, 28.
Froebelii, 33.
gandavensis, 29.
grandis, 3.
Hibbertii, 24.
Hollandia, 29.
hybridus, 35.
imbricatus, 6.
Kunderdii, 37.
Leichtlinii, 14.
Lemoinei, 30.
maculatus, 19.
major, 19.
Milleri, 27.
Mortonius, 24.
namaquensis, 2.
nanceianus, 31.
nanus, 28.
natalensis, 22.
oppositiflorus, 26.
Papilio, 13.
præcox, 36.
primulinus, 19.
princeps, 35.
psittacinus, 22.
purpureo-auratus, 23.
Quartinianus, 18.
ramosus, 28.
salmoneus, 19.
Saundersii, 17.
segetum, 12.
sulphureus, 20.
superbus, 17.
trimaculatus, 5.
tristis, 4.
turicensis, 34.
undulatus, 9.
versicolor, 3.
vinulus, 9.
vittatus, 9.
Watsonius, 1.

I. SPECIES OF GLADIOLUS (NOS. 1–27).

Few of the original species of Gladiolus are in cultivation in their pure form. When grown at all, they are prized chiefly as oddities, or because of their botanical interest. The following species are either offered at the present time in the trade or are parents of modern garden forms:

A. *Fl. with a long, slender, cylindrical curved tube, which is enlarged in the middle; segms. nearly equal. (Homoglossum.)*

1. **Watsònius,** Thunb. (*Antholyza revolùta,* Burm.). Corm 1 in. diam., globose: st. slender, 18 in. or less, with 1 long, narrow-linear and stiff lf. and 2–3 short sheathing lvs.: fls. 2–4, in a lax 1-sided spike, 2 in. or less long, bright red, the wide-spreading segms. oblong and acute, the lower ones smaller and lanceolate-falcate; stamens very short. S. Afr. B.M. 450.—Little known in this country, but offered by Dutch growers.

AA. *Fl. short and open, the tube short or scarcely any; segms. very prominently clawed, usually unequal.*

2. **alàtus,** Linn. Corm small, globose: small, the st. only 4–12 in. high, and slender: lvs. 3–4, linear and rigid: fls. 3–4 in a lax spike, the curved tube ½in. long, the perianth pink and often strongly veined; segms. very unequal, the 3 lower tongue-like and protruded, the others obovate or nearly orbicular, all of them differently colored toward the base; stamens nearly as long as upper segms. S. Afr. B.M. 586; 592; the var. **namaquénsis,** Baker, which is more robust, with broader lvs., more fls., the upper segms. broad.

AAA. *Fls. of medium length, with a funnel-shaped tube, which is flaring at the top; segms. narrowed below, but not distinctly clawed. (Gladiolus proper.)*

B. *Lvs. linear (½in. or less wide).*

C. *Perianth-segms. acute.*

3. **grándis,** Thunb. (*G. versícolor,* Andr.). Corm globose, with coverings of thick wiry fibers: st. slender, 2 ft. or less, terete: lvs. about 3, terete, strongly ribbed, 1½ ft. or less long: fls. 6 or less in a lax 1-sided spike, 3 in. long, with a curved tube; segms. nearly equal, oblong-lanceolate and cuspidate, as long as the tube and twice longer than the stamens, recurved and often wavy, yellowish or creamy, tinged and striped with purple-brown, especially on the keel: caps. oblong, 1½ in. long; seeds winged. S. Afr. B.M. 1042.

4. **trístis,** Linn. Very like the last: fls. 2–4, somewhat smaller (2 in. or less long); segms. shorter than the tube and not twice longer than the stamens, acute (short-pointed), yellowish white with purple or blackish pencilings, or var. **cóncolor,** Hort., Fig. 1648 (*G. cóncolor,* Salisb.), almost white or uniform yellow. S. Afr. B.M. 272, 1098. G. 21:649. Gn. 75, p. 420. G.C. III. 38:187 (var. *concolor*). G.F. 8:75 (reproduced in Fig. 1648).—Said to exhale a powerful and delightful lemon perfume at night.

5. **angústus,** Linn. (*G. trimaculàtus,* Lam. *G. cordàtus,* Thunb.). Corm globose: slender: st. 2–3 ft., simple: lvs. 3–4, very narrow, flat, 2 ft. or less long: fls. 2–6 in a very loose spike, long-tubed, white, the oblong segms. shorter than the tube and the 3 lower ones with a characteristic purple median line ending in a heart-shaped or spade-shaped mark; stamens half length of limb. S. Afr. B.M. 602.

CC. *Perianth-segms. obtuse.*

D. *Color purple or violet.*

6. **crispiflòrus,** Herb. (*G. imbricàtus,* Linn., var. *crispiflòrus,* Baker). St. 1–2 ft., rather slender: lvs. 2–3, sometimes ½in. broad: fls. 4–10, the tube ¼in. long and curved, the segms. obovate (1 in. long), crisped or wavy on the edge, dark purple, more or less marked with white and red: seeds winged. E. Eu. and W. Asia.—Hardy or nearly so.

7. **atroviolàceus,** Boiss. Corm ovoid, ¾in. or less diam.: st. 1–2 ft. high: lvs. 3, closely ribbed, firm: fls. few, the tube ⅓in. long and curved, the obovate segms. 1 in. long and dark purple or violet-blue: seeds globose, not winged. W. Asia. G.C. III. 41:378.—Hardy or nearly so.

8. **biflòrus,** Klatt. Corm globose, small (½in. diam.): dwarf (1 ft. or less), the st. slender and terete and bearing only 1 well-formed lf., which is subterete and very narrow and 5–6 in. long, the 2 upper lvs. rudimentary: fls. 2–3, lilac, the tube nearly straight, the oblong segms. twice as long as the tube; stamens reaching half-way the limb. S. Afr.—Connects with Geissorhiza.

DD. *Color (under-color) white or nearly so.*

9. **vittàtus,** Hornem. (*G. vínulus,* Klatt. *G. fasciàtus,* Roem. & Schult. *G. undulàtus,* Schneev.). Corm globose: plant low (about 1 ft.): lvs. 3–4, very narrow: fls. 3–6 in a lax spike, nearly erect, the slightly curved tube nearly or quite an inch long, the limb longer than the tube, pink, the 3 lower segms. with a purple central blotch; stamens reaching half-way the limb. S. Afr. B.M. 538 (as *G. undulatus,* var.)

BB. *Lvs. ensiform (½in. or more broad, and flat or flattish).*

C. *Under- or body-color essentially purple.*

10. **commùnis,** Linn. Corm about ¾in. diam.: st. 1½–2½ ft.: lvs. 3–4, 1 ft. or less long: fls. 4–8, small (1½ in. long), with a curved tube; segms. bright purple (flesh-colored in the var. *carneus*), nearly equal in length, all connivent or touching (making a narrow fl.), the 3 lower ones long-clawed and with a median line: seeds broad-winged. France, Germany. B.M. 86, 1575.—Hardy; little known in cult. in this country. Variable; Nos. 11 and 12 are by some considered to be forms of it.

11. **byzantìnus,** Mill. Fls. more and larger, plant more robust than in No. 10, segms. more spreading at maturity, although the 3 upper ones are contiguous, dark purple, the 3 lower ones with a prominent white median line: seeds winged. Medit. region. B.M. 874.—Hardy; little known in gardens.

12. **ségetum,** Ker. Differs from *G. byzantinus* in having globular (not winged) seeds, and in the flaring or spreading segms. of the bright purple, obovate-obtuse sepals. Canaries and Medit. region. B.M. 719.—Hardy and early; little grown.

13. **Papílio,** Hook. f. Corm of medium size, globose: st. 2 ft. or more: lvs. about 4, rigid, 1 ft. or more long and 1 in. or less wide: fls. 6–12, pale purple or lilac, yellow in the throat; perianth horizontal, the curved tube ¼in. long and broadly funnel-shaped at the top; 3 upper segms. obovate-spatulate, uppermost not reflexing, ½–¾in. broad, 1½ in. long, the lower ones very narrow below and marked with large red-brown spade-shaped yellow-edged blotches. S. Afr., in the Transvaal, Orange Free State and Natal. B.M. 5565.—Handsome. Varies to white in cult.

cc. *Under- or body-color essentially red* (*No. 22 may be sought here*).

14. **Leìchtlinii,** Baker. Corm large and globose: st. about 2 ft. tall, terete: lvs. about 4, ensiform, 1 ft. long: fls. 6–8, large, in a somewhat dense 1-sided spike, bright red, with a curved tube 1¼ in. long; upper segms. obovate and connivent, equaling the tube, 3 lower ones much smaller and acute, spreading, red at tip but yellow and minutely red-dotted below; stamens shorter than upper segms. Transvaal.

15. **cardinàlis,** Curt. Corm large and globose: st. 3–4 ft.: lvs. 4–6, glaucous-green, ensiform, nearly or quite 1 in. broad and reaching 2 ft. or more in length: fls. many (sometimes 20), nearly erect, bright scarlet, the tube 1½ in. long and nearly straight; upper segms. oblong-spatulate (2 in. long), scarlet, the 3 lower ones shorter and narrower, with a large white blotch; stamens more than half the length of the limb. S. Afr. B.M. 135.

1649. Gladiolus purpureo-auratus. (×⅝)

16. **cruéntus,** Moore. Corm large, globose: st. 2–3 ft.: lvs. about 4, ensiform, dark glaucous-green, 2 ft. or less long, ¾–1 in. broad: fls. 6–10 in a rather dense distichous spike, bright scarlet; tube 2 in. or less long, nearly straight; upper segms. obovate-spatulate, to 2½ in. long; 3 lower segms. 1½ in. long, white-blotched and red-spotted; stamens reaching half-way of limb. Natal. B.M. 5810.—Closely related to No. 15.

17. **Saùndersii,** Hook. f. Corm large, flattened-globose: height 2–3 ft.: lvs. 4–6, strongly ribbed and stiff, 1–2 ft. long and 1 in. or less broad: fls. 6–8, large, bright scarlet, the tube 1–1½ in. long and curved; 3 upper segms. oblong-spatulate, uniform scarlet, connivent (2 in. long), 3 lower smaller, white-blotched and scarlet-spotted. S. Afr., coast region to Transvaal. B.M. 5873. Gn. 12:64.—Handsome. Var. **supérbus,** Hort., is a form produced by the early infusion of *G. Saundersii* into the garden strains.

18. **Quartiniànus,** Rich. Corm to 1½ in. diam., globose: strong, 2–4 ft.: lvs. 3–4, rigid, sometimes nearly ensiform, the lower ones 1½ ft. or less long, and ¾in. or less broad: fls. 4–9, in an open spike, large, blood-red. the narrow curved tube 1½ in. long; upper segms hooded, the other smaller and more or less reflexed; stamens nearly equaling upper segms. Nile Land to Lower Guinea and Mozambique. B.M. 6739. G.C. III. 24:467, and Gn. 55:388 (var. *superbus*). Trop. Afr.—One of the best of the genus. Named for M. Quartin Dillon, who discovered it in Abyssinia.

ccc. *Under- or body-color at least, yellow.*

19. **primúlinus,** Baker. Very like No. 18 (with which Baker subsequently united it), but differs in the yellow color: corm globose, 1 in. and more diam.: lvs. about 3, ensiform, 1½ ft. long and to 1 in. broad: fls. 3–5, in a lax secund spike, clear primrose-yellow throughout; tube 1 in. long, much curved above; 3 upper segms. ovate or obovate, acuminate, hooded, 2 in. long and more than 1 in. wide, the central one covering the stamens and stigmas; 3 lower segms. deflexed and much smaller; style exceeding the stamens. Trop. Afr., occurring in the rain-forests. B.M. 8080. G.C. III. 36:191; 42:291. R.H. 1908, p. 9.—A handsome species, and although not discovered until 1887 and flowered under cult. in 1890, it is now much used as a parent in breeding. Several varieties are offered, as var. **maculàtus,** Lemoine, with fls. large, chrome-yellow, the inner surface of the reflexed segms. bearing a maroon-red spot. Var. **salmòneus,** Lemoine, with fls. saffron or salmon-color outside, the interior bright chrome-yellow, with fine purple lines. Var. **màjor,** Lemoine, large-fld., said to be a cross of *G. primulinus* and yellow *G. Lemoinei:* fls. chrome-sulfur-yellow with light brown marks on the interior of the segms.: plant strong. Var. **eréctus,** Lemoine. Erect, with large scarcely hooded chrome-yellow maroon-spotted fls. Var. **cóncolor,** Lemoine. Fls. large, 2 of the segms. sulfur-yellow and the remainder naples-yellow.

20. **sulphùreus,** Baker. Corm 1 in. diam., globose: stout, but low, the st. 1 ft.: lvs. 3–4, the blade short (2–3 in.) and somewhat ensiform: fls. 6–8, large, soft bright yellow, the curved tube 1½ in. long, upper segms. hooded, oblong or obovate, the 3 lower ones small; stamens shorter than upper segms. E. Trop. Afr.—The *G. sulphureus,* De Graaf (*G. Adlami,* Baker) is another species and the name is older. B.M. 7791.

21. **dracocéphalus,** Hook. f. Corm large, flattened-globose: st. stout and simple, 2 ft. or less: lvs. 3–4, rather firm, 1–1½ ft. long and 1 in. or less broad: fls.

3–6, of medium size, yellowish green, the tube (2 in. or less long) curved; upper segms. elliptic-obovate, hooded, yellowish and closely striate with purple, the other segms. much smaller and reflexing, mostly green and purple-spotted; stamens nearly equaling the segms. Natal. B.M. 5884.—Odd.

22. **psittacìnus,** Hook. (*G. natalénsis,* Reinw. *Watsònia natalénsis,* Eckl.). Corm very large, flattened-globose: st. 3 ft. or more, stout: lvs. about 4, rather rigid, 1–2 ft. long and 1–2 in. broad: fls. many and large, with a curved tube nearly or quite 2 in. long, in general effect rich yellow but thickly grained and overlaid with red (particularly about the margins of the segms.); upper segms. obovate and hooded, dark crimson, the lower much smaller and reflexing, red and yellow mixed. S. Afr., away from the coast. B.M. 3032. B.R. 1442. L. B. C. 18:1756.—One of the leading parents of garden gladioli.

23. **purpùreo-auràtus,** Hook. f. Fig. 1649. Corm large, globose: st. 3 ft., very slender: lvs. 3–4, short: fls. 10 or more, primrose-yellow, medium in size, the curved tube less than 1 in. long; segms. obovate, not widely spreading, the lower ones with a red-brown blotch; stamens reaching half-way up the limb. Natal. B.M. 5944. G.F. 2:89 (reduced in Fig. 1649).—Handsome. A parent of modern gladioli. Suggested by Baker as perhaps a color-variety of *G. Papilio.*

1650. Gladiolus turicensis. (×⅓)

cccc. *Under- or body-color white. (Forms of No. 13 may be sought here.)*

24. **blándus,** Ait. Corm medium size, globose: st. 2 ft. or less tall, sometimes branched: lvs. usually 4, 1 ft. or less long and ½–¾in. wide: fls. few, white and red-tinged, the curved tube 1½ in. long; segms. all oblong or oblong-spatulate and flaring or recurved, some of them red-marked in the throat; stamens more than half length of limb. S. Afr., coast region; variable. B.M. 625. Sometimes pure white. B.M. 648, *G. álbidus,* Jacq.; pink or flesh-color, B.M. 645; *G. cárneus,* Delar.; segms. white, with many pink markings, B. M. 3680, *G. Mortònius,* Herb.; taller, with longer lvs. and perianth-tube, *G. excélsus,* Sweet; pink fls. with red blotches on 3 lower segms., var. *Hibbertii,* Hort. *G. blandus* is an old garden plant.

25. **floribúndus,** Jacq. Corm globose: st. 2 ft. or less, often branched: lvs. usually 4, ensiform, 1–2 ft. long: fls. 12 or less, ascending, in a lax 2-sided spike, large, white tinged with pink, the slightly curved tube 2 in. or less long; segms. obovate or spatulate, obtuse or deltoid, wide-flaring, red-lined; stamens one-third or one-half length of limb. S. Afr., coast region; perhaps a form of *G. blandus.* B.M. 610.

26. **oppositiflòrus,** Herb. Much like the last, but fls. more numerous and smaller, white, sometimes marked with rose, the segms. oblong and distinctly pointed. S. Afr., in the eastern region. B.M. 7292. G.C. III. 13:291. Gn. 45:440.—A very handsome plant, growing 3–6 ft. high, and said to produce spikes 2 ft. long.

27. **Mílleri,** Ker (*Antholỳza spicàta,* Mill.). Corm medium size, globose: st. 12–20 in., simple: lvs. about 4, ensiform, shorter than the st.: fls. rather large, 4–5, nearly erect, milk-white, the tube 2 in. or less long and straight; segms. oblong and nearly acute; stamens one-third to one-half length of limb. S. Afr., coast region. B.M. 632.

II. Hybrids and Variants of Gladiolus in Cultivation.

The garden gladioli are derivatives of various kinds and degrees. Of many, the parentage is so confused that it cannot be made out. However, there were four early main lines of development or divergence, represented in the late-flowering *G. gandavensis, G. Lemoinei* and *G. nanceianus,* and the early-flowering *G. Colvillei.* To these have been added other lines in recent years.

28. **Cólvillei,** Sweet (*G. trìstis* var. *cóncolor* × *G. cardinàlis*). Fls. open or flaring, with oblong-acute segms.; scarlet, with long blotches at the base of the lower segms: early-flowering: spikes short. Hardy south of Washington with some protection. R.H. 1895, p. 289. G.C. III. 12:90. Gn. 28:566; 34:580; 50, p. 66. Gn.M. 4:189.—The oldest of the garden forms. Runs into many types and strains. The modern white-fld. type, var. *álbus,* represented by The Bride, is best known in this country. Small forms are known as *G. nànus:* Gn.W. 15:9; used for early flowering. Some forms are known as *G. floribúndus. G. delicatíssimus,* Blushing Bride, is a form of the same group: segms. white, with a large oval rose-crimson yellow-centered blotch on each of the 3 lower ones. Gn. W. 15:9. J.H. III. 49:213.

Another form of early-flowering gladioli is known as *G. ramòsus,* Paxt. (issue of *G. cardinalis* and *G. oppositiflorus*), but it is probably no longer possible to distinguish these two groups.

29. **gandavénsis,** Van Houtte (*G. psittacìnus* × *G. cardinàlis*). Fig. 1645. Upper segms. nearly or quite horizontal or hooded, the colors in bright shades of red and red-yellow, variously streaked and pencilled: late-flowering: spikes long. The commonest old-time type of garden gladiolus with the bloom much like that of *G. psittacinus* in form and size, but with a purer and better red. F.S. 2:84 (1846). R.H. 1846:141. P.M. 11:27. Gn. 64, p. 252. H.F. 1:208; 2:132. Gt. 59, p. 499 (var. *Europa,* with pure white fls.)—First offered to the trade by Van Houtte, Aug. 31, 1841. M. Souchet, of Fontainebleau, France, did much to improve the gandavensis type by repeated selections and breeding. By Herbert and some others, gandavensis is considered to be an offspring of *G. psittacinus* × *G. oppositiflorus.* Var. *citrìnus,* Hort., is like *G. psittacinus,* but the color is bright yellow. F.S. 5:539. *C. brenchleyénsis* is one of the gandavensis tribes; light red. *G. Hollándia* is a pink form of this.

30. **Lemòinei,** Hort. (*G. gandavénsis* × *G. purpùreo-auràtus*). Fig. 1646. A modern race characterized by highly colored yellow, red and purplish fls., purple-blotched on the lower segms. with a more or less bell-shaped form of corolla—the segms. broad and heavy and the upper ones horizontal or strongly hooded. Grown by M. Lemoine, Nancy, France, and first shown at the Paris Exhibition of 1878. Gn. 17:306; 30:76. R.H. 1879:330.—Fls. said not to open up so well when cut as do those of *G. gandavensis,* the st. being hard.

31. **nanceiànus,** Hort. (*G. Lemòinei* × *G. Saùndersii*). Fig. 1646. Robust, with very large, open-spreading fls.,

the 2 side segms. widely flaring and sometimes measuring 6–8 in. from tip to tip; upper segm. long and upright. First exhibited by Lemoine, the raiser, in 1889. The finest race, characteristically is full-open and large fls., in brilliant shades of red and purple. Gn. 41:190. G.C. III. 13:131. Gn. W. 7:797.

32. **Childsii** (*G. gandavénsis* × *G. Saùndersii*). Fls. wide open and large, with very broad petals: st. large and soft, taking up water well when fls. are cut. Originated by Max Leichtlin, Germany.

33. **Froèbelii,** Hort., is *G. purpùreo-auràtus* × *G. gandavénsis;* **G. Engésseri,** Hort., is of similar parentage; also **G. Brìneri,** Hort.

34. **turicénsis,** Hort. (Fig. 1650), is the offspring of a large-fld. *G. gandavensis* and *G. Saundersii* var. *superbus*. It is a fine purplish crimson, the lower segms. being beautifully marked with white: fls. 3 in. across. G.F. 3:89 (reduced in Fig. 1650).—This and the last 3 are the work of Froebel & Co., Zurich.

35. **prínceps,** Hort. (*G. hýbridus princeps*). Produced by W. W. Van Fleet, from seed of *G. cruentus* × *G. Childsii;* like the seed-parent in its scarlet-crimson coloring, with white and cream feather markings on the lower segms.: very large, the flat circular bloom expanding to 6 in. diam.: plant very large. G. 24:663; 34:533. Gn. 60, p. 197. G.M. 44:629.

36. **præcox,** Hort. Very early-flowering types, results of crossing of horticultural groups (p. 1340).

37. **Kúnderdii,** Hort. A strain or group of the ruffled or fluted kinds. See p. 1340.

Many species of Gladiolus are likely to be discussed in horticultural literature. The following have recently been prominently mentioned: *G. carmíneus,* C. H. Wright. Resembles R. ramosus, Paxt., but differs in its laxer habit, longer spathe and yellow anthers: slender, 1½ ft.: lvs. linear, acuminate, 8 in. long and ⅓in. broad: fls. carmine, about 3 in. across; tube narrow-funnel-shaped, white outside; segms. ovate, acuminate, 2 of the inner bearing a dark spot with a pale center; stamens rather more than half length of perianth. S. Afr. B.M. 8068.—*G. glaùcus,* Heldr. Dwarf, not exceeding 12 in.: st. and lvs. erect and stiff: fls. many, bluish red with red and white stripes at base. Greece.—*G. Mackínderi,* Hook. f. St. slender, 2 ft.: lvs. narrowly linear, the lower about 1 ft. long: fls. 5–6, the tube yellow, broad segms. scarlet and 1½ in. across. E. Trop. Afr. B.M. 7860. Named for Professor Mackinder, Oxford, who collected seeds at 10,000 ft. on Mt. Kenia in 1900. One of the Homoglossum section.

L. H. B.

1651. Glaucium flavum. (×⅓)

GLASSHOUSE. Any glass structure in which plants are grown, particularly one that is large enough to admit the operator. It is a generic term. See *Greenhouse.*

GLAÚCIUM (name refers to glaucous foliage). *Papaveràceæ.* Horned Poppy. Annual, biennial or occasionally perennial herbs, a few of which are grown for their large poppy-like flowers and glaucous-blue foliage.

Sepals 2; petals 4; stamens many; ovary with 2 (rarely 3) cells, the stigmas miter-shaped, the fr. becoming a long silique-like caps.: lvs. alternate, lobed or dissected.—A dozen or more species of S. Eu. and W. Asia.

Glauciums are low, branchy herbs, often somewhat succulent, with large flowers, mostly yellow or orange, but varying to red and purple. The flowers are usually short-lived, but they are borne in rapid succession. They are well adapted for foliage effects in borders or edgings. Of easy culture in any good soil. They prefer an open, sunny situation. Mostly propagated by seed, but the perennial kinds by division: however, the perennials are short-lived; and usually had best be treated as biennials; they should be grown from seed. Hybrids are announced by Burbank

flàvum, Crantz (*G. lùteum,* Scop.). Horn Poppy. or Sea Poppy. Fig. 1651. Sts. stout, 1–2 ft., pubescent: radical lvs. 2-pinnate and hairy the upper clasping and sinuate-pinnatifid and cordate at the base: fls. generally solitary, on long sts. 2–3 in. across, yellow or orange. Eu. C.L.A. 1:139. Gn. M. 9:86.—Sparingly naturalized E. Perennial or biennial; sometimes grown as an annual. Var. **tricolor,** Hort. (*G. tricolor,* Vilm.) has been advertised. It has parti-colored fls. and is showy. G.C. III. 36:115. G.M 48:697. Gn. 66, p. 59.

corniculàtum, Curt. (*G. phœníceum,* Gaert. *G. rùbrum,* Hort.). Lower: radical lvs. pinnatifid, pubescent, the upper ones sessile and truncate at the base: fls. red or purplish, with a black spot at the base of each petal. Eu.—Mostly annual. *G. Físcheri,* Hort., is probably a form of this.

leiocárpum, Boiss. A velvety perennial with oblong, sinuate-dentate, or much-divided lvs. which in the upper part of the plant are sinuate-lobed: fls. yellow, the calyx somewhat papillose. Medit. region.—Scarcely a showy member of the genus.

L. H. B.
N. Taylor.†

GLAÙX (Greek, *sea-green*). *Primulàceæ.* One small little pale herb, seldom seen in gardens, *G. marítima,* Linn. St. 9 in. or less high, erect or spreading, perennial by slender creeping rootstocks, growing in salt marshes and seacoasts from New Jersey and Calif. northward, and also in Eu. and Asia: lvs. oval to oblong-linear, entire and sessile, ½in. or less long: fls. purplish or white, the corolla wanting; calyx with 5 petal-like lobes; stamens and style exhibiting dimorphism: fr. a 5-valved few-seeded caps.

L. H. B.

GLAZIÒVA: *Cocos insignis.*

GLECHÒMA: *Nepeta*

GLEDÍTSIA (after Gottlieb Gleditsch, director of the botanic garden at Berlin; died 1780). Syn. *Gleditschia. Leguminòsæ.* Honey Locust. Ornamental trees grown chiefly for their handsome finely divided foliage; also the large conspicuous pods and the branched spines are attractive.

Deciduous, usually with large branched spines on trunk and branches: lvs. without stipules, alternate, abruptly pinnate, often partly bipinnate on the same lf. or wholly bipinnate, both usually on the same tree: fls. polygamous in racemes or rarely panicles; calyx-lobes and petals 3–5, petals nearly equal, not much longer than calyx, stamens 6–10; style short, with large terminal stigma: pod compressed, mostly large and indehiscent, 1- to many-seeded.—About 12 species in N. Amer., E. and Cent. Asia, in Trop. Afr. and in S. Amer.

The honey locusts are large trees with spreading branches forming a broad graceful rather loose head, with finely pinnate foliage, generally light green and turning clear yellow in fall; the greenish flowers appearing in racemes early in summer are inconspicuous, but the large, flat pods are ornamental and the fertile tree is therefore to be preferred for planting. *G. triacanthos* is a useful native and is hardy North; *G. japonica* is almost hardy North, while *G. Delavayi* and *G. sinensis* are tender. They are very valuable trees for park planting and for avenues, and make almost impenetrable hedges if planted thickly and pruned severely. The coarse-grained wood is durable and strong. The pulp of the pods of *G. triacanthos* is sweet when fresh, hence the name honey locust, but becomes bitter at length; that of *G. japonica* is used in Japan and that of *G. sinensis* and *G. macracantha* in China as a substitute for soap. The gleditsias are of vigorous growth and thrive in almost any soil; they stand drought well. Propagation is by seeds sown in spring about 1 inch deep; they should be soaked in hot water before being sown; varieties and rare kinds are sometimes grafted on seedlings of *G. triacanthos* in spring.

1652. Gleditsia triacanthos. (×⅓)

A. *Spines more or less compressed, at least at the base: walls of pod papery or leathery: lvs. pinnate with more than 12 lfts., or bipinnate.*

B. *Pod 1–2-seeded, oval, not pulpy.*

aquática, Marsh. (*G. inérmis*, Mill., not Linn. *G. monospérma*, Walt.). WATER or SWAMP LOCUST. Tree, to 60 ft., with short trunk, spiny: lvs. 12–18-foliolate or doubly pinnate with 6–8 pinnæ; lfts. ovate-oblong, usually rounded or sometimes emarginate at the apex, slightly crenate and often entire below the middle, glabrous except a few hairs on the petiolules, about 1 in. long: fls. in racemes; ovary glabrous: pods long-stalked, 1–2 in. long. May, June. S. C. and Ky. to Fla. and Texas. S.S. 3:127, 128.

BB. *Pod many-seeded, elongated and usually more or less twisted, pulpy.*

C. *Lfts. usually acute or acutish, often more than 20, not over 1½ in. long: ovary pubescent.*

triacánthos, Linn. HONEY or SWEET LOCUST. THREE-THORNED ACACIA. Fig. 1652. Tree, 70–140 ft., usually with stout simple or branched spines 3–4 in. long: lvs. 6–8 in. long, with pubescent grooved rachis; pinnate with 20–30 lfts., bipinnate with 8–14 pinnæ; lfts. oblong-lanceolate, remotely crenulate-serrate, ¾–1½ in. long: fls. very short-pedicelled in 1½–3 in. long, narrow racemes; ovary pubescent: pod 12–18 in. long, slightly falcate and twisted at length. May, June. From Pa. south to Miss., west to Neb. and Texas. S.S. 3:125, 126. Gn. 32, p. 304. Var. **inérmis**, Pursh. Unarmed or nearly so, of somewhat more slender and looser habit; var. **inérmis elegantíssima**, Grosdemange, is an unarmed form of dense bushy habit and with smaller lfts. R.H. 1905, p. 513. Var. **Bujòtii**, Rehd. (*G. Bujòtii*, Neum. *G. Bujòtii péndula*, Hort.). With slender, pendulous branches and narrower lfts.

CC. *Lfts. obtuse or emarginate, usually less than 20: ovary glabrous or only pubescent on the margin.*

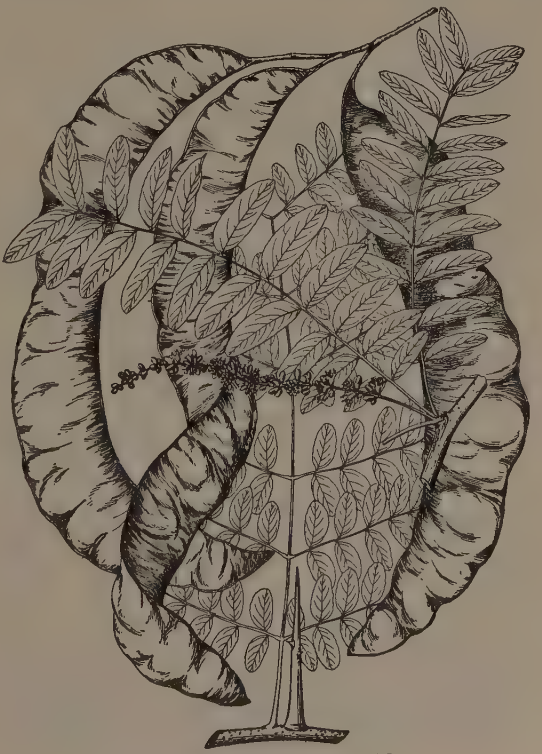
japónica, Miq. (*G. hórrida*, Makino). Fig. 1653. Tree, 60–70 ft., with somewhat compressed, often branched spines, 2–4 in. long: lvs. 10–12 in. long, with grooved and slightly winged, puberulous rachis, pinnate with 16–20 lfts., bipinnate with 8–12 pinnæ; lfts. ovate to oblong, nearly lanceolate, obtuse, entire or remotely crenulate, lustrous above, ¾–2 in. long: fls. short-pedicelled, in slender racemes: pod 10–12 in. long, twisted, bullate, with the seeds near the middle: pulp acid. Japan, China. G.F. 6:165 (adapted in Fig. 1653). Var. **purpùrea**, Rehd. (*G. sinénsis* var. *purpùrea*, Loud. *G. coccínea*, Hort. *G. sinénsis* var. *orientàlis*, Hort.). Lfts. broadly oval to oblong-oval, obtuse or emarginate, ½–1½ in. on the pinnate, smaller on the bipinnate lvs.

Delavàyi, Franch. Tall tree: spines compressed at the base, to 10 in. long: lvs. 12–18-foliolate, only on young plants partly bipinnate; lfts. obliquely ovate or ovate-oblong, obtuse or emarginate, slightly crenate or nearly entire, dark green and lustrous above, glabrous, to 2½ in. long, the lower much smaller, also much smaller on young plants: fls. in slender racemes; ovary glabrous: pod with leathery walls, to 15 or sometimes to 20 in. long and to 2⅓ in. broad, twisted. S. W. China.—Very handsome; recently intro.

AA. *Spines terete: walls of pod thick, woody; pod straight or falcate, not twisted: lvs. 8–16-foliolate, very rarely bipinnate.*

sinénsis, Lam. (*G. hórrida*, Willd.). Tree, to 40 ft., with stout conical often branched spines: lvs. 5–7 in. long, with grooved pubescent rachis, and 8–18 lfts.; lfts. ovate or oblong-ovate, obtuse or acute, crenulate-serrate, yellowish green, dull above, reticulate beneath, ¾–2 in. long: fls. distinctly pedicelled, in slender racemes; ovary glabrous: pod almost straight, thick, 4–7 in. long, 1–1½ in. broad. China. Var. **nàna**, Loud. Shrubby and less spiny, with smaller and narrower lfts.

G. amorphoìdes, Taub. (Garugandra amorphoides, Griseb.). Tree, to 50 ft., very spiny: lfts. obliquely ovate to linear-oblong, ½–1 in. long: fls. in racemes: pod oblong, falcate, 3–4 in. long, 1 in. broad, ½ in. thick. Argentina, Bolivia. Cult. in Calif.—*G. austràlis*, Hemsl. Tree with large spines: lfts. very oblique, oblong, crenate, leathery, shining: pod with coriaceous walls, 4–5 in. long. S. China. —*G. cáspica*, Desf. (G. horrida var. caspica, Schneid.). Allied to G. japonica. Lvs. pinnate with 12–20 ovate, crenulate lfts., or bipin-



1653. Gleditsia japonica. (×⅓)

nate with 6–8 pinnæ: pod thin, pulpy, to 12 in. long.—*G. fèrox*, Desf. Allied to G. sinensis. Spines very stout: lvs. 16–30-foliolate; lfts. oblong-ovate to oblong-lanceolate, crenate, ½–1½ in. long: pod to 10 in. long. China. Most plants cult. under this name seem to belong to G. japonica.—*G. Fontanèsii*, Spach=G. macracantha.—*G. heterophýlla*, Bunge. Allied to G. aquatica: lfts. obliquely obovate, pubescent below, ½–¾in. long: pod oval, 2–3-seeded, slender-stalked, about 1 in. long. N. China. Probably quite hardy.—*G. macracántha*, Desf. Allied to G. sinensis. Spines and lfts. generally larger: infl. paniculate; ovary pubescent: pod 4–6 in. long, ¾in. broad, often almost cylindrical. China.—*G. officinàlis*, Hemsl. Allied to G. sinensis. Spiny tree, to 40 ft.: lfts. 12–20, obliquely elliptic to elliptic-oblong, acutish, to 3½ in. long: pod oblong, thick, falcate, 3–4 in. long and little over ½in. broad. Cent. China.—*G. texàna*, Sarg. Allied to G. triacanthos. Lvs. 12–22-foliolate, often bipinnate: pod narrow-oblong, straight, 4–5 in. long. Texas. S.S. 13:627. Possibly hybrid of G. aquatica and G. triacanthos.

Alfred Rehder.

GLEICHÈNIA (W. F. Von Gleichen, 1717–1783). *Gleicheniàceæ.* Ferns mainly from the tropical and south temperate zones, growing naturally in dense thickets; one species has recently been found in Louisiana, *D. flexuosa.* (Amer. Fern Jour. 4:15).

The family is characterized by dorsal sori composed of a few nearly sessile sporangia; each sporangium is surrounded by a broad transverse ring, and opens vertically. The most striking thing about the family is the growth of the lvs. The lvs. of many of the species are perennial and show an indeterminate growth. During the growing season, the end of the lf. will keep unrolling after the usual manner of ferns. During the resting season this tip rests, but resumes its growth the next season. The lvs. of some species may thus become over 100 ft. in length. The species after the third (AA) are often catalogued under Mertensia, a name which, because used for a genus of flowers, must give way to Dicranopteris if they are separated and placed in a distinct genus, where they probably belong.

A. *Ultimate lobes small, roundish.*

B. *Sorus of 3–4 sporangia, superficial.*

rupéstris, R. Br. Lobes rounded or obtusely quadrangular, the margins thickened and recurved, somewhat glaucous beneath. Austral. Var. **glaucéscens**, Moore, has lvs. of thicker texture, which, when young, are very glaucous on both sides, contrasting with the reddish purple stalks.

circinàta, Swartz. Lobes ovate or rotund, with the rachides pubescent when young; 3–5 times forking, the ultimate pinnules 1 in. long. Austral., New Zeal.

Var. **spelúncæ**, Hort. (*G. spelúncæ*, R. Br.). Lvs. pendent but not curving; pinnules curved inward, forming small cavities. Var. **semivestìta**, Labill. (*G. semivestìta*, Hort.), differs in its close and very erect habit, and flat, deep green pinnæ. Var. **Méndellii**, Moore (*G. Méndellii*, Hort.). More robust and compact than the type, with flat, thicker and glaucous lvs. Gn. 51, p. 472.

BB. *Sorus of 2 sporangia concealed in slipper-shaped lobes.*

dicárpa, R. Br. Lvs. 2–4 times forked, with the lobes strongly arched, rotund or narrow, with the under surface rusty-hairy. Austral.

AA. *Ultimate lobes pectinate: sori near the middle of the veinlets.*

B. *Lf. after first forking, bipinnate.*

glaùca, Hook. Primary branches elongate, 2–3 ft. long: rachises with rusty scales; pinnæ 4–8 in. long, with closely placed entire segms., glaucous beneath. China and Japan.

BB. *Lf. with fan-shaped divisions.*

flabellàta, R. Br. Lvs. 2–3 times forked, the divisions ascending, 6 in. or more long, elliptic-lanceolate; ultimate divisions linear. Austral.

longipinnàta, Hook. Branches of the lvs. repeatedly dichotomous; pinnæ up to 2 ft. long, 3 in. wide. Trop. Amer.

AAA. *Ultimate branches with a pair of forked pinnæ: lf.-sts. zigzag, repeatedly dichotomous.*

dichótoma, Willd. With a distinct pair of pinnæ arising from the base of the forked branches; segms. not decurrent. Tropical regions generally, but several species have been confused here, as in many of the widely distributed species.

L. M. Underwood.
R. C. Benedict.†

GLIRICÌDIA (*rodent-poison*, from the seeds). *Leguminòsæ.* Eight or 10 woody plants, Cuba and Mex., to S. Amer., differing from Robinia in the wingless or marginless pods and coriaceous valves. Lvs. odd-pinnate, the lfts. entire: fls. rose-colored, racemose or fasciculate; calyx-teeth short and broad, the 2 upper ones joined; standard large, reflexed; wings falcate-oblong; keel incurved, obtuse; ovary stipitate, many-ovuled, becoming a broad-linear 2-valved pod. **G. platycárpa**, Griseb., of Cuba, is offered in S. Fla.: tree, to 25 ft.: lfts. 7–9, ovate or ovate-oblong, glabrous, the margins undulate: corolla pink or purplish; stigma ciliate: pod sessile, plano-compressed, lanceolate-oblong, 8-seeded. **G. maculàta.** HBK. (*Lonchocárpus maculàtus*, DC.), Guatemala to S. Amer., is reported as in cult. in S. Fla.: small tree: lfts. about 17, oblong, obtuse, somewhat appressed-pilose above and blackish-spotted and glaucescent beneath: pod linear, compressed, with thickened margin.

L. H. B.

GLÓBBA (Malayan name). *Zingiberàceæ.* Herbaceous conservatory plants with rhizomes and habit of canna, and a singular floral structure.

Flowers in terminal panicles; bracts usually deciduous; calyx funnel-shaped, 3-lobed; corolla-tube longer than the calyx, the lobes nearly equal, ovate; staminoid petal-like and fastened to the corolla-lobes; ovary 1-celled, forming a globose, tardily dehiscing caps.—Only one species is known to be cult. in Amer. This is known as *G. coccinea*, which is really *G. atrosanguinea*, figured at B.M. 6626. "Index Kewensis" is clearly in error in referring *G. coccinea* to *G. albo-bracteata*, as is plain from G.C. II. 18:71. Veitch intro. in 1881 a plant under the provisional name of *G. coccinea*, as it was supposed to be a new species, but the next year, it was identified with *G. atrosanguinea*. This plant was highly praised in 1893: "Plants in bloom the greater part of the year: sts. much crowded, 12–18 in. long, gracefully arching on all sides: fls. scarlet and yellow, in dense racemes." The credit for the discovery of this plant is generally given to F. W. Burbidge, but in G.C. II. 18:407, Burbidge gives the honor to Curtis. For cult., see *Alpinia*.

atrosanguínea, Teijsm. & Binn. (*G. coccinea*, Hort., Veitch). St. slender, becoming 2–3 ft. high: lvs. 3–4 in. long, elliptic, acuminate at both ends; sheaths purplish, pubescent, closely clasping the st.; lower flowerless bracts distant, brown, 6–9 lines long, upper and flowering bracts crowded, red: fls. 1½ in. long; corolla yellow, tubular, thrice as long as calyx. Borneo. B.M. 6626. G.Z. 27, p. 121.—Little known in Amer. outside of botanic gardens.

N. Taylor.†

GLOBE AMARANTH: *Gomphrena.*

GLOBE FLOWER: *Trollius.*

GLOBE HYACINTH: *Muscari.*

GLOBE THISTLE: *Echinops.*

GLOBE TULIP: *Calochortus.*

GLOBULÀRIA (the flowers in small, globular heads). *Globulariàceæ.* Herbs, subshrubs and shrubs, with small blue flowers mostly in spherical heads.

Leaves from the root or alternate, leathery, entire or with a few sharp teeth: fls. small, blue, in dense heads; calyx 5-lobed, sometimes obscurely 2-lipped; corolla-tube usually short, broad at the throat, the lobes oblique or unequal; stamens 4, didynamous, attached at the throat: fr. small, included in the calyx.—About a dozen species from the Old World. Probably the commonest and best species is *G. tricosantha*, which thrives at the front of well-drained borders, but is particularly showy in the rockery. For this and *G. vulgaris* and its forms, rather moist but well-drained soil and partial shade are advised. Prop. by division or seed.

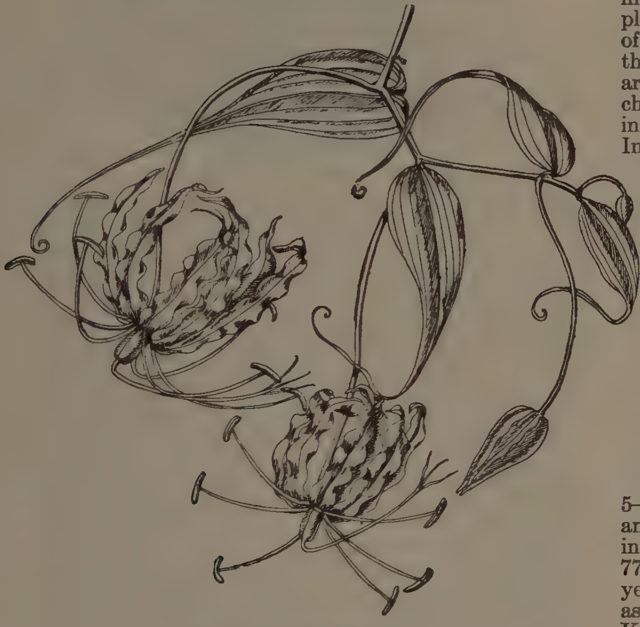
A. *Hardy herbaceous plants about 6–12 in. high.*

B. *Root-lvs. 1-nerved.*

trichosántha, Fisch. & Mey. Height 6 in.: root-lvs. spatulate, 3-toothed at apex; st.-lvs. obovate or oblong, mucronate, sessile. July, Aug. Asia Minor. Syria.

BB. *Root-lvs. 5-nerved.*

vulgàris, Linn. (*G. nudicaùlis*, Hort.). Height 8–12 in.: root-lvs. obovate, petiolate, nearly entire, apex entire, notched or mucronate; st.-lvs. lanceolate, sessile. S. Eu., Caucasus. July, Aug. B.M. 2256.



1654. Gloriosa superba. (×½)

AA. *Prostrate, woody herb, forming mats.*

cordifòlia, Linn. A low prostrate perennial with creeping, almost woody sts., and wedge-shaped, notched lvs., which form rosettes at the base of the solitary pedicel: fls. in a close head, not showy. S. Eu.—Useful for the rockery.

G. Alỳpum, Linn. Lvs. obovate-oblong, mucronate or 3-toothed at apex. Medit. regions.—Cult. years ago in S. Calif. by Franceschi, who says it is covered with fls. all winter; but not now in cult. Also cult. abroad under glass.—*G. bellidifòlia*, Salisb. = G. spinosa.—*G. spinòsa*, Linn. One ft. and more: radical lvs. obovate, attenuate into petiole, 3–7-toothed at apex; st.-lvs. lanceolate and sessile: head larger than in G. vulgaris; calyx 2-lipped, the tube ciliate and throat barbed; upper lip of corolla 2-parted, lower 3-parted. Spain.

N. Taylor.†

GLOCHÍDION (from Greek for *point*, the anthers being long-pointed). *Euphorbiàceæ.* Tropical trees or shrubs, rarely cult. Lvs. alternate, simple: fls. in axillary clusters or singly; staminate calyx imbricate, of 3–8 sepals; pistillate fls. without disk, stigmas short and thick, ovules 2 to each cell: fr. a caps.—About 135 species of Trop. Asia and Pacific islands, related to Phyllanthus.

J. B. S. Norton.

GLONÈRIA: *Psychotria.*

GLORIÒSA (Latin for *glorious*). Syn., *Methónica. Liliàceæ.* Tall, weak-stemmed plants, supporting themselves by means of tendril-like prolongations of the leaves. Odd and handsome plants, to be grown in a warmhouse.

Leaves oblong, lanceolate or lance-ovate: fls. many and showy, long-stalked, borne singly in the axils of the upper lvs.; perianth of 6 distinct long segms. which are undulate or crisped, and reflexed after the manner of a cyclamen, variously colored; stamens 6, long and spreading, with versatile anthers; ovary 3-loculed; style long, and bent upward near the base.—Five or perhaps more tropical species, all African, and 1 also Asian.

Gloriosas are not difficult to grow. The brightest flowers are produced in sunlight. The plants grow from tubers. These tubers should be rested in early winter, and started in pots in January to March. The plants bloom in summer and fall. When potting the old tubers, offsets may be removed (when they occur) and grown separately for the production of new plants. The tubers may be cut in two for purposes of propagation. Let the plants stand near a pillar or other support. Give freely of water when the plants are growing. In this country they are sometimes bedded out in summer. Gloriosas are sometimes grown outdoors in summer in Massachusetts, and the plants so treated are not much inclined to climb and flower so freely as under glass. In Florida, they may be grown permanently in the open. Success with gloriosa depends on having strong bulbs. Consult *Bulbs.*

A. *Perianth-segms. about 2½ in. long.*

Cársonii, Baker. St. erect and climbing, the lvs. st.-clasping, about 4–5 in. long, bearing long tendril-like processes: fls. very numerous, in a loose cyme; perianth-segms. not more than 2½ in. long, usually less than that, recurved and crisped, the margins yellow; style erect; stigmas 3.—F.S.R. 2, p. 355. A showy plant from Cent. Afr. Intro. in 1904.

AA. *Perianth-segms. longer than 3 in.*

B. *Segms.* (*or petals*) *much crisped.*

supérba, Linn. Climbing Lily. Fig. 1654. St. 5–10 ft. high: lvs. ovate-lanceolate: segms. 2–3 in. long and less than an inch wide, opening yellow, but changing to yellow-red and deep scarlet. Afr., Asia. B.R. 77. Gn. 38:576. B.H. 23:121. G.L. 18:277.—A yellow-fld. form of unknown origin has been described as *G. lùtea*, Hort; it is scarcely known outside of Kew. Var. **grandiflòra,** Hort., is advertised as "color a yellow-red, changing to deep scarlet;" it is unknown in the wild state.

BB. *Segms. somewhat undulate, but not crisped.*

símplex, Linn. (*G. viréscens*, Lindl. *G. Plántii*, Loud.). Fls. opening yellow, and remaining so in shade, but becoming deep yellow-red when exposed to the sun; wider than in *G. superba*, barely undulate and wavy, and not prolonged or hooked at the end as in the latter species. Afr. B.M. 2539. G. 26:556. Var. **grandiflòra,** Nichols. (*Methónica grandiflòra*, Hook.), has fls. 8 in. across. B.M. 5216. G. 27:477.

Rothschildiàna, O'Brien. St. climbing, simple at first, afterward branched: lvs. bright green, glabrous, oblong-acuminate, alternate or opposite: fls. solitary in the axils, or peduncles 3–4 in. long, abruptly curved near the ovary; perianth-segms. oblong-lanceolate, recurved, over 3½ in. long, crimson, with a dark purple mark near the base. Trop. Afr.—One of the best species. G.C. III. 33:323. G.M. 47:377. Gn. 65, p. 451. G.W. 9, p. 112; 13, p. 535. R.B. 34:339. F.S.R. 2:248. Var. **citrìna,** Hort., has fls. citron-yellow and claret-purple. It is a splendid showy addition. G.C. III. 38:211.

G. abyssínica, Rich., said to be the largest-fld. species, seems not to be in cult.—*G. Lèopoldii*, Hort., a beautiful form with yellow and purple fls., is probably some form of G. simplex grandiflora. G.C. III. 36:188. R.H. 1903:548.

N. Taylor.†

GLORY-OF-THE-SNOW: *Chionodoxa.*

GLORY PEA: *Clianthus.*

GLOSSOCÒMIA CLEMATÍDEA: *Codonopsis clematidea.*

GLOXINÈRA (*Gloxinia* and *Gesneria*). *Gesneriàceæ.* A bigeneric hybrid between *Gesneria pyramidalis* (seed-parent) and Gloxinia Radiance, by Veitch and first exhibited at the Royal Horticultural Society, London, May 8, 1894. It has the habit of a garden gloxinia, with inclined fls. of fair size, brilliant scarlet tinged with magenta in the shadows. The foliage is recorded as more nearly that of a gloxinia than a gesneria in appearance, being very succulent and covered with fine hairs. G.C. III. 17:145.

GLOXÍNIA (named for P. B. Gloxin, of Strassburg, who wrote in 1785). *Gesneriàceæ.* The genus Gloxinia was founded by L'Heritier in 1785 upon *G. maculata* of Brazil. Early in last century a related Brazilian plant was introduced, and it attracted much attention: this plant was named *Gloxinia speciosa* by Loddiges in his Botanical Cabinet in 1817, and it was there figured. In the same year it was figured by Ker in the Botanical Register, and also by Sims in the Botanical Magazine. Sims wrote that the plant was "already to be found in most of the large collections about town [London]." These writers refer the plant to the Linnæan class Didynamia, but Ker also suggests that it may belong to the Campanulaceæ. This *Gloxinia speciosa* was the forerunner and leading parent of the garden gloxinias, but it turns out that the plant really belongs to Nees' genus Sinningia, founded in 1825 on a Brazilian plant which he named *S. Helleri;* but the rules of nomenclature make the tenable name to be **Sinníngia speciòsa,** Benth. & Hook. (See *Sinningia.*) All the garden gloxinias are therefore sinningias, but to gardeners they will ever be known as gloxinias; therefore, the evolution of them may be traced here.

1655. Modern gloxinia blooms.—Sinningia speciosa. (×⅓)

Gloxinia has no tubers: Sinningia has a tuberous rhizome. Gloxinia has a ring-like or annual disk about the ovary: Sinningia has 5 distinct glands. The sinningias are either stemless or st.-bearing, with a trumpet-shape or bell-shape 5-lobed and more or less 2-lipped corolla, a 5-angled or 5-winged calyx, 4 stamens attached to the base of the corolla, and with anthers cohering at the tips in pairs, and a single style with a concave or 2-lobed stigma. The garden gloxinias belong to the subgenus Ligeria (subgenus of Sinningia), which has a short st. or trunk, and a broad-limbed bell-shape fl. Gloxinia has perhaps a half-dozen species from Mex. to Brazil and Peru; Sinningia has about 20 species, in Brazil.

1656. A good gloxinia plant.

The true gloxinias are not florists' flowers, and they are little known in cultivation. They are apparently not in the American trade. The old *G. maculata* is figured in the Garden 39:801 (p. 364), and it is probably to be found in choice collections in the Old World. It produces knotty rootstocks, which, as well as the leaves, may be used for propagation. It is also figured in B.M. 1191. *G. glabrata*, Zucc., from Mexico, is the *G. glabra*, Hort., *Achimenes gloxiniæflora*, Forkel, and *Plectopoma gloxiniflorum*, Hanst. It is a stemmy plant, bearing white flowers with yellow-spotted throat; B.M. 4430, as *G. fimbriata*, Hook. Plectopoma is now referred to Achimenes, and the plant then takes the name *Achimenes glabrata*, Fritsch. It appears not to be in the trade. Other related genera are Diastema, Dicyrta and Isoloma.

The garden gloxinias (genus *Sinningia*) are nearly stemless plants, producing several or many very showy bell-like flowers, each on a long stem. *G.* (*Sinningia*) *speciosa* originally had drooping flowers, but the result of continued breeding has produced a race with flowers nearly or quite erect (Figs. 1655, 1656). The deep bell of the gloxinia is very rich and beautiful, and the erect position is a decided gain. The flowers also have been increased in size and number, and varied in shape and markings; the leaves also have become marked with gray or white. The color of the original *Gloxinia* (*Sinningia*) *speciosa* was a nearly uniform purple. The modern races have colors in white, red, purple and all intermediate shades, some are blotched, and others are fine-spotted or sprinkled with darker shades. It is probable that the larger part of the evolution in the common greenhouse gloxinia is a direct development from the old *G. speciosa*, but hybridity may have played a part. One of the earliest recorded series of hybrids (1844) was with *Sinningia guttata*, which is a plant with an upright stem and bearing rather small spotted flowers in the axils of the leaves. (B. R. 1112.) The issue of this cross showed little effect of the *S. guttata*, except a distinct branching habit in some of the plants (B.R. 30:48). It is possible, however, that *S. guttata* has had something to do with the evolution of the spots on the present-day flower, although the original *G. speciosa* was striped and blotched in the throat. The student who wishes to trace some of the older forms of garden gloxinias may look up the following portraits: B.M. 1937, speciosa itself; B.M. 3206, var. albiflora; B.M. 3934, var. macrophylla variegata; B.M. 3943, var. Menziesii; F.S. 3:220, Teichleri (hybrid); F.S. 3:268; F.S. 4:311, Fyfiana (hybrid); F.S. 6:610; F.S. 10:1002; F.S. 14:1434–6; F.S. 16:1699 and 1705; F.S. 17:1768, 1772–6; F.S. 18:1846, 1878, 1885, 1918, 1919; F.S. 19:1955, double forms; F.S. 21:2164; F.S. 22:2324. I.H. 42:39, 41. Gt. 47, p. 79; Gt. 48, p. 80. Gn. 15:162; 43:392; 52, p. 268. R.H. 1846:301, Teuchlerii; R.H. 1848:201, Fyfiana; 1877:70, variabilis; R.H. 1883, p. 248. For florists' plants, see A.F. 11:7; A.G. 14:49; Gng. 6:83. There are many Latin-made names of garden gloxinias, but the plants are only forms of the *G. speciosa* type. One of the trade entries is *G. crassifolia*, a name applied to some of the best and largest-growing strains.

There are double forms of gloxinia, in which an outer but shorter corolla is formed. The forms are more curious than useful. L. H. B.

Cultivation of gloxinia.

Few flowers can surpass the large tubular blooms of gloxinia for richness and variety of coloring. The colors range through all the shades of blues and purples, pinks and crimsons, while some are pure white, and others again white with tinted edges; still others have the colors dotted on the lighter ground-color. The foliage also of gloxinias is very beautiful, being of a rich soft velvety texture. Gloxinias make a gorgeous display, therefore, when in flower and are especially valuable for the decoration of conservatories during the summer and early fall months.

Gloxinias are native of tropical America and therefore require a warm greenhouse or tropical temperature in the growing season. When first introduced into cultivation, and even for many years after, the flowers of gloxinias were all nodding, that is they hung down instead of standing upright; no one now grows the nodding-flowered kinds, the upright-flowered being so much more attractive.

Though they may be grown so as to flower at almost any season of the year, yet they are naturally summer-flowering plants, and do best when treated as such. They are propagated by seeds, or by cuttings made of leaves or stems. Seeds are preferable, unless one wishes to increase some very choice colored variety, when it is best to propagate by leaf-cuttings, using partly matured medium-sized leaves with a small portion of leaf-stalk attached (Fig. 1176, p. 929). These may be inserted in an ordinary propagating-bed, where if kept rather on the dry side, they will soon root and form tubers, when they may be potted and grown on. Seeds should be sown in a warm temperature early in February, in pans or shallow boxes containing a finely sifted mixture of peat, leaf-mold and silver sand in about equal proportions. The seedlings will begin to appear in about ten days, when great care must be exercised in watering, or they will "damp-off." In fact, success with these plants throughout the year depends largely upon the care exercised in watering. Even in their most active growth the water always should be given from the spout of a watering-can, taking care not to wet the leaves, though they like a warm, humid atmosphere during their growing season. As soon as the seedlings can be conveniently handled, they should be potted singly into thumb-pots and grown on rapidly, using in subsequent shifts a mixture of two parts leaf-mold, one part good fibrous loam and one part peat. The plants must be well shaded from sunlight and placed in a position free from draughts. The seedlings should begin to flower by the middle of August, when they should be given an abundance of air. After flowering, the leaves will begin to mature, when water should be gradually withheld. As soon as the leaves have all ripened off, the pots should be stored away in some convenient place for the winter, in a temperature of about 45°, giving just sufficient water to keep the tubers from shriveling. Toward the middle of February the tubers will show signs of starting into growth. A batch should be started at this time, choosing the tubers which appear most active, and the remainder should be held back for another month; this will give a much longer period of blossoming. The tubers should have all the old soil shaken off and be potted again in clean well-drained pots, using sizes just large enough to accommodate the tubers, the compost being the same mixture as before recommended. They should be given but little water until active root-growth commences. As soon as the pots are filled with roots, they should be shifted on at once into the pots they are intended to flower in, as frequent shifts would more or less damage their leaves, which have a tendency to cling round the sides of the pots. The first batch should come into flower in June.

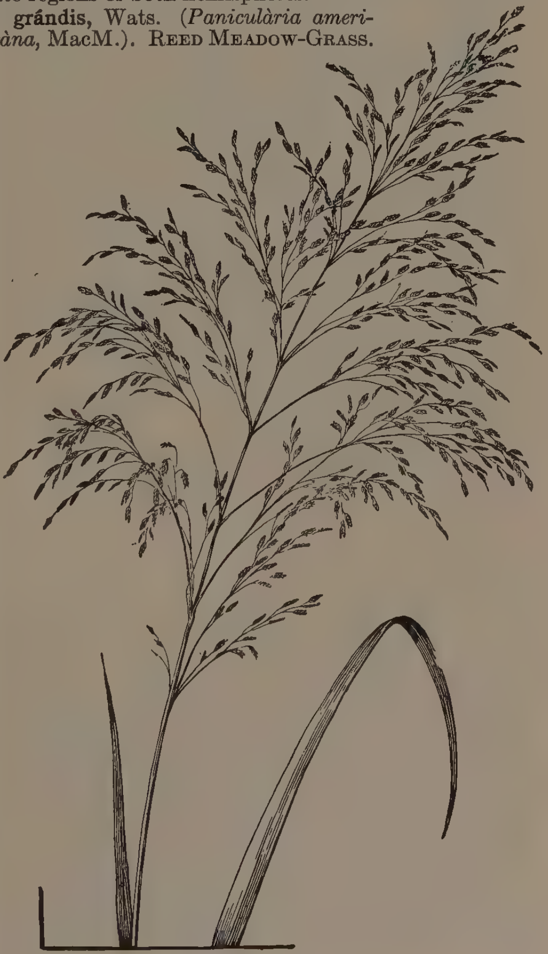
When carefully grown, gloxinias are particularly free from insect pests or fungous diseases, and the same tubers can be grown for several years.

Edward J. Canning.

GLYCÈRIA (Greek, *glukeros*, sweet). *Gramíneæ.* Marsh perennials with open (or rarely contracted) panicles, sometimes grown for ornament.

Spikelets few- to many-fld.; lemmas convex, firm, with a scarious margin or apex, usually obtuse, awnless, prominently 5–9-nerved.—Species about 16 in temperate regions of both hemispheres.

grándis, Wats. (*Paniculària americàna*, MacM.). Reed Meadow-Grass.



1657. Glyceria grandis. (×⅓)

Fig. 1657. Three to 5 ft.: lower sheaths rough and overlapping; blades 3–8 lines wide; glabrous: panicle 8–16 in. long, many-fld., open and spreading; spikelets 4–7-fld., 3 lines long. Dept. Agric., Div. Agrost. 7:286. N. U. S.

nervàta, Trin. (*Paniculària nervàta,* Kuntze). Fowl Meadow-Grass. One to 3 ft.: blades 1–2½ lines wide, scabrous above: panicle 4–8 in. long, open, the branches drooping; spikelets 3–7-fld., 1 line long. Ibid 287.—Widely distributed in U. S. A. S. Hitchcock.

GLYCÌNE (Greek for *sweet*). *Leguminòsæ.* The soybean and related plants. The glycines are allied to Dolichos, Vigna and Phaseolus: the cult. species are distinguished by small and hairy fls. in short axillary racemes: stipules very small and free from the petiole: lfts. 3, large.—Perhaps 40 species, mostly tropical, in Asia, Afr., and Austral., nearly all twining vines. In this country Glycine is known only in the soybean, **G. Sòja,** Sieb. and Zucc., which is an erect, hairy annual from Japan and China. It is also known as the soja or soya bean, coffee bean and coffee berry. It grows 2–6 ft. high, making a rank, bushy herb, and bearing axillary clusters of small hanging, hairy pods, with constrictions between the seeds. Fls. small, white or purple. The seeds are subglobose to oblong, yellow, green, brown or black, but in some varieties parti-colored. In China and Japan the beans are much used for human food and for the production of oil. For the latter purpose great quantities of seed have been exported in recent years from Manchuria to Eu. In this country the plant is grown for forage, its first use for this purpose dating from 1854. Since 1882, and especially since 1898, the crop has been steadily gaining in importance. The beans may be used as a substitute for coffee; and for this purpose the plant is often sold. The erect form of soybean is unknown in a wild state. It is clearly a domesticated form of **G. ussuriénsis,** Regel & Maack, which is wild in Japan, Manchuria, China, and India. For the economic merits of soybeans, see various experiment station reports; also Farmers' Bull. No. 372, U. S. Dept. of Agric. For a technical exhaustive paper see Bureau of Plant Industry, Bull. No. 197. The soybean has also been made the basis of a distinct genus under the name of Soja, Moench. Glycine was clearly used by Linnæus to refer primarily to the ground-nut, *Apios tuberosa.* Botanists who accept Glycine in that sense use Soja for the soybean and allied species. The plant named *Phaseolus max* by Linnæus is the soybean, and as the description is on a previous page to that of *Dolichos Soja,* some authors use the specific name *max* and designate the soybean as *Soja max.*

G. chinénsis = Wistaria sinensis. — *G. frutéscens* = Wistaria speciosa.—*G. sinénsis*=Wistaria. C. V. Piper.†

GLYCÓSMIS (from the Greek for *sweet,* and *smell*). *Rutàceæ.* Thornless shrubs or small trees, grown for ornament.

Leaves persistent, alternate; lfts. 1–9, alternate or nearly opposite, dark green above, pale below, coriaceous, entire or obscurely crenulate: fls. in axillary or terminal panicles, small, white, fragrant, urceolate, 5-merous; calyx pubescent (ciliate); ovary 2–5-celled with 1 ovule in each cell; style very short, persistent; stamens 10, free, inserted in 2 series on the disk: frs. small, with a fleshy pulp in which are imbedded the large rounded seeds; cotyledons epigeous in germination; first foliage-lvs. simple, opposite.—Several species are known, occurring in India and Ceylon and extending to Austral., the Philippines, and China. Only one has as yet been intro. into cult. in this country.

pentaphýlla, DC. (*Limònia pentaphýlla,* Retz. *Toluifera cochinchinénsis,* Lour. *G. cochinchinénsis,* Pierre). Small inermous shrubs with pinnate lvs. having 1–7 lfts.: fls. urceolate, very small, white, fragrant: berry 2–3-celled with 1 or 2 brownish green rounded seeds imbedded in the fleshy pulp.—A very variable species common throughout India, Indo-China, Philippine Isls. and Malayan Archipelago. Ill. Roxbg. Pl. Coromandel, 1:60, pl. 84. Talbot, For. Fl. Bombay, p. 192, fig. 117.—This species is sometimes grown as an ornamental in greenhouses or out-of-doors in the southern states. Because of its dark green glossy lvs. and translucent pinkish berries, it is a handsome shrub for warm semi-tropical climates. Walter T. Swingle.

GLYCYRRHÌZA (Greek, *sweet root*). *Leguminòsæ.* Licorice, also spelled Liquorice, and Lickorice. This genus contains the plant whose roots produce the licorice of commerce.

The genus has about a dozen widely scattered species of perennial herbs, often glandular: lvs. odd-pinnate; lfts. of indefinite number, rarely 3, entire, with minute glands or teeth: fls. blue, violet, white or yellowish, in axillary racemes or spikes, which are peduncled or sessile.—About a dozen species in the Medit. region, Trop. Asia, W. Amer. and S. Amer., only one of which appears to be cult.

The roots of *Glycyrrhiza glabra,* of southern Europe and central Asia, are used extensively by druggists; in America by brewers and manufacturers of plug tobacco; in Turkey, Egypt and France to make cooling drinks. Our supply—more than $1,500,000 worth in 1899—is derived mainly from Spain, Portugal, Italy, Turkey and Russia (Transcaucasia), the roots from Spain and Italy being considered best, and those from Turkey poorest on account of their bitterness. The soil for licorice must be deep, mellow, moist, rich and free from stones. Plants are usually set in rows, 3 feet or more apart, and not less than 1 foot asunder. After the plants have covered the ground, they are allowed to shift for themselves for three or four years. Harvesting is primitive, the roots being exposed by the plow and pulled by hand. Large quantities of roots are thus left to produce a succeeding crop or to overrun the field as weeds. One ton to the acre is considered a fair yield; 1.6 cents a pound an average price. In America the only fields worthy the name are in California, where licorice is not considered very paying. Experiment and experience with it are, however, but little more than begun. (M. G. Kains.)

glàbra, Linn. Height 2–3 ft.: lfts. ovate, subretuse, subglutinous beneath, 4–8 pairs, with an odd one: spikes peduncled, shorter than the lvs.; fls. closely clustered, the calyx glandular pubescent: pods glabrous, 3–4-seeded. Summer and autumn.—Seeds in pods are listed by a few dealers with miscellaneous agricultural seeds. Wilhelm Miller.

GLYPTOSTRÒBUS (*engraved* or *marked cone*). *Pinàceæ.* One or 2 species of trees of swamps and low grounds in China, separated by some authors from Taxodium, but here included in that genus. The basis of separation from Taxodium lies mostly in the fact that the cone-scales are deciduous, whereas in Taxodium proper they are persistent; the mature cones are obovoid with a long contracted base, the seeds scarcely angled and stipitate or narrowed at the base into a wing. *G. heterophýllus,* Endl. (*Taxòdium heterophýllum,* Brongn., which see), is a shrub to 10 ft. high, with lower branches pendulous: lvs. long, linear, 3-rowed or scattered, on the fruiting branches short and rather obtuse and spirally imbricate: cones ovoid, ¾in. long: tender, and little cult.

GMELÌNA (after one of five distinguished German botanists named Gmelin). *Verbenàceæ.* Trees and shrubs, bearing yellow or brownish irregular flowers sometimes nearly 2 inches across. A very few plants may be cultivated in European warmhouses, and in America only in southern Florida and southern California outdoors.

Spiny or not: shoots tomentose: lvs. opposite, entire, toothed or lobed: fls. in panicled cymes or racemes, tomentose at least while young; calyx bell-shaped, shortly 5-toothed or entire; corolla-tube slender below; limb oblique, 5- or 4-lobed; stamens 4, didynamous, nearly exserted: fr. a succulent drupe.—Eight or 10 species from E. Asia and N. Austral. The genus produces a fancy timber similar to teak, which is a product of the same order. Vitex and Clerodendron are better known congeners.

A. *Plant not climbing.*

B. *Lvs. becoming 9 in. long, 6 in. wide.*

arbòrea, Roxbg. (*G. Rheèdii,* Hook.). Unarmed tree, sometimes attaining 60 ft., deciduous, flowering with the young lvs.: lvs. cordate-ovate, entire: panicles often 1 ft. long, terminal. India, Malaya. B.M. 4395.—Cult. apparently only in S. Calif. by Franceschi, who keeps *G. Rheedii* separate.

BB. *Lvs. ½–1½ in. long.*

asiática, Linn. (*G. parviflòra,* Pers., a typographical error for *G. parvifòlia,* Roxbg.). Shrubby, sometimes spinescent: lvs. ovate or obovate, entire or lobed: fls. in racemose clusters, the corolla about 1½ in. across. India, Ceylon.

AA. *Plant scandent.*

Hýstrix, Kurz. A large spiny scandent shrub: lvs. 3 x 1½ in., entire, glaucous beneath: fls. in dense terminal cymes, the bracts very large and nervose, colored; corolla about 2 in. across, yellow, but not hairy on the outside as in *G. asiatica.* E. Indies.—A sprawling plant with the habit of bougainvillea.

N. Taylor.†

GNAPHÀLIUM. See *Leontopodium* and *Helichrysum.* There are various native gnaphaliums, but they are not in cultivation. *G. lanatum* of gardeners is *Helichrysum petiolatum.*

GNÌDIA (*Gnidus,* a place in Crete). *Thymelæàceæ.* Trees, shrubs or subshrubs, of about 100 species in Trop. and S. Afr. and E. India. Some of them have been grown abroad as greenhouse evergreen woody often heath-like subjects: lvs. mostly small: fls. white, yellow, red or violet, mostly in heads on the ends of the branches; perianth-tube cylindrical, at length detaching above the ovary, the lobes 4 and spreading, with scales in the throat alternating with the lobes; stamens 8; ovary sessile, 1-celled: fr. small and dry, included in the persistent base of the perianth. *G. polystàchya,* Berg. Handsome shrub, to 6 ft., with many graceful pubescent branches: lvs. crowded-imbricate: fls. small, yellow, in terminal heads. S. Afr. B.M. 8001. G.C. III. 41:294. *G. tomentòsa,* Linn. Three to 4 ft.: lvs. ovate or ovate-lanceolate, decussate and sometimes reflexed: fls. yellow, fascicled with the lvs. at the ends of the branches, the tube slender and silky. S. Afr. B.M. 2761.

L. H. B.

GOAT'S-BEARD is usually *Aruncus sylvester* (*Spiræa Aruncus*); also the genus Tragopogon.

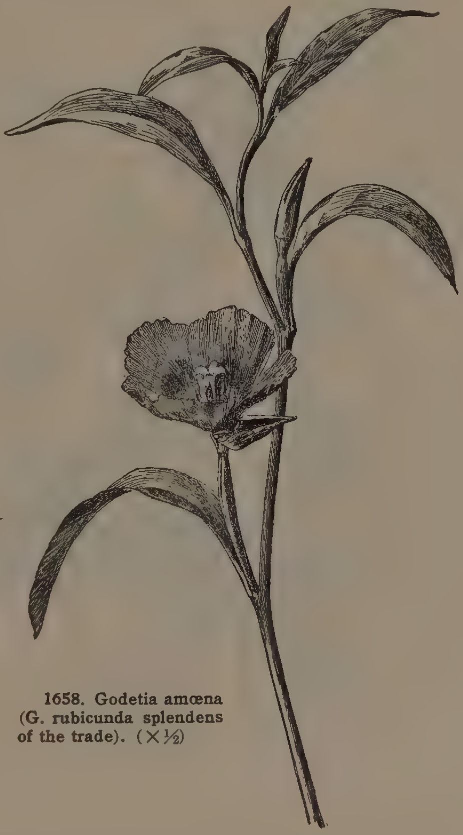
GODÈTIA (C. H. Godet, Swiss botanist). *Onagràceæ.* Mostly erect annuals with very showy flowers in leafy racemes or spikes.

Calyx-tube obconic or funnelform; petals rose, lilac-purple or white, often marked with a large deep crimson or purple spot; stamens 8; ovary 4-celled, inferior: fr. a many-seeded caps.—Twenty or more species in the western parts of S. and N. Amer., especially Calif.

Seed may be surface-sown in the late fall in order to be covered by the rains which follow, or in February lightly covered in sunny or in half-shady places. *G. amœna* is very popular and furnishes an abundance of bloom in early summer when many late spring annuals have succumbed to advancing heat. In the wild garden the species come again freely but have a tendency to move to new ground after the second year.

A. *Plants tall, slender: fls. loosely spicate-paniculate.*

amœna, Lilja. Farewell-to-Spring. Fig. 1658. Slender, branching, 1–2 ft. high: lvs. linear to lanceolate, ½–2½ in. long, often with smaller ones fascicled in the axils: buds erect: calyx-lobes united and turned to one side on expansion of the fl.; corolla lilac-crimson or red-pink, satiny, 1–2 in. broad: caps. teretish, sessile or very shortly pedicelled. Cult. also in European gardens (since 1818). Exhibits considerable variability, especially in the size, and color-scheme of the fls. *G. rubicúnda,* Lindl. (B.R. 1856), is the lilac-crimson form. *G. vinòsa,* Lindl. (B.R. 1880), is a white-fld. state. *G. Schwáminii* (Gn. 70:203), a double-fld. pink form. *Œnothèra Líndleyi,* Douglas (B.M. 2832), has the crimson petals with a large central blotch of deeper color. *Œnothèra róseo-álba,* Bernh. (Reichenbach, Icon. Bot. Exot., pls. 47 and 150), is a prolific-flowering form.



1658. Godetia amœna (G. rubicunda splendens of the trade). (×½)

Bóttæ, Spach. Similar to *G. amœna:* buds nodding: petals pink or light crimson; stigmas united at base to form a cup-like apex to the style: caps. long-stalked, usually with flat sides. S. Calif. near the coast.

AA. *Plants low: fls. in a short spike or cluster of spikelets.*

grandiflòra, Lindl. (*Œnothèra Whítneyi,* Gray). Fig. 1659. Stout, simple and dwarfish, 4–12 in. high: lvs. oblong, tapering to base and apex: buds large, 1–2 in. long; corolla 3–5 in. across, rose-red with a deeper blush or blotch in center, varying into pure white (Duchess of Albany), dark crimson (Lady Albemarle) or bright carmine (Lady Satin Rose): caps. sessile, 4-

sided, 8-ribbed. B.M. 5867. J.F. 318.—A highly prized species.

G. decúmbens, Douglas. Sts. ascending, strongly flattened, whitish pubescent: ovary white-woolly. B.M. 2889. B.R. 1221. —Not certainly known in a wild state. Seed originally from Ore. Differs little technically from G. quadrivulnera or its forms but is quite unchanged in its characters after 75 years or more of cult. in European gardens. It is an excellent illustration of the manner in which many strains of the smaller-fld. godetias maintain their slight but distinctive characters, although subject for many years to the varying conditions of garden cult.—*G. magellánica*, Burbank, a diffuse free-flowering species with lavender fls. the size of G. amœna, has been recently intro. from Patagonia by Luther Burbank.—*G. quadrivúlnera*, Spach. Erect, slender, pubescent: lvs. obovate to linear or the uppermost lanceolate and half-conduplicate: petals lilac or pale crimson, usually with a spot at apex, 4–6 lines long: caps. sessile, 4-sided, lightly 8-ribbed. B.R. 1119. Occasionally cult., but probably not in the trade.—*G. Romanzòvii*, Spach, from the "northwest coast," not now known in a wild state, has been cult. in Eu. nearly a century. Very leafy with young parts white-pubescent: lvs. oblong-oblanceolate. B.R. 562.

W. L. Jepson.

1659. Godetia grandiflora, Œnothera Whitneyi of the trade. (×⅓)

GOÈTHEA (Goethe, the great German poet, who was also a botanist). *Malvàceæ.* Two Brazilian evergreen shrubs, seldom grown in hothouses. Lvs. alternate, simple, entire or nearly so: fls. showy, in cymes from the leafless sts. or sometimes solitary in the axils, subtended by large cordate red showy calyx-like bracts; calyx 5-toothed, included within the bracts; petals short; stamens united in a column, which is 5-toothed below the apex; ovary 5-celled, each 1-ovuled. *G. strictiflòra*, Hook. (*G. cauliflòra*, Hort.), is a small shrub or bush with large ovate lvs. sinuate on upper half, and aggregated fls. in yellowish white red-tinged bracts; petals small, obcordate, veiny; calyx whitish or greenish, the lobes ovate-acuminate; fls. on short-peduncles that are aggregated in the axils along the st. B.M. 4677. J.F. 4:365. *G. multiflora*, Nichols., and *G. semperflorens*, Nees & Mart., belong in Pavonia.

L. H. B.

GOLDEN CHAIN: *Laburnum vulgare.*

GOLDEN FEATHER: *Chrysanthemum Parthenium.*

GOLDENROD: *Solidago.*

GOLDEN SEAL: *Hydrastis.*

GOLDFÙSSIA: *Strobilanthes.*

GOLD THREAD: *Coptis trifolia.*

GOMBO, Gumbo, or Okra: *Hibiscus esculentus.*

GOMÈSA (named in honor of Bernardinus Antonius Gomes). *Orchidàceæ.* Stove epiphytes.

Pseudobulbs 1- or 2-lvd.: racemes often many-fld., lateral; sepals free and spreading, or the lateral approximate or connate; petals equaling or wider than dorsal sepal; lip affixed to base of column, continuous, spurless, the lateral lobes small; pollinia 2.—About 5 or 6 species, natives of Brazil.

planifòlia, Klotzsch (*Odontoglóssum planifòlium*, Reichb.). Pseudobulbs ovoid, 1½–2 in. long, 2-lvd.: lvs. 4–5 in. long: racemes exceeding the lvs.; fls. fragrant, light greenish yellow; sepals and petals oblong, acute, the lateral sepals united nearly to the apex; lip shorter than petals, broadly oblong, acute, reflexed. B.M. 3504 (as Rodriguezia). G.W. 14, p. 517.

G. Binòtii, Hort. Racemes 15–30-fld.; fls. small, orange, with a white column. Brazil.—*G. Glaziòvii*, Cogn. Climbing: st. elongated: pseudobulbs 2–4 in. apart: fls. light green. Brazil.

George V. Nash.

GÓMPHIA: *Ouratea.*

GOMPHOCÁRPUS (*club-fruit*). *Asclepiadàceæ.* Perennial herbs, or subshrubs, of more than 100 species, mostly of the Old World, of which one has been mentioned recently in horticultural literature abroad; very closely allied to Asclepias, being distinguished mostly by the absence of crests or appendages on the hoods. *G. téxtilis*, Naudin, a warm-country species but nativity unknown, is a semi-woody plant 3 ft. high with slender branches: lvs. opposite, linear-lanceolate: fls. white, in terminal clusters, the lobes of the crown violet: fr. large, obliquely oval in outline, bladdery, pale green, long-hairy, to 4 in. long. R.H. 1902, p. 35. —Described as a showy and worthy plant for the border.

L. H. B.

GOMPHOLÒBIUM (name refers to club-shaped pod). *Leguminòsæ.* Two dozen Australian yellow- or red-fld. shrubs, rarely cult. Lvs. simple or compound, the lfts. mostly narrow: fls. papilionaceous, solitary, few or in short racemes; standard orbicular or reniform, exceeding the other petals; wings falcate-oblong; keel mostly broader than the wings, obtuse; stamens free: pod very wide or nearly globular, inflated, bearing small seeds. They are said to be excellent greenhouse shrubs; prop. by cuttings of young shoots. *G. polymórphum*, R. Br. Glabrous shrub or undershrub, variable in foliage and habit: lfts. 3, but sometimes 5 or 7 or 9, digitate, mostly linear, to 1 in. long: fls. orange-yellow to bright crimson: pod much inflated, ovoid-globular. B.M. 1533, 4179. H.U. 1, p. 166. B.R. 1574 (as *G. venulosum*, Lindl.). B.R. 1615 (as *G. tenue*, Lindl.). B.R. 25:43 (as *G. versicolor*, Lindl.).

L. H. B.

GOMPHRÈNA (name suggested by *Gromphræna*, Pliny's name for some amaranth, supposed to be derived from *grapho*, to write or paint; alluding to the highly colored or "painted" foliage). *Amarantàceæ.* Herbaceous plants grown as "everlastings."

Herbs erect or prostrate, pubescent to villous, with or without a leafy involucre: fls. short or long, white or colored: bracts short or long, concave, and keeled, winged or crested on the back.—About 70 species, mostly in the warmer parts of Amer. and Austral., but the globe amaranth is widely dispersed throughout the tropics. For cult., see *Annuals* and *Everlastings.*

This genus includes the globe amaranth, a common everlasting flower of easy culture. It is also known as bachelor's button, though two other utterly distinct plants (*Centaurea Cyanus* and *Ranunculus acris*) have the same popular name. The flower-heads are an inch or less in diameter, globose, of many colors, and chiefly remarkable for the showy bracts, which hide the true flowers. In a family remarkable for brilliant foliage this genus seems to be the only one valued for everlastings. Nearly all the other everlasting flowers of importance belong to the Compositæ.

globòsa, Linn. GLOBE AMARANTH. BACHELOR'S BUTTON. Height 18 in. or less: lvs. elliptic to obovate, the largest 4 in. long, 1½ in. wide, tapering to a petiole. July. B.M. 2815. R.H. 1890, p. 522. F.R. 1:333. The following names of horticultural varieties indicate the range of color: vars. **álba, aùrea, cárnea, nàna compácta** (=*alba*) **purpùrea, striàta, violàcea.** Dwarf and compact forms are likely to be associated with any color. There is a narrow-lvd. form of this species which Voss calls **G. Haageàna,** Klotzsch (*G. aurantìaca*, Hort. *G coccínea*, Decne.), which has lanceolate lvs., often 6 times as long as broad. The lvs. are rarely ½ in. wide. R.H. 1854:161. All are easily grown annuals.

G. gnaphalioìdes, Vahl=Pfaffia.

WILHELM MILLER.

GONGÒRA (after Don Antonio Caballero y Gongora, Bishop of Cordova). Includes *Acropèra. Orchidàceæ*, tribe *Vándeæ*, subtribe *Cyrtopòdieæ*. A small group of plants with curious spotted flowers, not common in cultivation, and of little value except for collections.

Distinguished from the other members of the subtribe by being epiphytic, having the dorsal sepal adnate to the column, and by its many-fld. raceme: dorsal sepal erect, spreading, thus appearing to spring from the base of the column; lateral sepals spreading or reflexed from the base of the column, wider; petals small, adnate to the base of the column; labellum continuous with the column, narrow and fleshy, with 2 thick lateral horned or aristulate lobes, and a central one which is saccate or even folded, forming a vertical plate; column erect or ascending, not winged: pseudobulbs sulcate, sheathed, bearing 1 or 2 large, plicate lvs.: fls. borne in a long, loose, pendent raceme arising from the base of the pseudobulbs.—Over 20 species from Brazil to Mex.

Gongoras are extremely free-flowering, and grow easily in a mixture of sphagnum and peat, with a little charcoal added for drainage. During the growing season they require plenty of water, and brisk heat. In the winter they require little water, but should be kept in a moist atmosphere in a cool, shaded house. They grow well with cattleyas, or in a temperature of 60° in winter and 80° in summer. Some growers prefer to use fine fern root packed tightly and for a top finish a little fine moss found in damp meadows, instead of sphagnum, which in this climate is quick to decay. (Wm. Mathews.)

A. *Lateral sepals ovate or oblong, truncate.*

truncàta, Lindl. Pseudobulbs deeply furcate: lateral sepals rotund, oblong, truncate, the upper one ovate, keeled; petals minute, ovate; sepals and petals pale straw-color, spotted with purple; base of labellum compressed in the middle, 2-horned; apex ovate, canaliculate. B.R. 31:56.

AA. *Lateral sepals broad, ovate, pointed.*

B. *Fls. light sepia-brown; ovary much incurved.*

galeàta, Reichb. f. (*Maxillària galeàta*, Lindl. *Acropèra Lóddigesii*, Lindl.). Fig. 1660. Pseudobulbs ovate-conical, clothed with membranous scales: lvs. broadly lanceolate, 6 in. long: racemes drooping, 6–8 in. long, with 6–12 pale sepia-brown fls.; dorsal sepal galeate; petals small, oblong-truncate; labellum 3-lobed; lateral lobes inflexed, middle one saccate. The plants bear several short, rather large-fld. racemes. Aug. Mex. B.M. 3563. L.B.C. 17:1645.

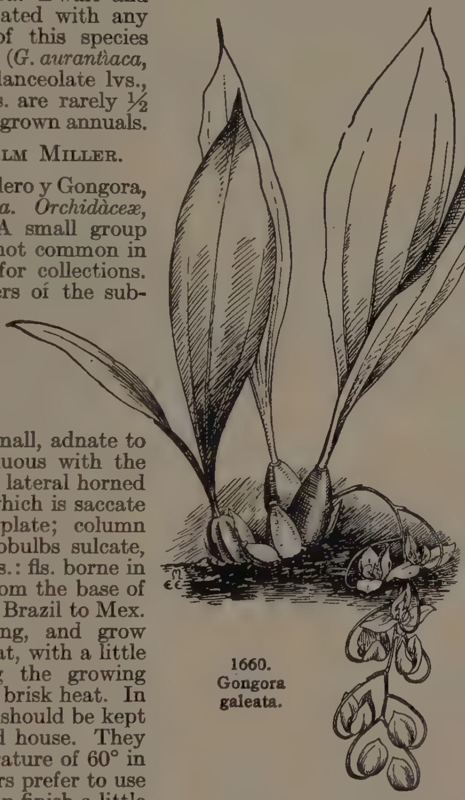
BB. *Fls. yellow; ovary somewhat incurved.*

armenìaca, Reichb. f. (*Acropèra armenìaca*, Lindl.). Pseudobulbs ovate, sulcate, 2-lvd.: raceme loose, bearing many yellow fls.; sepals ovate, rounded, apiculate, the lateral ones oblique; petals one-half as long as the column; labellum fleshy; apex ovate, plane, acuminate, base tuberculate, crested. B.M. 5501.

AAA. *Lateral sepals lanceolate to ovate-lanceolate.*

B. *Fls. chocolate-brown, spotted.*

atropurpùrea, Hook. Pseudobulbs oblong-cylindrical, deeply sulcate, 2-lvd.: lvs. about 1 ft. long, lanceolate, subplicate: racemes numerous, 2 ft. long, bearing many chocolate-colored, spotted fls. about 2 in. diam.; margins of the sepals revolute; petals small, twisted at the apex; labellum 4-horned at the base; apex folded so as to form a vertical triangular plate. Trinidad. B.M. 3220.—This species is the most common in cult. It is nearly always in flower during the summer.



1660. Gongora galeata.

BB. *Fls. yellow, spotted.*

quinquenérvis, Ruiz & Pav. (*G. maculàta*, Lindl.). Pseudobulbs ovate-oblong, deeply furrowed, 2-lvd.: lvs. broadly lanceolate, 5-plaited: racemes many, 2 ft. long, with numerous yellow fls. spotted with dark red; lateral sepals reflexed, meeting in the back; petals small, linear-oblong, from the middle of the column; lip 4-horned at base; apex folded, tapering to a setaceous point. May–Aug. B.M. 3687. B.R. 1616.—A curious plant, much resembling *G. atropurpurea* except in color and form of fls.

BBB. *Fls. dull red-purple spotted, with a yellow labellum.*

trícolor, Reichb. f. (*G. maculàta* var. *trícolor*, Lindl.). Pseudobulbs ovoid, 2½ in. long, deeply furrowed: lvs. ovate-oblong, acuminate, about 5-ribbed, 6 in. long: raceme slender, pendulous, lax-fld., 6–10 in. long; pedicels with ovary 1½–2 in. long, speckled like the rachis; fls. about 2 in. long; dorsal sepals lanceolate, with revolute margins, tip recurved, lateral sepals ovate-lanceolate, with revolute margins, dull red-purple, with a pale, stout midrib; free portion of the petal spreading, upcurved, lanceolate, speckled; labellum golden yellow, base cuneiform saccate, truncate in front, with an awn on each side, apical part broadly funnel-shaped, with a spurlike, slender, speckled tip, gibbous behind; column slender, speckled. B.M. 7530. B.R. 33:69.

G. Beyrodtiàna, Schlecht. Allied to G. truncata. Infl. pendulous, about 16 in. long; fls. pale yellow, spotted with purple. Colombia.—*G. bufònia*, Lindl. Resembles G. atropurpurea in habit, lvs. and pseudobulbs: fls. yellowish white, thickly spotted with dull purple. Brazil. B.R. 27:2. G.W. 13, p. 110.—*G. fuscàta*, Hort. (Acropera fuscata and luteola, Hort.), has been cult. for many years, but no description is available.—*G. Tracyàna*, Rolfe. Sepals and petals greenish yellow, marked with brown; lip ivory-white. Peru.

H. Hasselbring.

GONIÒMA (Greek, *gonia*, angle, corner; the corona cornered near the top). *Apocynàceæ.* Shrub, introduced for the warmer parts of the country.

A monotypic genus containing a S. African glabrous plant with coriaceous lvs. and terminal corymbose fls.: calyx small, with 5 more or less herbaceous sepals; corolla with 5 lobes, overlapping to the left; stamens inserted at the middle of the corolla-tube. Gonioma differs from Tabernæmontana in having the ovules arranged in 2 series instead of an indefinite number of series.

Kamássi, Mey. (*Tabernæmontàna Camássi*, Regel). Height 16–20 ft.: lvs. opposite or the upper ones in 3's, oblong-lanceolate, entire, leathery, 4–6 lines wide: corymbs small, terminal, 8–10-fld.; fls. salver-shaped, yellowish, 3 lines long; tube a little wider at the middle and angled, constricted at top, pilose within from the middle to the top; lobes a third as long as the tube, ovate, cordate, twisted to the right in the bud; style 2-cut: fr. 1–2½ lines long.—Yields the hard yellow Kamassi wood of S. Afr.

N. Taylor.†

GONIOPHLÈBIUM. A subgenus of Polypodium, (or perhaps a distinct genus), with a special type of anastomosing veins. For *G. subauriculatum* and *G. vacciniæfolium*, see *Polypodium.*

GONIÓPTERIS (Greek, *angled fern*). *Polypodiàceæ.* A generic name for a group of tropical ferns belonging with Dryopteris, with naked rounded sori and the lower veinlets of contiguous segments or lobes united. Has been placed under Polypodium. For *G. crenata*, see *Dryopteris crenata.*

GONIOSCỲPHA (name refers to the *angled perianth*). *Liliàceæ.* One species, *G. eucomoìdes*, Baker, an odd nearly stemless plant from the E. Himalayas, producing 1 thick dense short-peduncled spike 3–5 in. long, of small lurid green fls.: lvs. few in a rosette, 10–15 in. long, 5–6 in. broad, elliptic or elliptic-oblong, several-nerved; petiole 3–4 in. long, broad: perianth open, somewhat fleshy; anthers 6, sessile; stigma somewhat 3-lobed: fr. a 1-seeded globose-ellipsoid dark brown berry, becoming dry. B.M. 8078. G.C. III. 20:748. G.W. 12:750.—Blooms in late autumn; produces a short fleshy rootstock.

L. H. B.

GONÓLOBUS (name refers to the *angled pod* of one of the original species). *Asclepiadàceæ.* Mostly trailing or climbing plants, herbaceous or woody, of Amer., chiefly tropical: lvs. opposite and mostly cordate: fls. dull or dark-colored, of medium or large size, in fascicles or umbel-like cymes; corolla rotate to campanulate, 5-lobed; crown ring-like or cup-like, entire, lobed or divided; anthers short and borne under the disk of the stigma or on the margin of it; pollinia nearly or quite horizontal; stigma flat-topped.—Seventy-five or more species, only one of which seems to be in horticultural lists. **G. edùlis,** Hemsl., of Guatemala and Costa Rica, is a more or less rusty-hairy twining shrub, with ovate-oblong deeply cordate lvs., and 3–5-fld. short peduncles: corolla of medium size, white, densely bearded inside; crown short, with 5 interior longitudinal lamellæ: follicles the size of a swan's egg, edible.—It is said to be hardy at Santa Barbara and to bloom profusely but to set no fr. It is the guayote of the natives of Costa Rica.

G. Cundurángo, Triana=Marsdenia.—*G. Martiànus*, Hook., is properly Fischeria Martiana, Dcne. A handsome stove twiner with pretty fls. in early summer: lvs. oblong-ovate, hairy, acuminate: fls. white with a green ring at base and a red hairy calyx Brazil. B.M. 4472. J.F. 1:33.

L. H. B.

GOOBER is a commoner name in the South than "peanut," which is the universal name in the North. For culture, see *Peanut;* for botany, see *Arachis.*

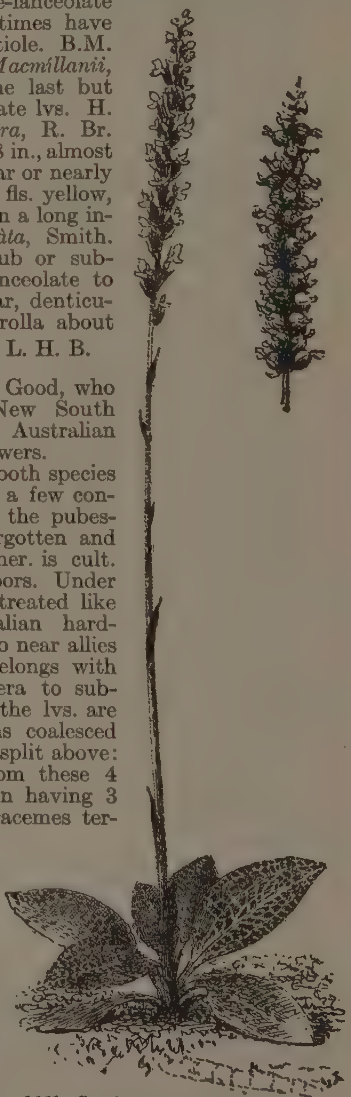
GOODÈNIA (Bishop Samuel Goodenough, England, 1743–1827, who wrote on Carex). *Goodeniàceæ* (sometimes written *Goodenovieæ*). The family Goodeniaceæ is allied to the Campanulaceæ, differing in never having milky juice, the style surrounded by an indusium or cup-shaped or two-lipped expansion, the cells of the ovary mostly more in number, and other technical characters. There are a dozen genera of herbs and shrubs and probably 300 species, mostly Australian. Probably none of them is in regular cultivation, although Goodenia and Scævola are sometimes mentioned in horticultural literature.

About 100 species of Goodenia occur in Australia: calyx-tube adnate to the ovary, the lobes free or adnate at the base; style undivided: caps. with 2 or rarely 4 valves: herbs, subshrubs, or shrubs, with yellow, purplish or blue fls. The species most likely to be met with in horticultural literature are: *G. grandiflòra*, Sims. Erect herb, with large yellow fls. more or less streaked purple, linear calyx-lobes, and broadly ovate or ovate-lanceolate toothed lvs. that sometimes have small lobes along the petiole. B.M. 890. B.R. 31:29. *G. Macmíllanii*, F. Muell., very like the last but with purple fls. and lyrate lvs. H. F.II. 4:240. *G. stelligera*, R. Br. Perennial herb: st. 12–18 in., almost leafless: radical lvs. linear or nearly so, entire, 3–6 in. long: fls. yellow, nearly or quite sessile, in a long interrupted spike. *G. ovàta*, Smith. Glabrous or viscid shrub or subshrub, to 4 ft.: lvs. lanceolate to ovate or nearly orbicular, denticulate: fls. yellow, the corolla about ½in. long.

L. H. B.

GOÒDIA (after Peter Good, who found the plant in New South Wales). *Leguminòsæ.* Australian shrubs, with pea-like flowers.

There are 2 goodias; both species have long been cult. in a few conservatories abroad, but the pubescent species is now forgotten and the glabrous one, in Amer. is cult. chiefly in S. Calif. outdoors. Under glass these shrubs are treated like Cape heaths or Australian hard-wooded plants. It has no near allies of garden value. It belongs with 4 other Australian genera to subtribe Bossiæa, in which the lvs. are mostly simple: stamens coalesced into a sheath, which is split above: seeds strophiolate. From these 4 genera Goodia differs in having 3 pinnate lfts. and its racemes terminal or opposite the lvs. instead of axillary. A. Schultheis writes that goodias are occasionally seen in florists' windows in America. Wm. Watson, of Kew, says the flowers are very fragrant, and remain on the plant a long time. He adds (G.F. 2:244): "Probably this plant, if taken



1661. Goodyera pubescens. (×½)

in hand by the florists, would prove quite as useful for spring flowering as the popular *Cytisus racemosus*."

lotifòlia, Salisb. Often misspelled "latifolia," but the name means "lotus-leaved." A tall much-branched glabrous shrub: lfts. ovate or obovate, very blunt, about ¾in. long: racemes loose, many-fld.; the fls. yellow with purple markings near the base. B.M. 958. J.H. III. 29:484. H.F. II. 6:358.—Likely to be confused with *Argyrolobium Andrewsianum*, belonging to the Crotalaria subtribe, in which the seeds are not strophiolate. In Argyrolobium the 3 lfts. are digitate and the stipules, bracts and bractlets small but persistent. *A. Andrewsianum* has sparsely silky lvs. In Goodia the stipules, bracts and bractlets are very evanescent.

Wilhelm Miller.
N. Taylor.†

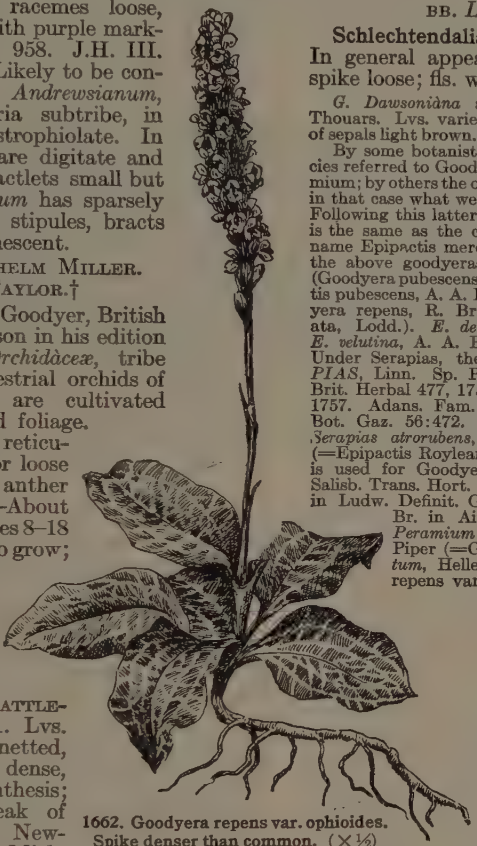
GOODYÈRA (after John Goodyer, British botanist, who helped Johnson in his edition of Gerarde's Herbal). *Orchidàceæ*, tribe *Polychóndreæ*. Dwarf terrestrial orchids of minor importance which are cultivated chiefly for their variegated foliage.

Leaves radical, usually reticulately veined: fls. in dense or loose spikes; labellum saccate; anther on the back of the column.—About 25 species. They have scapes 8–18 in. high at most. Difficult to grow; require shade. Includes the rattlesnake plantain.

A. *Plants hardy natives.*

B. *Labellum strongly inflated, with a short tip.*

pubéscens, R. Br. Rattlesnake Plantain. Fig. 1661. Lvs. ovate, deep green; veins netted, white: scape stout; spike dense, ovate in outline before anthesis; fls. globular, whitish; beak of stigma short, obscure. Aug. Newfoundland to Fla., west to Mich. and Minn. L.B.C. 1:1. B.B. 1:474. Mn. 2:54. F.S. 15:1555. A.G. 12:281; 13:520. C.L.A. 4:108. Gn.M. 4:15.—Should be grown in ordinary loam mixed with pine needles and dry pine twigs. Not well suited for greenhouse cult.


1662. Goodyera repens var. ophioides. Spike denser than common. (×½)

BB. *Labellum saccate, with an elongated tip.*

C. *Beak of the stigma shorter than its body.*

rèpens, R. Br. Lvs. ovate to oblong-lanceolate; veins dark: spike 1-sided; labellum with a recurved tip. L.B.C. 20:1987. Eu. Var. **ophioìdes,** Fern. (Fig. 1662), is the American form of this species, with very broadly marked lvs.

CC. *Beak as long as or longer than the stigma.*

tesselàta, Lodd. (*G. pubéscens* var. *mìnor*). Lvs. broadly ovate to oblong-lanceolate; venation exceedingly variable: scape slender; spike loose; fls. white; labellum less saccate than in *G. repens;* tip straight. N. U. S. and Canada. B.M. 2540. L.B.C. 10:952.—Confused by tradesmen with the next. Should be planted out in a rockery in shade, the roots being firmly placed among dead pine needles and loam.

BBB. *Labellum scarcely saccate, margin involute.*

Ménziesii, Lindl. Plant rather large, the st. sometimes 18 in. high, being taller than *G. tesselata:* lvs. ovate-lanceolate, dark green; veins netted: spike somewhat 1-sided, rather densely fld. W. U. S. to N. New England.—Advertised by Dutch dealers.

AA. *Plants tender exotics, cult. under glass.*

B. *Lvs. with a whitish midvein.*

velùtina, Maxim. Fls. whitish, tinged rose: lvs. ovate, velvety, purplish green, with white rib. Japan. F.S. 17:1779.

BB. *Lvs. with white, netted veins.*

Schlechtendaliàna, Reichb. f. (*G. japónica,* Blume). In general appearance like *G. tesselata.* Lvs. ovate: spike loose; fls. white. Japan.

G. Dawsoniàna and *G. díscolor.* See Hæmaria.—*G. nùda,* Thouars. Lvs. variegated: fls. whitish, with petals and midveins of sepals light brown. Mascarene Isls.—*G. quercícola.* See Physurus.

By some botanists, the name Goodyera is given up. The species referred to Goodyera are then by some authors placed in Peramium; by others the old application of the name Epipactis is used, and in that case what we have been calling Epipactis goes in Serapias. Following this latter disposition, the characterization of Epipactis is the same as the characterization given here for Goodyera, the name Epipactis merely supplanting Goodyera.—Under Epipactis, the above goodyeras take names as follows: *E. Willdenovii,* House (Goodyera pubescens, R. Br., Peramium pubescens, MacM., Epipactis pubescens, A. A. Eaton, not Pursh). *E. repens,* Crantz (Goodyera repens, R. Br.) *E. tesselata,* A. A. Eaton (Goodyera tesselata, Lodd.). *E. decipiens,* Ames (Goodyera Menziesii, Lindl.). *E. velutina,* A. A. Eaton. *E. Schlechtendaliana,* A. A. Eaton.—Under Serapias, the following synonyny would occur: *SERAPIAS,* Linn. Sp. Pl. 949, 1753. *Helleborine,* (Tourn.) J. Hill., Brit. Herbal 477, 1756. *Epipactis,* Zinn, Cat. Pl. Hort. Goett. 85, 1757. Adans. Fam. 2:70. 1763. *Amesia,* Nelson & MacBride. Bot. Gaz. 56:472. 1913. Species: *Serapias Helleborine,* Linn.; *Serapias atrorubens,* Hoffm. *Serapias gigantea,* A. A. Eaton (=Epipactis Royleana, Lindl.), and several others.—If Peramium is used for Goodyera, the synonymy becomes: *PERAMIUM,* Salisb. Trans. Hort. Soc. 1:301. 1812. *Epipactis,* (Haller) Boehm. in Ludw. Definit. Gen. Pl. 1760. Not Zinn 1757. *Goodyera,* R. Br. in Ait. Hort. Kew, ed. 2, 5:197, 1813. Species: *Peramium pubescens,* MacM.; *Peramium decipiens,* Piper (=Goodyera Menziesii, Lindl.); *Peramium tesselatum,* Heller; *Peramium ophioides,* Rydberg (=Goodyera repens var. ophioides Fernald).

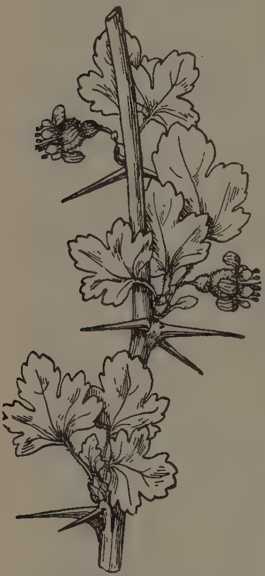
Oakes Ames.
L. H. B.†

GOOSEBERRY. A bush-fruit, grown for its large berries, which are mostly consumed green in cookery.

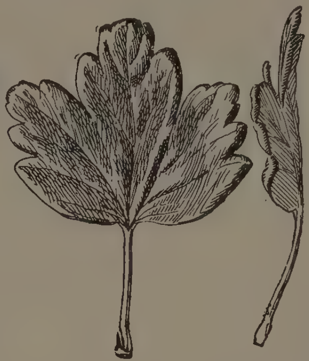
The gooseberry has received comparatively little attention in America, although in northern Europe, and especially in the British Isles, it has long been a prime favorite, and a great improvement has taken place in its size there during the last 200 or 300 years. When it was first cultivated in Europe—probably in the sixteenth century—the wild fruit, if it was like what it is now, would be only about ½ inch in diameter and less than one quarter of an ounce each in weight. The largest gooseberries which have been produced in recent years average several times this size, the largest one of which there is a record weighing two ounces, although there are doubtless larger specimens produced. The English and European gooseberries are derived from a species native of northern Europe, *Ribes Grossularia* (Figs. 1663, 1664). The varieties of *Ribes Grossularia* do not succeed well in America as a general rule, although in some places they do well. The chief obstacle to their successful culture is the gooseberry mildew, which it has been found very difficult to control.

As late as 1846 no cultivated varieties of American species of gooseberries were mentioned by writers, an early reference, according to Bailey, being in 1849 in the "Northern Fruit Culturist," by Goodrich, where the author writes: "We have it from good authority that native sorts have been discovered both in New Hampshire and Vermont well adapted to garden culture." In 1847 the Houghton's Seedling was exhibited at a meeting of the Massachusetts Horticultural Society, this being the first improved form of the native gooseberry of which there is a record. This variety was originated or found by Abel Houghton, Jr., Lynn, Massachusetts. It is probably a seedling of the native species, *Ribes hirtellum* (Figs. 1665, 1666, 1667). The first improvement on the Houghton was the Downing (Fig.

1668), a seedling of the Houghton, which was originated by Charles Downing, Newburgh, New York, and first brought into notice in 1853. It is thought by some authorities to have been a hybrid between Houghton and *Ribes Grossularia,* the European species. The Downing is still more largely planted in America than any other variety of gooseberry. This is doubtless largely due to the fact that comparatively little has been done toward improving the gooseberry in America during the past fifty years. The most work seems to have been done by William Saunders, late Director of the Dominion Experimental Farms, the originator of the Pearl, Josselyn (Red Jacket), and many other seedlings and crosses not yet on the market. There is a good field for work in improving the native gooseberries, as there is no apparent reason why the size should not be equal to the best English varieties. The quality of the American varieties is considered by some to be better than the average English gooseberry, but the flavor is not nearly so good as the best of the English sorts.



1663. Ribes Grossularia in bloom. (Natural size)



1664. Leaves of Ribes Grossularia. (Natural size)

As the gooseberry is found growing wild almost or quite to the Arctic circle, its culture will no doubt be extended very far north. The most useful native species is the smooth gooseberry, *Ribes hirtellum,* which is found wild from the Atlantic to the Pacific. Next in importance is the prickly gooseberry, *Ribes Cynosbati,* which has not so wide a range. Both of these gooseberries are of good quality. An interesting hybrid gooseberry was originated by Saunders by crossing *Ribes Cynosbati,* with Warrington, a cultivated English variety. The size of the fruit was increased very much, but the gooseberry although good in quality remained prickly. If greater hardiness is desired it may be got in *Ribes lacustre,* which grows almost or quite to the Arctic circle. In its present state it is not nearly so useful as the other two species, the fruit being smaller and inferior in quality. There are other native species, such as *Ribes Lobbii, R. divaricatum,* and *R. rotundifolium,* which may also play their part in the future improvement of the native gooseberry.

There is a steady though limited demand for gooseberries in America, but the gooseberry has never been generally popular on this continent. In England, gooseberries are used in great quantities for eating out of hand and for jam; in America few are used raw, most of the fruit being picked green and put into pies, or used as jam or canned. Those who are successful in growing the English varieties in America are usually enthusiastic in their praise as a fruit for eating raw.

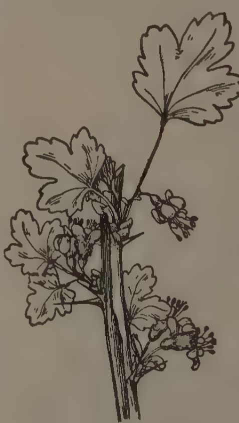
Propagation.

Gooseberries may be propagated either from cuttings or by layering. The average person will usually get the best results from layering, as cuttings are often very unsatisfactory. To propagate by layering, the bushes should be pruned severely in the autumn. This will induce a strong growth of young wood the next season. When these have made most of their growth, which will be early in July, the earth is heaped up around and through the bush until only the tips of the young shoots are left uncovered. The soil is packed down and then a covering of loose earth thrown over to retain moisture better. Most of the American varieties will have rooted well by autumn, and the young plants may be detached and planted in nursery rows either the same fall or the following spring, to be grown there for one season. English varieties usually take two years to root, and the soil must be left about the bushes for that time. Cuttings of American varieties will sometimes give fairly satisfactory results if made from well-ripened wood and treated as currant cuttings. The cuttings are made 6 to 8 inches or less in length, and buried in soil over winter. In spring they are set out in nursery rows, planting deep enough so that only one or two buds are above ground. Both American and English varieties may be propagated from greenwood cuttings in a greenhouse, or hotbed with bottom heat.

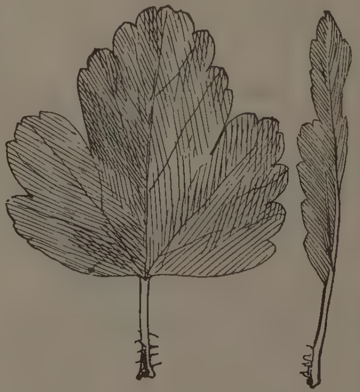
Soil, planting and culture.

The gooseberry is a moisture-loving plant, hence a soil should be chosen in which there will be a constant supply of water during the growing season. In dry soils gooseberries suffer very much in a dry time, the foliage often falling prematurely and the fruit being scalded by the sun. The soil should be a cool one. Moist soils are usually cool, but the surface of a sandy loam soil gets very hot in the summer, hence is not the best for this fruit. Well-drained, heavy clay loams are the most suitable for gooseberries as these usually are both cool and moist. The soil should have abundant plant-food easily made available. A good application of well-rotted manure thoroughly worked into the soil will do much to bring about these favorable conditions. The soil should be well prepared and made mellow as for a crop of roots. As gooseberries start to grow early in the spring it is usually preferable to plant in the autumn, and as the leaves drop early they may be planted in September and will be in good condition when winter comes. Well-rooted cuttings or layers may be used as plants. They should be set in rows about 6 feet apart and 4 feet apart in the rows.

Cultivation should be thorough to retain moisture and keep the soil cool, and as gooseberry roots near



1665. Ribes hirtellum in bloom. (×⅔)



1666. Leaves of Ribes hirtellum (Natural size) the surface, tillage should be shallow. Mulching with straw is sometimes advisable to keep the soil cool.

As the gooseberry makes much more wood than it is desirable to leave, severe pruning is necessary. English varieties are usually trained to a single stem, but this is not necessary, although the freer circulation of air when trained in this way may help to prevent the spread of mildew. The usual custom in America is to grow the gooseberry in bush form. The bush should at first be brought into a good shape by leaving a few of the strongest shoots regularly distributed to make an open head. Five or six of these shoots are quite sufficient to leave at first. As the bush gets older, new shoots are allowed to grow to take the place of the older ones, as the pruning should be done with a view to having only vigorous bearing wood. Fruit is borne on year-old wood and from spurs on older wood. It usually is not desirable to have any wood more than three years old. The best time to prune is in the autumn or winter. The weakest young shoots should be cut off at the ground, also all the stronger young shoots not required for fruiting or to take the place of the older branches to be cut away. The side shoots from the older branches should be headed back or cut out altogether so as to maintain a fairly open head, making it as easy as possible to pick the fruit and yet leaving sufficient wood to produce a good crop and shade the fruit from the sun, as in a hot dry time gooseberries are liable to be injured by scalding. When branches are more than three years of age they should be removed to make way for younger wood. It is advisable to cut out all branches which touch the ground as there will then be a better circulation of air, and the fruit will be kept off the ground. Gooseberries will often begin to bear the second year after planting, but there will not be a full crop until the fourth season. If the soil is kept in good condition by an annual application of well-rotted barnyard manure in the autumn, harrowed in the following spring, and if the bushes are kept sprayed and well pruned, the plantation will not need to be renewed for many years. Sometimes a plant is trained to a single stem (Fig. 1669), to secure extra fine fruit, but it is only a home-garden practice and scarcely to be recommended.

1667. An American gooseberry, Ribes hirtellum. (×½)

Yield of gooseberries.

The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of the Pearl have averaged at the Central Experimental Farm, Ottawa, Canada, in five years at the rate of 12,402 pounds an acre each year, or, at forty pounds to the bushel, over 310 bushels an acre. The highest yield was in 1905, when five bushes of Pearl 6 x 4 feet apart yielded seventy-five pounds, or at the rate of 27,225 pounds an acre, equal to over 680 bushels.

The highest yield mentioned by Card in his work on "Bush Fruits," is at the rate of 450 bushels an acre, obtained at the Geneva Experiment Station, New York. He gives the probable range from 300 to 500 bushels an acre. Bailey gives the average as 100 bushels an acre.

European gooseberries.

In Great Britain the gooseberry is one of the most popular fruits, and great quantities of the product are grown there every year. They are used to a large extent for eating out of hand when ripe, but are much in demand for making jam. Owing to their large size and good flavor, and their popularity in Great Britain, they were early imported into America, but it was soon found that owing to the gooseberry mildew the European varieties could not be successfully cultivated in most places in which the gooseberry grows. Where the climate approaches nearest to that of Great Britain, and the northern and moister parts of Europe, and there is considerable moisture in the air, not very high summer temperatures, and considerable cloudy weather, the European gooseberry succeeds best. Even in gardens in which there is a great deal of vegetation giving off much moisture, and in which the soil is shaded and cool, good success is often obtained and almost or quite as fine gooseberries produced as in England, but such instances are the exception.

Heavy clay soils are most suited to the gooseberry and there is little use trying to grow the European varieties in light soils. Clay soils are cool, and with them it is easier to secure the conditions necessary to success. Various methods are recommended for growing European gooseberries free from mildew. Mulching the soil heavily with straw is one. Mulching the soil with coal-ashes is another. Shading the soil with laths set on a frame 8 to 10 feet high is another. All these methods are useful, but unless the air is moist above as it is cool and moist below, the conditions will be still more or less favorable for the development of the disease. The conditions of a thickly planted garden, where there is partial shade, seem the most favorable.

1668. Downing gooseberry.

Varieties of gooseberries.

American: Pearl, Downing (Fig. 1668), Josselyn (Red Jacket). Houghton is the hardiest.

European (of most general adaptation): Whitesmith, Industry (Fig. 1671).

European (least affected by mildew at Central Experimental Farm, Ottawa, Canada): Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

European (grown by R. B. Whyte, Ottawa, Canada, under garden conditions): Triumph, Lofty, Green Ocean, Conn, Weatherall, Sportsman.

1669. Gooseberry trained in tree form.

Scalding of the fruit.

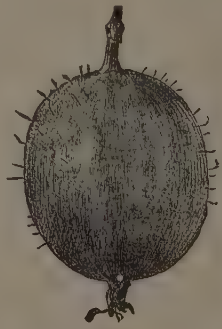
In a very hot dry time, gooseberries are often scalded, become unfit for use and fall to the ground. If the gooseberries are planted in heavy, cool soil and the ground kept well cultivated and the currant-worm prevented from eating the foliage there will be little trouble. Unfortunately, in many plantations the foliage is very scant, either on account of poor cultivation or injury from the currant-worm, and it is under such conditions that the greatest injury occurs.

Insects and diseases affecting the gooseberry.

Currant-worm or imported sawfly (*Pteronus ribesii*, Scop.).—By far the best known of all the insects which injure currants and gooseberries is the currant-worm. The black-spotted dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries, every year in almost all parts of the temperate regions of North America. The white eggs are laid in rows along the ribs of the leaf on the lower side, toward the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent them ripening fruit the first year, and also reducing the quality of the crop of the following season. There are at least two broods in a season. The first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs and of about the same size as a house-fly, but with a more slender body. The female is larger than the male and has the body as well as the legs yellow. *Remedy:* For the first brood a weak mixture of paris green, one ounce to ten gallons of water, may be sprayed over the bushes, or a dry mixture one ounce of paris green to six pounds of flour may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood paris green must not be used, but white hellebore; this is dusted on as a dry powder; or a decoction of this powder, one ounce to two gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, so as to reduce the number of females which would lay eggs for the second brood.

1670. Crown Bob, an Engish gooseberry. (×¾)

Gooseberry fruit-worm (*Zophodia grossulariæ*, Pack.).—Just before gooseberries ripen, clusters of two or three may sometimes be noticed, which are prematurely colored, and which are joined together by the webs spun by the caterpillar of a small moth. These caterpillars are pale greenish white and sometimes have a reddish tinge. They live inside the berries and, when the contents of one berry are consumed, attack another near at hand, joining it to the first by a silken web. When full grown they fall to the ground and spin brown parchment-like cocoons, just beneath the surface of the ground. The moths, which are pale gray, marked with dark streaks and bands, are very rarely observed. They fly early in spring, and there is only one brood in the year. *Remedy*: The best method of controlling this insect, which fortunately is never very abundant, is to pick by hand the clusters of injured berries. It is thought that chickens and other poultry are useful in destroying the larvæ and chrysalids; and it is certain that, while chickens are very small, they are useful in a garden in destroying a great number of injurious insects. The old hen, however, should be kept securely cooped up and not allowed to run at large.



1671. Industry, one of the English gooseberries. (Natural size.)

Gooseberry mildew (*Sphærotheca mors-uvæ*).—The gooseberry mildew has prevented the general culture of the European gooseberry in America. This disease attacks the leaves, twigs and fruit. When the attack is bad it destroys the foliage, covers the fruit and causes most of it to drop. It saps the growing shoots to such an extent that they do not ripen properly, and dry up without setting fruit-buds. It thus practically destroys the crop. The disease is apparent early in the season in the web-like covering which coats the leaves, shoots and fruit. This is the mycelium from which is given off the spores which propagate this disease. It is usually noticed first in the lower and most shaded parts of the bush. When the spores are being given off, the mildew has a powdery appearance. Winter-spores are formed later which germinate in the spring. As the mycelium and spores are both on the surface it might be thought this disease could be easily controlled, but the weather conditions in this country seem so favorable to the development of spores that the gooseberry mildew spreads with great rapidity, and constant and thorough spraying is necessary to prevent it from doing so. American varieties are seldom affected by gooseberry mildew, although occasionally they are slightly attacked. *Remedies:* So far, there has been no good remedy for the gooseberry mildew, but the most promising remedy is the lime-sulfur wash applied first when the buds are breaking and then at intervals during the growing season. So far, the best formulas and the best times to spray have not been accurately worked out. Potassium sulfide in the proportion of one ounce to two gallons of water has controlled the mildew in some cases but to secure satisfactory results the weather must be favorable and the bushes sprayed from four to six times or more. In some cases it has been found that it is not practicable to control the mildew with this spray; furthermore under certain conditions the foliage of some varieties is injured by the spray. Bordeaux mixture when the leaf-buds are breaking and again just before blooming is a partial preventive.

Leaf-spot, rust (*Septoria ribis*).—The disease which causes the spotting of gooseberry leaves and their falling prematurely is the same as that which affects currants, and may be dealt with in the same way.

W. T. Macoun.

GOOSEBERRY, BARBADOES: *Pereskia.*

GOOSEFOOT: *Chenopodium.*

GORDÒNIA (after James Gordon, an English nurseryman; died 1780). *Theàceæ.* Including *Franklínia.* Ornamental woody plants grown for their showy white flowers and handsome foliage.

Evergreen or deciduous trees or shrubs: lvs. alternate, petioled, entire or serrate: fls. solitary, axillary; sepals and petals 5; stamens numerous; ovary superior, 3–6-celled, each cell with 4 or numerous ovules; style slender, with a 3–6-lobed stigma: caps. 3–6-celled, woody, dehiscent, with few or many winged seeds in each cell.—About 15 species in Subtrop. and Trop. Asia and 2 in the S. Atlantic States.

The gordonias have very handsome shining foliage, and produce their large white flowers even on rather small plants. Only *G. alatamaha* is hardy north to Massachusetts, while the others are cultivated only in subtropical regions. They grow best in a somewhat moist, peaty, or sandy soil. Propagated by seeds, layers or cuttings from half-ripened wood under glass.

A. *Foliage deciduous.*

alatamáha, Sarg. (*G. pubéscens,* L'Her. *Franklínia alatamáha.* Marsh.). Shrub or tree, to 30 ft.: lvs. obovate-oblong, narrowed into a short petiole, sparingly serrate, bright green and shining above, pubescent below, turning scarlet in fall, 5–6 in. long: fls. short-pedicelled, pure white, about 3 in. across; petals roundish obovate, with crenulate margin, concave: caps. globular. Sept., Oct. Ga., but not found again since 1790. S.S. 1:22. Mn. 6:201. Gng. 7:167. M.D.G. 1899:25. F.E. 30:863. C.L.A. 2:34.—One of the few trees that flower in autumn. It does well in Mass. in sheltered positions or with slight protection, and blooms freely every year. A large tree in the Bartram garden, near Philadelphia, was long supposed to be the only living specimen of *G. alatamaha.* All other specimens in cult. are believed to have been prop. from the Bartram tree, which has lately died. All efforts since 1790 to rediscover this tree in the S. have failed.

AA. *Foliage evergreen.*

Lasiánthus, Ellis. Loblolly Bay. Tree, to 60 ft., usually shrubby in cult.: lvs. obovate-lanceolate, narrowed into a short petiole, crenately dentate, dark green and shining above, glabrous, 4–6 in. long: fls. long-pedicelled, white, 2–2½ in. across; petals oblong-obovate; stamens short: caps. ovate. July, Aug. Va. to Fla. and Miss. S.S. 1:21. B.M. 668. I.T. 2:41.

axillàris, Szyszylowicz (*G. anómala,* Spreng.). Large shrub: lvs. oblanceolate, narrowed into a very short petiole, entire or serrate, dark green above, 3–6 in. long: fls. almost sessile, creamy white, 2–3 in. across; petals roundish obovate. Nov. S. China. B.M. 2047; 4019 (as *Polyspora axillaris*). L.B.C. 7:675 and B.R. 349 (as *Camellia axillaris*).

G. grándis, André. Corymbs few-fld., terminal; fls. white, large. R.H. 1906:520.—A handsome greenhouse species.—*G. javánica,* Rollison. See Schima Noronhæ.

Alfred Rehder.

GORSE: *Ulex europæus.*

GOSSÝPIUM (ancient name of the cotton plant). *Malvàceæ.* Cotton. Perhaps thirty or more species of herbs and shrubs of warm countries, although more than 100 have been described; some authorities reduce them to about three. They are grown for the fiber that is borne on the seeds. See *Cotton.* They are scarcely horticultural subjects, and therefore are not treated fully in this work.

Gossypiums are tall stout herbs, or tree-form bushes: lvs. large, alternate, petiolate, mostly prominently 3–9-lobed but sometimes entire: fls. white, yellow or purplish, provided with 3–5 large cordate calyx-like bracts; calyx entire or somewhat 5-lobed; stamens united into a column; ovary 3–5-celled, each cell 3–11-ovuled; style 3–5-lobed: fr. a loculicidally dehiscent caps., bearing seeds that are obovate, rounded or slightly angular, sometimes smooth, but usually covered with a short down or fuzz and a longer coat of brown, creamy or white hairs, called the lint.

The cottons of commerce belong, according to Lewton, to about eight distinct botanical types and may be divided into two main groups, the New World and the Old World cottons. The New World group includes American Upland cotton (*G. hirsutum,* Linn.); Sea Island and Egyptian cottons (*G. barbadense,* Linn.); and the tropical tree cottons of South America (*G. brasiliense,* Macf. and *G. peruvianum,* Cav.). The Old World cottons include the Levant cotton (*G. herbaceum,* Linn.), cultivated in southern Europe and western Asia; the oriental tree cotton (*G. arboreum,* Linn.), with yellow or purple-red flowers; the common cotton of India (*G. neglectum,* Todaro); and the Chinese and Japanese cottons (*G. nanking,* Meyen.).

Cotton (probably *G. herbaceum*) was grown in gardens in Delaware and Maryland in colonial times as an ornamental plant.

Two species have been offered as ornamental plants. **G. Dàvidsonii,** Kellogg, from Lower Calif. and Cerros Isls., woody, with handsome yellow fls. purple at the base, 1 in. long, and small cordate mostly entire lvs. **G. Stùrtii,** F. Muell., endemic in interior of Australia; shrub, several feet high, more or less marked with black dots: lvs. broadly ovate, entire, 1–2 in. long, glaucous: fls. large, purple with dark center; bracts to 1 in. long, cordate, entire, many-nerved, black-dotted. The common fiber-cottons are sometimes planted in northern gardens for curiosity, but they seldom make attractive plants where the nights are cool; sometimes they are seen in warm glasshouses, with other economic plants.

L. H. B.

GOUÀNIA (Antoine Gouan, 1733–1821, professor of botany at Montpelier, France). *Rhamnàceæ.* About 40 species of tropical shrubs, sometimes tall climbers, tendril-bearing: branches long and slender: lvs. alternate, petiolate, penninerved, entire or dentate: fls. in clusters, on axillary and terminal, elongated peduncles; disk 5-lobed; style 3-fid: caps. with 3 indehiscent berries.—This genus includes the "chawstick" of Jamaica, a rapid-growing, shrubby vine, with pretty heart-shaped lvs., grown sometimes for ornament in the extreme S. It is suitable for screening unsightly objects. The sts. are chewed in the W. Indies. Tooth brushes are made from the frayed ends and tooth-powder from the pulverized wood.

domingénsis, Linn. Chawstick. Lvs. usually 1½–2 in. long, elliptical, glabrate, with distant serratures; veins tapering toward the margin: fls. very small, in slender interrupted axillary more or less leafy spikes: caps. winged, emarginate. W. Indies.

L. H. B.

GOURD. In England, a generic name for species of Cucurbita (which see). In America the term is used to designate those cucurbitous fruits that are hard-shelled, and are used for ornament or for the making of domestic utensils. The gourd of history is probably Lagenaria. In the northern United States, the small hard-shelled forms of *Cucurbita Pepo* (var. *ovifera*) are commonly understood when the word gourd is used. The gourds in the American trade are referable to their species as follows:

Anaconda, *Lagenaria vulgaris.*
Apple-shaped, *Cucurbita Pepo* var. *ovifera.*
Bicolor, *Cucurbita Pepo* var. *ovifera.*
Bonnet, *Luffa.*
Bottle-shaped, *Lagenaria vulgaris.*
Calabash. *Crescentia Cujete,* yields the true calabash; but the calabash gourd is *Lagenaria vulgaris.*
Coloquinte, *Cucurbita Pepo,* var. *ovifera* (Colocynth is *Citrullus Colocynthis*).
Dipper, *Lagenaria vulgaris.*
Dipsaceous, *Cucumis dipsaceus.*
Dish-cloth, *Luffa.*
Egg, Egg-shape, *Cucurbita Pepo* var. *ovifera.*
Gooseberry, *Cucumis Anguria.*
Hedgehog, *Cucumis dipsaceus.*
Hercules' Club, *Lagenaria vulgaris.*
Maté Gourd, small form of *Lagenaria vulgaris.*
Mock Orange, *Cucurbita Pepo.*
Onion-shaped, *Cucurbita Pepo.*
Orange, *Cucurbita Pepo* var. *ovifera.*
Ostrich Egg, *Cucumis dipsaceus.*
Pear-shaped, *Cucurbita Pepo* var. *ovifera.* (Fig. 1134).
Powder Horn, *Lagenaria vulgaris.*
Rag, *Luffa.*
Serpent or Snake (not Snake cucumber, which is a Cucumis), *Lagenaria vulgaris* and *Trichosanthes.*
Sponge, *Luffa.*
Spoon, *Lagenaria vulgaris.*
Sugar Trough, *Lagenaria vulgaris.*
Tashkent, *Cucurbita Pepo* var. *ovifera.*
Turk's Turban, *Cucurbita Pepo* var. *ovifera.*
Vegetable Sponge, *Luffa.*
Wax Gourd, *Benincasa hispida.*

L. H. B.

GOURLIÈA (Gourlié, a personal name). *Leguminòsæ.* One or two spiny shrubs or small trees of Chile, one of which is listed in S. Calif., somewhat akin to Sophora and Cladrastis: lvs. odd-pinnate, the lfts. small: fls. small, orange-colored, in racemes or fascicles, papilionaceous; standard orbicular, wings obovate and undulate, keel short: pod short, indehiscent. **G. spinòsa,** Skeels (*Lucùma spinòsa,* Molina. *G. chilénsis,* Gay). CHAÑAL. Tree, 12–15 ft., with long thick branches ending in spines: lfts. 3 pairs, ovate: fls. orange-yellow streaked red, in short loose racemes: fr. about 1 in. diam., brownish, the pulp the flavor of jujube: wood yellow and hard, used for cabinet-making. Chile, at elevation of 1,500–5,000 ft. L. H. B.

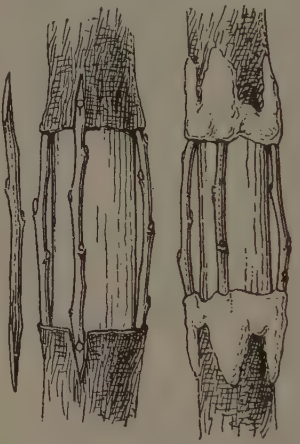
GOVÈNIA (J. R. Gowen, English gardener). *Orchidàceæ.* Terrestrial orchids of Trop. Amer., seldom cult., of perhaps a dozen species: rhizomes thickened into tuber-like enlargements or pseudobulbs, the sts. erect and few-lvd.: lvs. large, narrowed at base: fls. in simple racemes, medium in size, short-pedicelled, mostly white, cream-colored or yellow and more or less red-spotted; sepals and petals of about equal length, the former connivent; lip very short, without spur, jointed to column; pollinia 4, broadly ovate. *G. tingens,* Poepp. & Endl. Height 2–3 ft.: lf.-blade elliptic, about 8 in. long: fls. yellowish, with transverse purple lines, much larger than those of *G. superba;* segms. lanceolate to oblong. Peru. *G. supérba,* Lindl. Two ft.: fls. fragrant, yellow with red markings, sepals and petals acute: spike loose, erect. Mex. L.B.C. 18:1709. *G. sulphùrea,* Reichb. f. An odd species with onion-like pseudobulbs: lf.-blade cuneate-lanceolate and acuminate: fls. rather large; sepals sulfur-yellow; petals white with yellowish margin and purple lines; lip cordate-oblong, white with dark brown at apex.

L. H. B.

GRABÒWSKIA (H. E. Grabowsky, German apothecary and botanical author). *Solanàceæ.* A half-dozen or more spiny shrubs of Trop. and extra-Trop. S. Amer., with small violet or pale blue or whitish fls. borne singly at the nodes and in clusters on the ends of the branches, and oblong or obovate entire sometimes fleshy lvs.: calyx 5-toothed or becoming 10-toothed after flowering; corolla funnelform, with short tube and 5-lobed spreading limb; stamens 5, exserted: fr. drupe-like with 2 pyrenes. **G. boerhaaviæfòlia,** Schlecht. (*G. glaùca,* Hort.), of Peru, is offered in Calif. It is a lycium-like scrambling or wide-spreading bush with small lvs. alternate and tufted, with spines ¼in. long in the axils and the shorter branches often also sharp and spine-like: fls. whitish or pale blue, not conspicuous, in clusters of 3–5 or solitary: berries scarcely ½in. long. B.R. 1985.—In Calif., the plant has a good gray-green foliage and a graceful drooping habit, therefore making it adaptable for planting compositions in landscapes. L. H. B.

GRAFTING, Multiplication by. Grafting is the operation of inserting a part of one plant into another plant or part with the intention that it shall grow and produce its kind.

The practice of grafting, together with all the reasons, consequences and results, constitutes a department of knowledge known as *graftage.* The term *grafting* is ordinarily restricted, in popular speech, to propagation by means of short twigs or cions, and *budding* is used to designate the insertion of single buds that are severed from the branch on which they grew; but these distinctions are not fundamental. *Stock* is the plant or part on which the grafting is done. *Cion* (*scion, sion*) is the part inserted into the stock, although it is usually restricted to cuttings of twigs, and does not include detached buds. In many writings the word is spelled *scion,* but the other is shorter and it was a very early horticultural term, many old horticultural writings using *cion* and *cyon. Scion* is apparently later, and usage is not uniform. The word *graft* is sometimes used in the sense of *cion,* but it would better be used for the completed thing—the new plant or part made by the joining of cion and stock.



1672. Bridge-grafting. At the left, a cion; the cions in place; at the right, the ends waxed.

Grafting is not always employed for purposes of propagation. It may be a reparative process. What is known as bridge-grafting is of this kind. Wounds or girdles may be bridged by cions, as in Fig. 1672 (after Hedrick), for the purpose of supplying new tissue to connect the parts. Here the edges of the girdle are trimmed to the fresh firm tissue, cions whittled wedge-shape at each end are inserted, bandages are drawn around the trunk to hold the free edges of the bark and the ends of the cions, and wax is poured over the work. This operation is performed in spring, with dormant cions. The buds should not be allowed to throw out shoots. If the cions are placed close together, they will soon unite along their sides and make a continuous covering of the wound. Writing of bridge-grafting, Hedrick says (N. Y. Sta. Circ. No. 17): "Its most important use is to preserve trees injured or girdled by rodents or disease. Any ragged or diseased edges should be cleanly cut away, a longitudinal slit should be made in the bark, both above and below the wound, and the edges of the slits loosened slightly. A cion should then be cut 2 or 3 inches longer than the space to be bridged, one side beveled off at both ends (Fig. 1672), and inserted in the slits, its beveled face against the wood of the trunk. In order to guard against any accidental displacement it would be well to drive a small tack or nail through each end of the cion, which, however, must not be split in the operation. Other cions in a like manner may be inserted at intervals of about 2 inches over the entire injured surface. The ends of the cions should be covered with wax but it is not necessary to cover all the bridged portion of the trunk. If the tree operated upon is small and likely to weave in the wind it should be tied firmly to a strong stake as such movements might tear apart the tender uniting surfaces."

Cions are sometimes inserted freely in the stub left by a large broken limb, for the double purpose of providing other shoots to take the place of the branch and of facilitating the healing of the wound. Sometimes cions are inserted in limbs on a one-sided or misshapen tree for the purpose of securing better growth on that side, the variety perhaps being the same as that of the tree itself.

Another reason for grafting is to produce some radical change in the nature of the cion, as rendering it more dwarf, more fruitful, or otherwise changing its habit. Still another office is to adapt plants to adverse soils or climates. An example is the use of the peach root in the southern states upon which to work the plum, as the peach thrives better than the plum in sandy soils. The practice in Russia of working the apple on roots of the Siberian crab is an example of an effort to make a plant better able to withstand a very severe climate.

In general, however, grafting is employed for the purpose of multiplying or perpetuating a given variety, mostly of woody plants. It is used with plants that do not bear seeds, or in which the seeds do not come true or are difficult to germinate, or when the plants do not propagate well by cuttings or layers. It is also employed to increase the ease and speed of multiplying plants.

In common practice, the effect of the stock on the cion is rather more mechanical or physical than physiological or chemical. The influences are very largely those associated with greater or less growth. As a rule, each part of the combined plant—the stock and cion—maintains its individuality. There are certain cases, however, in which the cion seems to partake of the nature of the stock; and others in which the stock partakes of the nature of the cion. There are recorded instances of a distinct change in the flavor of fruit when the cion is put upon stock that bears fruit of very different character. There are some varieties of apples and pears which, when worked on a seedling root, tend to change the habit of growth of that root. Examples are Northern Spy and Whitney apples, which, when grafted on a root of unknown parentage, tend to make that root grow very deep in the soil. All these instances seem to be special cases, or exceptions to the general rule that each part maintains its individuality. Reasons for this change of nature in these cases have not been determined, and in most cases such results are not to be predicted. The most marked effect of stock on the cion is a dwarfing influence. Dwarfing may be expected whenever the stock is of a smaller stature than the cion. The most familiar example is the dwarf pear, made by working the pear on quince stock. Supplying a plant with a slow-growing root is only the beginning of the making of a dwarf. The plant must be kept dwarf by subsequent pruning and other care. There is comparatively little demand for large-growing forms of woody plants, whereas there is much demand for dwarf forms. See *Dwarfing*, page 1082.

The limits within which grafting can succeed are to be determined only by experiment. These limits are often within the species, and usually within the genus, but there are instances in which plants of distinct genera intergraft with success, as in some of the cacti. In general, the closer the affinity of cion and stock, the better the union. When stock of the same species can not be secured, it is allowable to chose another species. Thus it was for a time impossible to secure Japanese plum stocks upon which to grow the varieties of Japanese plums, and peach, Marianna, myrobalan and domestica plum stocks have been used, and are used to this day. In some cases another species grows more readily from seed, is cheaper, is less liable to fungous injury in the nursery, or has some other practical advantage. Thus, most domestica plums (*Prunus domestica*) in the North are worked on the myrobalan (*P. cerasifera*); many sweet and sour cherries (*Prunus Avium* and *P. Cerasus*) are worked on the mahaleb (*P. Mahaleb*); many kinds of roses are worked on manetti and *Rosa multiflora* stocks.

From time to time there arises an agitation against grafting, particularly in the Old World. Cases of poor unions and the difficulties of sprouting from the root or stock are cited as proofs that graftage is injurious and devitalizing. But these are examples of poor results. They show what should not be done. Properly performed, on plants of proper affinity, graftage is not devitalizing. It is essential to modern horticulture.

The ways or fashions of grafting are legion. There are as many ways as there are ways of whittling. The operator may fashion the union of the stock and the cion to suit himself, if only he apply cambium to cambium, make a close joint, and properly protect the work. Thus, Thouin in his "Monographie des Greffes," 1821, describes 119 kinds of grafting. All kinds of grafting may be classified into three groups:

1. Bud-grafting or budding. In the old days called inoculation.
2. Cion-grafting, or what is now thought of as grafting proper.
3. Grafting by approach, sometimes called inarching.

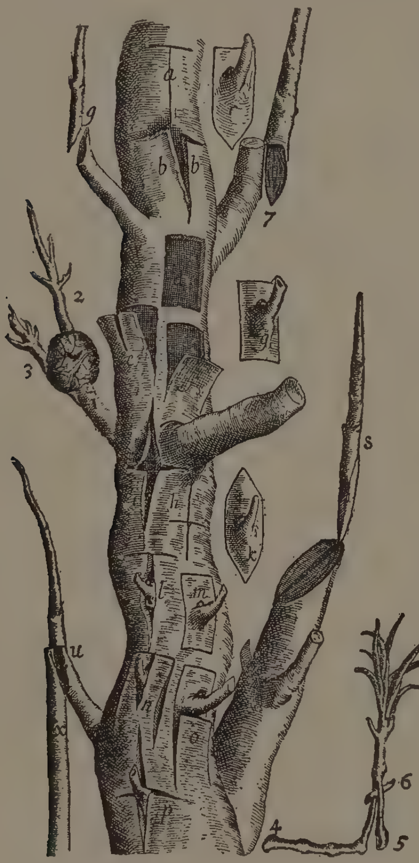
Early practice.

Grafting is one of the oldest of the arts of plant-craft. It is probable that the real art of grafting was held more or less as a professional or class secret in the ancient world, for the writers seem to have only the vaguest notion of its possibilities and limitations. Virgil writes (Preston's translation):

> But thou shalt lend
> Grafts of rude arbute unto the walnut tree,
> Shalt bid the unfruitful plane sound apples bear,
> Chestnuts the beech, the ash blow white with the pear,
> And, under the elm, the sow on acorns fare.

It seems to have been a popular misconception that any kind of plant will grow on any other. Pliny asserts that the art of grafting was taught to man by nature. Birds swallow seeds, and these seeds, falling in "some cleft in the bark of a tree," germinate and make plants. "Hence it is that we see the cherry growing upon the willow, the plane upon the laurel, the laurel upon the cherry, and fruits of various tints and hues all springing from the same tree at once." This, of course, is not grafting at all, but the implanting of seeds in earth-filled chinks and cracks, in which the plants find a congenial foothold and soil. But the ancients have left us abundant testimony that genuine grafting was employed with success. Pliny describes a cleft-graft. He gives several precautions: the stock must be "that of a tree suitable for the purpose," and the graft must be "taken from one that is proper for grafting; the incision or cleft must not be made in a knot; the graft must be from a tree "that is a good bearer, and from a young shoot;" the graft must not be sharpened or pointed "while the wind is blowing;" "a graft should not be used that is too full of sap, no, by Hercules! no more than one that is dry and parched;" "it is a point most religiously observed, to insert the graft during the moon's increase."

Herein are seen the beginnings of the grafting practices of the present day, together with some practices of layering. Sharrock treated the whole subject of grafting under the head of "Insitions," and here he minutely describes the cleft-graft, and speaks of it as "the common way of grafting." The practice which we now know as inarching or grafting by approach, he significantly calls "Ablactation" (that is, *suckling* or *weaning*). Now that so much is said about the proper and careful selection of cions, it is interesting to read Sharrock's advice on this subject: "Good bearing trees are made from Cyons of the like fruitfulness. . . . Cyons are best chosen from the fairest, strongest shuits, not from under shoots or suckers, which will be long ere they bear fruit, which is contrary to the intention of grafting." But we have seen that Pliny gave similar advice before the Christian era,—which is only another illustration of the fact that most of our current notions have their roots deep in the past.



1673. Sharrock's illustration of grafting. 1672.

The accompanying cut (Fig. 1673) reproduced two-thirds size from Robert Sharrock's "History of the Propagation and Improvement of Vegetables," 1672, shows various kinds of grafting in vogue over two centuries ago. Following is the literal explanation of the plate:

a. Denotes the ordinary cutting of the bark for inoculation.
bb. The sides of the bark, lifted up for the putting in of the shield.
c. The shield taken off with the bud, which lies under the stalk of the leaf cut off.
ln. The shield put into the stock to be bound up.
d. The bark cut out in an oblong square, according to another usual way of inoculation.
g. The shield cut out for the fitting the disbarked square.
m. The same shield put into the stock.
f. A variation of the forementioned way, by cutting off the upper part of the oblique square, and binding the lower part down upon the shield.
o. The shield so put in to be bound up.
e. Another variation by slitting the bark, that the bud and leaf may stand forth at *e*, and the bark slit be bound down upon the shield.
h. A cross cut for inoculation.
i. The same cross cut lifted up in this figure, somewhat too big.
k. The shield cut off to be put therein.
p. The shield put in.
g or *q.* The cut of cyon or stock for whip-grafting.
r 7. The cut of cyon and stock for shoulder-grafting.
s. The cut of the cyons, and slit of the stock for grafting in the cleft.
x. The stock set for ablactation or approach.
u. The cyon of the branch for the same operation.
1 2. The branch that is to be taken off by circumposition.
3. The branch that bears up the mould to the disbarked place.
4. The branch of a carnation to be laid.
5. The joynt where the slit begins.
6. The next joynt where the slit is propped open, with a piece of a carnation leaf put in.

Budding.

The operation of budding consists of inserting a single detached bud underneath the bark of the stock. It is employed only in stocks of small diameter, and preferably in those not more than one year old. The operation may be performed whenever the bark will peel and whenever mature buds may be secured. The bark will peel in early spring and again in late summer or early autumn, and the operation of budding in the open ground is therefore performed at those times. In the spring the buds are secured from twigs of the previous season's growth. At the second budding season, in late summer or early autumn, the buds are secured from growing twigs of the season. At that time of the year the buds will be sufficiently developed to be easily recognized and handled.

Budding is much employed in nurseries. Peaches, cherries, plums, and most stone fruits, are habitually budded rather than cion-grafted. In the East, apples and pears are usually budded in the nursery; but in the West apples at least are usually root-grafted. Third-rate stocks are sometimes set in nursery rows and budded the following July.

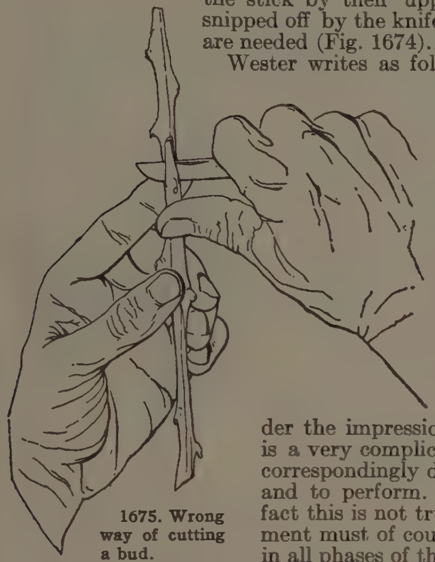
It is practicable to insert buds rather than cions in the tops of young trees, for the purpose of changing the tree into a different variety. Sometimes the buds are inserted in limbs two and three years old; but it is usually preferable, if the tree is of some age, to cut back the tree somewhat heavily the previous season or the previous spring, to get a growth of suckers into which the buds may be set.

The cutting from which the buds are taken is known to budders as *a stick* (Fig. 1674). In early spring-budding, this stick is the last year's growth of the variety which it is desired to propagate. Later in the season, the stick is the twig grown in that season. Not all the buds on the stick are strong enough or good enough for budding. The budder will usually discard the weak ones at the top and at the bottom, unless he is very much pressed for buds, as may be the case with new or rare varieties. If the stick is taken late in the season the leaves will be on; but these are quickly cut off to prevent too much evaporation from the cutting. About ¼ inch of the leaf-stalk is left to serve as a handle to the bud.

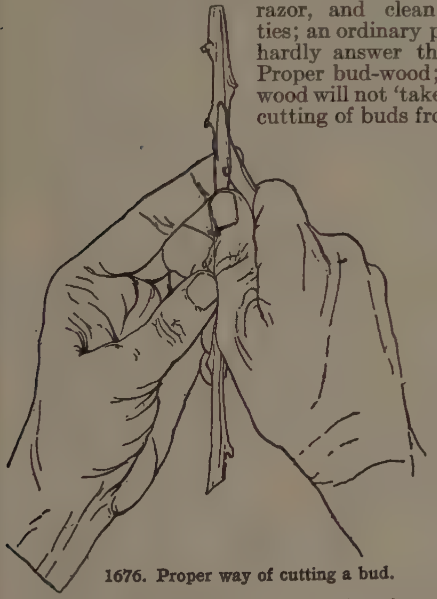
1674. Stick of buds. (×⅓)

Shield-budding.

The ordinary operation of budding is shown in the illustrations. It is known as shield-budding, from the shape of the removed bud. With a thin-bladed, sharp knife, the operator slices off the bud by placing his thumb beneath the bud and making a deft and quick stroke of the blade. Just under the bud he cuts a little into the wood. Some budders afterward remove this bit of wood; but this is not essential. If this wood is somewhat hard and dry, or if it carries some pith, it may then serve to dry out the bud or to prevent intimate contact with the cambium of the stock. In ordinary operations this truncheon of wood is not removed. Most budders cut all the buds on a stick before they insert any of them; but they are allowed to hang to the stick by their upper ends, being snipped off by the knife as fast as they are needed (Fig. 1674).

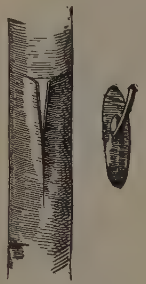

1675. Wrong way of cutting a bud.

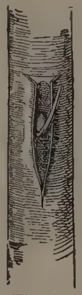
Wester writes as follows on the requirements in budding citrus fruits (Bull. No. 27, Bur. Agric., Philippine Isls.), and the directions will apply to other plants; and he gives pictures (Figs. 1675, 1676) of part of the manual operation: "Many people are under the impression that budding is a very complicated operation, correspondingly difficult to learn and to perform. As a matter of fact this is not true. Some judgment must of course be exercised in all phases of the work, but the art of budding itself is a mere matter of manual skill that anyone should be able to master who is at all deft in the handling of a knife. Necessary essentials for success are: (1) Stock plants in condition for budding; i. e., the flow of sap must be good so that the bark separates readily from the wood. (2) A suitable budding-knife, the edge of which should be sharp and keen as a razor, and clean of all impurities; an ordinary pocket-knife will hardly answer the purpose. (3) Proper bud-wood; immature bud-wood will not 'take' and the proper cutting of buds from old and hard bud-wood is difficult. (4) The bud-wood should never be allowed to dry out by being exposed to the air or sun. (5) The buds should be inserted immediately after being cut, and the bud tied at once. (6) No foreign matter or water should be allowed to enter the bud incision. (7) The bud should be cut so that there is no break or tear in its tissues."

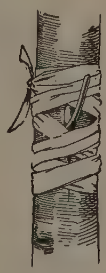

1676. Proper way of cutting a bud.

The stock is first prepared by removing all the leaves and twigs from the area to be budded. In the case of nursery stock, it is customary for a boy to strip the lower leaves of the stock a day or so in advance of the budding. If the stripping is done three or four days or a week before the budding, it will sometimes cause the bark to set and, therefore, interfere with the operation. Nursery trees are usually budded as near the ground as the operator can work—not more than 2 or 3 inches above the surface. In most cases, the budder prefers to set the bud on the north side of the stock, that it may be shaded from the hot sun.

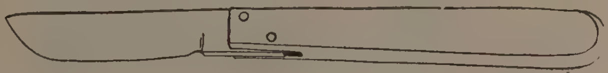
A T-shaped incision, just through the bark, is made on the stock (Fig. 1677). The crosswise incision is usually made first. As the operator takes his knife from the last incision, he gives it a deft turn to right and left and loosens the flaps of the bark, so that the bud is easily inserted. The bud is now taken from the stick and shoved into the matrix underneath the bark until it is entirely within the cleft (Fig. 1678). A boy follows and ties the bud, making four or five deft turns and holding the strand by covering the lower end underneath one of the turns (Fig. 1679). No wax or other mastic is used. Any soft strand may be employed for the tying. It was the old custom to use basswood bark, which was taken in the spring from the inner layers of the bark of the basswood tree. This material was then macerated in water and afterward pounded to make it soft. Yarn is also used. At present, raffia is universally employed. This is the stripping of an oriental palm, and it can be bought in the market and is cheaper than home-made materials; it is also better. It is customary to lay it on the ground or in a damp place over night to soften it and to allow the operator to flatten out the strands. This raffia is cut in the length to suit before the tying is begun, and the bunch of strands is then held underneath the belt or carried in a box. For budding, the operator prefers a small, thin-bladed knife, with a rounded or thumb-shaped cutting surface (Fig. 1680). Budding knives are regularly on the market.


1677. Shield-budding. (×½)


1678. The bud set in the matrix. (×½)

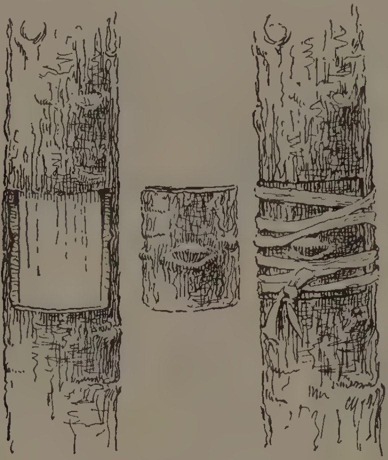

1679. The bud tied.

When budding is performed late in the season, the bud does not throw out a shoot until the following spring. It merely grows fast or "sticks" to the stock. Two or three weeks after the setting of the bud, the bandage is cut so that it will not restrict the swelling of the stock. If the stock grows very rapidly, it may be necessary to cut the bandage before that time. Nothing more is done with the tree until the following spring, at which time the whole tree is cut off about 1 inch above the bud. This one bud now throws out a shoot and makes a very heavy growth, being impelled by the strong root. In this first season of growth, a peach tree will attain the height of 4 to 6 feet, and be ready for market in autumn. If the bud is set early in the spring it will throw out a shoot the same season; but ordinarily it would not make the growth in one season that the bud does in the other case. Spring-budding in the open air is rarely employed in nursery practice. It is sometimes used in the top-budding of established


1680. Budding knife. (×½)

plants. In all budding practices, it is important to keep down the suckers from the stock.

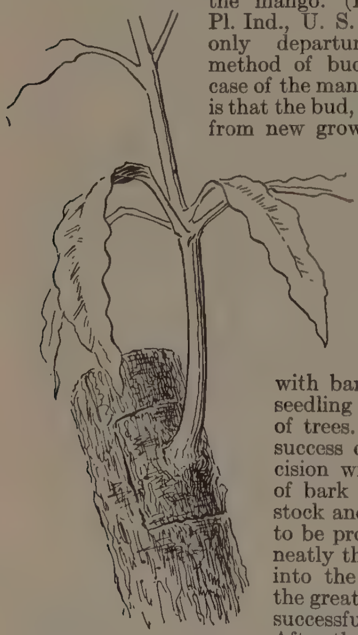
In the South, a peach tree may be large enough in June, if the seeds are planted in February or March, to be budded. The bud will grow the same year, and by autumn will make a salable tree. This operation of budding in early summer on stocks which grow that year is known as June-budding. As a rule, June-budded trees are smaller than fall-budded trees; but they can be secured one year sooner.

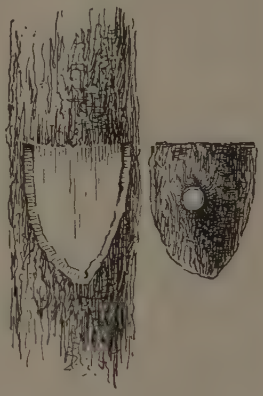

1681. Rectangular patch-budding.

Other forms of budding.

There are many ways of shaping the bud. These modes may have distinct advantage in certain plants, because of the way in which the bark holds its shape, of the relation to the drying out of the parts, and otherwise.

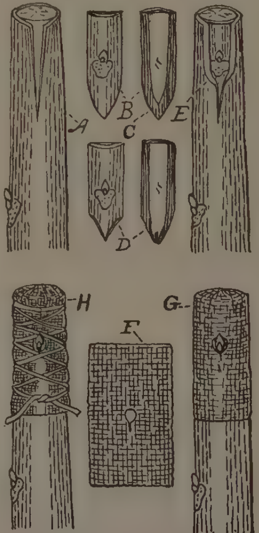
The rectangular-patch method is illustrated by Sharrock (*d*, *g*, *m*, Fig. 1673). It is recently described by Oliver as one of the successful methods of propagating the mango. (Bulletin No. 46, Bur. Pl. Ind., U. S. Dept. Agric.): "The only departure from Sharrock's method of budding as used in the case of the mango at the present time is that the bud, instead of being taken from new growth, must be selected from wood old enough to have lost its foliage. This means that the bud-wood will sometimes be over two years old. The use of bark of this age and even older insures success in budding the mango, as it unites rapidly with bark of a similar age on seedling stocks or on branches of trees. To a certain extent success depends upon the precision with which the section of bark is removed from the stock and also from the variety to be propagated, as the more neatly the bud section is fitted into the space prepared for it the greater the probability of a successful union (Fig. 1681). After the section of bark from the bud-stick is nicely fitted in place, and before tying, a small quantity of grafting-wax should be smeared over the parts where they come together and tied firmly in place with thick strands of raffia. This effectually prevents the admission of air to the spaces which, no matter how carefully the operation be performed, exist between stock and cion; it also serves to prevent moisture from gaining access to the cut surfaces. The cut surfaces and all but the bud should then be covered with strips of cloth dipped in melted paraffin, wrapping being begun at the lower part, so that when finished water will not gain entrance to the wrapped section of bark. If that part of the stock where the bud is tied be exposed to the sun, it is always advisable to furnish shade which is best supplied by strips of paper tied above the bud and extending down over it. Two weeks may be allowed to pass before an examination is made. The cloth wrappings may then be removed and the raffia should be loosened if there is danger of its cutting into the bark. When a sufficient time has elapsed to make certain that a union has taken place, part of the top of the stock should be removed in order to encourage the bud to start. This it will do with very little coaxing. When sufficient growth has been made, all of the stock above the bud may be removed and the cut part coated with liquid grafting-wax or tar to exclude moisture and prevent rotting." Fig. 1682 shows the successful growth of the patch-bud.


1682. The rectangular patch-bud growing.


1683. Spade-budding.

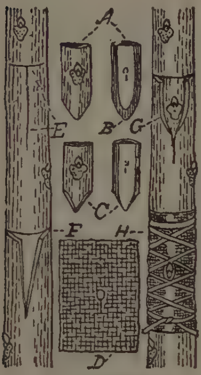
The spade-shaped bud, shown in Fig. 1683, has been employed with the mango and other plants. The pointed end makes it possible, according to Oliver, "to push the bark of the cion down tight against the bark of the stock; the top part is then cut off square with the transverse cut in the bark of the stock, and is pressed firmly into position previous to tying and waxing in the usual way." These two forms of budding are given here only for the purpose of illustrating interesting methods, and not necessarily to advise their use.

Improved methods of budding the pecan have been developed in Texas by Charles L. Edwards. He prefers spring-set buds, as they have the whole growing season before them and make salable trees by autumn. The summer-bud makes only a start before autumn, at best; most of them remain dormant till spring, and not a few dry out and perish. One method is shown in Figs. 1684, 1685. The stocks are cut off bodily, and straight across. A slit is then made in the bark at the top (A), and the bark opened to receive the bud. The buds are cut like shield-buds for peaches and plums (B, front and back views), but in addition, the bark is cut away from the lower end of the bud (C), reducing it to a point so it will slip into place easily (D). By removing the thick rim of bark from the lower end of



1684. Crown-budding the pecan; 1685 (below), the bud wrapped and tied.

the bud, the sap from the stock will enter it easily, and force it into immediate growth, whether put on in early spring or as late as September. At E the bud is shown in place, and the flaps pared. To put on the wrapper, use an oblong little square of waxed cloth with an eyelet in the middle for the bud to emerge from (F). In preparing the cloth for these wrappers, use only beeswax, not grafting-wax for this purpose. Be sure to tie on the wrappers firmly, and see also that they cover the entire top of the stock, leaving no part of the wounds made by the knife uncovered. A modified shield-bud is used by Edwards. In Fig. 1686, the part marked A shows the outside and inside of the bud as commonly made for the pecan; B shows the thick rim of bark at the lower end. The modification consists in trimming away the lower end, as at C; also in paring away part of the flap, as at G. At E is the regular slit; F, the bark opened to receive bud; D, waxed wrapper; H, wrapper tied on. See *Pecan.*



1686. Modified shield-bud.

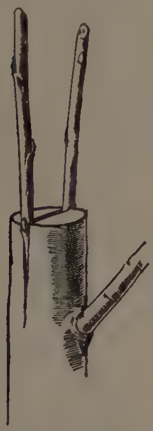
Proper time to bud. (Hedrick.)

Inasmuch as the various kinds of trees used as stocks for budding vary greatly in length of their growing season, it naturally follows that the time during which they may be budded will vary accordingly. In a normal season, the figures for New York are about as follows:

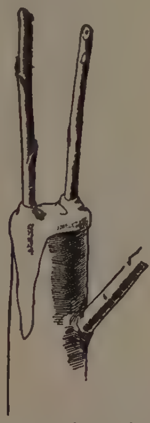
Rose	July 1 to July 10.
Pear	July 10 to July 15.
Apple	July 15 to August 1.
Plum (St. Julien stock)	July 15 to August 1.
Plum (Myrobalan stock)	August 15 to September 1.
Cherry (Mazzard stock)	July 20 to August 1.
Cherry (Mahaleb stock)	August 20 to September 1.
Quince	July 25 to August 15.
Peach	August 20 to September 10.

Grafting.

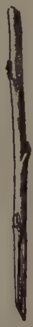
Grafting proper is the operation of inserting a twig or a woody cion into a stock. They may be classified in respect to the place or position of the cion on the stock:



1687. Cleft-grafting.



1688. The cleft-graft waxed.



1689. Cleft-graft cion.

Root-grafting, or the insertion of the cion in the root of the stock;

Crown-grafting, or the insertion of the cion at the crown (surface of the ground);

Stem-grafting, or the insertion of the cion in any part of the main stem or trunk;

Top-grafting, or the insertion of the cion in the top or branches of the plant.

Grafting may again be classified in respect to the maturity of the cion: dormant wood grafting; and soft-wood or herbaceous grafting, in which the cion is taken from green or growing wood.

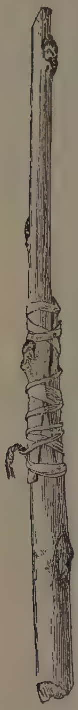
It is customary to classify grafting on the way in which the union is made. There are few general types in common use in this country: as cleft-grafting, whip-grafting, veneer-grafting (side-grafting, bark-grafting).

Cleft-grafting.

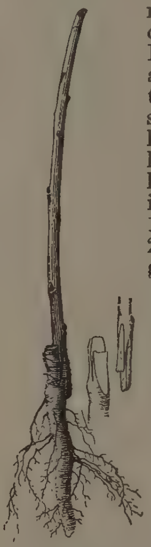
Cleft-grafting consists in splitting the stock and inserting a wedge-shaped cion into the cleft. It is employed only in rather large stocks, preferably in those an inch or more in diameter. The stock is cut off, and it is split with a knife or tool made for the purpose. The cleft is then held open by a wedge and the cions are inserted in the side of the cleft in such position that the cambiums of the stock and cion are in contact (Fig. 1687). The whole surface is then securely waxed, to prevent evaporation and to protect the wounds from the sun (Fig. 1688). Cleft-grafting is performed in early spring. The cions are taken some time previously from the last year's shoots. They are stored in a cellar or other cool place in order that they may be perfectly dormant. It is customary to cut them of three buds' length; but if the shoot is very long-jointed and if the variety is new or rare and the wood therefore scarce, they may be made of one or two buds. The wedge-shaped part should be somewhat thicker on the outside so that it may be clasped tightly in the cleft (Fig. 1689). It is customary to have one bud near the top of the wedge. Although this bud is covered with wax, it is the most likely to grow, since it is nearest the source of food-supply and is less injured by external conditions. It pushes through the wax. It is customary to insert two cions in all stocks, even though only one branch is desired. By inserting two cions, the chances of success are doubled, and the wounds heal better if a twig grows on either side. After a year or two, one of the cions may be cut off if desired.

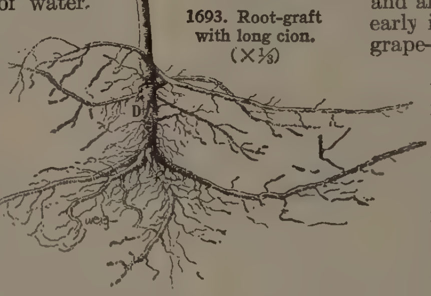
1690. One way of cleft-grafting an old tree.

Cleft-grafting is the method usually employed in the top-grafting of fruit trees, as apples, pears, plums and cherries. Old peach trees are rarely changed over to a new variety. If they are, budding is employed, as already suggested: the limbs are headed back so that new wood is secured in which the buds may be set. It is important, in all top-working of fruit trees, to keep down the suckers which spring up around the cion, and which sometimes completely choke it. In changing over the top of a fruit tree, all the leading branches should be grafted (Fig. 1690). It is well to stand at some distance from the tree and make a mental picture of how the tree will look when the new top is secured: the grafts should be set in approximately a radius from the center of the tree. It is rare that the stock should be larger than 2 inches in diameter where the cions are set. On some of the main branches it may be necessary to graft side branches lower down in order to fill the top and to afford footholds to pickers and pruners. It will require from three to four years to change over a tree in full bearing to a new variety. Each year a little more of the original top is removed, and the cions take more and more of the space.


1691. Whip-graft.

Grafting-wax is of many kinds, but the most serviceable for applying with the hands in the open air is made by melting together one pound (by weight) of rendered tallow, two parts of beeswax and four parts of resin. The melted liquid is poured into a pail or tub of water, when it immediately hardens. It is then pulled until it is light-colored and develops a grain. It is then put away for future use, and will keep indefinitely. When the wax is used, the warmth of the hands will cause it to soften. The hands should be greased to prevent it from sticking.


1693. Root-graft with long cion. (×⅓)



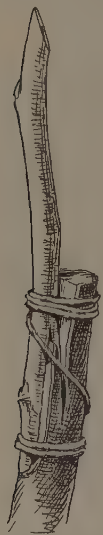
1694. Tree grown from a long-cion root-graft. The union is at D.

For a softer wax, more tallow may be used; or linseed oil may be substituted, but because of adulteration of the oil the results are not always reliable.

Alcoholic waxes, or plastics, are sometimes made, to be applied with a brush or swab; on application, the alcohol disappears and the material hardens. A standard formula (Lefort's) is: best white resin, one pound; beef tallow, one ounce; melt, then remove from fire and add eight ounces alcohol. Keep in tightly closed bottles. Sometimes a teaspoonful of turpentine is added.

Whip-grafting.

Whip-grafting, or tongue-grafting, is employed in the nursery and on very small stocks. It is not used in top-grafting except now and then on small limbs. The cion and stock should be of approximately equal size. Each is cut off in a slanting direction, and a split or tongue is made near the middle. The same shape is given to cion and stock. The pictures sufficiently illustrate how the work is done. (Figs. 1691–1693). The object of the tongue is to hold the parts together securely; it also presents more contact. The cion is then bound to the stock, preferably by means of waxed cord. If the graft is above ground, the wounds should be thoroughly waxed over the string. If the graft is below ground, the tie will be all that is necessary: the moist earth packed around the wound will prevent evaporation and protect it.


1692. Whip-graft, before waxing.

The chief use of the whip-graft is in root-grafting, which is employed largely on apples and mostly at the West. In the East, other things being equal, budded apple trees are preferred to root-grafted trees. In the West, however, it is necessary to have apple trees on roots of known hardiness. The seedling stocks are not of known hardiness, even though the seeds have come from the hardiest varieties. It is therefore customary to use cions 6 to 12 inches long, grafted on pieces of roots 2¼ to 4 inches long. (Fig. 1693.) The graft is set so deep that only the top bud of the cion projects above the surface. The piece of root acts as a nurse, and roots may start from the cion itself. (Fig. 1694.) When the tree is transferred to the orchard, the original root may be cut off in case it is not very vigorous; although this is not done if the union seems to be good and the foster roots are strong. This root-grafting is done in winter (December and January preferred); the grafts are stored in clean sawdust, sand or moss in a cool cellar, and are set in nursery rows in the open early in the spring, after the manner of grape-cuttings.

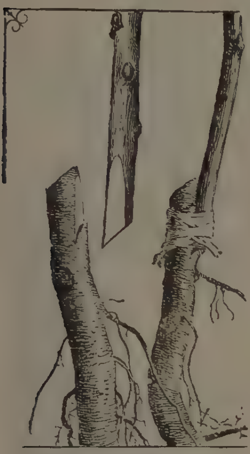
The waxed string, with which the whip-grafts are tied, may be made by dropping a ball of yarn into melted grafting-wax. In five minutes the wax will have penetrated the ball, but the strand can readily be unwound. The best material for this purpose is No. 18 knitting-cotton. This is strong enough to hold the work together, and yet weak enough so that it may be broken in the hands without cutting the fingers. It will ordinarily decay during the year, and thereby not interfere with the growth of the tree. If the grafting is performed in a room at a living temperature, the waxed string should be soft enough to stick to the stock without being tied. Four or five turns are made around the union. Waxed manilla paper, cut in narrow strips, is also used; also single strand cotton "chain" or warp-thread, either waxed or not waxed.

Any sharp knife with a handle large enough to be grasped readily is useful for whip-grafting. The blade should be thin, and the steel of best quality. The handle should also be strong. Fig. 1695 shows a common form of grafting-knife. Good shoe-knives may be used. This and similar knives are in the market. A hone and whetstone should be near at hand, for the edge should be keen.

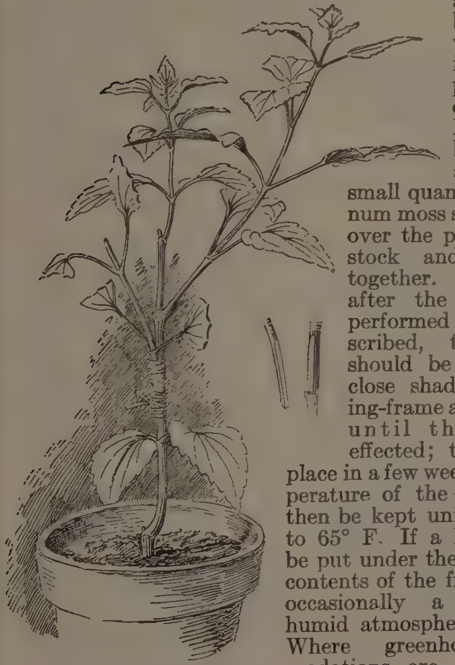
1695. Grafting-knife. (×½)

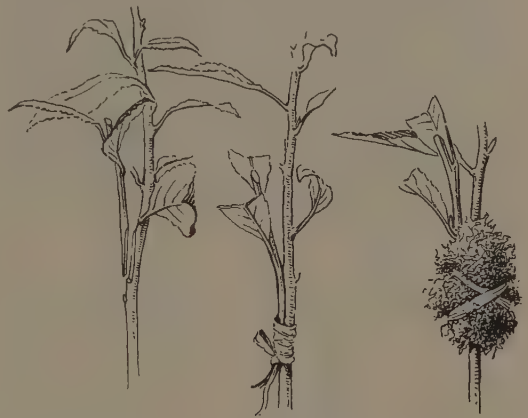
Veneer-grafting.

This style of grafting, which is considerably used under glass with fancy and ornamental plants, consists in simply champering the sufaces of cion and stock and applying the one to the other. (Fig. 1696.) The cion is bound to the stock by raffia or other material. If the graft is in the open, the wounds are thoroughly waxed; but in the house they may be covered merely with moss. This style of union is used with herbaceous plants, as well as on hard wood. Sometimes the stock is severed at the point of union, as in Fig. 1696; but in other cases it is not severed nor headed back until the cion has taken hold (Fig. 1697). In the latter case, the stock is not injured in case the graft does not grow.


1696. Veneer-grafting.

Writing of the propagation of the tea plant under glass (which is suggestive for other plants in houses), Oliver says: "Seedling stocks may be grown in 4- or 5-inch pots for the reception of cions by the veneer method of grafting. To have the plants in perfect condition for working, it is necessary that they be grown from the seedling stage without a check, as the healthier the plant the better the chance of a successful union. Another important matter in this connection is that the stock plants should not be allowed to form matted roots in small pots; therefore, it will be found better to lift them from the nursery and put them in pots previous to the operation: or they may be grown and grafted while in garden flats. If this last-named method is chosen the plants should be situated far enough apart in the flats to be easily handled. If the grafting is performed while the stocks are in active growth, the union will take place more quickly than when the plants are in a dormant condition. The operation should be performed in the early part of spring. Fig. 1698 shows how the incision in the stem should be prepared. This should be made with a sharp knife and the cut at the deepest part should not be more than one-third of the diameter of the stem. The cion must be shaped at the base so that it will fit neatly into the place prepared for it on the stock. It should then be tied, and afterward a small quantity of sphagnum moss should be tied over the part where the stock and cion come together. Immediately after the operation is performed as above described, the plants should be placed in a close shaded propagating-frame and kept there until the union is effected; this will take place in a few weeks. The temperature of the frame should then be kept uniformly at 60° to 65° F. If a layer of moss be put under the pots and the contents of the frame syringed occasionally a favorably humid atmosphere will result. Where greenhouse accommodations are not available for the propagating-frame a hotbed may be built out-of-doors in a location where the sun will not have much effect in raising the temperature. From 6 to 9 inches of stable litter and leaves will provide ample heat during the spring. When it is found that the cions have made connection with the stocks, air should gradually be admitted to the frames. Shortly after this the tops of the stocks may be cut off close to the cions. Planting out may be deferred till the cions have made their first growth."

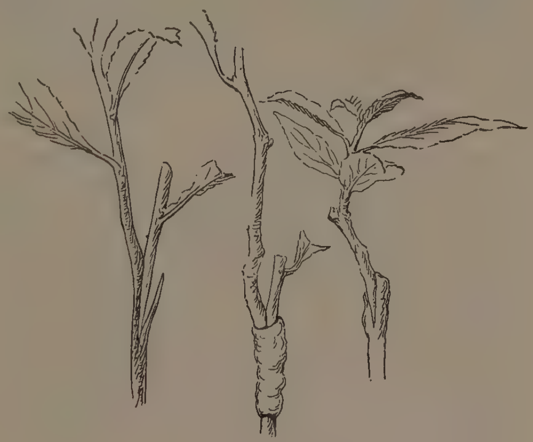

1697. Veneer-grafting.


1698. Veneer-grafting.

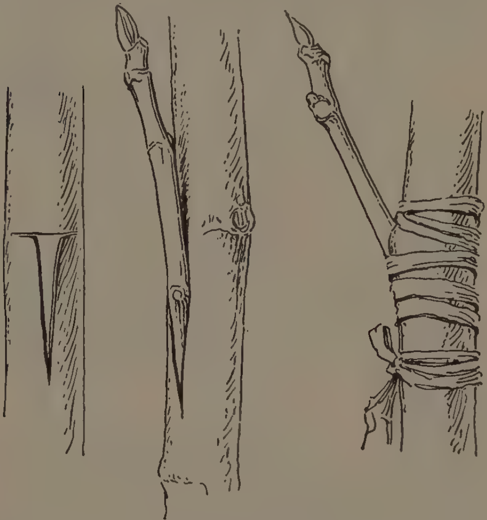
A form of veneer-graft is what is sometimes called the side-graft. It is shown in Fig. 1699 (adapted from Oliver).

Cion-budding.

When a woody cion is inserted underneath the bark in the side of the stock, as a shield-bud is inserted, the method is sometimes known as cion-budding. In describing a simple way of propagating the fig, Oliver writes: "This method consists of preparing the stock for the reception of the cion as in shield-budding. This is done by making a transverse cut through the bark ¾ inch in length. From the middle of this incision another cut is made toward the main stem or root for fully an inch. The bark is then pried up as seen in Fig. 1700. Instead of inserting a single shield-bud, a small twig having one terminal and one or two lateral buds is used. The cion is prepared as follows: A long scarf is made at one side through the pith and a thin piece of the bark on the reverse side is removed. With


1699. Side-grafting.

the long cut facing the stock the cion is pushed deeply into the place prepared for it, and is tied firmly with raffia. The corners of the bark of the stock are brought close to its own stem and bound firmly in that position. Melted grafting-wax should then be put on, or narrow strips of waxed cloth may be applied instead, to exclude air and moisture. If possible, the cions should be selected from branches not over ½ inch in diameter when they can be found of sufficient firmness of that thickness. Small lateral shoots having a terminal bud and only an inch or two in length and quite thin will unite by this method very easily. It is not necessary for the cions to be dormant, but they should be fully matured and the leaves cut off to about ½ inch from the buds. The bark slips readily from the time growth begins in spring, so that the operation may be performed at any period during late spring and summer. In the course of about two weeks after the operation is performed, if the cions remain fresh, the probabilities are that a union will have been effected. Part of the top of the stock may then be removed to induce the cion to start growth, and when it has made some headway the top of the stock may be cut off near the cion."


1700. Cion-budding.

Bark-grafting.

Bark-grafting (Fig. 1701) is an excellent method of grafting fairly large limbs, since it does not injure the stock so much as does the cleft-graft. The cions are cut thin and inserted between the bark and wood. The bark is securely bound to hold it tight, and the entire surface is waxed, as in cleft-grafting. This method is called crown-grafting by the French and English.

This method is useful when it is necessary to graft very large limbs, for the stub does not need to be split and several cions may be set. When large limbs are broken from apple and pear trees, the stub may be trimmed and several cions set around it, to hasten the healing and to afford strong shoots with which to renew the part.

Herbaceous grafting.

Pelargoniums, chrysanthemums, cacti, and other soft-wooded greenhouse plants are sometimes grafted for the novelty of having more than one variety growing on the same root. Probably most herbaceous plants can be grafted readily, with the exception of the endogens, which do not lend themselves to the operation, although there are examples in which grafting has been successful on them. To succeed with an herbaceous cion, it is necessary that the room be rather close and moist, so that evaporation will not be very rapid. One should endeavor to secure the general conditions that obtain in a good propagating-house. The temperature should be kept rather below the normal for that species until union has taken place. It is usually best to cover the union with moss or some other material to protect the wound and to check evaporation. Best results are secured when the cion is firm in texture, as also in the case of herbaceous cuttings. The kind of graft is of less importance, although it is customary to use the veneer-graft cions, since there is less injury to the stock and the outer surfaces are easily applied to each other. The cion ordinarily consists of one or two joints, and if the leaves are large, they are cut in two, as in the making of softwood cuttings.

1701. Bark-grafting.

Inarching, or grafting by approach.

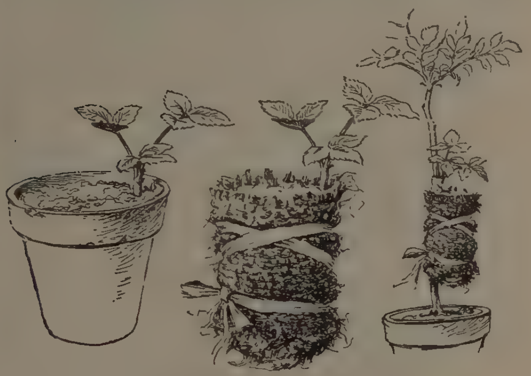
In those cases in which union takes place with much difficulty, it is possible to effect the conjunction by allowing the cion to grow fast to the stock before it is severed from its own roots. The plant which it is desired to have grow on the stock is bent over to the stock, the surfaces of the two are exposed so that the cambiums may be pressed close together, and the two are then bound until union takes place. In some cases a tongue is made in both the cion and the stock, much as in whip-grafting, so that the surface of contact is greater and the parts are held together more securely. When the cion has become thoroughly established on the stock, the cion is severed from its own root and the top of the stock is cut off. This inarching or grafting by approach is also used in the greenhouse when it is desired to transfer the whole top or the whole branch of one plant to another. The illustration (Fig. 1702) shows such a case. Inarching is not much employed in this country in a commercial way.

Inarching is sometimes employed to unite two branches into one for the purpose of making a specimen fruit grow larger. If, for example, a twig of an apple tree is inarched into a limb just back of a fruit, the extra food-supply may cause that fruit to grow larger, and a finer specimen may be secured. This use of the graft is employed only for the purpose of securing extra-fine specimens for exhibition or other purposes.

1702. Inarching the branches of two plants.

The seedling-inarch has recently been described in detail by Oliver (Bull. No. 202, Bur. Pl. Ind., U. S. Dept. Agric.). Such difficult subjects as the mangosteen, litchi and mango respond readily to this method. The idea is to inarch a very young seedling on an older stock, thereby saving time and securing more wood for further propagation. "Seedlings raised from seeds of new and rare trees, shrubs, and vines may be induced to grow very quickly if used as cions when a few weeks old by inarching to strong-growing plants of other species of the same genus or in some cases on species of other genera of the same family. This has been done recently with such plants as chestnuts, walnuts, hawthorns, oaks, and many others. It is not necessarily done for the purpose of hastening the flowering or the fruiting of new plants, but to give quickly an abundance of material for propagation by budding or grafting when the new material is assumed to be valuable. If a hardwood seedling of hybrid origin is tied to a large stock and they fail to unite, there is little or no danger of losing the seedling, provided its roots are kept damp during the period of making the attempt. If the inarch is not successful, the seedling can be repotted and grown in the usual way."

In Fig. 1703 is shown the method of seedling-inarch. A rose seedling is grown near the side of a pot, it having been pricked off into a 2-inch pot shortly after the cotyledons are developed; it is next shown, after two or three weeks' growth, removed from the pot and tied in a cloth to facilitate handling, a little fresh soil being held in place by the covering; the ball is then secured to the stock, and the seedling is inarched by chamfering the surfaces in contact. When union is complete, the root of the seedling is removed.



1703. Seedling-inarch of the rose.

Literature.

For further discussion of the whole subject of grafting, the reader is referred to current works on fruit-growing; also to the two American special books on the subject—Fuller's "Propagation of Plants" and Bailey's "Nursery-Book." In English, Baltet's "Budding and Grafting" is standard. It is an English version of "L'Art de Greffer." L. H. B.

GRAHÀMIA (Robert Graham, Scotch botanist, died 1845). Two genera have been made of this name. The accepted one is of the Portulacaceæ, comprising one species (*G. bracteata*, Gill.) of extra-tropical South America; this plant is not recorded in cultivation. The other Grahamia (of Sprengel) is now referred to Cephalophora; and Cephalophora is by Hoffmann (Engler & Prantl, Pflanzenfamilien, iv:5) included in Helenium. Of this Grahamia, *G. aromatica* is offered abroad; it is accounted for under *Helenium*.

GRAMMÁNGIS (Greek, *gramma;* perhaps referring to the markings of the flowers). *Orchidàceæ*, tribe *Vándeæ*. Epiphytic orchids grown in greenhouses.

Pseudobulbs short and thick, with foliage-lvs. only at their summit, hence not inclosed in the lf.-sheaths: fl.-clusters from the base, many-fld., pendulous; fls. not spurred; middle sepals strongly concave, lateral sepals somewhat sac-shaped at base, free, spreading; petals ascending, somewhat different in form and color; lip 3-lobed, with erect lateral lobes and recurved middle lobe; column slender, winged.—Species about 4, of Madagascar and Java. Nearest Cymbidium, differing chiefly in having the foliage-lvs. only at the end of the pseudobulb, and the rostellum crescent-shaped (in Cymbidium it is triangular). From Grammatophyllum (which see), Grammangis differs in the attachment of its pollen-masses and in the position of its foliage-lvs. Best cult. in baskets hung near the glass, where the light is most intense. The plants can also be grown successfully in pots placed near the glass, or fastened to blocks, but in the latter case they must be given more water.

Éllisii, Reichb. f. (*Grammatophýllum Éllisii*, Lindl.). Pseudobulbs 7–11 in. long, each bearing 5–6 lvs.: lvs. 1½–2 ft. long: sepals yellow, elegantly marked with dark transverse lines; petals and lip pale pink, the latter with a strong mid-nerve. Summer. Madagascar. B.M. 5179. C.O. 2.

G. Húttonii, Benth. & Hook. (Cymbidium Huttonii, Hook. f.). Pseudobulbs of a single internode, 3–5 in. long, elongated, obovoid, green: lvs. in pairs, 6–8 in. long, 2–2½ in. wide, dark green, coriaceous: raceme about 10-fld., drooping; sepals obovate, recurved, light brown outside, streaked transversely inside with chocolate-color; lip greenish, with chocolate stripes. June. Java. B.M. 5676. O.R. 14:153. G.M. 48:467. G.C. III. 38:63.

T. H. Kearney.

GRAMMÁNTHES (Greek, *letter-flower;* the petals of the full-colored varieties have a darker mark like a letter V, whence also the name of the synonymous genus *Vauanthes*). *Crassulàceæ*. One small very variable half-hardy, succulent annual, with thick fleshy leaves and yellow flowers, growing about 6 inches high and is used for edgings, baskets and pots.

Erect, forking: calyx bell-shaped, semi-5-fld.; corolla-tube as long as the calyx; limb 5–6-lobed: carpels 5–6, many-ovuled, with awl-shaped styles: scales minute, or evanescent: follicles many-seeded. In sandy ground in the western part of the Cape region, S. Afr.

dichótoma, DC. (*G. gentianoìdes*, DC.). Glabrous, somewhat glaucous: branches forking: sts. rigid, filiform: lvs. opposite, distant, oblong, ovate or nearly linear: fls. orange, yellow, or creamy white, and marked as above described. F.S. 5:518. Var. **vèra**, (Harv.), has lvs. ovate-oblong: limb of corolla ovate-oblong, a third longer than the stamens. Var. **chloræflòra,** (Harv.), has lvs. oblong or linear: fls. a little larger; limb of corolla ovate-lanceolate, twice as long as the stamens. B.M. 4607, 6401. There are other named forms. Some of them are very depauperate in their native region, some of them only 1–2 in. high. Wilhelm Miller.

GRAMMATOCÁRPUS: *Scyphanthus.*

GRAMMATOPHÝLLUM (Greek, *gramma*, a line or streak, and *phyllon*, leaf; probably referring to the parallel leaf-veins). *Orchidàceæ*, tribe *Vándeæ*. A group of perhaps 8 or 9 epiphytic species, of which about half are well-defined, inhabiting the islands from Madagascar to the Philippines and New Guinea. The genus includes some of the largest and showiest of cultivated orchids.

Roots numerous: sts. or pseudobulbs many-lvd.: lvs. long, ribbon-shaped, thick, evergreen: racemes long-stalked, loosely many-fld., springing from near the base of the pseudobulb; fls. large, not obviously spurred; sepals and petals nearly equal, spreading; lip comparatively small, with margin entirely free, 3-lobed, with erect lateral lobes; column slender. Allied genera are Grammangis and Cymbidium, from both of which Grammatophyllum differs in having the pollen masses each borne upon an appendage of the stalk, while in the two related genera they are attached to a common stalk without special appendages.

The few species in cultivation are such infrequent bloomers that the flowering of a fine example is something of an event. They are propagated from pieces of the pseudobulbs. The plants are best grown in good-sized and well-drained pots filled with peat, and need considerable water while actively growing. They should be allowed to rest occasionally. Season of bloom and further cultural details with each species.

A. *Pseudobulbs very long, comparatively slender.*

speciòsum, Blume (*G. Sanderiànum*, Hort.). LETTER PLANT. Fig. 1704. Pseudobulbs 6–10 ft. long, slender, flexuous: lvs. 2-ranked, 1–2 ft. long: fl.-clusters open, sometimes 6 ft. long from the base of the stalk; fls. numerous, 6 in. diam., clear yellow, spotted with deep red purple. Winter. Malayan region, notably Java. G.C. III. 7:297; 13:1; 22:145, 147; 33:391; 40:86; 42:169, 170. B.M. 5157.—This magnificent plant, one of the very largest of its family, has been well-named the "queen of orchids." A huge individual growing on a tree in the open at the Botanical Garden of Buitenzorg, Java, has the following dimensions: diam. of whole plant, 18 ft.; collar about the trunk of the tree formed by the closely interwoven roots, 7½ ft. diam., 2½ ft. thick, and over 3 ft. high; fl.-clusters (appearing at the same time) 50–60, each 2 ft. or more in length and bearing 70–100 fls. And it must be remembered that this huge plant is an epiphyte! Temperature, especially soil temperature, should be carefully regulated in growing this plant. Owing to the brighter light, it does better in American than in European hothouses.

1704. Grammatophyllum speciosum.

AA. *Pseudobulbs comparatively short and thick, leafy only at summit.*

B. *Fls. greenish or yellowish, spotted with brown.*

Fenzliànum, Reichb. f. (*G. Measuresiànum*, Hort.). Lvs. 4–6: fl.-clusters sometimes 15 at one time, each over 5 ft. long and containing over 60 fls., sepals and petals narrow, greenish yellow, tipped and spotted with brown; lip streaked with purple. April. Isl. of Amboina, Philippine Isls.(?). J.H. III. 29:123. G.M. 34:334. Var. **Measuresiànum**, Hort. (*G. Measuresiànum*, Hort.). Fls. larger and brighter; sepals and petals emerald-green, marked with brown-purple. G.W. 2, p. 73.

Rumphiànum, Miq. (*G. Guilélmi II*, Kränzl.). Pseudobulbs 6–8 in. long, ovoid or fusiform: lvs. 1–2 ft. long: raceme nodding or hanging, 3–4 ft. long from the base of the stalk; fls. often 30–35, 3 in. diam., green outside, green blotched with brown-purple within; sepals and petals similar; lip purple-veined, downy. Molucca Isls., Borneo, New Guinea, and the Philippines(?). B.M. 7507. C.O. 1.—A large, showy species.

BB. *Fls. brown, streaked with green.*

multiflòrum, Lindl. Lvs. 3–4: fl.-clusters nearly 2 ft. long. Summer. Philippine Isls. P.M. 6:217.—This very desirable species has not yet found its way into American trade. It is easily grown, either in a pot filled with a well-drained "compost of heath soil and potsherds," or merely fastened to copper wire and hung from the roof.

G. Éllisii, Lindl.=Grammangis Ellisii.—*G. indeterminàle*, Hort. =(?).—*G. levíctum*, Hort.=(?).

T. H. KEARNEY.
GEORGE V. NASH.†

GRAPE. Plants of the genus Vitis, and the berries thereof, abundantly grown for fruit.

The grape is one of the oldest of domesticated fruits. It is probable that wine was made from it before the plant was brought into cultivation. It seems to have been cultivated at the dawn of history. Its product was apparently no rarity in Noah's time.

The grape of history is the Old World *Vitis vinifera*, the "wine-bearing Vitis," probably native to Asia. The paramount use of the grape always has been the production of wine. A secondary value is the production of raisins; and another is fruit for the dessert and for culinary uses. Great efforts were made to introduce the cultivation of the European grape into the American colonies, but they resulted in failure. It was not until the latter part of the last century that the chief causes of this failure became known: the depredations of the phylloxera and mildew,—and even then the causes were discovered largely because these American parasites had made incursions into the vineyards of Europe. In the meantime, one or two of the native species of Vitis had been ameliorated, and American viticulture had become established on a unique and indigenous basis, and the fruits are grown to eat rather than to drink. So fully did these early American ventures follow European customs that the grapes were usually planted on terraced slopes, as they are on the Rhine and about the continental lakes. Those early experiments finally failed because of the black-rot.

North America is richest in species of Vitis (see the article *Vitis*). These species range from ocean to ocean and from the British possessions to the tropics. The species that has been most improved is *Vitis Labrusca* of the Atlantic slope, although it seems to possess less native merit than some of the southwestern species-

1705. The Labrusca or Fox-Grape type. Niagara (at left); Brighton.

types. Of this species are the Concord and Catawba types (Fig. 1705). To some extent it has been hybridized with *Vitis vinifera* (as in Agawam, Lindley, Barry, and others of E. S. Rogers' varieties), and with native species. Already a number of the popular varieties represent such wide departures that they cannot be referred positively to any species. Of these, Delaware and Isabella are examples. The second most important species, in point of amelioration, is *Vitis æstivalis*, from which several of the best wine grapes have sprung (Fig. 1706). The post-oak grape (*Vitis Lincecumii*, or *V. æstivalis* var *Lincecumii*) of the Southwest, is one of the most promising species, and already has given excellent results in hybridization. See Fig. 1707. The Muscadine (*V. rotundifolia*) of the South has given the Scuppernong and a few less known forms. (Fig. 1708.) Beyond these species, there are none which has given varieties of great commercial importance, although considerable has been done in improving them. Some of the best of the wild species are practically untouched; there is only a comparatively small area of our great country which has yet developed large interests in grape-growing: the grape-types of a century hence, therefore, may be expected to be very unlike the present-day varieties. For an extended sketch of American grape history, see Bailey, "Evolution of Our Native Fruits" (1898). The American grape literature is voluminous. More than fifty authors have written on the subject. Yet there is very little of this writing which catches the actual spirit of American grape-growing; this fact, together with the technicality and diversity of the subject itself, makes it seem wise to devote considerable space to the grape in this Cyclopedia.

1706. Horticultural product of Vitis æstivalis—Onderdonk, seedling of Herbemont. (×⅝)

While the native grape was being ameliorated in the East, the Old World *Vitis vinifera* was becoming established on the Pacific slope. In fact, *Vitis vinifera* has there run wild. The phylloxera and mildew are not native there, and the climate better suits the species. The Pacific coast viticulture, therefore, is of the Old World kind.

We now know that the phylloxera or root-louse can be evaded when the vinifera grape is grafted on native or resistant stocks, and the mildew can be combated by fungicides. Of late years, therefore, new efforts have been made to grow the wine grape in the eastern states, and in the southern latitudes some of these experiments promised well for a time. However, so great attention is required to produce a satisfactory product as to discourage the growing of vinifera varieties in the open in the East. Vinifera types will always be special grapes in the East, adapted only to particular conditions, for it is not to be expected that they can compete with the more easily grown and cosmopolitan varieties of the native species. Under glass, however, the vinifera varieties thrive; and a special discussion is given herewith (page 1388) to this branch of the subject.

The greatest development of the native grape industry has taken place in Ontario, New York, and Ohio, bordering lakes and large streams. These areas are the lower Hudson River Valley; the region of the central-western New York lakes; the Lake Erie region of New York, Pennsylvania and Ohio; the so-called peninsular region of Ontario lying between Lake Erie and Lake Ontario. There are also important grape interests in Michigan, and other northern parts. There is considerable interest in grape-culture in the cooler parts of Georgia and Alabama, and there are enlarging areas in the country extending from the Ozark region southward. Nearly all the country, excepting the northernmost parts, raises grapes, but in most cases the growing of them cannot be said to be extensive enough to be called an industry. Although the grape sections of the North follow the water areas where the land is often steep, all grape-growers prefer nearly level land. The Old World plantations are largely on very steep lands; such lands, by virtue of their warmth and drainage, are thought to give an extra quality of wine. These ideas were brought to this country, and many of our early vineyards were planted on terraced slopes. But we grow grapes for a different purpose from the Europeans, and land is cheap and labor is dear. Old World

1707. Hybrid of Vitis Lincecumii and a fox-grape derivative—Husmann. (×⅝) methods cannot be followed in the American commercial plantations.

The cosmopolitan American grape, of the native type, is the Concord, which originated with Ephraim W. Bull, of Concord, Massachusetts (Fig. 1709.) Other varieties of leading prominence in the North are Catawba, Delaware, Niagara, Worden.

1708. The Muscadine grape.—Vitis rotundifolia.

The ideal bunch of grapes is of medium size for the variety, compact, uniformly developed and ripened throughout, containing no small or diseased berries, and with the bloom intact. A very dense or crowded cluster is not the most desirable, for all the berries cannot develop fully, and the cluster is not easily handled when the fruit is eaten. Fig. 1710 shows a cluster of good shape and compactness: Fig. 1711 is too broad and irregular; Figs. 1712, 1713, are rather too dense and compact.

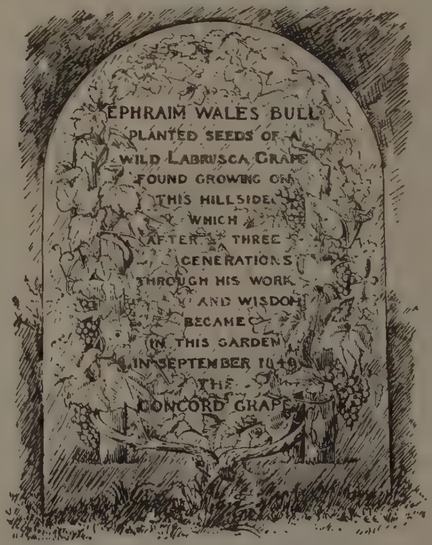
The American grape is essentially a dessert fruit. It is eaten from the hand. There are several manufactured products, but, with the exception of wine, they have been of minor importance until recent years, although there are many large wine-cellars in New York and Ohio, and the product is of excellent quality. Unfermented grape juice is now manufactured in great quantities and has become an important article of commerce (see Cyclo. Amer. Agric. Vol. II, p. 178). The lack of secondary domestic uses of the grape has been one reason for the very serious gluts in the markets. However, one year with another, the profit on a good vineyard may be expected to exceed that on the staple farm crops.

Pruning and training.

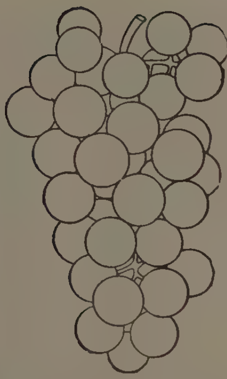
A grape-vine is pruned in order to reduce the amount of wood (that is, to thin or to limit the amount of fruit), and to keep the plant within manageable shape and bounds. A vine is trained in order to keep it off the ground, out of the way of the workmen, and so to arrange the fruit that it will be well exposed to light and air. In order to understand the pruning of grapes, the operator must fully grasp this principle: *Fruit is borne on wood of the present season, which arises from wood of the previous season.* To illustrate: A growing shoot, or cane of 1914, makes buds. In 1915 a shoot arises from each bud; and near the base of this shoot the grapes are borne (one to four clusters on each). This is shown in Fig. 1714. The 1914 shoot is shown at the top. The 1915 shoot bears four clusters of grapes. While every bud on the 1914 shoot may produce shoots or canes in 1915, only the strongest of these new shoots will bear fruit. The skilled grape-grower can tell by the looks of his cane (as he prunes it, in winter) which buds will give rise to the grape-producing wood the following season. The larger and stronger buds usually give best results; but if the cane itself is very big and stout, or if it is very weak and slender, he does not expect good results from any of its buds. A hard well-ripened cane the diameter of a man's little finger is the ideal size.

The second principle to be mastered is this: *A vine should bear only a limited number of clusters,*—say from thirty to eighty. A shoot bears clusters near its base: beyond these clusters the shoot grows into a long, leafy cane. An average of two clusters may be reckoned to a shoot. If the vine is strong enough to bear sixty clusters, thirty good buds must be left at the annual pruning. How much a vine should be allowed to bear will depend on the variety, distance apart of the vines, strength of the soil, age of the vine, system of pruning, and the ideals of the grower. The Concord is one of the strongest and most productive of grapes. Twelve to fifteen pounds is a fair crop for a mature vine; twenty pounds is a heavy crop; twenty-five pounds is a very heavy crop. An average cluster of Concord will weigh one-fourth to one-third of a pound. The vine may be expected to carry from thirty to sixty clusters; and the annual pruning will leave from fifteen to thirty buds.

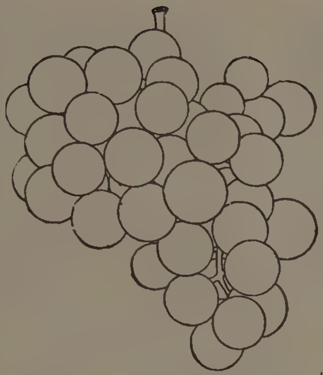
Since the bearing wood springs from new canes, it follows that the fruit of the grape is each year borne farther from the main trunk of the vine. Observe that the fruit of wild vines is borne beyond reach when they climb over thickets and trees. It is a prime object of the grape-grower to obviate this difficulty. The third principle in the pruning of grape-vines is this: *The bearing wood should be kept near the original trunk or head of the vine.* When one cane is sending out fruit-bearing shoots, another shoot is taken out from near the main trunk or head to furnish fruit-bearing shoots for the next year; and the other or older cane is entirely cut away after the fruit is off. That is, the wood is constantly renewed; and the new shoots which are to give bearing wood the following year are called *renewals.* Some systems of grape-training renew back to the root every year or two, and these have been called renewal systems; but every system of grape-pruning must practise renewal in one way or another.



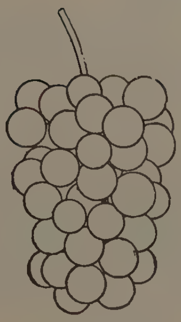
1709. Monument to the Concord grape and Ephraim W. Bull. Erected by the town of Concord.



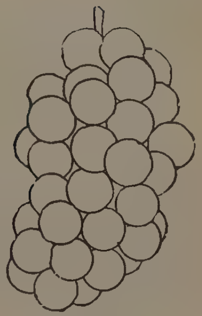
1710. Grein Golden. A good grape cluster.



1711. Eaton.



1712. Moore Early.

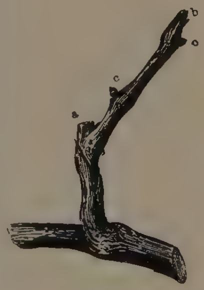


1713. Massasoit.

An old system of renewal was by means of spurs. Fig. 1715 illustrates this. The horizontal part is a permanent arm or branch. We will suppose that it grew in 1912. In 1913 a shoot grew upward. It bore two or three clusters of fruit. In autumn it was cut back to *a*, two buds being left to supply the shoots of the succeeding year. This short branch is now called a *spur*. Only one shoot was wanted for the next year, but two buds were left in case one should be injured. In 1914, a branch grew from one of these buds: it bore fruit: in the fall it was cut back to *b*. In 1915 a shoot will grow from one of the buds, *c*. Thus the spur elongates year by year, becoming a forking, complicated, stubby branch. After a few years it may become weak: the grower sees this, and if a new shoot should start from the main arm near the base of the spur, he encourages it and cuts off all of the old spur: thus he renews back again to the main vine. Shoots from adventitious or secondary buds are likely to spring from the main arm or the spur at any time. These are usually weak and are removed, but now and then a strong one arises. Spur-pruning is now rarely used except in grapes grown on arbors or under glass, in which cases it is necessary to have a long, permanent trunk. On arbors it is best to carry one arm or trunk from each root to the top of the framework. Each year the lateral canes are cut back to spurs of two or three buds. The pruning of glasshouse grapes is discussed under *Grapes under glass* (page 1389).

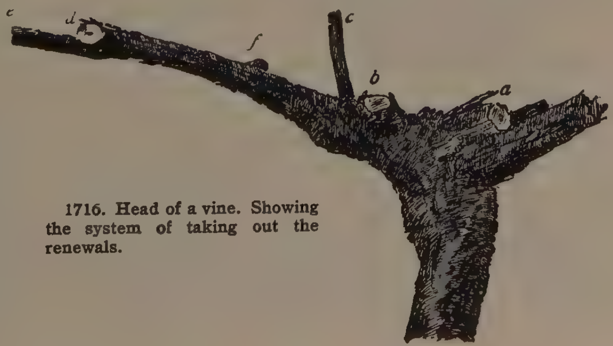
1714. Fruit-bearing of the grape.

The current systems of pruning renew to a head—or to the main trunk—each year. The trunk is carried up to the desired height—to one of the wires of the trellis—and one or more canes are taken out from its top each year. The object is to keep the bearing wood near the main trunk and to obviate the use of spurs. This type of pruning is illustrated in Fig. 1716. This engraving shows the head of a vine seven years old, and on which two canes are allowed to remain after each annual pruning. The part extending from *b* to *f* and *d* is the base of the bearing cane of 1914. In the winter of 1914–15, this cane is cut off at *d*, and the new cane, *e*, is left to make the bearing wood of 1915. Another cane arose from *f*, but it was too weak to leave for fruiting. It was, therefore, cut away. The old stub, *b*, *f*, *d*, will be cut away a year hence, in the winter of 1915–16. In the meantime, a renewal cane will have grown from the stub *c*, which is left for that purpose, and the old cane, *b d*, will be cut off just beyond it, between *c* and *f*. In this way, the bearing wood is kept close to the head of the vine. The wound *a* shows where an old stub was cut away this winter, 1914–15, while *b* shows where one was cut off the previous winter. A scar on the back of the head, which does not show in the illustration, marks the spot where a stub was cut away two years ago, in the winter of 1912–13. This method of pruning can be kept up almost indefinitely, and if care is exercised in keeping the stubs short, the head will not enlarge out of proportion to the growth of the stock or trunk.



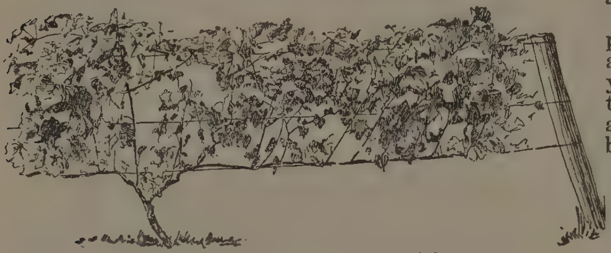
1715. Pruning to a spur.

Two common styles of training are in use in the



1716. Head of a vine. Showing the system of taking out the renewals.

northern states, but each of them practises essentially the system of renewals described in the last paragraph. One style of training carries the trunk only to the lowest wire of the trellis. The canes—usually two in number—are tied horizontally on the bottom wire, and the bearing shoots are tied, as they grow, to the two wires above (Fig. 1717). This is an *upright system*. The other style carries the trunk to the top wire. The canes are tied on the top wire, and the bearing shoots hang. This is the *drooping* or *Kniffin system*. If the shoots run out on the top wire by clinging to it by tendrils, they are torn loose, so that they will hang: this is a very necessary practice. There is controversy as to the comparative merits of these systems, which proves that each has merit. It is probable that the upright system is better for the slender or shorter varieties, as Delaware, and also for those whose shoots stand erect, as Catawba. The Kniffin has distinct merit for strong-growing varieties, as Concord; it is also cheaper, since it requires no summer tying. This system is well illustrated (as given by E. W. Williams in "Garden and Forest," I: 461) in Figs. 1718–1720.

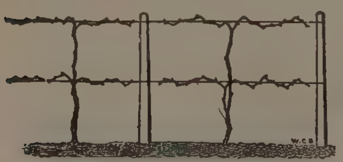


1717. Upright system of grape-training.

At the winter pruning, all the top will be cut away except two canes near the center; these two will be laid down in opposite directions on the bottom wire for the next season's fruiting.

One- or two-year-old vines are planted either in the fall or early spring. At planting, the vine is cut back to three or four buds, and the roots are shortened (Fig. 1724). If all buds start, the strongest one or two may be allowed to grow. The canes arising from this bud should be staked and allowed to grow through the season; or in large plantations the first-year canes may be allowed to lie on the ground. The second year this cane should be cut back to the same number of eyes as the first year. After growth begins in the second spring, one of the strongest shoots should be allowed to remain. This cane may be grown to a single stake through the second summer. At the end of the second year the cane may be cut back to the bottom wire of the trellis, if upright training is to be employed. The cane may be strong enough at this time to be made the permanent trunk of the Kniffin training, but in most cases the trunk is not carried to the top wire until the third year.

The main pruning is performed when the vine is dormant. The ideal time is January and February in the North, although the work is often begun in November if the area is large. Pruning in spring causes the vine to bleed, but bleeding is not injurious. But late pruning interferes with tillage, and the buds are likely to be injured after they are swollen. Summer pruning is now practised only to the extent of pulling out suckers and weak shoots, and even this is not always done. Heading-in the vine in summer is likely to start side growths, which are useless and troublesome.

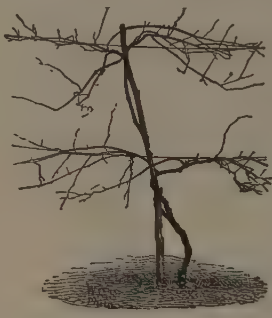


1718. The Kniffin system of grape-training.

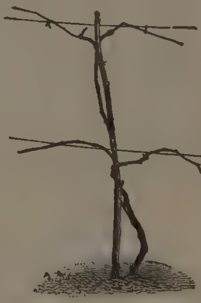
Propagation.

The grape grows readily from seeds, which may be kept over winter and germinated in the house early in the spring. They may even be planted in beds in the open, but the proportion of failures will be greater. Seeds produce new varieties, and they are used only in an experimental way.

The commercial propagation of grapes is accomplished by means of hardwood cuttings. These cuttings are taken in the winter from the trimmings of vineyards. In all ordinary cases they are made of two or three buds' length, preferably three (Fig. 1721). They are cut as soon as the canes are trimmed, tied in small bundles, and these bundles are then buried half their depth in damp sand in a cool cellar. By spring the cuttings will be more or less callused. The cuttings are planted in the open on the approach of warm weather. A loose loamy soil is chosen, and it is well and deeply prepared. The cuttings are inserted until only the upper bud stands at the surface of the ground. These cuttings are placed 6 to 8 inches apart in rows, and the rows are far enough apart to allow of horse cultivation. These cuttings may give plants large enough for sale the following autumn; but it is usually preferred to let the plants grow two years before they are put upon the market. In such cases it is customary in many of the best nurseries, to transplant at the end of the first season. When wood is scarce, the canes are sometimes cut to single eyes. In this case about an inch of wood is left on either side of the bud. Single-eye cuttings are nearly always started under glass, preferably on the greenhouse bench. If they are started in February, they will be large enough for transplanting in a well-prepared seed-bed very early in the spring. Greenwood cuttings are sometimes used in the summer with new and rare varieties, but they are not in general favor. In California, rooted vines of one year are preferred; and in soil in which cuttings root readily, they are sometimes planted directly in the vineyard.



1719. The Kniffin vine before pruning.



1720. The vine after pruning.

The grape is easily grafted. Because of the flexible nature of the vine, however, it is customary to make the graft below the surface of the ground. An ordinary cleft-graft is usually employed. The whole vine is cut off 4 or 5 inches below the surface, and the graft is inserted in the same fashion as in apple or pear trees. The surface may then be waxed or covered with clay or other material, to keep the water out of the cleft, although if the earth is firmly packed around the graft and no water stands, the union may be perfectly satisfactory without any cover. (Figs. 1722, 1723.) Vines of any age may be grafted. It is important that the cions be perfectly dormant. These cions are taken and stored in the same way as cuttings. The grafting should be done very early in the spring, before the sap starts. Grafting may also be performed late in the spring, after all danger of bleeding is over; but, in that case, it is more difficult to keep the cions dormant, and the growth is not likely to be so great the first season. Vineyards composed of unprofitable varieties may be changed to new varieties very readily by this means. Vinifera varieties can also be grafted on our common phylloxera-resistant stocks by the same method. Almost any method of grafting can be employed upon the grape-vine if the work is done beneath the surface.

1721. Common 3-bud cutting of grape.

Insects and diseases.

The grape is amenable to many insect and fungous attacks. The most serious difficulty is the phylloxera, which, however, is practically unknown as an injurious pest on the native grapes. On the vinifera varieties it is exceedingly serious, and it is working great devastation in many of the vineyards of the Old World and of the Pacific coast. The most practicable means of dealing with this pest is to graft the vinifera vines on native or resistant roots.

The mildew and black-rot are the most serious of the fungous enemies in the central and eastern parts of the continent. Both these diseases cause the berries to decay. They also attack the leaves, particularly the mildew, causing the leaves to fall and preventing the grapes from maturing. It is the mildew that has worked such havoc in European vineyards. The mildew is most serious on thin-leaved and smooth-leaved varieties, as the Delaware. It produces yellowish patches on the leaves, with frost-like colonies on the under sides. It causes the berries to decay with a gray and finally a brown rot, the berries usually remaining small and firm but not greatly wrinkled. The black-rot causes the berries to become very hard, dry and shriveled, and the epidermis is covered with minute pimples. (Fig. 1286, Vol. II.) The treatment for both these diseases is the same—spraying with bordeaux mixture. In regions in which the diseases have not been very prevalent, it is usually sufficient to begin the spraying after the fruit has begun to set, and to spray two or three times, as the case seems to require. When the diseases have been very prevalent, however, it may be well to begin before the buds swell in the spring. In infested vineyards, the foliage and diseased berries should be raked up and burned in the fall.

The anthracnose or scab (*Sphaceloma ampelinum*) is a very serious fungous disease. It is most apparent on the fruit, where it makes a hard, scabby patch. Its most serious work, however, occurs on the stems of the clusters and on the young growth, where it makes sunken, discolored areas, and where it interferes seriously with the growth of the parts. It is not so easily controlled as the mildew and the black-rot. Careful attention to pruning away all the diseased wood and burning it will help in controlling the disease. Before growth starts, spray the vines, trellis and posts with sulfate of iron solution. After the leaves open, use the bordeaux mixture.

In grape-houses the powdery mildew (*Uncinula spiralis*) often does much damage. It also occurs in the open vineyard, but it is usually not serious there. It appears as a very thin, dust-like covering on the leaves. It sometimes attacks the berries, causing them to remain small or to crack. This fungus lives on the surface, and is therefore readily controlled in grape-houses by dusting with flowers of sulfur or by the fumes of evaporated sulfur.

The oidium is the most prevalent fungous disease in California. It is controlled by dust-sprays of sulfur (page 1387).

Many other insects and diseases prey upon the grape, but those mentioned above are widespread and may be considered as perhaps the standard parasites. (See Vol II, pp. 1031, 1053.)

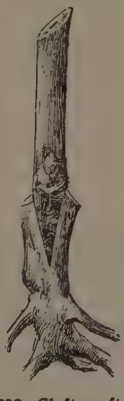
Literature.

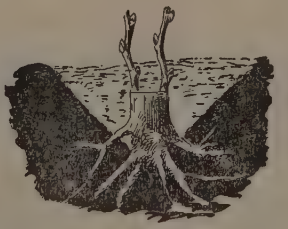
The American book literature of the grape is nearly as large as that of all the tree-fruits combined. Probably 100 books, counting the various editions, have been published in North America since Adlum's volume in 1823 (see "Evolution of Our Native Fruits," pp. 117–126). The earlier books were founded largely on European practices. The leading current works are: "Bushberg's Descriptive Catalogue and Grape Growers' Manual;" Mitzky's "Our Native Grape;" Fuller's "Grape Culturist;" Husmann's "American Grape Growing and Wine Making." For the Pacific slope, Husmann's "Grape Culture and Wine Making in California," Wickson's "California Fruits," and Eisen's "Raisin Industry" are useful guides. Detailed discussions of pruning and methods of training are contained in "The Pruning-Book." A standard European monograph is Foëx's "Cours Complet de Viticulture." The recent standard American works are Munson's "Foundations of American Grape Culture," and Hedrick's "Grapes of New York," which are notable contributions to horticultural literature. L. H. B.

Grapes in the North (Canada).

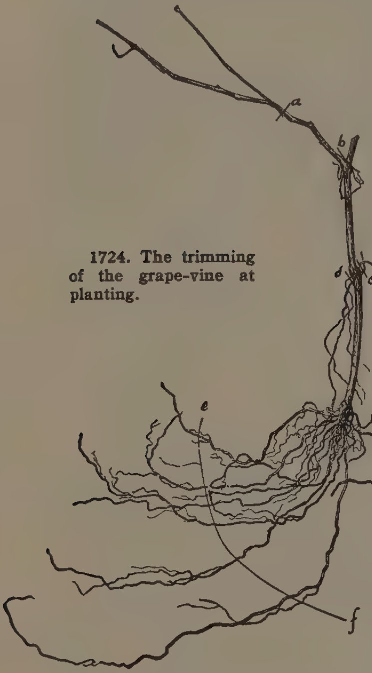
Any section in which grapes will thrive without winter protection may be said to be a commercial section. For home use they are grown far north by covering with earth or litter during the winter. When the leaves are falling or have fallen in autumn, the vines are pruned—fan system, with the old stalks very close to the ground, and laid flat upon the earth. Here they are left under their straw or earthy covering until danger of frost is past, the following spring, when the covering is removed and the canes tied to the wires. But this is expensive and the method is not commercial.

For market purposes, grapes are grown with one of two main objects in view: either for wine (sweet or fermented) or table and dessert purposes. The purpose determines the variety. Concords and varieties approaching it in type and quality are the choice for the former purpose, while for the latter the variety is determined by the season and the market demand. In the former case, also, the number of varieties is limited, while in the latter they are numerous, ranging from the earliest, Champion, to the latest, Vergennes, and intermediate varieties of all colors and grades.


1722. Cleft-grafting the grape.


1723. Cleft-grafting the grape.

Grapes, unlike peaches and cherries, are not subject to very great fluctuations in price and yield. They are comparatively steady in their returns, and, while never advertising themselves by enormous yields and profits, are ever pushing to the front in acreage, yield to the acre and importance. The acreage increase has been very rapid until now New York, the leading northern state of the United States, which thirty-five years ago had but a small acreage, today has more than 70,000 acres, and Ontario, the leading province of the Dominion, has approximately 14,000 acres. The rapid increase has not been because of high prices, but rather steady average prices from $18 to $30 a ton, delivered at the winery, or an equal price f.o.b. the shipping-station. The average yield has not been over two tons to the acre, but, under good conditions, with intelligent management, an average of four to six tons is not uncommon.



1724. The trimming of the grape-vine at planting.

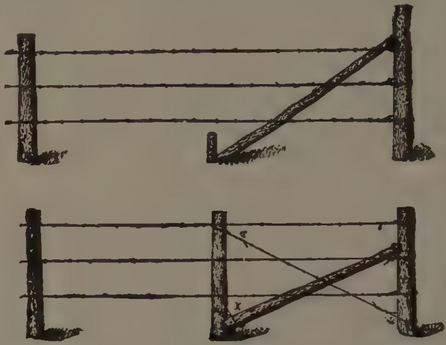
Soils and location.

Grapes are grown on all types of soils, on many sites, in various locations. But the loams and clays with good drainage, the sites with good air-circulation, and the locations that are reasonably free from frost are preferred. Quality is to a large extent determined by soil. Some of the wineries will accept only fruit that is grown on clay soils. The product is more uniform, it ripens more regularly and the sugar-content is higher. Also some coöperative companies that are catering to a special trade, advise their members to plant only on heavy soils because the grapes are sweeter and of higher quality. The ideal soil, however, is the rich, deep, alluvial, easily drained loams that have taken centuries to build up from the washing of the hillsides toward the margins of the lakes and rivers.

The site is of importance for two reasons, those of air-circulation and sunlight, both of which serve the same purpose: to assist the grower in his fight against disease. Disease can live only in conditions that favor it, and light and air are its hereditary enemies. Site is also often discussed with reference to early bud-development and late spring frosts, but its importance has been overdrawn. The number of vineyards injured annually in this manner in the commercial districts is very small.

1725. A vineyard in its first summer.

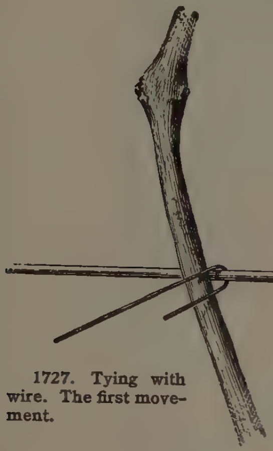
Location (and by that is here meant the situation of a district) is of extreme importance. In the Niagara Peninsula, Ontario,—the largest grape-growing center in Canada,—the aspect is north, with a hill in the rear, and facing the waters of Lake Ontario. Here the crop naturally varies, but it never fails. The same applies to the best parts of New York State, the commercial sections of the one being but continuations of the other. The favored spots in Ontario are not on the shore of the lake but rather just below the escarpment where the water has less influence. Grapes on the shore sometimes fail to ripen well and the quality is consequently inferior. Because of this, many vineyards on the shore have been removed in late years, while the interior plantings have largely increased. If the volume of water were smaller, the influence would be sufficient only for frost-protection; but, where it is so large, it retards early development. The water influence is striking, as the fruits (peaches, for example) ripen from six to ten days later on the shore than two to four miles inland.



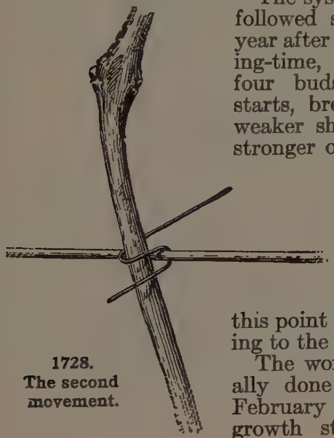
1726. Illustrating the bracing of the end post in a fence or trellis.

Stock and pruning.

One-year-old plants are the choice for planting. These should be well grown and healthy. Two-year-old plants are often only one-year culls. The plants are set as early in the spring as possible on land that has been previously prepared by growing a cultivated crop. Plants set in sod or on unprepared land do not thrive, and poor growth the first year is not made up two years later. The stock is heeled-in as soon as it comes from the nursery, but is left heeled-in only until the ground is ready for planting, which is as early as possible. When planting, time is saved by plowing a furrow, sometimes by throwing out two furrows, one each way. A man with a spade deepens this, or loosens the soil in the bottom, and then packs it again firmly around the roots. Before planting, all broken and damaged roots are cut away and sometimes the healthy ones are cut back. (Fig. 1724.) The tops are cut back to two to four buds. Distances of planting vary greatly, depending on the variety and the ideas of the planter. The popular distances are 7 by 10 feet to 8 by 10 feet for the small-growing varieties, to 9 by 11 feet for the larger-growing varieties. A few of the small-growing varieties are planted 6 by 9 feet, but this is exceptional. The first year the vines are allowed to run as they will. (Fig. 1725.) The posting is done the second or third year. This consists of driving posts sharpened at one end or digging holes and setting them about 21 to 27 feet apart. One post is set for each three vines. The end posts are either braced the same as ordinary fence-posts or anchored. (Fig. 1726.) Various anchors are used, such as large stones buried in the ground, cement used the same as stones, or a patent anchor which consists of a V-shaped piece of iron to which is attached a wire. This is driven in the ground to a depth of 30 to 36 inches. The posts are 8 feet in length, usually cedar or chestnut, and cost from 15 to 25 cents each—an average of 20 cents. The wiring is done the second or third year, preferably the second year, and consists of stretching two No. 9 galvanized wires the entire length of the row. The first is about 30 inches from the ground and the second about 30 inches above this. Some use three wires, but two are more popular. The wires slacken easily and the posts heave some every winter. This must be corrected regularly before tying the grapes. Drive the posts to place with a ten- or twelve-pound mallet and tighten the wire by turning the patent stretcher on the anchored posts. When putting the wire on the posts and tying the vines to the wire always place them on the windward side, as they are less likely to be blown down and damaged. The vines may be secured with raffia or with wire. (Figs. 1727–1730.)

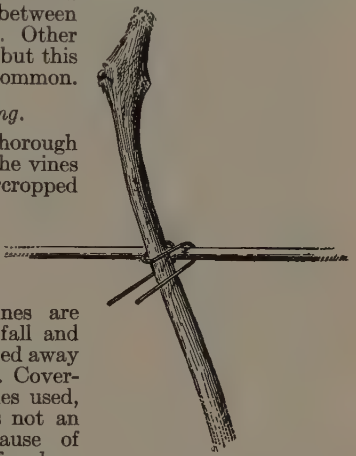

1727. Tying with wire. The first movement.

Pruning systems are many and varied, and the advocates of each system claim for their ideal special merits. Kniffin, Improved Kniffin, Fan, Arm and High Renewal systems are all used to some extent, but the Fan and Improved Kniffin are the most popular. Many growers believe that it is impossible to prune to a definite system, but by others this is not found to be the case. Many leave the necessary number of strong healthy canes and tie them up as best they can space them on the wires. From twenty-eight to forty buds is the popular number to leave, and the ideal of the grower is the only guide on which canes to leave these buds. The preference is usually given to the strong quality-looking canes on which the buds are close together.


1728. The second movement.

The system of pruning to be followed should be started one year after planting. As at planting-time, cut back to three or four buds and after growth starts, break or rub off the weaker shoots. This gives the stronger ones an opportunity to thrive. Tie to the lower wire. The second season it may be advisable to cut back similarly, especially if the growth has been weak. From this point train the vines according to the system to be followed.

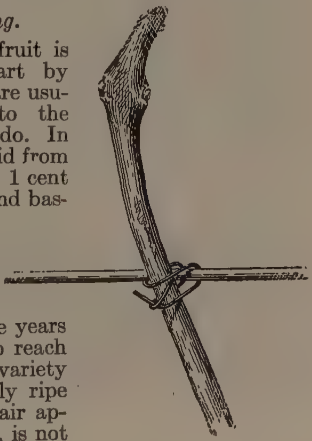
The work of pruning is usually done in the spring, from February to April, before any growth starts. If growth has started, the vines will bleed. The brush is gathered, in most cases, with a pole about 11 or 12 feet long, 3½ inches in diameter at one end and tapering to about 1½ to 2 inches. This must be of strong material that will bend without breaking. A chain is attached from 24 inches to 36 inches from the large end, and as it is drawn by the team the brush collects between the chain and pole. Other methods are used, but this is by far the most common.


1729. The third movement.

Tillage and fertilizing.

Cultivation is thorough for best results. The vines are sometimes intercropped with cultivated crops the first year after planting, but later they require all the care. The vines are plowed up in the fall and disced and grape-hoed away the following spring. Cover-crops are sometimes used, but the practice is not an extensive one because of damp conditions for harvesting in the fall. Cover-crops are sometimes not plowed under till the following spring. The tying is done by women and girls in early spring before the buds are so swollen that they are easily damaged. Many materials are used, but the most common are wire and a soft wool twine made for the purpose. The twine is most used, although the wire is very handy. The canes are spaced when tying, and thus held in place until the tendrils of the new shoots secure them to the wire.

Fertilizing is still done in a haphazard way. Some of the best men make a regular practice of mulching the roots with farmyard manure in the fall. Some apply no farmyard manure at all. The use of commercial fertilizer is still in the experimental stage. Its value is admitted but its use is not fully understood. On light and gravel soils some potash compounds are being used. On the deep alluvial soils some growers are using it in the form of wood-ashes rather than the prepared commercial product. Some bone-meal, at the rate of 300 to 600 pounds to the acre, is being used also. Some state profitable results from their methods; others think that with light applications of farmyard manure and thorough cultivation the commercial fertilizers are not required.


1730. The tie complete.

Harvesting and marketing.

The cutting of the fruit is done for the most part by women and girls, who are usually paid according to the amount of work they do. In some cases they are paid from $1 to $1.25 a day, but 1 cent for an eight- to ten-pound basket is more satisfactory. Cutting starts as soon as the earliest grapes are ready for the market. In Canada, Champions have of late years been the first variety to reach the wholesaler. This variety colors before it is really ripe and, though having a fair appearance in the baskets, is not really ripe. Sharp criticism is leading the growers to be more cautious and to some extent drop the variety for the more satisfactory Campbell and Moore Early. These varieties are later, but please the purchaser. For wine purposes the fruit is left on the vines as long as possible so that it becomes fully matured. Grapes, unlike apples and especially pears, do not ripen off the vines and must be left until fully mature if the highest quality is expected, especially for dessert.

Of late years large acreages have been planted especially for the markets of the Canadian West. Coöperative associations have been organized to handle all varieties extending over the season; but, in the case of one large company, one variety only, Worden, is handled. This ripens before Concord and consequently brings a high price. The location of the vineyards of this particular company is ideal; the fruit is of good quality and ripens early and it seems that under those particular conditions the Worden is the most profitable grape to grow.

The forming of coöperative associations for the purpose of marketing the fruit has the distinct advantage of improved distribution. It has also cut down the handling expenses. Very few baskets, except special orders, are sent great distances by express. The coöperative associations have enabled the growers to secure car rates, and though prices have been comparatively low, even as low as 10 cents for an eight-pound basket, f.o.b. shipping station, the cheap and rapid methods of handling have made the industry profitable.

Returns.

Grapes, as grown at the present, might be considered a long-term investment with every prospect of regular dividends. The cost of planting, posting and early cultivation is comparatively high, but the vines bear early. Good crops are produced the third and fourth years after planting and the following year the vines should be in full bearing. The cost of planting and growing an acre of grapes to three years of age can only be estimated. Men, methods and conditions vary so much that no figures can be taken as absolute; but the figures and calculations serve as a guide and as such they are given here:

FIRST YEAR.

Land	$125 00
Fall preparation of land	3 00
Spring cultivating and marking furrows	1 50
Cost of 435 vines at 4 cents	17 40
Planting	3 00
Cultivating	3 00
Fall plowing	2 00
Total expenditure for first year	$154 90

SECOND YEAR.

Working soil in spring	$1 50
Cultivating	3 00
Pruning and tying	1 00
120 posts at 20 cents	24 00
120 posts (including digging and setting) at 5 cents a post	6 00
Staples, wire and wiring	22 00
Total	$57 50

THIRD YEAR.

Pruning	$1 50	
Tying	50	
Cultivating and plowing	5 50	
Fertilizing	8 00	
Spraying twice	1 00	
Average crop for third year 435 baskets an acre.		
435 baskets at 12 cents		$52 20
Cost of 435 baskets at $34 a thousand	14 79	
Picking 435 baskets at 1 cent a basket	4 35	
Covering	1 00	
Delivery	75	
Total expenditure for third year	$37 39	
Total revenue		$52 20
Net revenue		$14 81

Total expenditure for first three years:		
First year	$154 90	
Second year	57 50	
Third year	37 39	
	$249 79	
Third year revenue		$52 20
Net expenditure for three years	$197 59	

FOURTH YEAR.

Pruning	$3 00	
Tying	2 25	
Gathering and burning brush	50	
Spraying	1 40	
Plowing and cultivating	5 50	
Fertilizing	8 00	
800 baskets at 12 cents		$96 00
Cost of 800 baskets at $34 a thousand	27 20	
Picking 800 baskets at 1 cent a basket	8 00	
Covering	2 00	
Delivering	1 00	
	$58 85	$96 00
Profit		$37 15

The late J. W. Spencer, in his article in Cyclopedia of American Horticulture, on "Grapes in the North," gave the following as submitted by A. B. Clothier, Silver Creek, N. Y.:

Plowing and marking an acre of land	$3 00
Number of plants, 8 x 9 feet, 605 cost	12 10
Cost of planting	1 50
Number of cultivations first season, seven; cost	7 00
Cost of cultivation second season	7 00
Number of pounds of wire for two-wire trellis, 600 pounds; staples, 6 pounds; cost	22 80
Number posts for trellis, 202; number braces, 20; cost	14 14
Cost of putting up trellis	3 00
Cost of acre of grapes, exclusive of land	$70 54

Varieties.

The prospective planter will do well to consider carefully the best-known and most popular varieties before planting. More than 75 per cent of the grapes planted in the commercial sections of Canada are Concords and Wordens. The same is true of New York State. The Concord almost alone is used in the grape-juice industry. It is the leading fermented wine grape also. Worden is in second place, being a little earlier, and although a smaller yielder, is cutting into the Concord market for ordinary purposes. Lindley, Wilder, Vergennes, Agawam, Catawba and some related varieties all hold a place for general market purposes and the plantings are increasing. When quality is expected, these are the varieties to grow, but the yield will not be so heavy as for the Concord. Delaware is in good demand because of its quality when well grown. Moyer and Brighton are giving way to better varieties.

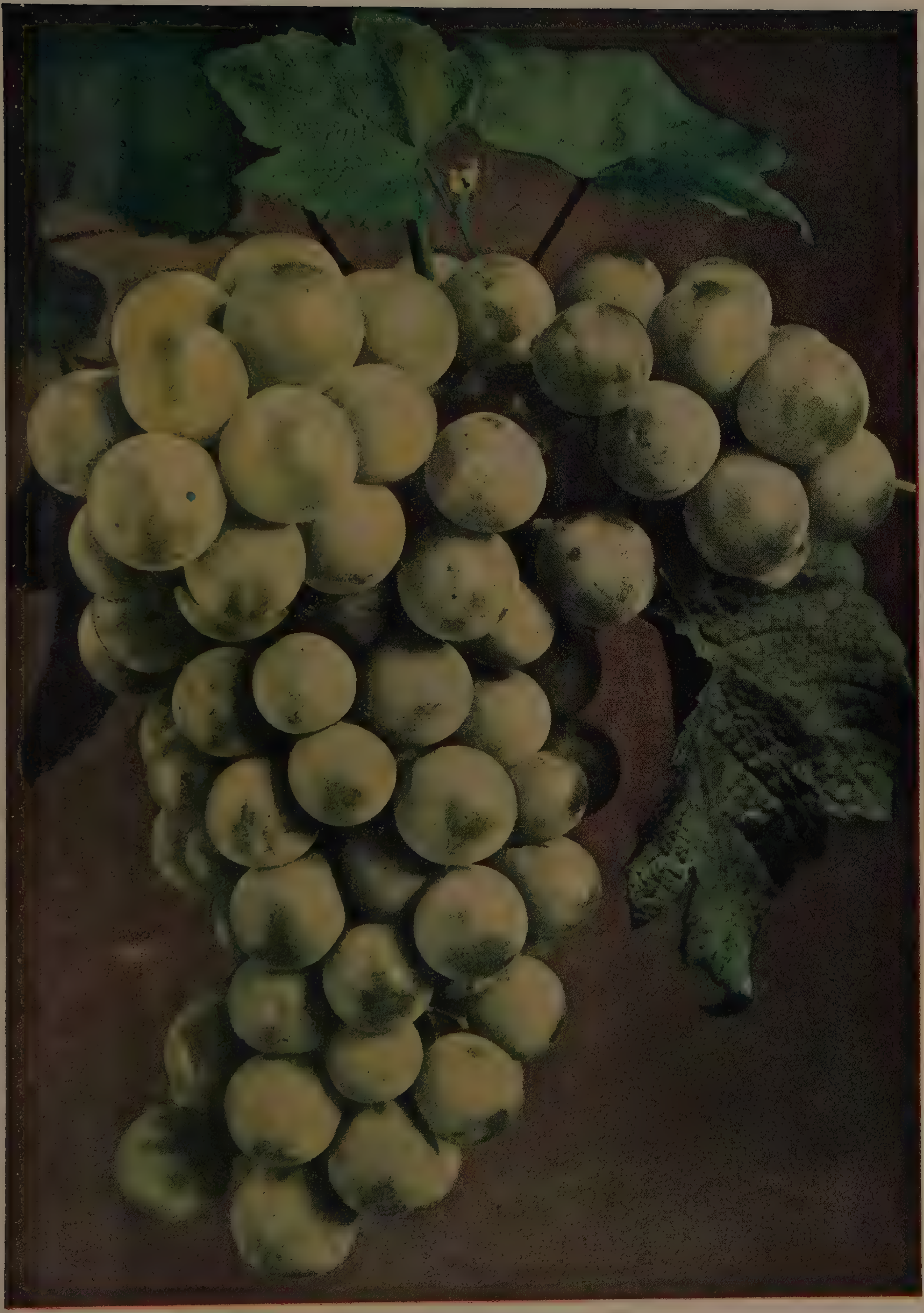
The Niagara, in spite of its many drawbacks, is still a favorite, and although a few years ago it suffered somewhat from over-advertising, it has again found its proper place and is in steady demand. The newer varieties have not been tested long commercially and it is well for the new grower to plant them only in limited numbers until they have proved they are worthy of a larger place.

All the commercial varieties grown out-of-doors are Labrusca or Labrusca-vinifera hybrids and seedlings, and no attempt is being made to grow the pure vinifera.

F. M. CLEMENT.

Grapes in the South.

The region south of the 38th degree north latitude has in it more native species of grapes than all the world besides. This alone would lead one to suppose the South naturally adapted to vineyard culture. Yet New York, Ohio and California up to the present far excel it in vineyard area, although only three or four species are native in these states. The cause of this is that diligent experimenters and originators have pro-



XLIX. The Niagara grape.

duced varieties of good marketable value adapted to those regions, from natives of the regions, or hybrids of natives with hardiest foreign kinds. In the case of California, the vinifera varieties are mostly grown because the climate and other conditions are so similar to those of the native region of the vinifera. But the South has chiefly planted the northern and foreign varieties which succeed but indifferently in most southern localities, and has neglected almost entirely its native varieties until quite recently. Now experimenters have shown that most excellent and very successful varieties of all colors and seasons can be and have been produced by selection and hybridization of some of the large fine-fruited varieties.

While the foregoing predicts by actual existence in practical market vineyards in a number of localities in the South what is in store for the South as a whole, the present state of grape-culture in that region at large is a different matter. Information gathered from best sources throughout the South shows that grape-culture is a very small industry.

Varieties.

The leading varieties cultivated in the northern sections of the South are Catawba, Concord, Delaware, Early Victor, Elvira, Ives, Moore Early, Moore Diamond, Niagara, Norton Virginia, Perkins, Worden, Wyoming. Favorable mention is made of America, Beacon, Brilliant, Campbell Early, Gold Coin, Green Mountain, Laussel, Ozark, Presly.

East of Texas and south of Tennessee, the following are chiefly planted: Brighton, Champion, Concord, Delaware, Diana, Diamond, Elvira, Goethe, Hartford, Herbemont, Ives, Missouri Reisling, Moore Early, Niagara, Norton Virginia (Cythiana), Perkins, Worden. Of the muscadine class for wine: Flowers, James, Mish, Scuppernong, Thomas. Favorable mention, of varieties testing, is made of Brilliant, Bertrand, Carman, Fern, Gold Coin, Jaeger (Fig. 1731), Laussel, Marguerite, Superb. In the southwestern section, west of the 96th meridian, are chiefly planted the Herbemont, Jacquez (Black Spanish, Lenoir), Niagara and Golden Chasselas, Malaga and some other vinifera varieties near the Gulf coast and in western Texas under irrigation. By several who have had them under trial for several years favorable mention is made of Bertrand, Brilliant, Carman, Fern, Jaeger, Marguerite, Muench, Neva, Perry, as furnishing successful table and wine grapes for this region.

1731. Jaeger.—Hybrid of Vitis Lincecumii and an æstivalis offshoot. (×½)

The following varieties are superior for commercial and home planting in the South, especially the Southwest, and some in the North: Headlight, Brilliant, President, Captivator, Hidalgo, Hernito, Delakins, Salamander, R. W. Munson, Mericadel, Ericson, Krause, Bailey, Extra, Blondin, Jaeger, Carman, Ellen Scott, Armalaga, Edna, Fern, Last Rose, named in order of ripening. These cover a season of ripening in north Texas (latitude of Atlanta, Georgia), from June 25 until September 15 or later. They include white, red and black colors in their different shades, many comparing favorably in appearance and quality with the better vinifera grapes, while the vines are all perfectly hardy in the South and some of them far north, making a fine record in New York and even about Boston. Some of these varieties are now planted largely along the Gulf coast country, where vine-culture was supposed to be impossible a few years ago.

The section of Texas south of San Antonio, lying between the Gulf and the Rio Grande River, as large in area as the state of New York, has a climate and soil excellently suited to the vinifera grapes, and in the last six years, since railroads began to ramify that section, and where irrigation facilities are afforded, considerable plantations of vinifera grapes have been made, the Flame Tokay, Malaga (Pensé), Muscat of Alexandria, Cornichon, Black Morocco, and so on, being the varieties chiefly used. Of course these require grafting upon resistant stocks, in all but the very sandy soils.

Georgia.

For Georgia, Hugh N. Starnes contributes the following notes:

"Leading varieties of grapes for Georgia are as follows: Ives, Concord, Niagara, Delaware, Moore Early, Goethe, Lindley; and for wine, Norton Virginia, Scuppernong and Thomas.

"The general distance apart to plant is 10 by 10 feet; Delawares 8 by 8 feet; Rotundifolias 30 feet. Single-stake spiral method of training is chiefly used, and either spur-renewal or cane-renewal pruning employed, according to circumstances. Some growers employ trellises instead of single stakes, using either one or two wires and adopting the umbrella Kniffin or low wire arm spur Kniffin system of training.

"Very little wine is now made in this state, and that is nearly all claret from Norton Virginia, Ives or Concord. In southern Georgia a poor article of Scuppernong wine is made, but it is not adapted to trained palates. Delaware and Goethe blended are sometimes used to make a very good Rhine wine, and when properly handled sometimes produce an excellent article. Goethe must, reinforced with 20 per cent of California brandy, makes a good pale sherry; yet it is difficult to sell wine here profitably. When it can be sold at all, prices range from 50 cents to $2 a gallon, according to the grade. Grape vinegar, while generally regarded as inferior to cider vinegar, will bring about 25 or 30 cents at retail and 20 cents wholesale, and at these figures is more profitable than wine.

"When sold fresh, the grapes are generally shipped in refrigerator cars in ten-pound baskets to different northern points. Later shipments take a southerly direction to Atlantic, and Gulf seaports. Sometimes the regulation six- or nine-carrier peach-crates are used for shipping grapes, but are not so satisfactory as the ten-pound separate baskets. Delawares are generally shipped in five-pound baskets. Returns are uncertain. They vary from 1½ cents a pound to 5 cents according to circumstances. Sometimes as high as 10 cents is realized on very early and very late shipments or with choice grapes, but this is seldom. Distilleries pay three-fourths of 1 cent a pound delivered, or gather and pay ½ cent a pound. If only one ton to the acre of grapes is the yield, the gross return (and also the net return) an acre would thus be from $10 to $15. This is more than cotton ordinarily nets. With two tons to the acre of grapes, which is not an enormous yield, the return would be $30 an acre delivered at the still. To those who have no scruples in regard to so disposing of their crop, this is probably the most profitable method. There are local stills in almost every county.

There is not much encouragement now for grape-raising in Georgia, and vineyards are annually being destroyed by hundreds of acres. Some planting, however, is still going on in southern Georgia, in the "wire grass" country, where the industry is still found profitable by reason of the fact that the northern market may be entered ahead of competition, and also that insects and fungous pests have not yet put in an appearance in that region.

Planting, training, and the like.

The vines of the true southern grapes, such as Herbemont and the Post-oak grape hybrids, are planted 12 to 14 feet apart, in rows 9 feet apart, while such northern varieties as are planted are set 8 feet apart in row. The Muscadines, such as Scuppernong, are mostly grown upon arbors about 7 feet high and rarely or never pruned, although trained on trellis, as are other grapes, and, pruned early in fall, after leaf-fall, succeed excellently. The culture is mostly with the plow, turning first away and then to the rows, hoeing the space along the row not reached by the plow. The trellis mostly used is the 3-wire trellis; first wire at 18 to 24 inches from the ground, and the others successively 1 foot apart, above the first. The training is commonly an indifferent attempt at the Kniffin system, and no system is generally carried out. Some pinch back the leading shoots once, few twice. Some use single posts and spur-prune. A few have made the Munson canopy trough trellis of 3 wires, and report most favorably of it.

Fungicides are used successfully by some. Others plant only such as Ives, Norton Virginia, Moore Early, Perkins, and some other varieties not subject to rot and mildew, so as to avoid spraying. They also avoid, thereby, having grapes of the finer qualities, and get only the lowest prices. From such mostly come the report that grape-culture with them is unprofitable. So it should be, as such grapes in the market have the effect to depress prices on all kinds of grapes. In the moister parts of the South, black-rot, downy mildew and ripe grape-rot are very prevalent, but, excepting the ripe rot, are readily overcome by the bordeaux mixture spray properly applied.

Few growers in the South use fertilizers in their vineyards. Some use barnyard manure, but the more intelligent use cotton seed or cotton-seed meal in connection with ground bone, kainit and soluble phosphates.

Marketing and profits.

The crop is mostly marketed fresh in the local or nearby markets, as the ordinary freight and express rates will not permit profitable returns on the varieties mostly grown. But it has been demonstrated that fine grapes that will carry well can easily be grown in the South, and, when handled in best manner in neat baskets, are profitable.

There are a few established wineries in the South, which use Ives, Norton Virginia, Herbemont, LeNoir, and the Scuppernong and other Muscadine varieties. The chief complaint of wine-growers is that legislation brought about by the prohibition movement is adverse and often entirely prohibitive. In consequence, some have bottled the juice fresh under some sterilizing process, but the people are not yet educated up to the use of this excellent, healthful, nourishing beverage; yet the demand for it is growing, and may be largely increased by enterprising makers.

Reports collected from all parts of the South state the profits all the way from nothing up to $150 an acre, sometimes higher, and it is clearly evident that the intelligence and enterprise of the planter are the chief elements in controlling profits. Of course, localities, soils and varieties play important parts, but an intelligent grower would not select poor locality, situation, soil and varieties to start with, just as he would not pursue poor methods in the conduct of the business.

There appears no reason why the South may not become one of the greatest grape countries in the world and it promises everything to the wide-awake, intelligent grape-grower, for its capabilities are unlimited in the production in quality and season when no other section competes with it, and it has vast markets at home and in the great cities just north of it.

T. V. Munson.

Grapes on the Pacific slope.

Grape-growing was introduced into California by the Franciscan Missions during the latter half of the eighteenth century. At all the missions from San Diego to Sonoma the same variety was cultivated practically exclusively. This variety, now known generally as the "Mission" or locally as the "California" and "El Paso," reached California from Mexico through the Jesuit missions of lower California. It seems probable that it was brought over from Europe as early as the time of Cortez but it has never been completely identified with any European variety. It is very close to the Monica of Sardinia which it resembles in its great vigor, heavy growth, the form of its leaves, the size, shape, color, texture, and flavor of its fruit, and differs principally in the less dense indument of its foliage. It seems probable that it is a seedling of this variety selected by the padres on account of its close resemblance to its parent, which is a favorite with the monks of Sardinia. It was admirably adapted for the purposes of the missions, for besides being a good table grape, keeping well and not sensitive to primitive methods of handling, it could be used for the manufacture of white or red wine and was especially adapted to the production of a sweet wine of sherry type.

For a long time, even after the American occupation of California, it remained the only variety grown in vineyards, but, with the arrival of immigrants from various grape-growing countries, other varieties were introduced, and, at present, it is little grown in California except as a good, cheap, easily handled table grape for local supply and in some regions as an ingredient in the manufacture of sweet red and white wines. It still forms the bulk of the vines grown on the Mexican plateau and extends into New Mexico and southwestern Texas, but is gradually giving way even there to varieties better adapted to special purposes. At present, Zinfandel for wine, Muscat of Alexandria for raisins, and Flame Tokay for shipping, constitute the bulk of the grapes grown in California, although about twenty-five varieties are grown on a large scale and over twice that number in considerable commercial quantities. Including all the varieties which occasionally or locally appear on the market as table, raisin or wine grapes, there are over one hundred varieties of commercial importance.

All these varieties, with one or two unimportant exceptions, belong to the European type, *Vitis vinifera*. Varieties of *V. Labrusca* and other American types grow vigorously and bear well except in the hottest and driest sections, but the grapes are unsuited for the main purposes of the industry in California. They cannot be made into raisins, are inferior to vinifera for wine and are less suitable for distant shipment as table grapes. Scattering, small patches of the variety Pierce (an improved sport of Isabella) are grown in the cooler parts of the northern coast counties, and an occasional patch of Concord in the San Gabriel Valley. The crop of these vines finds a market in San Francisco, Los Angeles and other large coast towns and is often very profitable, but the market is small and easily over-stocked. These grapes attain regularly a higher percentage of sugar and lower acidity than is usual in the eastern states and they have been used successfully in the manufacture of unfermented grape juice, for which they are particularly adapted.

The vineyard industries of the Pacific slope, however, will always be based principally on the growing of vinifera grapes, owing both to their greater intrinsic value for most purposes and to the fact that they cannot be grown on a large industrial scale in any other part of the United States.

Certain American species of vines are nevertheless essential to the success of California grape-growing, owing to their resistance to the phylloxera which rapidly destroys all vinifera varieties whenever it secures a foothold in the vineyard. They are useful as stock on which to graft the vinifera varieties and are extensively used in the northern and central coast counties and in certain sections of the great valley and the Sierra foothills. The insect has not yet become established in southern California nor in Imperial. The chief resistant stocks used are varieties of riparia and rupestris, although certain hybrids of these species with Berlandieri, and vinifera are also used for special conditions. The Labrusca varieties are almost as susceptible to injury from phylloxera in California as the vinifera and also require grafting on resistant stock in infested regions.

The most essential requirement for the successful growth and bearing of vinifera varieties is a dry summer with abundant sunshine and a winter cold enough to render the vines dormant for at least several weeks. These conditions are found in California from the Mexican to the Oregon borders, and in favored locations in several of the other Pacific slope states. Along the coast north of Monterey Bay, the summer sea fogs interfere with the ripening of the grapes and make the control of the oidium difficult. These sea fogs cover a belt which in the north extends considerably into the interior but gradually becomes narrower as one proceeds south, until in the latitude of Santa Cruz, where the mean annual precipitation falls below 20 inches, grapes can be grown almost down to the sea. In the remainder of California, grapes can be grown almost everywhere that the elevation above sea-level is not too great. In the latitude of Napa the limit is about 1,500 to 1,800 feet. Farther south, vineyards are found at Ben Lomond in Santa Cruz County at 2,500 feet and at Colfax in Placer County at 2,400 feet. At these elevations vines succeed only in favored locations. In others and at higher elevations, killing frosts often occur both in spring and autumn.

Grape-growing in a large way began in California soon after the American occupation. In 1858, according to the State Register, there were 3,954,548 vines in the state, equivalent to about 6,500 arces. Collections of European varieties were introduced and state aid was secured for the promotion of viticulture. By 1870, the vineyard acreage had increased to nearly 30,000 acres. Wine was produced in fairly large quantities, but its sale was at first attended by many disappointments which discouraged planting and for ten years the new vineyards barely sufficed to compensate for the loss of vineyards by phylloxera in the north and a peculiar disease of unknown cause in the south.

In the meanwhile, the demand for Californian wines increased and a propaganda for extension with more suitable methods and better varieties was earnestly taken up. Again the state granted funds liberally, and the agitation resulted in vine-planting and cellar-construction throughout the state. At the same time, vast plantings were made in the new Fresno region and between 1880 and 1883 the vineyard area of California increased from about 35,000 acres to nearly 140,000.

This rapid expansion naturally led to over-supply and inferior products, which restricted further extension. In the period from 1891 to 1897 the vineyard area actually decreased owing to the rapid destruction of the vines of the large Santa Clara section by phylloxera and drought. In 1904 the vineyard area was estimated to be about 200,000 acres and since then the new plantings, especially of table grapes, have been steady and the area in 1913 may be estimated roughly at about 385,000 acres, of which about 75,000 consists of table grapes, 130,000 of raisin grapes, and 180,000 of wine grapes.

The vineyard products of California, according to the statistician of the California State Board of Agriculture, for 1912 were: Wine, 47,491,772 gallons; brandy, 8,721,693 gallons; raisins, 185,000,000 pounds; table grapes, 6,363 (1913) carloads.

1732. Trunk of a vinifera grape, with the fruit-bearing canes cut back.

Vinifera varieties of grapes have a very wide range of adaptation. They grow in all fertile soils, but succeed best in light, deep, warm loams in the valleys and on the hillsides. The American varieties used as stocks are less adaptable and some care must be exercised in choosing a stock suited to the chemical and physical character of the soil. The extremes of temperature and elevation endured by vinifera vines are very great, especially if care is taken in the selection of varieties.

In the Pacific coast states outside of California, the growing of grapes is still largely experimental. In parts of Oregon and near the confines of Idaho and Washington almost to the borders of British Columbia, vinifera varieties of table grapes are giving very promising results in favored locations. The vines need some protection in the winter by covering with straw or earth, but the hot, dry summer will ripen even such southern and late varieties as Flame Tokay and Cornichon. The American varieties succeed in a much wider territory in these states. The varieties most favorably mentioned are Concord, Delaware, Diamond, Moore, Niagara and Worden. In parts of Arizona and of southern Nevada and Utah, vinifera vines have been planted and promise to be profitable for local sale or, in special locations, for early shipments.

Propagation and cultivation.

New vines are grown from cuttings of one-year-old dormant wood. These cuttings should be from 10 to 18 inches long, the shorter cuttings for moist soils in the cooler localities and the longer for drier soils in hot regions. A 14-inch cutting is usually employed. It is generally best to root the cuttings in a nursery and plant them out in the vineyard the following spring. In well-prepared, moist soil they may be planted directly in place, only one bud being left above the surface. Where phylloxera exists, resistant vines must be used. These are obtained by grafting a one- or two-bud cutting of vinifera on a 9- to 12-inch resistant cutting from which the buds have been removed. This graft is united in a callusing bed, rooted in the nursery and planted out in place when one year old. The resistant stock is often first rooted in the vineyard and grafted in place when one or two years old. This method is uncertain and gives many poor unions except with a few stocks and in very expert hands.

1733. The canes of a vinifera grape before pruning.

The soil should be plowed as deeply as practicable before planting. The best vineyardists turn the soil 9 to 12 inches, often following with a subsoiler penetrating 6 or 8 inches deeper. This treatment results in a more complete "stand," quicker development and full bearing at three to five years. It is especially useful for grafted vines.

Resistant stocks.

The principal phylloxera-resistant stock grown is the rupestris St. George (=du Lot). It succeeds in a wide variety of soils providing they are deep, permeable and well supplied with water below. In shallow, compact or very wet soils it often fails. It forms good unions with most of the common vinifera varieties. Exceptions seem to be, in some localities, Emperor, Cornichon and Muscat. For the shallower soils of the coast counties, riparia × rupestris 3309 is to be recommended; for stiff clay soils, Berlandieri × rupestris 420 A; for rich, moist, well-drained soils in the cooler locations, riparia gloire de Montpellier. For varieties of difficult affinity the Mourvèdre × rupestris 1202 is promising in soils similar to those suited to St. George.

Pruning and thinning.

It must be recognized that the vinifera grapes have a different habit of growth from the native grapes grown in the East. They are not always trained on wire trellises. The old trunk (Fig. 1732) is short and stump-like and supports itself. The cane-growth (Fig. 1733) is relatively short, and it is cut back to near the head of the trunk, as shown in Fig. 1732, and also in Fig. 1734.

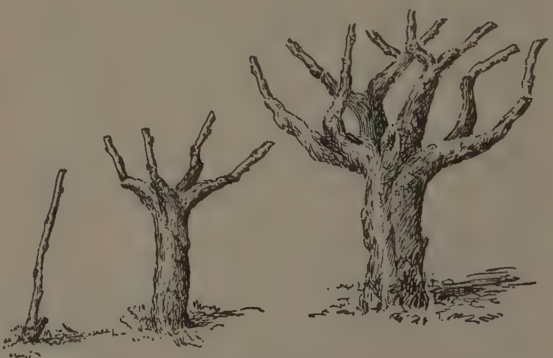
In the first year, the vines need no attention except thorough cultivation and one or two irrigations in dry sections. In the following winter, the dormant growth is thinned to one cane which is cut back to one or at most two buds. The vines should then be staked. Redwood stakes, 3 to 4 feet long and 1½ inches thick, are the best, placed 2 inches from the vine on the leeward side. These are sufficient for the goblet system of training, but longer stakes may be necessary when canes are left at pruning.

During the second year, all buds or shoots but one should be removed before they have made any considerable growth. The whole energy of the vine is thus forced into a single shoot which should be carefully tied to the stake and, if vigorous, topped at about 3 feet to cause it to produce laterals. All suckers from below ground should be carefully removed at their origin and also any cion roots which may develop on grafts. At the second winter pruning, all canes but one should be cut off clean if more than one has been allowed to grow. This cane should then be cut back to the height at which it is desired to "head" the vine, which will be about 15 inches for small-growing vines such as Zinfandel and 24 to 30 inches for heavy-growing vines such as Flame Tokay. Table grapes, as a rule, are headed higher than wine or raisin grapes. When strong laterals have developed, these should be left with one or two buds when they occur in positions where it is desired to develop arms.

In the third year, no shoots should be allowed to develop on the trunk of the vine within 8 to 15 inches of the soil, according to the height of the head. It is usually necessary to pinch back all the shoots from the head when they are 15 to 18 inches long to protect them from wind injury while they are still brittle. At the end of this year, the vine should have developed sufficiently so that it can be given three to six spurs in the positions desired for the permanent arms. These spurs should consist of two to four buds, the more vigorous the vine the more spurs and the more buds.

In the future prunings, the number of spurs is gradually increased until the vine reaches its adult stature. The number will vary from four or five to fifteen or twenty, according to the vigor of the variety and the distance apart of the vines. During the first four or five years, great attention should be given to forming the vine with a clean vertical trunk and symmetrically placed arms and also, with grafted vines, to the careful removal of stock suckers and cion roots. As the vines become older and less vigorous, the spurs left at the annual winter pruning should be shorter, consisting usually of only one or two complete joints.

This method of pruning, illustrated by Fig. 1734, is known as the vase or goblet method and is adopted in most of the vineyards of California. A few varieties, notably the Sultanina (=Thompson Seedless) do not bear satisfactory crops with this method. For such varieties the treatment for the first three or four years is the same, but at that time it is necessary to erect a trellis. This consists usually of two No. 11 or No. 12 galvanized iron wires stretched along the rows at about 18 and 36 inches from the surface of the soil. These wires are supported by redwood stakes 6 feet long and about 2 inches in diameter. The vines are then pruned by leaving a suitable number of "fruiting canes" about 4 to 6 feet long, which are tied to the wires. Near and below the base of each fruiting cane is left a "renewal spur" consisting of two buds, whose function is to supply a fruit-cane and renewal spur for the following year. Care should be exercised to choose fruit-canes which originate from the spurs of the previous year and not from older wood. The vines, instead of being given the symmetrical goblet form described, should



7734. The common short-pruning goblet system used for the vinifera grape in California.

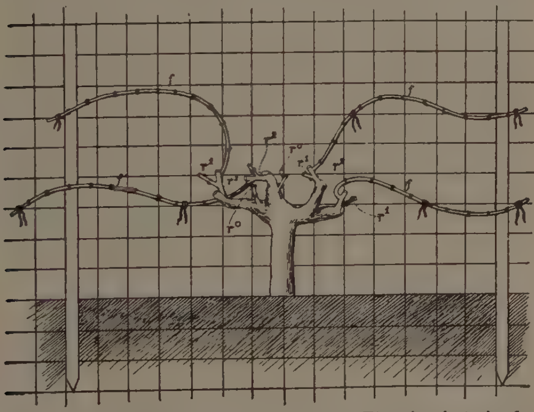
be flattened fan-shape to facilitate cultivation, which can take place only in one direction. This method of pruning and training is shown in Fig. 1735.

Goblet-pruned vines are planted on the square system from 7 to 12 feet apart, 8 feet apart being usual for the northern coast counties and 9 or 10 feet for the hotter regions. Muscat of Alexandria vines are usually planted 6 by 12 feet to 8 by 14 feet to facilitate drying the raisins, and trellised vines are usually planted in the same way.

Some special practices and modifications of the usual methods are found to be useful in the production of table grapes for shipping. In general, the vines should be raised a little higher and the arms given a somewhat wider spread. This is to keep the fruit from contact with the soil and to spread out the bunches so that they will develop, ripen and color evenly. The removal of water-sprouts and sterile shoots, not needed for new arms, before or soon after the grapes set is also very useful. This tends to make the bunches and berries larger by concentrating the energies of the vine on the bearing shoots. An equally important effect of this practice is to facilitate the gathering of perfect bunches. When neglected, the water-sprouts often grow through the bunches. Such bunches cannot be gathered without injury. Some of the grapes are pulled off, some broken and, worst of all, some of them are slightly loosened around the pedicel. Most of the broken berries can be removed by the trimmers in the packing-house, but many of those simply loosened escape their scrutiny and are a fruitful cause of decay.

Many otherwise suitable grapes do not ship well on account of the excessive compactness of the bunch. A compact bunch is difficult to pack without injury and cannot be freed from imperfect berries without spoiling good berries.

This excessive compactness can be prevented by thinning before the berries are one-third grown. Thinning, moreover, increases the size of the berries, hastens ripening, promotes coloring, and lessens some forms of sunburn. The practice has been employed with success by growers of Tokay, Black Morocco, and other grapes in northern California. While apparently costly, the expense is often more than counterbalanced by the saving in trimming of the ripe grapes. The increase of quality thus becomes a net gain.



1735. The long-pruning of vinifera vines. The vine is trained on two horizontal wires.

f f, Fruit-canes growing out of the renewal spurs r^2 the previous year; r^1, renewal spurs to supply fruit-canes for the following year; r^0, replacing spurs to supply wood for use when the over-elongated arms are cut back.

The bunches are thinned at any time after the berries have set and before they have reached one-third their mature size. No bunches are removed, but only a certain proportion of the berries of each bunch. The number of berries to be removed will depend upon how compact the unthinned bunches usually become. In general, it will vary from one-third to one-half of the total number. The thinning is effected by cutting out several of the side branchlets of the bunch. The branchlets should be removed principally from the part of the bunch which has most tendency to compactness, usually the upper part. The work can be done very rapidly as no great care is necessary in preserving the shape of the bunch. However irregular or one-sided the bunch looks immediately after thinning, it will round out and become regular before ripening. A long, narrow-bladed knife or a pair of grape-trimming scissors can be used conveniently for this work.

1736. Tokay grapes.

Harvesting and packing.

The grapes should not be harvested until they contain at least 17 to 19 per cent of sugar, varying with the variety and the locality. Unripe grapes are distasteful to the consumer, spoil the market for later and better grapes, and are more liable to deterioration from wilting and decay. After every care has been taken to produce good shipping grapes on the vines, their proper handling is no less important. A bunch of grapes which is perfect in the vineyard may easily be ruined by careless gathering or hauling before it reaches the packing-shed.

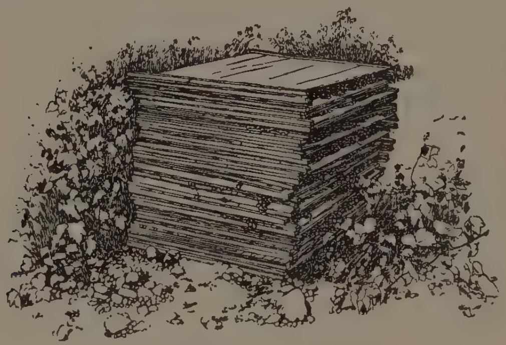
The grapes, in gathering and packing, should be touched as little as possible and handled only by the main stem. They should be placed carefully in wide, shallow boxes in a single layer. Hauling to the packing-house should be done very carefully, in wagons provided with springs. The grapes should be protected from the dust and the direct rays of the sun, and the boxes should be so stacked that there is no danger of crushing the grapes. Fig. 1736 shows two crates or boxes of grapes.

The most usual way of packing table grapes in California is in square chip baskets holding about five pounds and placed in fours in open-sided crates. Extra-large bunches or "clusters" are sometimes packed in oblong baskets of twice this size, of which two are placed in a crate. Experiments have been made with various "fillers" to protect the grapes during transit and to increase the time during which they will remain in good condition. The cork-dust or waste used in Spain for the grapes of Almeria is unavailable. Various substitutes have been tried. Early attempts to utilize ordinary sawdust for this purpose proved unsuccessful for the reason that the grapes failed to hold in good condition and absorbed disagreeable flavors from the wood. Recently it has been demonstrated that pure, dry redwood sawdust, from which the chips and finest particles have been removed by screening, is even superior to ground cork for grape-packing. Redwood is neutral in odor and flavor and imparts no disagreeable taste to the grapes packed in it and held in cold storage. During the past three years this method of packing and storing has received wide commercial application. The shipments of Emperor grapes packed in sawdust during 1913 amounted to nearly 300 carloads. Table grapes for local markets are often shipped in the fifty-pound "lug" boxes in which they are gathered.

Raisins.

Practically all the raisins in California are sun-dried. Artificial driers were formerly used to some extent to dry the second crop of Muscat and are still used occasionally to finish drying in seasons of early rains. The second crop is now utilized by the wineries.

Muscat grapes should not be gathered for raisin-making until they show at least 24° Bal.* of sugar. Better raisins are made at 26° to 27° Bal. The crop increases with increasing ripeness. At 27° Bal. the yield of raisins to the acre may be 40 per cent greater than at 23° Bal. The grapes are gathered on wooden trays with cleats, holding twenty-two pounds of grapes which dry to five and one-half to seven pounds of raisins. The trays are furnished with bottom and top end cleats which allow a space of 2½ to 3 inches for the grapes when they are stacked. The filled trays are placed in alternate rows running east and west where the soil has been given a slight inclination by means of a V-shaped scraper in order to expose the grapes more directly to the rays of the sun. After about nine to twelve days, the grapes are turned by placing an empty tray on top and inverting the two trays together. In about three to four days after turning, they are dry in good weather, but the total time of drying may vary from about ten days to nearly a month according to the ripeness of the grapes and the temperature and moisture of the air. The best raisins are made when the average maximum daily temperature lies between 85° and 90° F. Above 100° F. the grapes are somewhat injured in flavor and appearance but still make good loose or seeded raisins. If rain falls after the grapes have begun to dry, especially after they have been turned, they are liable to injury. When rain threatens, it is sometimes necessary to pile the trays up in stacks and to spread them out again as soon as the rain or the danger is over. In some seasons this stacking has to be repeated two or even three times, much increasing the cost and time of drying. (Fig. 1737.)



1737. Stacked trays of raisins.

When the grapes are nearly dry, the full trays are stacked in piles of 12 or more and covered with an empty tray. Here the drying is completed and the moisture equalized. They remain in the stack for a week or more and are then placed in large "sweat-boxes" holding about ninety pounds of layers, or 125 pounds or more of loose raisins. When fine layer raisins are made, these are picked out by hand before putting in the sweat-boxes and the layers separated by sheets of paper. The raisins are delivered to the packing-houses in the sweat-box.

Sultanina and Sultana grapes are sometimes cured in the same way as the Muscats, but the resulting raisins are of a dark amber-color and cannot compete with the light golden yellow Sultana raisins. These are made by passing the grapes through a "dip" and then through a sulfur-box before drying.

Various dips are in use, the commonest being composed of one pound of good potash lye in twelve gallons of water. This is kept boiling hot and after immersion in it for an instant, the grapes are plunged in cold water and placed on the trays. Some growers add an emulsion made of three-fourths of a pound of lye, one quart of olive or of the purest cottonseed-oil, and three quarts of water. A gallon of this emulsion is added to each ten gallons of the lye-dip. Some growers say that they secure equally good results by dipping simply in boiling water. Similar dips are sometimes used to facilitate the drying of second-crop or inferior Muscats and such grapes as Malaga and Feher Szagos.

After dipping, the grapes on trays are exposed to sulfur fumes and spread out to dry. In hot weather much of the drying is done in the stack, too much exposure to the hot sun tending to darken the color of the raisins.

Raisins or dried grapes are of four main classes: (1) Raisins proper, of which the dried fruit of the Muscat of Alexandria is the type. California produces more than half the world's crop of this class. Most of them are made from the Muscat of Alexandria or from its variation, the Muscat Gordo Blanco. When the demand is good, Malaga, Feher Szagos and occasionally other large sweet white varieties are used. (2) Sultana raisins are made from the Sultanina (=Thompson Seedless or Oval Kechmish). California also produces large quantities of this class, the principal centers of production being the upper San Joaquin Valley and Sutter County in the Sacramento Valley. The Sultana (=Round Kechmish), also a seedless grape, is grown in large quantities, principally in the Sacramento Valley. From it is produced a raisin resembling a small Sultana in appearance but more allied to a "currant" in flavor. Both of these varieties require long pruning with fruit-canes of 4 to 8 feet. (3) Currants which are made from the very small seedless Black Corinth and to a less extent from the somewhat larger White Corinth, are not produced on a commercial scale in California. The Black Corinth does not bear and the White Corinth produces a raisin which is too large to pass as a "currant" and too small to secure a remunerative price as a "Sultana." (4) Dried grapes are made from almost any kinds and are occasionally produced in large quantities when the price of fresh grapes is low. They are used for various purposes, principally for the manufacture of imitation wines in foreign countries.

Grapes for shipping.

Table grapes are grown all over California for family and local consumption and include hundreds of varieties, principally vinifera. The commercial growing of table grapes, however, is for the purpose of shipping to large centers of population, especially in the eastern states. It is localized in certain regions and utilizes a comparatively small number of varieties.

The earliest grapes come from Imperial County in June, followed in July and early August from Fresno, Kern and Tulare Counties and from the warm eastern slopes of the inner coast range in Yolo County. The earliest variety is the Luglienga, usually shipped under the erroneous name of Madeleine; the next the Chasselas doré, usually called Sweetwater; both are white. These varieties have not given satisfaction in Imperial, where Persian No. 23, and allied varieties, promise

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24° Bal. means that the juice has the same concentration as a pure sugar solution of 24 per cent. The juice is tested by a Balling hydrometer for sale by all chemical supply houses.

better results for the earliest markets. The Khalili is even earlier then the Luglienga and seems promising for Imperial. Blue Portuguese is the only very early black grape that appears on the market and is of poor quality. Bellino is promising for Imperial County but loses its extreme earliness farther north. By the middle or end of July all varieties are ripe somewhere, the latest varieties ripening about that time in the earliest localities. Distinctions regarding earliness apply, therefore, more to districts than to varieties.

The Flame Tokay, which appears to be identical with the Amar bou Amar of Algeria, is the chief shipping grape of California. It fails to develop its bright red color in Imperial so that the first shipments are from the Winters and Vacaville region. The bulk of the crop is raised in the middle part of the Great Valley from Stockton to Sacramento, Lodi being the principal center. There are numerous other smaller centers of production, the latest being the Santa Cruz Mountains. The next most abundant varieties are the Malaga, the principal variety of the Imperial Valley, a white grape raised largely also in the San Joaquin Valley from Tulare to Stanislaus County, and the Emperor, a large, late red grape raised chiefly in Tulare and Fresno but more or less in several other counties from Los Angeles to Sacramento County. In the cooler regions its color is almost black. The Cornichon (=Malakoff Isjum), a long, late, black grape, the Black Prince (=Rose of Peru), a moderately early round grape, and the Verdal, a very late white grape, are also largely raised, the last only in the Santa Cruz Mountains. The Black Morocco (=Trevoti), the Ferrara, the Gros Colman and the Pizzutello are also raised in considerable quantities. Promising new varieties are the Olivette de Cadenet, Flame Muscat and some of the Persian varieties, especially the Paykani Razuki, a brilliant red grape which bears well only when grafted, except in the Imperial Valley. The Muscat of Alexandria and the Sultanina (=Thompson Seedless), while primarily raisin grapes, are shipped as table grapes in large quantities in most seasons. The only eastern variety grown for the market is the Pierce, which satisfies the small demand for a "slip-skin."

All the varieties of table grapes mentioned succeed with the goblet form of pruning, although some, such as the Malaga, Cornichon and Emperor, require fairly long spurs and in very rich soils even moderate long pruning.

The grape season in California extends over at least six months. The earliest varieties ripen in the Imperial and Coachella Valleys by or before June 1 and the latest varieties in the latest localities do not ripen until November 1 and in dry autumns may hang on the vines in good condition for a month longer.

Grapes for wine.

The great bulk of all the red wine, both dry and sweet, is made from the Zinfandel. This variety was introduced very early into California but its identity has never been established. It has many good qualities. It bears at an early age and with short pruning. If the first crop is destroyed by spring frosts it produces regularly a fair second crop. It succeeds best in the warmer parts of Napa and Sonoma Counties. In the cooler parts it fails to develop its color or flavor. In the hot interior it is subject to sunburn and its peculiar flavor becomes unpleasantly intense. Other widely grown red wine grapes are Petite Sirah, Alicante Bouschet, Carignane, Mataro and, in southern California, Blue Elbling. Varieties recommended for dry red wine in the coast counties are Petite Sirah, Barbera, Beclan and Cabernet Sauvignon; for the hotter interior, Valdepeñas, Lagrain and St. Macaire; and for sweet reds of Port type, Grenache, Alicante Bouschet, Tinta Madeira and Trousseau.

The dry white wines are made from a large number of grapes of which the chief heavy-bearing varieties are Burger, Palomino, Feher Szagos and Green Hungarian and the chief high quality varieties, Colombar, Semillon and the Rieslings,—Johannisberg, Franken and Gray. The sweet white wines are made from the above-mentioned heavy-bearing varieties and also from Mission, Grenache and other light-colored red grapes. Large quantities of wine and brandy are also made from the culls of raisin and table grapes and in years of over-production from the main crop. Varieties recommended for dry white wine are the Rieslings in the coolest localities, Semillon and Colombar for the warmer parts of the coast counties, and Burger, Green Hungarian and Vernaccia Sarda for blending wines in the interior. For sweet wines Palomino, Beba, Mission and Grenache are suitable.

Various degrees of pruning are needed for these different varieties but in a general way the heavy bearers should be pruned short and the fine varieties long.

Diseases and insects.

Vines on the Pacific slope are remarkably free from serious fungous diseases owing to the absence of summer rains. Oidium (*Uncinula spiralis*), the only exception, occurs everywhere but is controlled cheaply by one or two thorough dustings with fine sulfur in the warm interior and two to four in the coast regions. The ubiquitous saprophytic blue, gray and black molds sometimes injure late grapes in wet autumns.

Insect pests are more serious. The phylloxera renders resistant stock necessary in most of the older districts. The vine-hopper (*Typhlocyba comes*) is often very troublesome in the warmer regions, but its attacks can be much lessened by complete clearing out of green growth a week or two before the starting of the buds, timely use of a hopper-cage to trap the over-wintering adults in early spring before they deposit their eggs and by a nicotine spray in May or June when the first brood appears. Much injury is done locally by the grape root-worm, the larva of the grape beetle, *Adoxus vitis*. It can be controlled by spraying the vines in May with lead arsenate which kills the adults before their eggs are laid. Erinose (*Phytoptus vitis*) is widely distributed but seldom harmful and easily controlled with dry sulfur as used for oidium. Climbing cut-worms (larvæ of Noctuid moths) are very generally harmful to the buds and young shoots in many seasons. Most species can be controlled by the use of poisoned bait. The bait most used is made by mixing forty pounds of bran with two gallons of molasses and five pounds of arsenic. A better bait is made by mixing twenty-five pounds of bran and twenty-five pounds of middlings with five pounds of arsenic and applying dry. A pinch of the bait is placed at the base of each vine or, with large vines, in the center of the head. Grasshoppers and other general feeders are sometimes troublesome, especially in new districts.

A number of imperfectly understood diseases whose causes are unknown are recognized. The chief of these is the Anaheim or Californian disease. This name is inappropriate as it seems to occur also in southern Europe and Algeria where it is ascribed to over-bearing coincident with a series of dry seasons or other weakening causes. Another widely spread disease of a similar nature but less fatal is known as Little-leaf. Various causes for this disease have been suggested, but the most plausible opinion seems to be that it is a case of mal-nutrition due to unfavorable soil temperatures during the spring.

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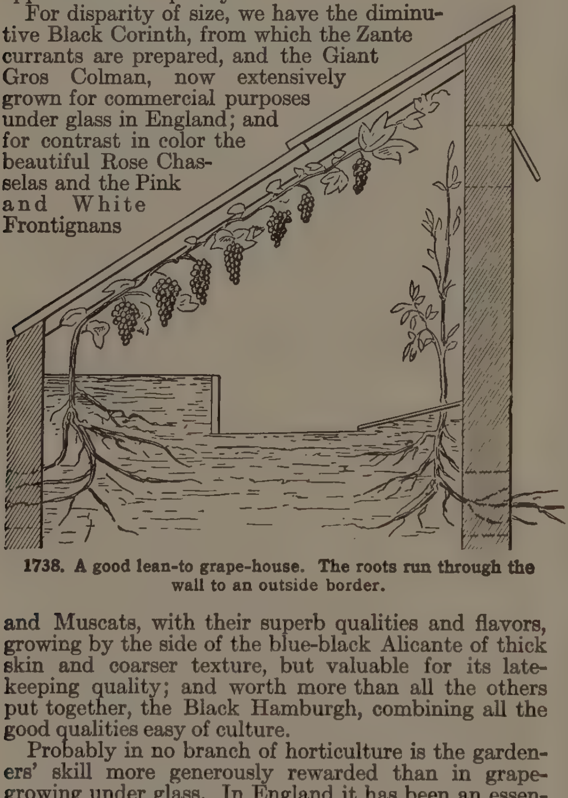
States Dept. of Agric., 1902, article on "Grape Raisin and Wine Production in the United States;" Yearbook, 1904, article on "Some Uses of the Grape Vine and its Fruit;" Farmers' Bull. No. 471; U. S. Dept. of Agric. Bull. No. 35; Reports California State Viticultural Commission; Gustav Eisen, "The Raisin Industry." F. T. Bioletti.

Grapes under glass. (See, also, page 1261.)

Under glass, the European varieties alone are used. This species, *Vitis vinifera*, is the vine of the ancients, and is indigenous to the more salubrious parts of eastern Asia and southern Europe. It is referred to in the earliest mythological writings of ancient Egypt and thence on numberless occasions, notably in the Bible and the New Testament. The story of the spies from the promised land, with its generous illustration, has excited the admiration and perhaps questioned the credulity of many of us. It is only fair, however, to state that the size of the cluster there represented has been amply borne out in recent years. The type *Vitis vinifera*, if there ever was a type, has become so merged and modified by cultivation in different climates and countries that it is difficult to trace it at the present day. Over 2,000 varieties are described, covering the widest range in size, color, texture and flavor, general appearance and quality.

For disparity of size, we have the diminutive Black Corinth, from which the Zante currants are prepared, and the Giant Gros Colman, now extensively grown for commercial purposes under glass in England; and for contrast in color the beautiful Rose Chasselas and the Pink and White Frontignans and Muscats, with their superb qualities and flavors, growing by the side of the blue-black Alicante of thick skin and coarser texture, but valuable for its late-keeping quality; and worth more than all the others put together, the Black Hamburgh, combining all the good qualities easy of culture.


1738. A good lean-to grape-house. The roots run through the wall to an outside border.

Probably in no branch of horticulture is the gardeners' skill more generously rewarded than in grape-growing under glass. In England it has been an essential feature of horticultural work for more than a century, resulting in fruit of a finer quality and flavor than that grown in the open air and very often enormous clusters, weighing from twenty to thirty pounds. Started there as a matter of luxury, it has become of late years a matter of profit, and vineries of large extent have been erected for commercial purposes. Probably this work has been retarded here by the introduction of the many very excellent varieties of our native grapes, *V. Labrusca*, so easily grown in the open air and so constantly improved by hybridizing with the European, and undoubtedly this work will yet result in a much closer approach to the standard of European quality.

The essential difference between American and European kinds is that in the American the pulp separates from the skin, is usually tough and more or less acid, so that it is disagreeable to remove the seeds, while in the European the pulp adheres to the skin, is tender and sweet throughout, and the seeds are easily removed. European grapes, when well grown, are valuable and agreeable for the use of invalids, and, undoubtedly, in the judgment of the majority of persons, surpass in quality any other fruit grown.

The subject of grape cultivation under glass may be divided under several heads, as follows: *The houses; The border; The vines; The fruit.*

The houses.

Houses are mainly of two forms, span-roof and lean-to, with occasional modifications between. Unless one has ample time and a desire to study their construction, it is better to have plans and estimates furnished by professional builders.

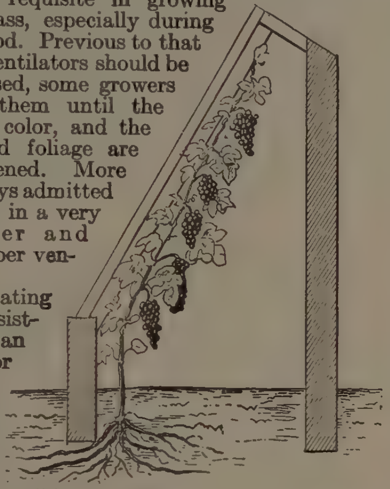
Span-roof houses are adapted to large places with spacious grounds, and especially where an ornamental effect is desired. On account of their exposure on all sides, they require very careful attention, especially if used for early forcing of grapes. When early work is not desired, or for use without artificial heat, their disadvantage is not so apparent. Houses without artificial heat, known as cold graperies, were in earlier years in more general use than those with heat, but have about disappeared with the introduction of the modern economical heating apparatus, and the very great advantage in the use of the same, if only to a limited extent.

Lean-to houses, on account of their snug construction and protection from northerly or prevailing winds, are especially desirable for early forcing of grapes (Figs. 1738, 1739). Often a stable or other building may be utilized for the north side, but generally a wall of brick or stone is erected for this purpose. Such a wall can be covered on the outside with *Parthenocissus tricuspidata*, or Crimson Rambler roses, producing a beautiful and ornamental effect. A good house, on a small scale, can be made of hotbed sash (Fig. 1739).

Foundations for the other three sides or for a span-roof vinery can be constructed of masonry or wood. Masonry is preferable, as the conditions of heat and moisture requisite are very destructive to woodwork, especially near the ground. With masonry, piers are erected, starting from solid ground and up to near the surface. They should be about 2 feet in length with spaces of 2 feet between, and opposite each space a vine is to be planted inside the house, as hereafter described. Strong capstones thick enough to come slightly above the surface of the border and about 18 inches wide are then laid from pier to pier. On such a foundation a superstructure can be erected with some confidence. For the base of the superstructure masonry is preferable, about 18 inches in height being necessary before the glasswork begins. A hollow wall, constructed of hard brick and cement, is desirable, and openings should be left for ventilation. The upper surface of these walls should be covered with cement. If constructed of wood, the same general plan should be carried out, using the most durable kind only.

Aside from its durability, masonry has an advantage over wood in being a better equalizer of temperature, and the heavy back wall of a lean-to house can be made of great value for this purpose. The general plans of the superstructure are shown in the illustrations. It should present as much glass surface as possible. The frame can be of iron or wood, as preferred. Light, heat and moisture are the great features desired, also a generous supply of air under favorable conditions. The glass should be of good quality, otherwise blisters will burn the foliage and fruit. Small ventilators should be built in foundation walls, and large ones at the upper part of house. A special ventilator covered with wire gauze is desirable for the lower opening. Ventilation should always be free from draft or sudden change of temperature. A draft is as unpleasant to a sensitive vine in a house as to a human being, and if subjected to it disease is sure to follow, mildew being the first evidence; and yet a generous supply of air is a prime requisite in growing grapes under glass, especially during the ripening period. Previous to that time the lower ventilators should be very carefully used, some growers never opening them until the grapes begin to color, and the new growth and foliage are somewhat hardened. More or less air is always admitted around the glass in a very equable manner and thence to the upper ventilators.

The modern heating apparatus, consisting of a boiler in an adjacent pit for heating water with circulating pipes throughout the house, as shown in illustrations, is a very perfect and economical supplier of heat, and it should be erected by a practical builder. A little heat at a critical time will often save a house full of grapes, and, while it can be dispensed with, its advantages are very material.


1739. Lean-to grapery glazed with sash.

It is possible to fruit grapes in benches in pots, removing the pots when the fruit is past, and using the house for other purposes (Fig. 1740).

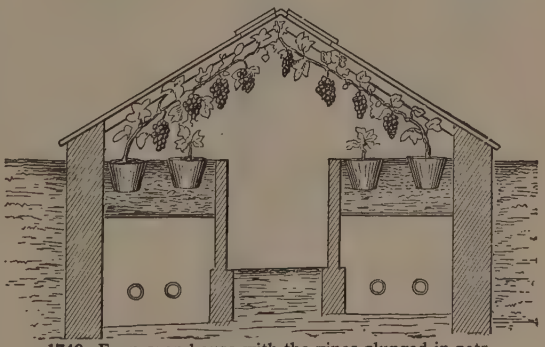
The border.

A good border is of great importance, as no permanent success can be obtained without it; probably the difference between success and failure more often lies here than in any other feature.

It is a good plan to construct vineries so that their borders can be somewhat elevated above the surrounding ground, as better drainage is thus secured, and good drainage is imperative (Fig. 1738). The border should fill the house inside and extend outside adjacent to where the vines are planted at least 6 feet when first made, and to this outside border additions should be made every two or three years of 2 to 4 feet until a width of 20 feet is secured. The border can hardly be made too rich, provided the material is well decomposed. A mixture of six parts good loamy turf from an old pasture or piece of new ground, and one part of well-prepared manure, one part old plaster or mortar, and one part of ground bone, all to be well composted together, will meet all the requirements. If the subsoil is clay, a foundation of old brick and mortar is very desirable to insure drainage. The border above this should be from 2 to 3 feet in depth. No trees or shrubs should be permitted to extend their roots into it, a very common cause of trouble, and nothing whatever should be grown on it, although the temptation to try a few melons or some lettuce is often too great to be overcome, and these probably do a minimum of damage. In such a border, if properly supplied with water, the vine roots will remain at home, and not go wandering off into trouble. When extra-early work is not desired, no attempt should be made to keep the frost entirely out of the border during the winter, as this is apt to result in a heavy, sodden surface in spring. It is better to spade it up roughly just before winter and cover with a good coat of manure, permitting the frost to enter the ground some inches. In the spring, it is dug over again and, when raked off, presents a rich, lively surface. The inside border is to be covered with a coat of well-rotted manure, and spaded up and well watered at the time of starting the vines. For midseason work from February 15 to March 1 is the proper time to do this in New York state, the inside border carrying the vines nicely until the outside border is in shape a month or more later. Then without hard forcing early grapes can be brought in by the last of June or July, and the later ones through the following two or three months. It is better to store late grapes in modern grape-rooms, where they can be kept fresh and plump for several months through the winter, than to attempt extra-early work by starting vines in heated borders in November and December.

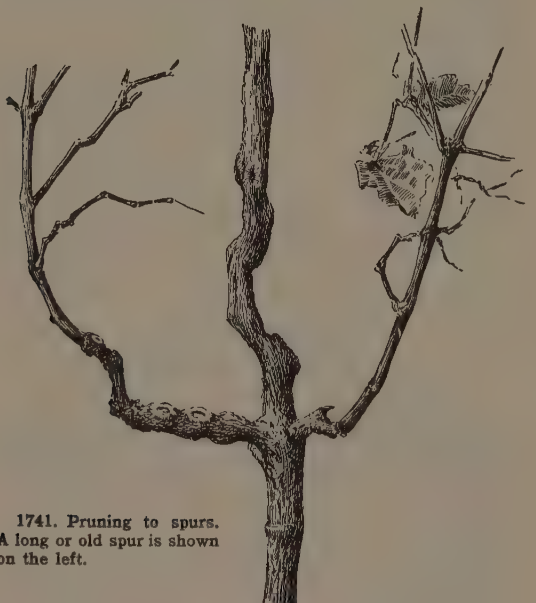
The vines.

The amateur should purchase plants from some nurseryman of established reputation. Vines one or two years old are better than older ones. For supporting the vines light cast-iron brackets are secured to the rafters, and these support wires running lengthwise of the house about 15 inches from the glass, and to these wires the vines are tied as fast as they grow. The vines are to be planted inside the house about a foot from the front wall and about 4 feet apart, placing one opposite each opening in the foundation as before described. It is not desirable to plant them along the back wall of a lean-to house. They should be cut back to two or three buds near the ground, and when these start the strongest shoot only is selected for training and the others rubbed off. As this shoot advances it is tied to the wires and it may reach the limit of the house by July 1, or perhaps not until September 1, depending on the care, the vigor of the vine, and the border. Once there, the end is pinched and the cane continues to strengthen and increase in size and store up material in the lateral buds until the end of the season, when it is taken down and pruned to one-third its length, laid on the ground and covered from the sun for the winter. Care should be taken that mice do not eat out the buds, as once out they can never be restored. In the spring of the second year, or as soon as it is desired to start the vines, they are tied up again, and the terminal shoot again trained to the top of the house, where it is stopped as before. Any fruit appearing on this shoot should be removed. The lateral shoots that start out each way below the terminal should be thinned to about 12 or 15 inches apart on each side. This is an important feature, especially if one adopts the spur system of pruning, which will be first considered, for the vine is being established for a long term of years, and it is desirable to have it symmetrical, with the side shoots and fruit evenly distributed over its entire length. An example of a well-balanced vine is the illustration of the Muscat of Alexandria (Fig. 1743). A few clusters of fruit may be taken from this part of the vine this second year, and the


1740. Even-span house with the vines plunged in pots.

laterals should be pinched at two eyes beyond the cluster, and as they break pinched again through the season. As soon as the leaves fall the vines are again taken down for pruning. The terminal should be shortened about one-half and side shoots cut back to a bud very close to the main stem, when it goes through the winter as before.

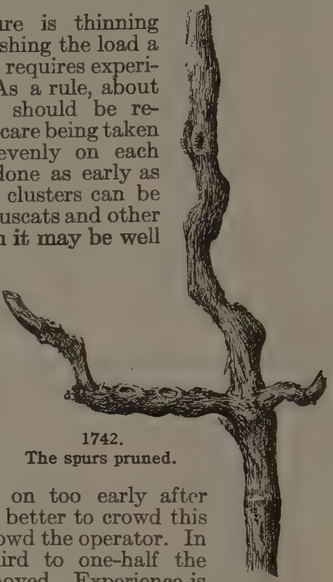
At the beginning of the third year, the terminal again goes to the top of the house without fruit, when it is stopped and the laterals are allowed to bear as before, say not more than one pound of fruit to a foot of the main stem. The vine is now established to the top of the house, and the only pruning in after years is to cut the laterals each year close to the main stem. A bud will nearly always be found in the first ⅛ inch, sometimes several of them. When these start, the strongest is selected and the others rubbed off, unless one is desired for training to the opposite side to fill a vacancy there. When the vines attain full strength, two pounds of fruit to the foot of main stem can be grown, but heavy loads require great care. Too heavy a load causes shanking, and then all is lost. The stems of the berries wither and the fruit turns sour before ripening. Rigid pinching of the laterals is very important. Commence at the second joint beyond the cluster, or about 18 inches from the main stem, and pinch thereafter as fast as new shoots break and show a leaf. Pinch early and often. It has been said that a good gardener can carry the summer prunings from a large vinery for an entire season in his vest-pocket. Some require a wheelbarrow. At the place where the laterals start, a spur soon forms on the main stem, from which the system takes its name. It often becomes several inches in length and quite ungainly. This spur system of pruning is represented in Figs. 1741–3.



1741. Pruning to spurs. A long or old spur is shown on the left.

In the other system of pruning, known as the "long rod" or "long cane" system, a new cane is grown up from a bud near the ground every year to replace the old one, which is entirely removed. It is sometimes desirable to replace an old cane fruiting on the spur system in this manner. If the vine is well established, this new cane can be fruited its entire length the first season, the laterals being pinched, as before described. It will produce finer fruit, but it is not so safe with a heavy load as an old cane.

An ample supply of water judiciously and freely used, especially at the time of starting the vines, is an absolute necessity. It should not be applied in the house, however, during the period of blossoming, as a dry air is advantageous for the transfer of the pollen for fertilization.



1742. The spurs pruned.

An important feature is thinning the clusters and establishing the load a vine has to carry. This requires experience and judgment. As a rule, about one-half the clusters should be removed,—often more,—care being taken to balance the load evenly on each side. This should be done as early as the general form of the clusters can be seen, except with the Muscats and other shy-setting kinds, when it may be well to wait for the berries to set, as some clusters set perfectly while others fail.

Thinning the berries should be attended to promptly, selecting cool days and mornings for this work. Close-growing kinds, like Alicante, cannot be commenced on too early after setting, and it is much better to crowd this work than to have it crowd the operator. In many varieties one-third to one-half the berries have to be removed. Experience is the only guide in this. A pointed stick is very useful with the vine scissors, and never touch the clusters with the fingers.

Tying up the shoulders of the clusters is necessary to permit a free circulation of air and light, otherwise the interior may decay, and, once started, the cluster is soon gone. The principal diseases or troubles to guard against are mildew and red-spider. The remedy for the former is sulfur, and for the latter moisture. Mildew is generally brought on by a sudden change of temperature. A vigorous condition of the vine has much to do in resisting it. Red-spider will almost always appear in the hot weather of July and August if the vines are allowed to become too dry.

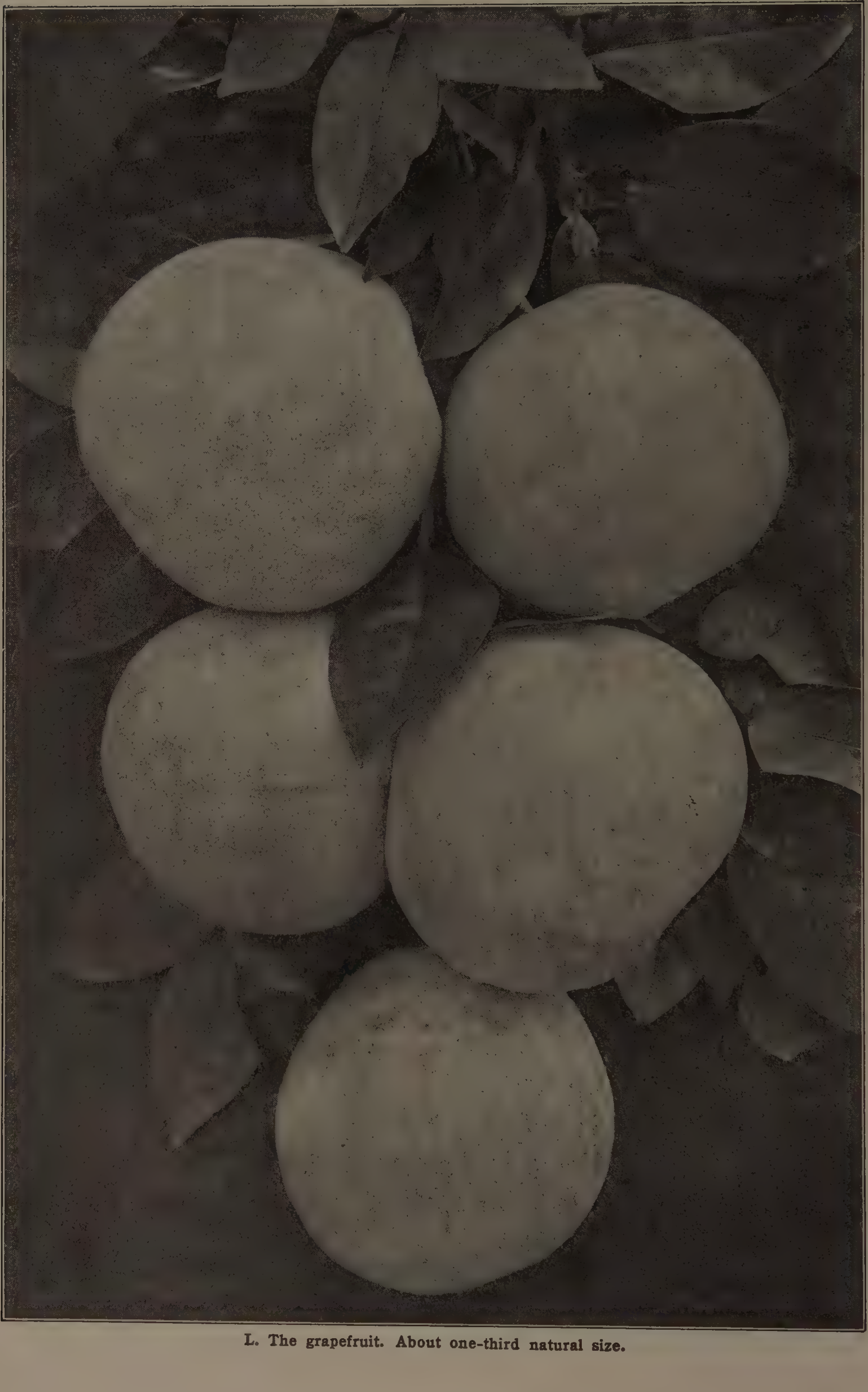
Thrips are sometimes very injurious, but can be controlled with nicotine, which, if properly applied, will not injure the fruit. Thrip and red-spider, if not taken in time, multiply rapidly, and "an ounce of prevention is worth a pound of cure" in these cases.

Perhaps, in a general way, the most important requisite of all is a large amount of enthusiasm and love for the work. This is necessary to insure the continued care and culture requisite to permanent success.

The fruit varieties.

As said before, very many varieties exist, but probably not one-half of these are in active cultivation at the present time. Varieties are adapted to localities, soils, climates, and the like. Perhaps fifty have been grown under glass in this country. Of these we will consider a few of the more prominent.

The Black Hamburg is more extensively grown and of more value for this purpose than all others put together, because it meets the requirements of the ordinary cultivator and will stand abuse and neglect and still give fair results, better than any other kind. It rarely gives very large clusters, but is a free bearer, sets fruit perfectly, will carry heavy loads and matures early. Under better care the appearance and improvement in quality is remarkable, and it can be made as good as the best. It is the variety with which the novice begins. Many houses consist entirely of Black Hamburgs, and many would give far better satisfaction if they did.



L. The grapefruit. About one-third natural size.

Muscat of Alexandria is the best of the white varieties for general cultivation. It requires a higher temperature and longer season than the Black Hamburgh to come to perfection, and will keep longer after cutting than that variety. When well grown and ripened it many be taken as a standard of quality. (See Fig. 1743.)

Muscat Hamburgh is a black grape, probably a cross between the two above-named varieties, and presenting marked characteristics of each. It has beautiful tapering clusters of fine quality.

Barbarossa is a good variety for those ambitious to grow large clusters and when well grown is of fine quality. It is a late black grape, requiring a long season to ripen well, but repays for the trouble by keeping thereafter for a long time. Clusters frequently grow to 8 or 10 pounds in weight, measuring about 24 inches each way, and they have been grown to more than double this weight.

Other large-growing varieties are the White Nice and Syrian, the latter of which is said to be the kind that the spies found in the land of promise. Clusters of 20 to 30 pounds weight are common to these two coarse-growing kinds, but their quality is so poor that they are now rarely grown.

Grizzly Frontignan is a beautifully mottled pink grape,—quite a deep pink sometimes,—and has long, slender clusters. In quality and flavor it is unsurpassed by any other grape, and it ripens quite early.

Royal Muscadine is an early white grape of fair quality and good habit quite common in English houses.

Gros Colman, a large black grape of fine quality and a late keeper, is now grown largely for commercial purposes in England and sent to this side to supply our wants in this line in spring. The berries frequently measure 4½ inches around, and it therefore requires early and severe thinning.

Alicante is a black grape of very distinct character, seeming to depart somewhat from the vinifera type, very juicy, and of fair quality. It has a very thick skin, and is about the best for long keeping.

1743. Muscat of Alexandria, bearing on spurs (as explained in Figs. 1741, 1742).

Lady Downs is another late black grape of good quality, but not adapted to all localities. Rose Chasselas, a small red grape, is the earliest and very beautiful. Trentham Black, the earliest black grape, has small clusters, but large, soft berries quite like Alicante. Foster Seeding is a beautiful midseason, amber-colored grape, with large clusters and berries sometimes liable to crack. Madresfield Court Muscat is a midseason grape—fine in quality, but also inclined to crack. This trouble can often be controlled by twisting or slitting the stems of the clusters, thereby checking the flow of sap.

D. M. Dunning.

GRAPEFRUIT (*Cítrus grándis*). *Rutaceæ.* Figs. 975, 1744. Plate L. A large globose fruit having slightly bitter acid pulp; it is used as a breakfast fruit and also for salads and desserts. It is grown in Florida, California, Arizona, and the West Indies, and is now extensively used by Americans. The name grapefruit, under which this fruit is known commercially, seems to have come from the West Indies and owes its origin to the fact that the fruits are often borne in clusters of three or four to twelve or more, much like a bunch of grapes. This fruit is also known as pomelo. The shaddock or pummelo is a distinct strain, not grown for commerce in this country. See *Citrus* (page 782) and *Pomelo*.

Grapefruit trees are large round-topped, with regular branches: lvs. dark glossy green, ovate with broadly winged petioles: spines slender, flexible, borne in the axils of the lvs.: fls. large, white, borne singly or in clusters in the axils of the lvs.; stamens 20–25; ovary globose, sharply set off from the style, which is deciduous: fr. pale lemon-yellow, flattened spheroid or globose, 4–6 in. diam., segms. 11–14, filled with slightly bitter acid pulp; seeds large, flattened and wrinkled; peel ¼–½in. thick, with numerous oil-glands.

The grapefruit appears to have been introduced into Florida by the Spaniards in the early part of the sixteenth century and until a quarter of a century ago it was grown only by the Florida pioneers. Since its culture has been undertaken on a commerical basis, the acreage planted to this fruit has rapidly increased, 1,061,537 boxes having been produced in Florida in 1909 as compared with 12,306 in 1899, and 122,515 boxes in California in 1909 as compared with 17,851 boxes in 1899. The total value of the crop in 1909, as reported by the Census, was over $2,000,000.

An excellent appetizer, the grapefruit is the most popular of breakfast fruits. It is also probable that it possesses valuable tonic properties, and it has been recommended by physicians in cases of malaria and biliousness. The sprightly flavor of the fruit, due to its slightly bitter principle, makes the grapefruit one of the most refreshing of all citrous fruits.

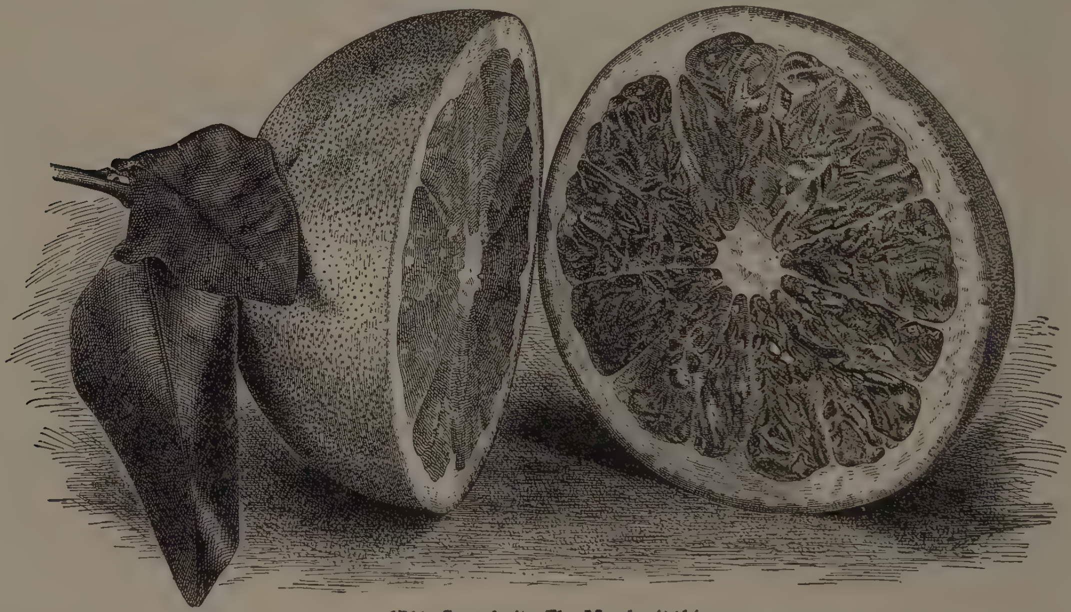
The grapefruit is more susceptible to cold than ordinary citrous fruits and its profitable culture is consequently restricted to regions below the frost line. The selection of a location is a matter of supreme importance in Florida where the occasional freezes have wrought so much damage in the past. The grapefruit, like most citrous fruits, prefers a light, well-drained soil, sandy or porous, though, because of its dense foliage, it grows better on poor soil than does the orange. The trees must be well fertilized in order to produce the best results, for it must be remembered that the care and fertilizer given are important factors in determining the quality and character of the fruit produced. Budded trees usually begin to bear in three to four years and generally reach full bearing in about ten years. They continue to bear for an indefinite period. The trees may be set from 18 to 25 feet apart, depending upon the stock on which they are grown. The seedlings make excellent stocks because of their well-developed root-systems and are extensively used for this purpose. They are hardier than the rough lemon but not so hardy as the orange. Grapefruits are usually propagated by budding because of the variations in the different varieties.

One of the most extensively grown varieties in Florida is the Duncan: fruits medium to large, oblate, light yellow; pulp a pleasant bitter acid flavor with few seeds; peel medium, firm; a late bearer, fruits keep well on the tree. The Duncan is one of the hardiest grapefruits, especially when budded on trifoliate orange stock (*Poncirus trifoliata*). Among others grown in Florida are Hall (Silver Cluster): fruits yellow, pleasantly bitter, globose, medium to large, in large bunches; a heavy bearer. Pernambuco: fruits large.

smooth-skinned. Introduced from Pernambuco, Brazil, by the United States Department of Agriculture. Triumph: fruits medium size, heavy, smooth-skinned, not very bitter; a prolific and a strong grower, but rather tender; season early. The Bowen, Excelsior, Josselyn, Leonardy, Manville, McCarty, McKinley, May, Standard and Walters are Florida seedlings cultivated locally in that state.

In California one of the best varieties is the Marsh (Marsh Seedless): fruit large (see Fig. 1744), subglobose, light yellow, not very bitter, often seedless, tree low and spreading. This variety originated in Florida but is best adapted to California conditions. The popularity of the grapefruit in California has been increasing during the past few years and it seems certain that this fruit is destined to become one of the standard fruits of that state. It should be noted that in California the grapefruit is really a summer fruit; in Florida it is a winter and spring fruit.

Hybrids.—The tangelo, the result of a cross between the tangerine orange and the grapefruit (pomelo) is a striking new citrous fruit. The Sampson tangelo, obtained by the writer in 1897 by crossing the tangerine with the Bowen grapefruit, is the first of this new group of fruits to be grown commercially. Other tangelos are now being tested. See *Tangelo.*



1744. Grapefruit—The Marsh. (×½)

Diseases.—The grapefruit tree is decidedly resistant to mal-di-gomma or foot-rot and is only slightly affected by scab. It is, however, more susceptible than any other citrous fruit to citrus canker. This disease was first discovered near Miami, Florida, in July, 1913, by E. V. Blackman. It is believed to have been introduced from Japan. In appearance somewhat similar to the scab, this disease has spread over a large area in southern Florida. It is very infectious and has been carried from one grove to another by wagons, birds, and other means. No remedy is known, and Florida growers, in order to check its spread, have been obliged to burn hundreds of infected trees. Investigators differ as to the cause of citrus canker. Walter T. Swingle.

Grapefruit, or pomelo, in California.

Pomelos have been grown for many years in California, but, although they succeed admirably, they have not been produced in a commercial way until within recent years. Even at present, the product is only a small fraction of that of the orange and lemon. Perhaps not more than 400 or 500 cars are annually shipped out of the state. All of the Florida varieties have been tested, many of them proving unsuited to the conditions. At present the Marsh, or Marsh Seedless as it is commonly called, is planted almost exclusively. The Triumph and the Imperial are also grown to some extent, while the Nectar and the Clayson are new varieties which are attracting attention.

But little attention has been paid to the handling of this fruit in California, and it is undoubtedly true that many of the seedling and miscellaneous varieties which have been inadvisedly put on the market have been very much inferior to Florida-grown pomelos. Usually, on account of the poor varieties grown, California pomelos are shipped mainly to Pacific and intermountain states where they do not come in such active competition with the Florida product. It is undoubtedly true, however, that certain varieties of the pomelo when well grown and intelligently handled are equal to the best Florida product. There is no reason why the production of pomelos in California should not be considerably increased. Growers, however, seem to fear an over-production and new plantings are at present quite small.

The pomelo, in its general growth, resistance to frost, propagation, culture, fertilizing, irrigation, and the like, is similar to the orange. The season in California is from February 1 until September 1. J. Eliot Coit.

GRAPE HYACINTH: *Muscari botryoides.*

GRAPE, SEASIDE: *Coccoloba uvifera.*

GRAPTOPHÝLLUM (Greek words referring to the variegated foliage). *Acanthàceæ.* Tender shrubs, one of which is cultivated in a very few American conservatories for its variegated foliage, and is said to be very popular in India and the tropics.

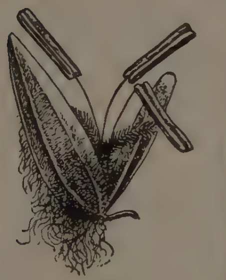
Leaves opposite, entire (in one species spiny-dentate), often colored: fls. reddish purple, wide gaping, clustered either in a terminal thryse or in the axils; calyx divided to the base into 5 segms.; corolla-tube inflated above; upper lip with 2 short recurved lobes; lower lip 3-cut; stamens 2: fr. a club-shaped or oblong caps.

—About 5 species, oriental. No two lvs. are marked exactly alike, but the yellow color is near the midrib rather than at the margins. The genus is close to Thyrsacanthus, but in Thyrsacanthus the fls. are not so distinctly 2-lipped. For cult., see *Justicia*.

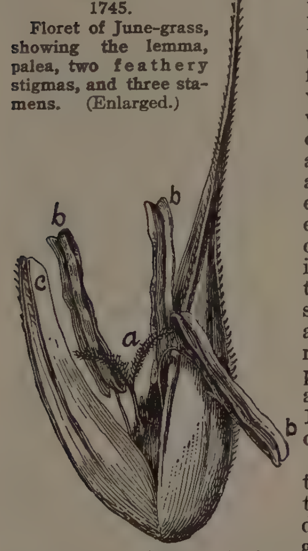
horténse, Nees (*G. pictum*, Griff. *G. picturàtum*, Hort. *Justícia pícta*, Linn.). CARICATURE PLANT. Height finally 6–8 ft.: lvs. elliptic, acuminate, irregularly marked with yellow along the midrib: fls. crimson, in axillary whorls; corolla pubescent. Habitat (?). B.R. 1227. Lowe 45. B.M. 1870 shows a variety with reddish brown coloring.—A yellowish-fld. form has been offered under the name *G. picturatum*, but it does not seem to differ otherwise. N. TAYLOR.†

GRASS (*Gramíneæ*). Annual or perennial, mostly herbaceous plants with usually hollow sts. (culms) closed at the joints (nodes), and 2-ranked lvs. Culms woody in the bamboos and in a few other groups such as the genus Lasiacis, sometimes solid as in maize: lvs. consisting of two parts, the sheath and the blade, the sheaths enveloping the culm above each node, the margins overlapping or occasionally grown together as in Bromus and Melica, the blades parallel-veined, usually linear or elongated (in some tropical grasses short and broad), on the inside bearing at the junction with the sheath a membranous or hyaline appendage or rim called the ligule; in some tropical grasses, especially bamboos, a petiole inserted between the sheath and blade: infl. paniculate or contracted into a raceme or spike, or more rarely into a head, the branches usually bractless; fls. usually perfect, sometimes monœcious as in maize, or diœcious as in salt-grass (Distichlis), small, without a distinct perianth, arranged in spikelets consisting of a shortened axis (rachilla) and 2 to many 2-ranked bracts, the lowest pair (the glumes) empty, one or both of these sometimes absent; each succeeding bract (lemma) including a single fl. and, with its back to the rachilla, a 2-nerved bract or prophyllum (palea), the fl. with its lemma and palea being termed the floret; stamens usually 3, with delicate filaments and 2-celled versatile anthers; pistil 1, with a 1-celled, 1-ovuled ovary, usually 2 styles and plumose stigmas: fr. a caryopsis with starchy endosperm, and a small embryo at the base on one side; grain (caryopsis) inclosed at maturity in the lemma and palea (or sometimes exceeding these as in maize and pearl millet), adherent to the palea as in the oat, or free as in wheat. Figs. 1745–1748 show the structure of various grass florets.

The lemmas are sometimes empty and are then termed sterile lemmas to distinguish them from the glumes. The spikelets may be inclosed in a spiny involucre or bur as in the sand-bur, or in an indurated shell as in Job's tears (Coix), or the entire spike in numerous husks as in maize.



1745. Floret of June-grass, showing the lemma, palea, two feathery stigmas, and three stamens. (Enlarged.)



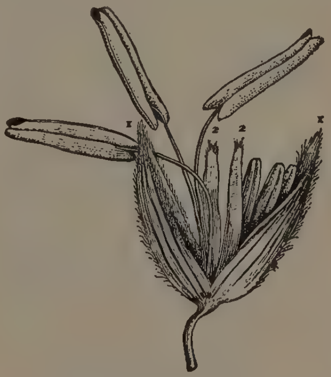
1746. Floret of a grass (rye). *cc*, lemma and palea: *a*, stigmas: *bbb*, stamens. (Much enlarged.)

The perennial species of grasses may produce creeping underground stems (rhizomes) by which they propagate. Kentucky blue-grass and awnless brome-grass are examples of this class. Such grasses usually form a sod. Those, such as orchard-grass, in which no rhizomes are produced usually grow in bunches or tussocks and are known as bunch-grasses.

The true grasses (*Gramineæ*) may be distinguished from other grass-like plants such as sedges (*Cyperaceæ*) and rushes (*Juncaceæ*) by the two-ranked leaves and the cylindrical or flattened stem. Sedges have three-ranked leaves and usually a triangular stem. There are also important differences in the floral structure.

A. S. HITCHCOCK.

1747. Spike of a grass (rye), containing many spikelets.



1748. Staminate spikelet of a grass (maize), showing two flowers, one of which (with three stamens) is expanded. 1, 1, glumes; 2, 2, palea. (Enlarged.)

Uses of grasses.

Among the species most commonly known are timothy, redtop, June-grass, orchard-grass, meadow foxtail, the fescues, oat-grass, sweet vernal, quack-grass, Bermuda-grass, sugar-cane, chess, and the cereals, such as wheat, barley, rye, oats, rice, sorghum, Indian corn. In number of species the grass family occupies the fifth place with 3,500, while the compositæ, legumes, orchids and madderworts are larger. In number of individuals, the grasses excel any other family. Seed plants are arranged in 200 to 220 families, and of all these the true grasses are of greatest importance; in fact, they are of more value as food for man and domestic animals than all other kinds of vegetation combined. None of these families is more widely distributed over the earth's surface, or is found in greater extremes of climate or diversity of soil.

The species are very numerous in tropical regions, where the plants are usually scattered, while in a moist, temperate climate, although the species are less numerous, the number of plants is enormous, often clothing vast areas. Where soil is thin or moisture insufficient, the grasses grow in bunches more or less isolated. Plants of one section of the family, Panicaceæ, predominate in the tropics and warm temperate regions, while plants of the other section, Poaceæ, predominate in temperate and cold regions.

Overstocking dry grazing districts checks the better grasses, destroying many of them, and encourages the bitter weeds which multiply and occupy the land.

A grass extends its domain by running rootstocks, by liberating seeds inclosed in the glumes which are caught by the breeze, by some passing animal, or the nearest stream; the twisting and untwisting of awns bury some of them in cracks, crevices or soft earth. In case a growing stem is thrown down for any reason, several of the lower nodes promptly elongate on the lower side and thus bring the top into an erect position. Each sheath supports and holds erect the tender lower portion of the internode, where it is soft and weak; it also protects the young branches or panicles. Thrifty blades of grasses suitable for pasture and lawn elongate from the lower end, so that when the tips are cut off the leaves do not cease to elongate, but renew their length. When exposed to sun or dry air, the blades develop a thicker epidermis, and, by shrinking of some of the delicate bulliform cells of the upper epidermis, they diminish their surface as they roll their edges inward or bring them together, like closing an open book. When the plant is in flower the minute and delicate lodicules become distended just in time to spread the glumes and liberate the stamens.

Grasses are not so much employed for ornamenting homes as their merits warrant. By selecting, some can be found suited to every week of the growing season, though many of them are in their prime during June, the month of roses. Wild rice (Zizania) is fine for rich soil in the margins of ponds, and masses of reed grass for deep beds of moist muck. For massing or for borders the following and others are stately: *Arundo Donax*, *A. conspicua*, maize, pampas-grass, Eulalia, ribbon-grass, *Andropogon formosus*, *A. halepensis*, Hystrix, Tripsacum. For glaucous blue-green, use *Elymus arenarius*, *Festuca glauca*, and *Poa cæsia*. For potting and borders, there are striped varieties of Dactylis, Anthoxanthum, *Holcus lanatus*, *H. mollis*, *Poa trivialis*, *Phleum pratense*, and others may soon be produced. For table decoration nothing is better than the elegant, airy panicles of large numbers of wild grasses, such as species of Poa, Kœleria, Sphenopholis, Panicum, Paspalum, Eragrostis, Muhlenbergia, Bromus, Festuca, Agrostis, Deschampsia, Uniola, Briza, *Cinna latifolia*. For large halls and exhibitions, nothing surpasses sheaves of wheat, barley, rice, oats or any of the wild grasses. For decoration, grasses should be cut before ripe, dried in the dark in an upright position, and may be used in that condition or dyed or bleached. For paths, nothing is more pleasing than strips of well-mown lawn.

Drainage keeps out sedges and encourages the better grasses; manure and irrigation help the best grasses to choke and diminish most weeds. Enough has already been done to show that rich rewards are sure for him who patiently and intelligently attempts to improve grasses for any purpose whatever by selection and crossing. Quack-grass is excellent for holding embankments; *Ammophila arenaria* for holding drifting sands. The grass family furnishes its full quota of weeds, among them quack-grass, crab-grass, chess, June-grass, sand-bur, stink-grass.

Turf-forming grasses are those that spread freely by creeping rootstocks, such as June-grass, quack-grass, Bermuda-grass, Rhode Island bent and redtop, while most others are more or less bunchy. For northern regions not subject to severe droughts, sow Rhode Island bent and June-grass both, or either one alone; for certain regions, which are liable to suffer from dry weather, sow June-grass and plant Bermuda-grass. These two on the same ground supplement each other in different kinds of weather, securing a green carpet during every part of each growing season. W. J. Beal.

GRASSES, POPULAR NAMES OF. Few grasses hold commanding positions as specimen plants, although the agricultural values of grasses are transcendent. Some of the commoner vernacular grass names (not all of true grasses) are given with references to the proper genera: **Animated Oats,** *Avena.* **Artificial-G.,** sometimes used for certain forage plants, as sorghum, but also leguminous plants, as clover, lucerne, sainfoin. **Awnless Brome-G.,** *Bromus inermis.* **Beach-G.,** *Ammophila arenaria.* **Bear-G.,** unusual name for *Yucca filamentosa.* **Beard-G.,** *Andropogon;* also *Polypogon monspeliensis.* **Bengal-G.,** *Setaria italica.* **Bent-G.,** *Agrostis.* **Bermuda-G.,** *Cynodon Dactylon.* **Blue-eyed-G.,** *Sisyrinchium.* **Blue-G.,** *Poa.* **Bluejoint-G., Bluestem-G.,** *Calamagrostis canadensis, Andropogon furcatus, Agropyron Smithii.* **Bog-G.,** *Carex.* **Bristly Foxtail-G.,** *Setaria magna.* **Brome-G.,** *Bromus.* **Canada Blue-G.,** *Poa compressa.* **Canary-G.,** *Phalaris canariensis.* **Cat-tail-G.,** *Phleum pratense.* **China-G.,** *Bœhmeria nivea.* **Citronella-G.,** *Cymbopogon.* **Cocksfoot-G.,** *Dactylis glomerata.* **Cotton-G.,** *Eriophorum.* **Couch-G.,** *Agropyron repens.* **Crab-G.,** *Eleusine* and *Digitaria sanguinalis.* **Crested Dog's-tail G.,** *Cynosurus cristatus.* **Deer-G.,** *Rhexia virginica.* **Dog's-tail-G.,** *Cynosurus.* **Eel-G.,** *Vallisneria spiralis.* **English Rye-G.,** *Lolium perenne.* **Esparto-G.,** *Stipa tenacissima.* **Feather-G.,** *Stipa pennata.* **Feather Sedge-G.,** *Andropogon saccharoides.* **Fescue-G.,** *Festuca.* **Finger-comb-G.,** *Dactyloctenium.* **Finger-G.,** *Chloris.* **Fly Away-G.,** *Agrostis hiemalis.* **Four-leaved-G.,** *Paris quadrifolia.* **Fowl Meadow-G.,** *Poa triflora.* **Golden-Top G.,** *Lamarckia aurea.* **Guinea-G.,** *Panicum maximum;* also erroneously used for *Holcus halepensis.* **Hair-G.,** *Agrostis hiemalis.* **Hare's-tail G.,** *Lagurus ovatus.* **Hassock-G.,** *Deschampsia cæspitosa.* **Herd's-G.,** in New England is timothy (*Phleum pratense*); in Pennsylvania, fiorin (*Agrostis alba*). **Holy-G.,** *Hierochloa borealis.* **Hungarian-G.,** *Setaria italica.* **Italian Rye-G.,** *Lolium multiflorum.* **Japanese Lawn-G.,** *Zoysia pungens.* **Job's-tears,** *Coix.* **Johnson-G.,** *Holcus halepensis.* **June-G.,** *Poa pratensis.* **Kentucky Blue-G.,** *Poa pratensis.* **Large Quaking-G.,** *Briza maxima.* **Little Quaking-G.,** *Briza minor.* **Love-G.,** *Eragrostis elegans.* **Lyme-G.,** of upholstery is *Deschampsia cæspitosa.* **Marram-G.,** *Ammophila arenaria.* **Myrtle-G.,** *Acorus Calamus.* **Oat-G.,** *Arrhenatherum elatius;* also various species of Avena. **Orchard-G.,** *Dactylis glomerata.* **Palm-leaved G.,** *Panicum sulcatum.* **Pampas-G.,** *Cortaderia.* **Pepper-G.,** *Lepidium;* also *Pilularia globulifera.* **Plume-G.,** *Erianthus Ravennæ.* **Pony-G.,** *Calamagrostis stricta.* **Purple Bent-G.,** *Calamovilfa brevipilis.* **Quack-, Quick-,** or **Quitch-G.,** *Agropyron repens.* **Quaking-G.,** *Briza.* **Rattlesnake-G.,** *Briza maxima;* also *Glyceria canadensis.* **Ray-G.,** *Lolium perenne.* **Redtop G.,** *Agrostis alba.* **Reed-G.,** *Arundo, Bamboo.* **Reed Bent-G.,** *Calamagrostis.* **Reed Canary-G.,** *Phalaris arundinacea.* **Rescue-G.,** *Bromus unioloides.* **Rhode Island Bent-G.,** *Agrostis canina.* **Ribbon-G.,** *Phalaris arundinacea* var. *picta.* **Rough Bent-G.,** *Agrostis hiemalis.* **Roughish Meadow-G.,** *Poa trivialis.* **Roughstalked Meadow-G.,** *Poa trivialis.* **Rye-G.,** *Lolium perenne.* **Sand-G.,** *Calamovilfa longifolia.* **Scurvy-G.,** *Cochlearia officinalis.* **Scutch-G.,** *Cynodon Dactylon.* **Seacoast Bent-G.,** *Agrostis alba* var. *maritima.* **Seneca-G.,** *Hierochloa borealis.* **Sesame-G.,** *Tripsacum.* **Sheep's Fescue-G.,** *Festuca ovina.* **Silk-G.,** *Agrostis hiemalis.* **Silver Beard-G.,** *Andropogon argenteus.* **Sour-G.,** local name for *Rumex Acetosella.* **Squirrel-tail-G.,** *Hordeum.* **Star-G.,** *Callitriche;* also locally for *Hypoxis* and *Aletris.* **Striped-G.,** *Phalaris arundinacea* var. *picta.* **Sweet-scented Vernal-G.,** *Anthoxanthum odoratum.* **Tall Meadow Oat-G.,** *Arrhenatherum elatius.* **Tickle-G.,** *Agrostis hiemalis.* **Tear-G.,** *Coix Lachryma-Jobi.* **Texas Blue-G.,** *Poa arachnifera.* **Timothy,** *Phleum.* **Tufted Hair-G.,** *Deschampsia cæspitosa.* **Vanilla-G.,** *Hierochloa borealis.* **Viper's-G.,** *Scorzonera.* **White Bent-G.,** *Agrostis alba.* **Whitlow-G.,** *Draba,* especially *D. verna,* and *Saxifraga tridactylites.* **Wood Meadow-G.,** *Poa nemoralis.* **Woolly Beard-G.,** *Erianthus.* **Worm-G.,** *Spigelia;* also *Sedum album.* **Yellow-eyed-G.,** *Xyris.* **Zebra-G.,** *Miscanthus sinensis.*

GRATÌOLA (Latin, *grace* or *favor*, from its reputed healing properties). *Scrophulariàceæ.* Low herbs, rarely planted.

Plants with opposite lvs.: fls. yellow or whitish, peduncled, axillary, hypogynous, perfect; calyx 5-parted, nearly regular; corolla gamopetalous, tubular-funnelform, more or less 2-lipped; upper lip entire or 2-toothed, lower 3-lobed; perfect stamens 2, the anterior pair wanting or rudimentary; ovary superior, 2-celled; style filiform; stigma dilated 2-lobed: fr. a 4-valved, many-seeded caps.—About 25 species in many parts of the world, none of which is of commercial importance. The following species has been advertised for sale and would make a good plant for covering the muddy borders of ditches and aquatic gardens. Most species are perennial.

aûrea, Muhl. GOLDENPERT. GOLDEN HEDGEHYSSOP. Annual, prostrate, viscid, puberulent or glabrate: lvs. lance-oblong, 2–12 lines long, denticulate, sessile by a broad base: fls. bright yellow, showy, 6–7 lines long. Wet sandy shores, Maine and Ont. to Fla., mostly along the coast. B.B. 3:162.

K. M. WIEGAND.

GRAVÈSIA (after C. L. Graves, who collected in Madagascar). *Melastomàceæ.* Dwarf warmhouse foliage plants, natives of Madagascar, and cultivated in a few American conservatories.

Flower parts in 5's or the stamens 10, all equal; petals obovate, obtuse or sometimes with a short spine-like process: fr. a 3-valved caps.—Three species. For cult. and for distinctions from allied genera, see *Bertolonia*, under which name most of the varieties are still known.

guttàta, Triana (*Bertolònia guttàta*, Hook.). Caulescent, erect: branches obtusely 4-angled: petioles 2½–3 in. long, densely scurfy-powdery: lvs. membranous, 5-nerved, rotund at base, slightly scurfy above and spotted, under side and calyx scurfy-powdery: cymes terminal, several-fld. Intro. 1865, and first described in B.M. 5524 as *B. guttata*, where the lvs. are shown with fairly well defined, double, longitudinal rows of roundish pink dots. F.S. 16:1696 is probably a copy of B.M. 5524. (See, also, Gt. 1865, p. 385, and B.H. 1865, p. 225.) Var. **supérba,** Hort., I.H. 26:359 (1879), is shown, with more and larger reddish purple spots, which are less regularly arranged. Var. **Legrelleàna** (*B. Legrelleàna*, Van Houtte). An alleged hybrid obtained by Van Houtte and figured in F.S. 23:2407. Coigneux refers this plate to *Gravesia guttata*, but no fls. are shown, nor have the lvs. any spots. The nerves are outlined in white, and some of the cross-veins for short distances. Var. **Alfred Bleu** is brilliantly spotted and lined with bright red, the nerves boldly outlined, the cross-veins interruptedly outlined. I.H. 41:13 (1894). Var. **margaritàcea,** Nichols. (*B. margaritàcea*, Hort. W. Bull=*Salpinga margaritacea.* F.S. 16:1697). See DC. Mon. Phan. 7:537.

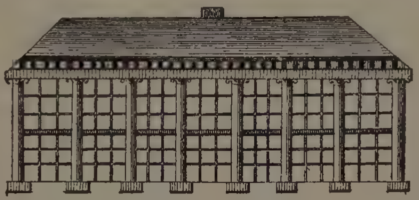
N. TAYLOR.†

GRAVÌSIA (the name unexplained). *Bromeliàceæ.* South American acaulescent herbs, differing from Æchmea in the character of the pollen-grains and other technical features, and requiring similar treatment in cult. Lvs. densely rosulate, conspicuously sheathing, brown-scurfy, the margin more or less spiny: scape arising from the center of the rosette, bearing a panicled or bipinnate infl.: petals yellow or orange. **G. exsûdans,** Mez (*Æchmèa exsùdans*, Baker. *Tillándsia exsùdans*, Desf. *Bromèlia exsùdans*, Lodd. *Hohenbérgia capitàta*, R. & S.) Fls. congested in sessile heads composing a compound panicle, the floral bracts spine-pointed: lvs. whitish beneath, oblong, spiny. L.B.C. 9:801.—Fls. said to exude a whitish greasy substance, whence the name. Plant 2–3 ft. Apparently very little grown.

L. H. B.

GREENHOUSE. In America the word greenhouse is used generically for any glass building in which plants are grown, with the exception of coldframes and hotbeds. Originally and etymologically, however, it means a house in which plants are kept alive or green: in the greenhouse plants are placed for winter protection, and it is not expected that they shall grow. The evolution of the true greenhouse seems to have begun with the idea of a human dwelling-house. At first larger windows were inserted; and later, a glass roof was added. In early times it was thought best to have living-rooms above the greenhouse, that it might not freeze through the roof. Even as late as 1806, Bernard M. Mahon, writing in Philadelphia, felt called upon to combat this idea. The old or original conception of a greenhouse as a place for protecting and storing plants is practically extinct, at least in America (Fig. 1749). In England, the word greenhouse is mostly used for a house or structure in which are kept or grown those plants that do not require a very high temperature.

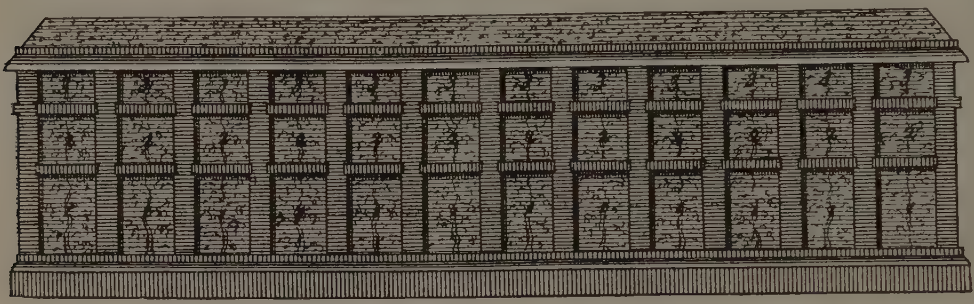
Other types of plant-houses are the conservatory (which see), in which plants are kept for display; the forcing-house (see *Forcing*), in which plants are forced to grow at other times than their normal season; the stove or warmhouse; the propagating-pit. Originally the warmest part of the plant-house, that part in which tropical plants were grown, was heated by a stove made of brick, and the house itself came to be called a stove. This use of the word stove to designate the warmest part or room of the range is general in England, but in America we prefer the word warmhouse (and this word is much used in this Cyclopedia). Originally, hothouse was practically equivalent to stove, but this term is little used in this country, and when used it is mostly applied generically in the sense of greenhouse.



1749. The old-time greenhouse with opaque roof and sash-made sides (Abercrombie, 1786).

It will thus be seen that there is no one word that is properly generic for all glass plant-houses. The word glasshouse has been suggested, and it is often used in this work; but there are other glass houses than those used for plants. It seems best, therefore, to use the word greenhouse for all glass buildings in which plants are grown; and American usage favors this conclusion.

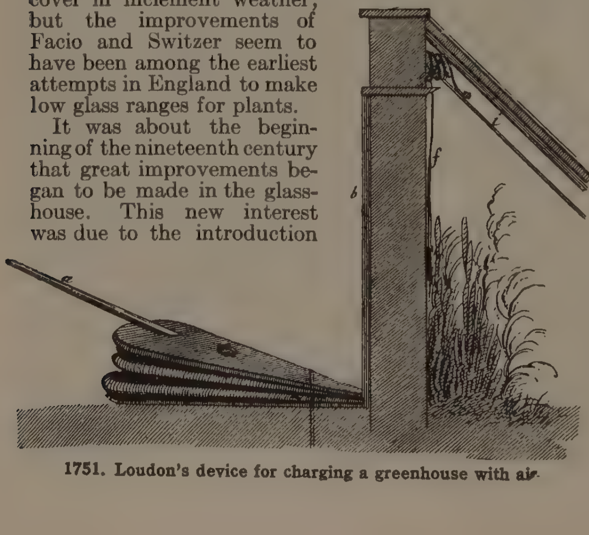
The long, low greenhouse range, of the type we now know in our commercial establishments, probably had a different origin from the high-sided greenhouse. The glasshouse range appears to have developed from the practice of protecting fruits and other plants against a wall. In European countries, particularly in England, it is the practice to train fruits and other plants on stone or brick walls, that they may be protected from inclement weather and receive the greater sun heat that is stored in the masonry. It occurred to Nicholas Facio Duilhier to incline these fruit walls to the horizon so that they would receive the greater part of the incident rays of the sun at right angles. He wrote a book on the subject of "Fruit-Walls Improved," which was published in England in 1699. Facio was a mathematician, and he worked out the principle of the inclined walls from mathematical considerations. Such walls were actually built, but according to the testimony of Stephen Switzer, who wrote in 1724, these walls were not more successful than those which stood perpendicularly. Certain of these walls on the grounds of



1750. Switzer's glasshouse, built on an inclined wall (1731).

Belvoir Castle, and over which grapes were growing, received the additional protection of glass sash set in front of the inclined walls and over the vines. In addition to this, flues were constructed behind the wall in which heat might be supplied. The construction of hollow heated walls was not uncommon in that day. The satisfactory results that followed this experiment induced Switzer to design glass-covered walls. The "glasshouse" which he pictured in the "Practical Fruit-Gardener" (1731) represents a greenhouse 3½ feet wide in the clear (Fig. 1750). At the back of this house is an inclined heated wall on which the grapes are grown. Three and one-half feet in front of this a framework is erected to receive the sash. There are three tiers of openings or windows along the front, the two lower ones of which are for window-sash, and the upper one is vacant in order to provide for ventilation and to allow space to receive the lower sash when they are lifted up. The whole structure is covered with a roof or coping. Switzer declares that the introduction of these covered sloping walls "led the world" to the "improvement of glassing and forcing grapes, which was never done to that Perfection in any Place as it is upon some of the great Slopes of that elevated and noble Situation of *Belvoir Castle.*" Johnson, in his "History of English Gardening," quotes the remarks of Switzer, and makes the statement that the use of these walls "led to the first erection of a regular forcing structure of which we have an account." The immediate outcome of these covered walls seems to have been the lean-to greenhouse, and from that structure has perhaps developed the double-span glass range of the present day. Long before Switzer's time plants were forced in a crude way, even by the Romans, mostly by being placed in baskets or other movable receptacles, so that they could be placed under cover in inclement weather; but the improvements of Facio and Switzer seem to have been among the earliest attempts in England to make low glass ranges for plants.

It was about the beginning of the nineteenth century that great improvements began to be made in the glasshouse. This new interest was due to the introduction of new plants from strange countries, the improvement of heating apparatus, and the general advance in the art of building. The ideals that prevailed at the opening of the century may be gleaned from J. Loudon's "Treatise on Several Improvements Recently Made in Hot-Houses," London, 1805. One of the devices recommended by Loudon will interest the reader. It is shown in Fig. 1751. The bellows is used for the purpose of forcing air into the house, that the plants may be supplied with a fresh or non-vitiated atmosphere. "By forcing the air into the house, once a day or so, double the quantity of air which the house usually contains" can be secured. The house could be "charged." The tube leading from the bellows is shown at *b;* it discharges at *c.* Curtains run on wire, *i;* the curtain cord is at *f.*



1751. Loudon's device for charging a greenhouse with air.

Greenhouses are now built on the plan of the long low glass range with sides varying from 5 feet 6 inches to 7 feet in height. The tendency in commercial structures is for a height of 7 feet from ground to eaves. The taller glass structures are used for conservatory purposes, housing such table plants as palms, tree-ferns, or the like, or when an architectural feature is desired. The general tendency of the building of glass structures is toward extreme simplicity (Fig. 1547, p. 1256). In the extreme South, lattice-work buildings are sometimes used for the protection of plants, both from light frosts and from the sun (Fig. 1752). The heating now employed in this country is of three different kinds: hot water under very low pressure or in the open-tank system; hot water in practically closed circuits; and steam. Hot water under low pressure is an old-time mode of heating, and is not now popular in this country except for conservatories and private establishments. The heavy cumbersome pipes are not adapted to laying over long distances and under varying conditions. The commercial houses are now heated by means of wrought-iron pipes, which go together with threads. The comparative merits of steam and hot water in these wrought-iron pipes are much discussed. For large establishments, hot water under pressure is now employed to some extent. Much progress has been made in methods of heating in recent years, and either steam or hot water gives good results when competently installed. The merits of one system or the other are very largely those of the individual establishment and apparatus, and the personal choice of the operator (see page 1403; also pages 1400 and 1402).

The simple straight and direct house is now much in favor with the commercial growers of carnations, chrysanthemums, violets, roses, vegetables, and with propagators. Most of the greenhouse construction firms are designing houses most admirably adapted to the growing of these plants. Each firm has a few original forms worked into the detail plans, calculated to appeal to the growers' fancy. Perhaps the ideal structure for carnations, for example, is a single detached house, about 50 feet wide and 500 feet or less in length, with ventilators on each side of the ridge and on each side below the eaves, and the eaves, or the gutters, 6 feet above the grade.

With the refinements of architecture and the growth of satisfaction in home-building, the glasshouse is becoming an integral part of the residence. Sometimes it takes the form of a sun-parlor, and in which certain plants may be kept at least temporarily; sometimes it is a real plant-house added to the residence, a glass or covered garden that carries bloom and verdure through the cold weather and enables the homemaker to span the year. The best results in plant-growing are secured when the structure is separate, with its own heat, its normal exposure, and its own essential set of conditions; but it is worth while to add a garden-room to a residence even if the horticultural results are not great. Some of the architectural combinations of glass and other materials are very artistic and interesting.

L. H. B.

Greenhouse construction.

For convenience, this subject may be considered under the following heads; i. e., *Location, Plans, Grading, Foundations, Framework, Glazing and painting, Plant-tables, Ventilation, Heating.*

Location.

Greenhouses which are intended for use in connection with the gardens should be placed, for convenient attendance, within the garden inclosure or along its boundary. A good location for the garden will usually be found the best one for the greenhouse.

A conservatory or greenhouse designed for a private place, where specimen and blooming plants will be kept for the pleasure of the family and entertainment of visitors, should be attached to the dwelling or located as near as possible in a well-kept part of the grounds. A conservatory does not require a full southern exposure. Most decorative plants thrive as well or better and continue in bloom for a longer time if kept in a house having plenty of light, but so located as to receive but little direct sunlight. Large ranges of glass adapted to a variety of purposes are generally kept separate from other buildings. In parks the location should be near a main entrance.

The location of a range of glass for commercial purposes, where the elements of expense and profit are to have the first consideration, is of great importance. The chief items that determine the desirability of a suitable location are the adaptability and value of the land, cost of fuel delivered, ample and inexpensive water supply and proximity to a market. The top of a bleak hill and the bottom of a valley should both be avoided. Level land, or that having a southerly slope, is the best.

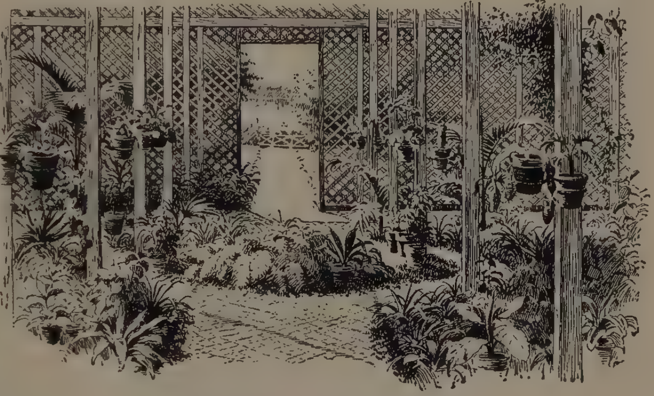
Plans.

When a site for the proposed greenhouse has been decided upon, full plans should be made before commencing to build. The plans should embrace not only the glass, which is required at once, but should provide for the largest increase which can be anticipated. In this way houses can be erected which are convenient to work and have a good appearance, with small extra cost for building only part at a time. Attention should be given to the special peculiarities of the location, like the exposure to the sun, grade of ground, shape of lot and best location for the heating apparatus. Each compartment should have the proper form of house and exposure to the light adapted to the plants for which it is provided.

It will readily be seen that to locate and plan a range of glass to the best advantage requires skill and experience. In a communication received by the writer from a superintendent of one of the most important botanic gardens in the country, it was remarked that "when the architect prevails, the gardener fails." It is also true to a greater degree than in almost any other class of buildings that the beginner or amateur who undertakes to plan and construct his own greenhouse is likely to pay well for his experience, and will at least sympathize with the "lawyer who pleaded his own cause and found he had a fool for a client." This is perfectly true, as many know to their cost. To plan a greenhouse satisfactorily, the designer must have a practical knowledge of the requirements. To meet this increasing demand, specialists can be found, known as "horticultural architects," who devote their entire time to this branch of work.

Grading.

The floor of the greenhouse should be a few inches above the outside grade. As most greenhouses are necessarily built low to accommodate the plants, a small terrace around them adds to the elevation and the good appearance of the structure. It will usually be best to keep the floor of a greenhouse all on one level. When the variation in the grade of the ground is not too great, the floor line should be at the highest point of the grade. In the case of a long house, the floor line is sometimes made the same as the natural grade, but such an arrangement is to be avoided when possible. For locations on a hillside, the different apartments may have different floor-levels, with necessary steps between them.


1752. A lattice-covered plant-house.

All the sod and loam should be removed from the space to be covered by a greenhouse and all the filling necessary made with subsoil. The latter should be laid in thin layers and each wet down and thoroughly tamped. Loam used for filling under a greenhouse is likely to become sour, and will continue to settle for a long time, causing much trouble and annoyance.

Foundations.

Too much care cannot be given to the preparation of good foundations. These are usually of brick, but may be made of stone or concrete. The brick walls take up less room in the house than stone, and are usually less expensive. The foundation walls should be extended down to a point below the frost line, generally 3 or 4 feet deep, and are usually raised about 2 feet above the grade. An inexpensive wall of rubble stone work or of concrete is all that is needed in the ground. The part of the wall showing above grade may be of plain brick, or brick faced with stone, or the entire wall may be built of concrete finished with cement plaster. It is usual to construct the walls of the same material as the surrounding buildings, or with some material that will harmonize with them. Until a few years ago, double boarding was used exclusively for the side walls in greenhouses built by florists, the rafters being carried into the ground about 30 inches. Today, light concrete walls about 4 inches thick are built. The cost of the concrete is almost the same as double boarding but has the advantage of being indestructible.

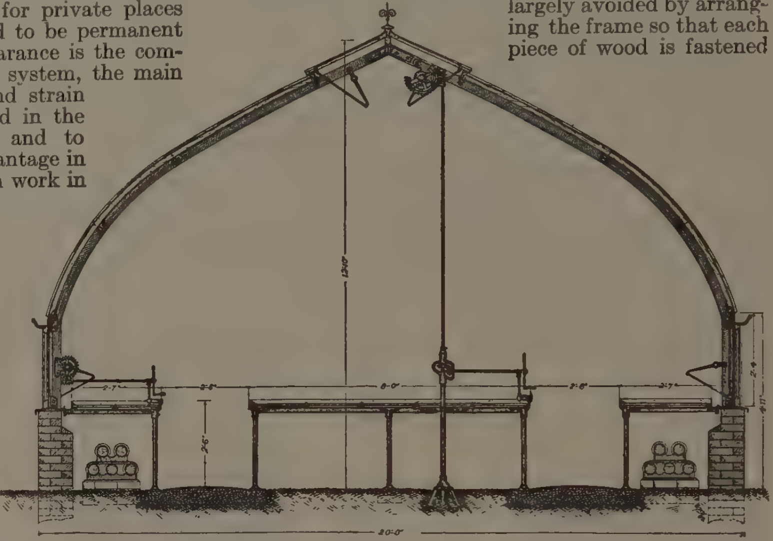
Framework.

The construction best adapted for conservatories, park houses and greenhouses, and for private places where the improvements are desired to be permanent in character and attractive in appearance is the combination of iron and wood. In this system, the main frame which supports the weight and strain is of iron, or steel, wood being used in the frames as a setting for the glass and to form a non-conductor of great advantage in the heating of the house. The iron work in this style of construction usually consists of cast-iron sills capping the foundation walls, wrought-iron rafters setting on the sills, about 8 feet apart and running from sill to ridge, forming the side post and rafter in one piece, cast-iron gutters, and angle iron purlins between the rafters, all securely bracketed and bolted together, forming a complete framework of metal, light, strong and durable. The wood used consists of light sash-bars for supporting the glass, sashes for ventilation and doors. This woodwork being entirely supported by the metal frame, and not being used where it will be continually wet, will be found as durable as any other material, and for many reasons better adapted for the requirements of a greenhouse roof. This combination system of metal and wood construction has been extensively adopted by florists, growers of cut-flowers and also the progressive vegetable-growers. In the houses built for the above, the masonry foundation walls are omitted. Posts constructed of wrought-iron are placed in the sides extending from about 30 inches below grade to the height of the eaves. These posts occur at every rafter, to which they are connected with steel or cast-iron fittings. The posts are embedded in concrete below grade, and 4-inch concrete walls built extending from 6 inches below grade up to the under side of the glazing sill.

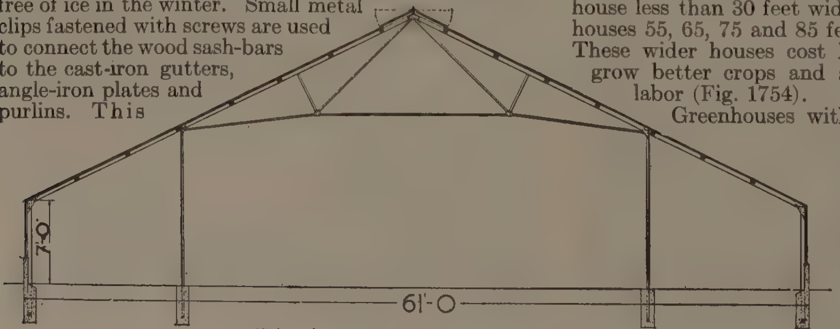
Gutters are seldom used at the eave line in this type of house. An angle-iron eave-plate is substituted for the gutter so framed as to allow the snow and ice to slide over it, keeping the roof entirely clear from such accumulations which darken a house in winter.

The first cost is somewhat increased over an all-wood construction, but in view of its greater durability and saving in repairs, it will be found in the end, the better investment.

Cast-iron gutters are provided to collect the rain-water from the roof. By exposing the inner side of these gutters to the heat of the house, they are kept free of ice in the winter. Small metal clips fastened with screws are used to connect the wood sash-bars to the cast-iron gutters, angle-iron plates and purlins. This method of securing the sash-bars in place is very convenient in case of repairs, and renders the structure practically portable. A careful examination of any old greenhouse will show that the parts of the frame which decay first are those pieces of wood which are joined together, for water penetrating the joints soon destroys the wood. This trouble is largely avoided by arranging the frame so that each piece of wood is fastened directly to the iron frame instead of to another piece of wood. Joints between wood and iron do not rot the wood, the latter being preserved by the corrosion of the metal.



1753. Even-span curvilinear greenhouse, with cast-iron piping.



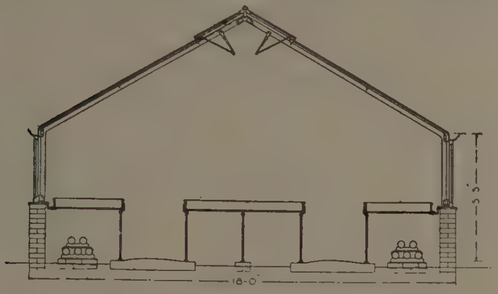
1754. A very wide plant-grower's house.

The curvilinear form of house (Fig. 1753) is ornamental and particularly well adapted for conservatories, palm-houses and show-houses of all kinds. It is preferred for vineries and fruit-houses, as the form allows the canes to be supported on the line of the roof without a sharp bend at the plate line. The light in a curved house, being admitted at different angles, is better diffused and more natural than when reflected through a long pane of straight glass. The cost of a curved roof is slightly greater in the construction, but the arched frame is stronger and will keep its shape better than a house with straight lines, thus largely compensating for the extra cost. For special purposes and locations, special forms of frames may be used. Good forms of commercial houses are shown in Figs. 1754–56.

The ridge-and-furrow type of house (Fig. 1757) is seldom built now except in cases in which the amount of land available is limited. The superior growing qualities of greenhouses built separately has been thoroughly demonstrated, as has also the increased productiveness of wide houses. A florist now seldom builds a house less than 30 feet wide. It is oftener 40 feet, and houses 55, 65, 75 and 85 feet wide are not uncommon. These wider houses cost less in proportion to build, grow better crops and are more economical as to labor (Fig. 1754).

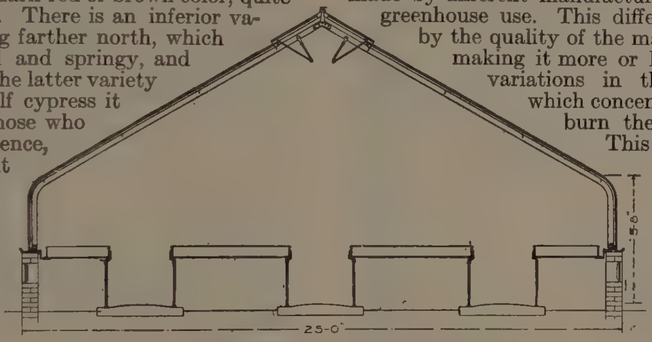
Greenhouses with curved eaves (Fig. 1756) are being built more and more. This type presents a pleasing appearance and eliminates shade-casting members at the eaves. A combination sill and gutter is substituted for the plain sill on top of masonry wall to which the rafters and bars are secured.

It is commonly admitted that the so-called "sash-bar construction" is not the best or lightest method of construction, but as the absence of most of the framing reduces its cost so that it is the cheapest to build, it remains a popular method of putting up a commercial greenhouse. Circulars showing the various methods adopted by the dealers in greenhouse material can readily be secured by applying to them.



1755. A compact two-walk house.

The best wood to use for greenhouse framework and plant-beds is undoubtedly cypress. In purchasing this lumber, care should be taken that only that grown in the states bordering on the Gulf of Mexico be selected. This will be found of a dark red or brown color, quite soft and easily worked. There is an inferior variety of cypress growing farther north, which is light in color, hard and springy, and likely to be shaky. As the latter variety is cheaper than red Gulf cypress it is frequently used by those who do not know the difference, to the serious detriment of the work and the loss of reputation of cypress for such purposes.



1756. Section of curved-eave house.

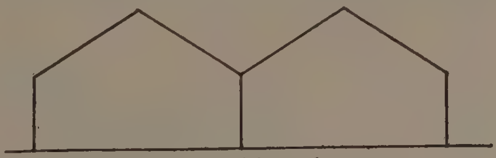
In the market there are three grades of cypress lumber, and it is important to know which to choose. The best grade is known as "firsts and seconds," and calls for lumber with a small extent of sap on the edges and occasionally a small sound knot. This is the quality which should be ordered for all the framework of the roof, sash-bars, and so on. In order to make the material entirely free from sap there will be a waste in cutting up this quality of 10 to 20 per cent. The second grade is known to the trade as "selects." This name indicates that it has been graded so that one face of each piece of lumber is of about the same quality as the "firsts and seconds," the other face generally being largely sap. This quality is fit only for outside boarding in greenhouse construction; it has too much sap. The cost is usually about five dollars a thousand less than the best grade. As it looks to the inexperienced eye almost the same as the best grade, too much of it finds its way into greenhouse structures. Such sap lumber usually will not last more than two to five years. Too great care cannot be exercised to avoid its use. The third grade of cypress lumber is termed "cutting up," and is so called because it embraces all the pieces which have imperfections, such as large knots and splits, which bar them from the better grades. This is a good quality to purchase for base-boards and plant tables, for by cutting out the sap and objectionable knots it will be found satisfactory for these purposes. The "cutting up" grade costs about ten dollars less a thousand than the "firsts and seconds." The percentage of waste in cutting up will be somewhat greater than in the other grades. Cheap timber is likely to give unsatisfactory results in greenhouse work.

Cypress lumber which has been in use for gutters, sash-bars, plates, and the like, in greenhouses where high temperatures have been maintained is still, after many years, apparently in as good condition as when first used. Owing to the porous texture of the wood, the paint, when applied, sinks in and does not make so fine a coat as on some other woods, but because of this fact the paint adheres to the wood better and lasts longer.

Glazing and painting.

Ordinary sheet or window glass is in general use for greenhouse glazing. It is better to use only the thickness known to the trade as "double-thick." This weighs from twenty-four to twenty-six ounces a square foot. The thickness known to the trade as "single thick" weighs only about sixteen ounces to the square foot, and is entirely too frail for the purpose. There is very little difference at present in the quality of the imported French or Belgian and the American glass. The weight of most of the glass of American manufacture is about 2 ounces greater a foot than the imported, and therefore it is proportionately stronger. This greater strength is of considerable importance in the additional security which it affords from damage caused by that enemy of the florists, the hail-storm. There is a great difference in the quality of the glass made by different manufacturers in its adaptation to greenhouse use. This difference is caused chiefly by the quality of the material used in the glass, making it more or less opaque, and in the variations in thickness causing lenses which concentrate the sun's rays and burn the foliage of the plants. This last defect in the glass cannot be wholly guarded against, as the product of a factory does not always run the same so that any favorite brand cannot be fully relied upon in this respect. The waves which burn will be found in all the different grades of glass, firsts, seconds and thirds, with little, if any difference, the grading being done chiefly for other defects, such as affect the value of the glass for window purposes. For these reasons, in selecting the glass for a greenhouse, it requires experience to decide what make of glass it will be best to purchase. It will be well to purchase from someone who makes a specialty of furnishing glass for greenhouses or call in the aid of some friend who has had experience in building, and can give intelligent advice.

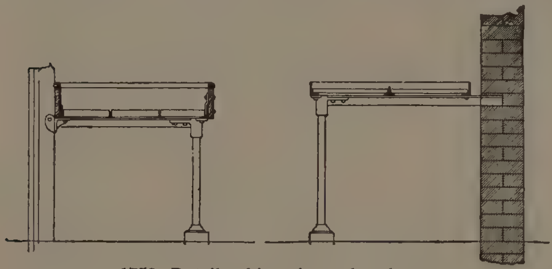
The second quality of glass is usually selected for the best greenhouse work. The standard widths are from 12 to 16 inches, and lengths vary from 16 to 24 inches. A favorite size is 16 by 24 inches. This is about as large as it is practicable to use double thick glass, and makes a roof with comparatively few laps.



1757. Ridge-and-furrow houses.

It is not safe to purchase fourth quality of glass or the so-called "greenhouse glass" frequently offered by window-glass dealers, as both of the grades contain the culls and lights only fit to glaze cheap sash for market-gardeners, and is of doubtful economy even for this purpose. Rough plate and ribbed glass is used on large palm-gardens and conservatories in which the maximum of light is not an essential feature. Where this glass is used larger roof-bars are needed and stock construction has to be materially changed. Recently a few conservatories have been glazed with thick, polished plate-glass, making very handsome roofs, but rather expensive.

To set glass properly in a greenhouse roof, it should be bedded in the best putty on wood sash-bars and lapped at the joints. The bars should be spaced accurately, so that the glass will fit the rabbets with not over $\frac{1}{16}$ of an inch allowance, and the panes of glass should lap each other not more than from ⅛ to ¼ of an inch. Zinc shoe-nails fasten the glass best, using from four to six to each pane, according to the size of the light. No putty should be used on the outside of the glass. A comparatively new system of glazing has been adopted by some florists in which no putty is used, but the glass is placed directly on the rabbets of the bars and the ends of the panes are butted together and held in place by wood caps fastened to the sash-bars. This system does not make a tight roof, allowing considerable water to enter the house through the joints, nor does it provide any means of escape for the condensed water from the under side of the glass, which is a very serious objection. In ordinary glazing, where each light laps over the one below, the condensed water passes through the joints to the outside, forming a perfect remedy for this trouble. The difference in the cost is very slight, if anything, provided the work is equally well done, as the value of the putty omitted is fully offset by the extra cost of the caps.


1758. Details of iron-frame benches.

The painting of a greenhouse roof is a very important part of the work. Owing to the extremes of heat, cold, dryness and moisture to which it is exposed, the conditions are decidedly different from ordinary buildings. Three-coat work is the best. The priming coat on the woodwork should be mostly oil, and, as far as possible, the material should be dipped into a tank of paint. Iron and steel framing material should be primed with a metallic paint. The priming coat should be applied before the material is exposed to the weather. The material of the second and finishing coat should be pure linseed oil and white lead. Experience has shown that this material is the best for this work. The color should be white or a light tint of any desired shade may be used, but no heavy color should be adopted which requires coloring matter in place of the lead in the mixing. Each coat should be applied thin and well rubbed out. While the appearance may not be quite so fine when the work is first done, the paint will not peel off, and will last longer and form a better protection for the structure than when it is put on in thick coats. It will also form a good base for repainting, and this should be done in a similar manner. It is economical to repaint a greenhouse every two years, and generally one coat will be sufficient. Neglected unpainted greenhouses soon suffer, and are also very unattractive.

Plant-tables.

Stages for plants in pots, or raised beds for planting out, usually cover the entire area of a greenhouse except the walks, and their cost constitutes a considerable proportion of the expense. Palms are usually grown in solid beds or in pots or boxes sitting on the ground. Many vegetables are grown in solid beds near the ground-level. Roses and carnations are usually in raised beds. Angle-iron frames supported on adjustable gas-pipe legs, with slate or tile bottoms, form the best plant-tables (Fig. 1758). Wood bottoms which can be readily renewed are frequently substituted, saving a part of the first cost. When the table supports are of wood, care should be taken that they are not fastened against any part of the framework of the house, unless iron brackets are used so as entirely to separate the woodwork.

Ventilation.

No greenhouse is complete without a good ventilating apparatus. About one-tenth of the roof should be arranged to open or close for ventilation, although this percentage will vary according to the form of house and the purpose for which it is used. It is not desirable to open all the ventilators in a long house with one set of apparatus, for frequently one end will not need so much ventilation as the other end or may be affected by the wind, forming a current lengthwise of the house. To avoid this, a greenhouse 200 feet long should have three or four sets of apparatus which can be operated separately. In all greenhouses of considerable width it is desirable that ventilation should be provided on both sides of the ridge so that the ventilation can be given on the "leeward" side, which will prevent the wind from blowing directly into the house.

Heating.

The success of the florist, gardener or amateur in the management of a greenhouse depends largely on the satisfactory working of the heating apparatus. There are two systems of greenhouse heating which, when the apparatus is properly installed, are economical and satisfactory; viz., hot water and steam. The open-tank hot-water heating has more advantage in its adaptation to general use than any other, and is so simple that its management is readily understood by anyone. It is practically automatic and is capable of maintaining an even temperature for ten hours without attention. Low pressure steam-heating is well adapted to large commercial ranges, and to large conservatories in parks and private places where a night attendant can be kept in charge of the fires to turn on and shut off steam from the radiating pipes as the changing outside temperature may require. The heating of greenhouses to the best advantage, under the varying conditions of climate and interior requirements, demands, like the designing of greenhouses, the services of an experienced specialist in horticultural work.

LORD & BURNHAM CO.

Vegetable forcing-houses.

The evolution of the vegetable forcing-house has been rapid and very pronounced. From the low-built, flue-heated, dark stuffy type of house to the high, well-lighted, steam- or hot-water-heated, well-ventilated house is a change that has come not only in a very short time but which has been as marked as the transition from the ox-cart to the automobile.

Location.

In selecting a suitable location for vegetable forcing-houses, one of the most important things to consider is the marketing possibilities. It would be folly to go to the expense of building a forcing-house in which to grow vegetables to make money if they could not be sold at a profit above cost of production. The most desirable markets are those within easy driving distances. If it is necessary to ship the produce to be grown, electric lines will usually be found more economical carriers than steam lines. A grower is nearly always at a disadvantage if he has but one available road to ship over. Competition insures cheaper and better service. Cities with 25,000 to 50,000 population are often more desirable markets than much larger cities. Cities which are the chief shipping-points for southern-grown vegetables are not so good markets for forcing-house products as are the cities which are not so accessible from the localities making a business of growing winter vegetables for northern markets.

Another matter of importance to consider in choosing a forcing-house site is the cost of fuel. If natural gas can be secured at a reasonable cost it is a very satisfactory fuel. Coal is used most commonly as a fuel. When calculating the cost of coal, the hauling of it from the nearest shipping-point to the forcing-house should be included. It is expensive to move large quantities of coal a long distance, especially if the road is not good. When a dirt road must be used, it is usually best to do the hauling in late summer rather than in winter.

While any productive soil can be made suitable for forcing purposes, it is easier and cheaper to prepare a sandy soil than a heavy clay soil. Other things being equal, therefore, a location where the soil is a sand or sandy loam is to be preferred to a clay soil.

As large quantities of water are used in the forcing-house, an abundant supply should be known to exist before a site is selected for the houses. It is cheaper to build and easier to operate a forcing-house on level than on sloping land. A level site should, therefore, be selected if possible.

It is also an advantage to have the houses protected on the sides from which the prevailing winds come. Trees, hills or buildings are suitable for this purpose, providing they are not near enough to shade the houses much of the time. The site should not be far from the dwelling, and the closer it is to the market or shipping-point the better. A location which cannot be satisfactorily drained or which is subject to overflow should of course be avoided.

Types of forcing-houses.

Of the various types of forcing-houses, even-span, three-quarter-span, hillside and lean-to, only two are being built very generally at present. Many New England growers prefer the three-quarter-span, while the even-span is most popular in all other sections of the country in which forcing-houses are commonly erected. The three-quarter-span is used on sloping land as much as the hillside type of house, or even more. Good results are secured with either form.

Form of construction.

All-wood houses.—In the all-wood form of construction no iron is used except in the heating-plant. The walls may be all wood, or wood and concrete. The posts may or may not be set in concrete. The all-wood house was by far the most common form of construction only a few years ago and certain growers in various parts of the country still prefer the all-wood houses. Red cedar and cypress are the kinds of wood commonly used for forcing-house erection.

Semi-iron houses.—In the semi-iron form of construction all supporting posts, purlins and braces are made of iron pipes or angle-iron. The walls are usually made of concrete and all interior posts are set in concrete. The semi-iron houses are more expensive to erect than the all-wood houses but they are more durable and most growers think they are cheaper in the end.

All-iron houses.—In the all-iron construction the entire framework is of iron. The various parts are put together in such a way that the houses are very rigid. This form of construction is the most durable of all and will stand a greater weight of snow and more severe winds than the semi-iron or all-wood houses. The first cost of the all-iron houses is from one-third to one-half greater than the semi-iron construction, and this fact alone stands in the way of the general use of this construction. In spite of this objection, a number of large all-iron houses have been erected recently and they seem to be increasing in popularity, especially in the eastern part of the United States.

Trussed houses.—In the trussed form of construction, steel truss-rods are used to take the place of a part or all of the iron or wooden posts and braces used in the other forms of construction. The trussed houses are very convenient to work in and very little shade is cast by the framework. The truss-rods are frequently made to support the heating-pipes. They are also convenient supports for the wires upon which the cucumber and tomato vines are supported. As built in the past, trussed houses have not been strong enough, in all cases, to resist the weight of heavy snows and the force of severe winds. Several such houses have been demolished. If this defect can be eliminated this type of house will be very desirable.

Special features of forcing-house construction.

Width of houses.—The width of the forcing-houses in general use varies from 12 to 150 feet. In the East the tendency is to build houses 40 to 50 feet or more in width. In most parts of the West, the preference is for houses from 12 to 40 feet wide. However, there are individual growers in most sections of the West who prefer houses over 40 feet wide. The narrower houses are cheaper to build and can be kept in repair more cheaply and easily than wide houses. The wider houses, it is thought, can be heated more economically and are better adapated to the growing of warm plants such as cucumbers and tomatoes in winter than the narrower houses.

Length of houses.—The length of forcing-houses varies from 50 to 800 feet. When the gravity system of hot-water heating is used the houses are seldom over 200 feet in length. When either steam or hot water with artificial means of circulating is used, the houses may be of any length up to 1,000 feet. In most forcing centers the length of the houses has not exceeded 500 feet.

Direction of houses.—Lean-to and hillside houses are usually built with a southern exposure. Three-quarter-span houses are generally built to run east and west with the long span to the south. Even-span houses are built to run north and south, east and west and in some cases northeast and southwest. While there is not much difference in the results secured in even-span houses run either direction, there is a better distribution of sunlight throughout the day in houses which are run north and south.

Height of gutter.—Low gutters are almost entirely a thing of the past. Modern houses are usually built with gutters at least 6 feet high and 7-feet gutters are not uncommon. The outside walls of modern houses are very largely of glass construction. Connected houses are commonly built with no dividing partition except in case of extreme width when an occasional glass partition is put in. Some of the advantages of the high gutters combined with glass in the side walls and few or no dividing partitions are: greater convenience in working, better circulation of air and less shading. The former belief that the glass must be close to the plants, for best results has been found to be erroneous.

Pitch of roof.—The roofs of most even-span forcing-houses are built with a pitch of 30° to 35°. Three-quarter-span houses are usually built with the short span of the roof steeper than the long span. Hillside and lean-to houses are sometimes built with considerable less than a 30° pitch to the roof.

Glass and glazing.—Nothing but "A" quality glass is used in modern forcing-houses. Single-strength has been almost entirely replaced by double-strength glass. The standard size is 16- by 24-inch glass. It is usually laid the narrow way, although in sections of the country in which the snowfall is light the glass is frequently laid the 24-inch way. Twenty- by 24-inch glass is used by some growers. Butted glass was popular for a time and is yet with some growers, but lapped glass is most commonly used at the present time. When lapped, the glass is imbedded in putty and secured in place by the use of glazing-points. Butted glass is held in place by grooved strips of wood placed over the edges and fastened to the sash-bars with screws.

Ventilation.—An abundance of ventilation should always be provided, as the health of the plants is governed to a considerable extent by the ventilation given or not given at the proper time. When the narrow ridge-and-furrow type of forcing-house is used, provision is made for ventilators on only one side of the roof. If the houses are 30 or more feet in width, ventilators are usually placed on both sides of the ridge. In some cases, the ventilators are continuous, but owing to the liability of binding when so built most growers use separate ventilator sash. The sash are separated from each other by one or two lines of fixed glass. They are hinged on the ridge or on the header at the lower edge of the sash. When they are hinged on the header and open at the ridge the ventilation is more free, but cold draughts of air and rain or snow are more liable to enter than when the sash are hinged at the ridge and open at the lower edge. Side ventilators are a decided advantage in warm weather. When they are not provided, the air in the houses often becomes stale and oppressive. In such a condition it is unsuitable for normal plant-growth and unpleasant for those who are obliged to inhale it. Easy-working ventilator machinery should be provided for the ventilators both on the sides and roofs.

Heating.—For small forcing-houses, hot water is undoubtedly the most satisfactory method of heating. Some of the advantages of hot water over steam heat are: No night fireman is needed in small forcing-houses as the fire can be left for several hours without attention. Less fuel is required, especially in mild weather. The proper amount of moisture in the air can be maintained more easily. The heating-pipes if kept filled with water will outlast steam-heated pipes. The chief advantage of the steam heat over hot water is that it is cheaper to install. The reason for this is that when gravity is the means of circulating the water, larger pipes are required for properly heating the houses with water than are necessary where steam is the heat used. The gravity system is the principal method used in small hot-water-heated houses. Another advantage of steam over hot water is that the heat can be regulated more easily. When steam sterilization is practised it is an advantage to be able to use the same boilers for this purpose as are used for heating the houses. While a larger part of the large ranges of houses are heated with steam, some of the largest are heated with hot water. A ten-acre range of houses near Toledo, Ohio, is heated with hot water which is pumped through 1¼-inch heating-pipes. The houses are 700 feet long and cover a width of over 600 feet. There is but one heating-plant and it is located at the center of one side of the range. The heating-pipes are close to the ground and are nearly level from one end of the houses to the other. The water is pumped through the entire length of pipes in a very few minutes. The installation of this hot-water heating-plant cost little if any more than a steam heating-plant would have cost and it can be operated more cheaply than a steam plant which would be large enough to heat a range of houses of the same size.

Heating-pipes.—Practically all pipes used for heating purposes at the present time are of wrought-iron. They are threaded and can be united by screwing them into connections made for the purpose. This method of connecting furnishes a tight joint and can be easily put together. Two-inch pipes are used as a rule for hot-water heating with gravity means of circulating. For hot water with forced circulation and for steam, 1¼-inch pipes are generally considered the best size to use.

Benches vs. beds.—In nearly all vegetable-forcing centers, except Chicago, raised benches are no longer used except by an occasional grower. The cost of building the benches is so great that most growers think the added cost more than offsets the advantages of the benches over the beds. Cement benches when arranged for sub-irrigation are very satisfactory. They are especially desirable for lettuce and tomatoes. Surface-watered benches are not nearly so satisfactory for these crops as sub-irrigated benches. Ground beds are frequently made with concrete sides but the more recent plan is to have nothing but narrow concrete walks to separate one bed from another.

Service room.—One of the features which goes with an up-to-date vegetable-forcing plant is a conveniently arranged and well-lighted service room. Provision should be made for washing vegetables and for other operations which go with a proper preparation of the vegetables for the market.

Plant-house.—Another important adjunct to a modern forcing-house is a plant-house which is independent of the other part of the range so far as the heating of it is concerned. To grow young plants successfully, especially warm plants such as cucumbers and tomatoes, it is important to be able to provide the proper temperature for each kind of plant. This can be done to best advantage if the plants can be grown in a plant-house built especially for that purpose. C. W. Waid.

Greenhouse glass.

The selection of glass for greenhouses, and the nature of the imperfections which render it undesirable for such use, are questions which have received much attention from horticultural writers, and which have brought forth a variety of answers. Three qualities are essential in all glass to be used in greenhouse construction: first, minimum of obstruction to solar rays; second, strength sufficient to withstand the strain of winds and storms, especially hail; and third, freedom from defects that render it liable to burn plants grown under it.

1759. Burned areas on a begonia leaf.

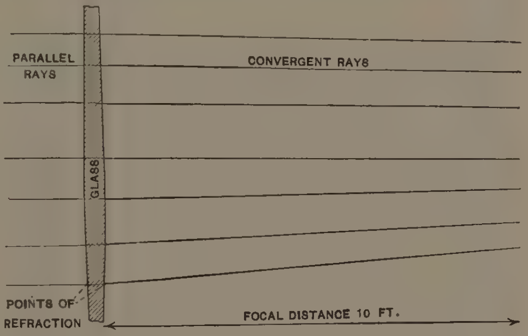
It is an established fact that plants thrive best under a clear and transparent glass, which lets through the greatest possible percentage of the sun's rays. This includes all the solar rays, calorific or heat rays, and actinic or chemical rays, as well as the colorific or light rays. Clear white glass of the grade known as "single thick" (twelve panes to the inch) lets through from 60 to 70 per cent of the sun's rays; common green glass of the same thickness, 52 to 56 per cent, and "double thick" (eight panes to the inch) common green glass, from 50 to 52 per cent. This percentage is reduced by other colors, dark blue glass letting through but 18 per cent. In connection with the matter of tint, it should be noted that some glass, especially clear white glass purified with arsenic acid, or that in which a large amount of potash is used in proportion to the amount of lime employed in manufacture, becomes dull after long exposure to the weather, the dullness being occasioned by the efflorescence of salts contained in the glass. Before this disintegration has proceeded too far, the crust or efflorescence may be removed with muriatic acid.

The strength of glass depends upon its thickness and upon the thoroughness of the annealing. Glass is annealed by passing through a series of ovens, where it is raised to a high heat and then gradually cooled; whatever toughness and elasticity the finished product may contain is due to this process. The thickness of glass varies, not only with grades (single and double thick), but also more or less within the grades, and even in different parts of the same pane. Single thick glass is too thin for use in greenhouses; in selecting any glass for such a purpose it should be examined pane by pane, and all showing marked variation in thickness, either between panes or in different parts of the pane, rejected. A pane of varying thickness is much more liable to breakage from climatic changes or sudden shocks than one which is uniform in this regard. From the foregoing statements it will be seen that, in general, the ordinary double-thick green glass is best as regards both tint and strength, green glass being less liable to change in tint than white, and the double-thick being the stronger grade. By green glass is meant simply the ordinary sheet glass, the green color of which is noticeable only at the cut edge.

It has long been a common opinion that such visible defects in sheet glass as the so-called "bubbles," "blisters," and "stones," produce a focusing of the solar rays passing through them, thus burning the foliage of plants grown under glass containing these defects (Fig. 1759). This view has been held by glass manufacturers and horticulturists alike, and seems not to have been contradicted publicly until 1895 (Bulletin No. 95, Cornell University Agricultural Experiment Station, page 278). In view of the erroneousness of this theory, it is rather remarkable that it should have gained such prevalence. Nearly all bubbles and blisters are thinner in the middle than at the periphery, being thus concave rather than convex lenses, and actually diffusing the rays of light passing through them rather than producing destructive foci. While it is true that sand-stones or knots in glass may produce foci, these points of focus scarcely ever exist more than a few inches from the surface of the glass; consequently, these defects can do no damage when occurring in roofs several feet distant from the growing plants below.

The only full and complete series of experiments on this subject in this country (conducted at the Cornell University Agricultural Experiment Station, the Physical Laboratory of Cornell University, and a glass factory in Ithaca, New York, but yet unpublished) shows the true cause of the burning by glass to be the variation in thickness of the entire pane, or a portion of it, thus producing a prismatic or lens-like effect (Fig. 1760), which causes a more or less distinct focusing of the sun's rays at distances varying from 5 or 6 feet to 30 feet, or even more, from the glass.

This defect usually occurs along the side or end of the pane and is not visible to the eye, but it may be detected easily by using the micrometer caliper or by testing in the sunlight. It may be found in all kinds of glass, and is caused by the glass-blower while reducing the upper or pipe end of the cylinder from which sheet glass is made, thus facilitating the removal of the "cap" or neck end of the cylinder, by which it is attached to the pipe while being blown. The defect, as already stated, is one which may be found in all grades and qualities of sheet glass, of both foreign and domestic manufacture. The fact is well known that differences in the thickness of spectacle lenses, which are imperceptible to the eye, may produce sufficient refraction to vary materially the direction of rays of light passing through such lenses, and it is not difficult to see that the same effect may be produced by similarly imperceptible variations in the thickness of sheet glass. That this is the case has been conclusively shown by the series of experiments mentioned above. These also show that burns on plants caused by defective glass roofs occur in lines and not in isolated spots, burns of the latter description being usually the result of a weakening or deterioration of tissue, due to carelessness in the matter of ventilation, humidity of the atmosphere, water, and temperature of greenhouses, rather than to defects in the glass.



1760. Refraction of light rays by an irregular pane of glass.

If, therefore, it is not possible to secure glass of uniform thickness with certainty, it may be found cheaper and often fully as satisfactory to purchase the lower or common grades of double-thick glass, using in the roof only those panes which show, after testing in the sunlight for foci, an entire lack of the prismatic character which makes them dangerous to plants grown under them.

J. C. Blair.

Greenhouse heating.

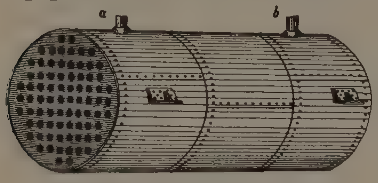
In all sections in which the temperature drops below the freezing point, it is necessary to provide some artificial means for heating greenhouses. Nearly all modern structures are warmed either by steam or hot water, although hot-air flues are occasionally used. While hot water is preferred for small ranges of glass, as it can be depended upon to furnish an even degree of heat when left for a number of hours, steam is very generally used for extensive plants, as the cost of piping the houses is much less than when hot water is used. Steam boilers require more attention than hot-water heaters, but when there is more than 10,000 or 12,000 square feet of glass, it is best to have a night fireman and watchman, and the extra expense can be made up by the saving in the cost of fuel, as it will be possible to use a lower grade of coal. Under these conditions the cost of running a steam plant will be as low as with hot water, but in small houses, where hard coal is used, and the fires receive no attention for six to eight hours during the night, hot-water heaters will be cheapest to operate, and will be most satisfactory. Some of the up-to-date ranges of the largest size make use of hot water and are able to secure a perfect circulation by the use of steam or electric pumps, which also make it possible to reduce the size of the piping, and as a higher temperature is maintained in the water, the amount of radiation required and consequently the cost of piping the houses is reduced practically to that in steam systems. Similar results can be secured in closed systems where some method of placing the water under pressure is used. See, also, under *Forcing-houses*, p. 1402.

As the various flowers and vegetables grown under glass require different temperatures, the piping of greenhouses has to be varied accordingly. Thus, although it may vary from 3° to 5° for different varieties of the same species, our common plants require the following night temperatures: violets and lettuce, 45° to 55°; radishes and carnations, 50° to 55°; roses and tomatoes, 60° to 63°; cucumbers and stove plants, 70°.

Boilers.

For small ranges, whether steam or hot water is used for heating, the best boilers are those constructed of cast-iron as they will be found more durable than those in which wrought-iron or steel is used. By using either vertical or horizontal sections, it is possible to build up boilers of considerable size, but, especially if to be used for steam heating, it will be preferable to use wrought-iron or steel boilers if they have a capacity of more than 2,000 square feet of radiation. Except for those of extremely large size, the ordinary tubular boilers will be found adapted both for steam and hot-water heating, although when used for hot water they will be more effectual if the entire shell is filled with tubes, as there is no occasion for leaving a steam space at the top of the boiler. Such boilers are of low cost, economical and durable.

There are also on the market several forms of wrought tubular boilers which are giving good results for heating greenhouses with hot water. For ranges of the largest size, where forced draft is used, water-tube boilers are extremely powerful and very satisfactory. When installing a heating-plant, it will be safest to use two or more boilers rather than one large one of the same capacity, as when there is only a single boiler serious losses may result if repairs to the boiler become necessary in extremely cold weather, which might be lessened or entirely prevented when there are two or more boilers in the battery, and it is possible to cut out the one which has become damaged. Especially in mild weather during the spring and fall, the firing will be more economical when it is possible to use a boiler just large enough to heat the houses, rather than one which is several times larger than is necessary at that time, as would be the case when only one boiler is used.



1761. Horizontal tubular boiler for hot water.

The durability of the boiler and the economy of heating will be greatly increased when the heating capacity is considerably larger than is really necessary, as when the firing is forced in extremely cold weather it will not only result in a loss both in fuel and labor, but will shorten the life of the boiler.

The size of hot-water boilers is usually expressed in terms of radiation, or the number of square feet of heating surface it can supply economically. In a given boiler there is a fixed ratio between the size of the grate and the area of the fire surface of the boiler, but this will depend very largely upon its construction and efficiency of the fire surface, as well as upon the size of the boiler. In the case of small hot-water boilers the ratio between the grate and fire surface is often as small as 1 to 15, while it may be as much as 1 to 35 in larger ones, and even more when the boilers have frequent attention and hard coal is used. One reason for using a relatively large grate in small boilers is because it makes it possible to leave the fire for eight or ten hours without care or attention, while for large boilers and where a night fireman is employed, the ratio between the grate and fire surface may be much greater.

The capacity of steam boilers is usually rated in horse-power, and it is considered that for each horse-power a boiler will heat 100 square feet of radiation; an average of 15 square feet of fire surface is considered equal to one horse-power, it being customary to estimate that 10 or 12 feet in a large boiler will equal one horse-power, while in a very small one as much as 18 feet would be required. Thus, in medium-sized boilers an area of 10 square feet of grate will answer for 250 square feet of fire surface and this will be sufficient for about 1,700 square feet of radiating surface when steam is used; and as 75 to 100 per cent more radiation will be required when hot water is used, a boiler of the above size will answer for 2,800 to 3,400 square feet of hot-water radiation. In the case of small boilers that will not have attention at night, it is usually advisable to reduce the above estimates about 25 per cent, and when a boiler is required for 1,000 square feet of radiation, we should select one that is rated at 1,250 square feet.

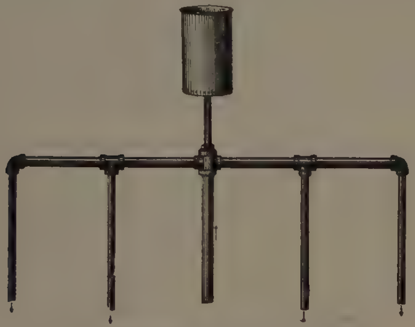
Home-made coil boilers are sometimes constructed for hot-water heating since the cost will generally be considerably less than for tubular boilers. As a rule, however, they will be found less durable and lacking in efficiency as compared with the better class of greenhouse boilers now on the market. For making such boilers, 2-inch wrought-iron pipe in lengths of 4 to 6 feet is used. Formerly 1-inch pipe was used for coil boilers but it is comparatively thin, and, especially where the threads were exposed it was quickly eaten through so that it proved far from being as durable as the larger sizes of pipe. There was also more trouble from the boiling over of the water than when larger pipes were used and if the boilers are constructed of 1-inch pipe it is necessary either to have an elevated expansion tank or run it as a closed system. In making a coil boiler, the pipes are cut of the desired length and the ends are connected either by return bends or by manifolds so as to form a number of vertical coils, each containing from six to ten pipes. The upper ends of the manifolds are joined at the front end of the heater and connected with the main flow-pipe; while the lower ends of the rear manifolds are joined to the returns. As a rule, the grate is of the same width as the coils and from one-half to two-thirds as long.

Although a box coil is much cheaper than a cast-iron heater, when we have added the cost of the grate, doors and other fittings, and of bricking it in, the amount saved will not be large, and its use will often be found less economical, especially as the coil boilers are, as a rule, not more than one-half as lasting as cast-iron boilers, most of which are complete in themselves and require no brickwork or trimmings.

Hot-water piping.

When hot water first came into use for the heating of greenhouses, 4-inch cast-iron pipes were used, but, as the joints were packed with oakum, cement or iron filings, they frequently gave trouble by leaking and it was much more difficult to make changes or repairs than in the present systems for which small, wrought-iron pipes with screw joints are used. Owing to the large amount of water in the cast-iron pipes, the circulation was necessarily quite sluggish and it was not easy to secure the high temperature in the water that can be obtained with smaller pipes. Another objection to the use of these large pipes is that it is not possible to carry the flows overhead, while with smaller pipes one may not only have the flows but some or all of the return-pipes above the level of the benches. By elevating the pipes above the level of the boiler, the rapidity of the circulation and the temperature of the water in the pipes can be considerably increased.

In case a number of houses are to be supplied from one boiler, or if the heater is at some distance from the coils, it is better to start from the boiler with one large flow-pipe, or with two pipes leading from different sides of the boiler, rather than carry an independent pipe to each house. When there are several houses to be heated, it is customary to have them side by side and one large flow-pipe can then be run across the nearest end of the houses from the boiler. If the houses run north and south, the boiler may be located at one corner or in the middle of the north end of the range, and either a work- or storeroom, or some other form of a head house, should be constructed in which the main heating-pipes can be carried, as well as to protect the north end of the houses and facilitate getting from one to another. Sometimes greenhouses run east and west, in which case there should either be a head house at the east end of the range, or if the houses are more than 200 feet in length it may be run through the center of the houses.


1762. Supply-pipe for under-bench flows.

The size of the main feed-pipe as well as of the branch pipes should be in proportion to the amount of radiation they supply. In determining the amount that can be handled by pipes of different sizes, it is always advisable to use somewhat larger supply-pipes when all of the radiation, both flow and return, are under the benches, than when all of the flow-pipes, at least, are overhead. A similar allowance should be made when the boiler is partly above the level of the returns, as compared with systems in which the coils are a number of feet above the top of the boiler, since in the latter case a much smaller supply-pipe will suffice. In a general way, the following sizes can be used as supply-pipes:

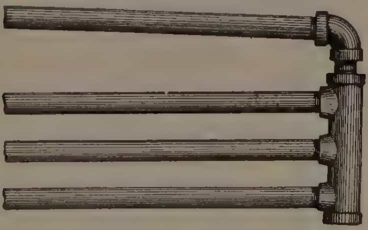
Size of pipe.	Square feet of radiation.
1½-inch	75 to 100
2 -inch	150 to 200
2½-inch	250 to 350
3 -inch	400 to 600
3½-inch	600 to 800
4 -inch	1,000 to 1,200
5 -inch	1,500 to 2,000
6 -inch	2,500 to 3,500

The main supply-pipe or pipes should, if possible, rise vertically from the heater to a point somewhat higher than the highest point in the system, and then as it runs out through the houses should be given a slight fall, say 1 inch in 20 feet, so that there will be no opportunity for the pocketing of air in the pipe. While a slight downward slope will unquestionably give better results than the uphill arrangement which is sometimes used, the difference will be comparatively slight and, if the circumstances make it preferable to run the flow-pipes uphill, satisfactory results will be obtained provided they are considerably elevated above the boiler. Especially, if the flow-pipes run uphill, it will be advisable to have them of good size.

When taking off the supply for each of the houses, one large pipe of a size sufficient to provide the amount needed may be used, or from two to five smaller pipes may lead from the main flow-pipe into each of the houses. For houses up to 250 feet in length, it will generally be found desirable to run 2½-inch flow-pipes through the house, but for longer houses 3-inch flow-pipes should be used. Just how many flow-pipes will be needed will depend not only upon the length of the house, but upon the number of return-pipes to be supplied. Thus, while a 2½-inch flow will supply two 2-inch returns in a house 250 feet long, the number of returns which it will feed in shorter houses will be nearly in inverse proportion to the length of the return coils. When the amount of radiation to be supplied does not exceed 250 to 350 square feet, one 2½-inch flow-pipe in a greenhouse will be sufficient and this should preferably be placed from 1 to 3 feet below the ridge. For slightly larger houses, two flow-pipes may be located on the wall plates. If as many as five pipes are necessary, the fourth and fifth pipe may be suspended from the roof under the middle of the sash-bars. In the case of houses so large that more than five 2½-inch flow-pipes are required, 3-inch flows should be used.

The length of the coils and their height above the boiler will determine the size of the pipe which should be used for the returns, since a smaller size will answer in short coils and in those that are considerably elevated than for long coils which are but little, if any, above the level of the boiler. For the construction of coils 75 feet or more in length, 2-inch pipe should be used, and it will generally be found preferable to a smaller-sized return-pipe when they are only 50 feet in length, especially if the flows are under the benches or when the coils are below the top of the boiler. For short coils, pipes as small as 1¼-inch may be used where they are somewhat elevated but for ordinary commercial greenhouses it will be better to use 2-inch pipe for the returns, although 1½-inch pipe might answer in houses up to 75 feet in length, as, while small pipe furnishes the most effective radiation to the square foot, the increased friction impedes the circulation.

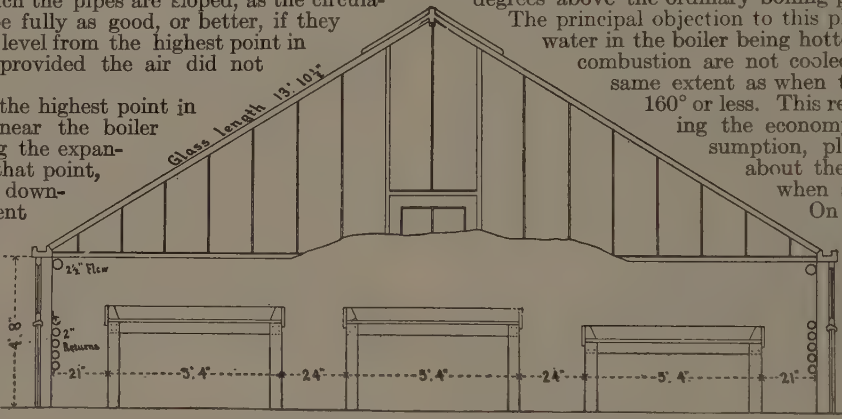
In narrow houses, the return-pipes may be placed upon the side walls, but as the width increases it will be generally advisable to have from one-third to one-half of the returns either under the benches or in the walks when beds are used. From the fact that running the pipes overhead will not only improve the circulation but will prevent cold draughts of air upon the plants, it is often desirable when but one overhead flow-pipe is used to bring back one return upon each of the purlins. When the end of the house is much exposed, it is an excellent plan to drop down one feed-pipe from the end of the main, or two when there is a door in the end of the house, and supply coils running in either direction to the corner of the house and thence along the walls toward the end where the heater is located. Particularly when the pipes are but little, if any, above the top of the boiler, the circulation will be improved by carrying the return-pipes as high as possible, but of course care should be taken when they are under the benches not to have them so high that they will dry out the soil.


1763. Pipe work for modern greenhouse heating. A wall coil.

The returns may be arranged in horizontal coils under the benches, or in vertical coils on the walls, or on the sides and supports of the beds and benches. The pipes in the coils may be connected at their ends either by means of manifolds, or by tees and close nipples, but in either case provision should be made for expansion of the pipe which with vertical wall coils may be done by running them partly across the ends of the houses and the same means may be used in horizontal coils, or the headers at the lower ends of the coils may be connected with the ends of the pipes by means of nipples and right and left ells. Whenever possible, there should be at least two returns supplied by each of the flow-pipes and the number may be increased until the capacity of the flow is reached. In determining just how many returns may be supplied by a given flow-pipe, one should always make allowance for the radiation furnished by the flow-pipe itself and, as the friction will be greater in a large number of short returns than for the same radiation with long returns, this should be considered in adjusting the ratio between the flow- and return-pipes.

Even greater attention should be given to the grading of the small return-pipes than to the larger flow-pipes, as the danger from pocketing of the air will be increased. For the smaller sizes, it will be advisable to give them a slope of at least 1 inch in 15 feet; but, if carefully graded and securely supported at intervals of 10 feet, good results can be obtained with 2-inch pipe with a fall of 1 inch in 20 feet; and if no more than 1 inch in 30 feet is available even this light fall will generally suffice to rid the pipes of air. This is really the main object for which the pipes are sloped, as the circulation would be fully as good, or better, if they are run on a level from the highest point in the system, provided the air did not pocket.

By having the highest point in the system near the boiler and attaching the expansion-tank at that point, one secures a downhill arrangement of the pipes which not only gives a better circulation than when the flow-pipes run uphill, but it does away entirely with air-valves which must be provided when the flow-pipe runs uphill and which often give trouble.



1764. Carnation-house, 100 x 23 ft. 6 in., piped for hot water.

The method of piping which has been advocated, i.e. running one or more pipes in each house to the farther end and there connecting them with the returns, will give a more even temperature than can be secured in any other way. Formerly, it was the custom to connect the supply-pipes with the coils at the end of the house nearest the boiler. In some cases, one-half of the pipes in the coils served as flows to feed an equal number of return-pipes, or all of the pipes in the coil were connected at the farther end of the house with a main return-pipe, of the same size as the feed-pipe, which was brought back underneath the coil, or all of the coils in the house were connected into one main return. When the latter arrangement is used, the heating of the house is less uniform than with an overhead flow-pipe, the farther end of the house being cooler than the one near the heater.

Unless the heating system is connected directly with the water-supply system, which is used as an expansion-tank, a special tank must be provided and connected with the highest part of the flow-pipe or with one of the returns near the heater. While it would answer if this tank is located at some point but slightly above the heating system, it is always desirable to have it somewhat elevated, as this will raise the boiling-point of the water in the system and hence increase its efficiency, as well as lessening the danger of its boiling over. The pipe connecting the expansion-tank with the heating-pipes should not be less than ¾inch and this should be increased to 1½ to 2 inches in large systems. The size of the expansion-tank should be sufficient to equal the amount which the water in the system will increase in volume when it is raised from a temperature of 40° to 200°, with a margin of perhaps 50 per cent. By connecting the expansion-tank with the highest part of the system, one not only does away with the necessity of using air-valves but also lessens the tendency of the water to boil over.

When there are several houses in the range connected with one system, it is always a good practice to have a valve upon the supply-pipe leading to each house, with other valves upon at least one-half of the coils. It will thus be possible to reduce the radiation in each house or to cut it out entirely if desired.

Hot water under pressure.

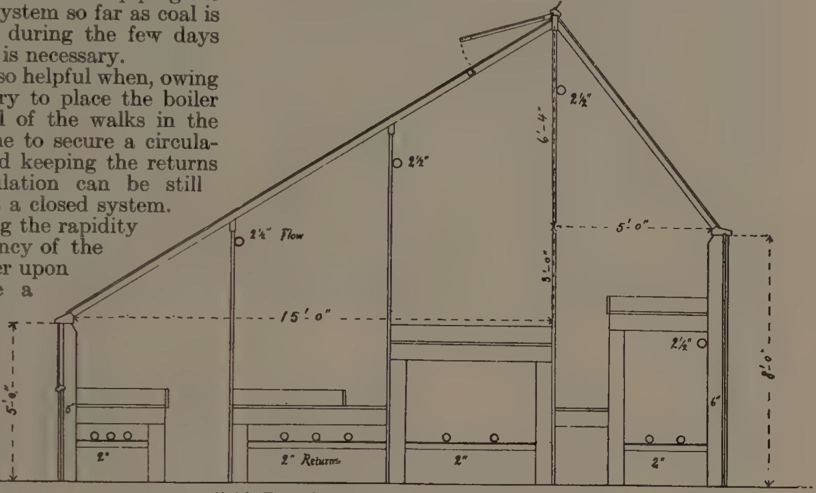
Especially in large ranges it is now becoming customary to place the water under pressure, thus making it possible to raise the temperature at which it will boil, and in this way the circulation can be improved, and instead of the water in the returns having an average temperature of 150°, it can be maintained several degrees above the ordinary boiling-point of water. The principal objection to this plan is that the water in the boiler being hotter, the gases of combustion are not cooled down to the same extent as when the water is at 160° or less. This results in lessening the economy of coal-consumption, placing it upon about the same plane as when steam is used. On the other hand, this system has the merit of reducing the amount of radiation required in the heating-system, and in this way lessening the cost of piping the greenhouse fully twenty-five per cent.

Various methods of placing the water in the heating-system under pressure have been employed. Among them is to use a safety-valve and a vacuum-valve, either upon the expansion-tank, or if this is not closed, upon the expansion-pipe within the tank. The safety-valve allows either the air or the water, as the case may be, to pass out of the system when the pressure desired is reached, while the vacuum-valve permits the air or water to re-enter the system when the pressure drops

What is known as the "mercury generator" or "circulator" also serves the same purpose. In these a column of mercury prevents the escape of the water in the system until the pressure has reached the point desired, when it allows a portion of the water to escape and, later on, to re-enter the system when the pressure decreases. It will be seen that this acts in exactly the same way as the safety-valve and vacuum-valve described above. By raising the boiling-point of water and improving the circulation, it not only makes it possible to use smaller pipes both for flows and returns, but the amount of radiation required will be considerably reduced. In fact, although it is not advisable to carry it to that extent, it is possible to reduce the amount of radiation practically to that required for steam-heating.

This system is of value particularly in sections of the country in which the usual winter temperature is well above zero but where the mercury drops 10° to 15° for a short period each winter. By piping the houses so that the desired temperature can be obtained for the houses in ordinary weather by using an open system, it will then be possible by using a "circulator" to maintain the same temperature in the houses even though the mercury drops 15° or 20° lower. This will make a considerable difference in the cost of piping the houses and the efficiency of the system so far as coal is concerned will be affected only during the few days when the use of the "circulator" is necessary.

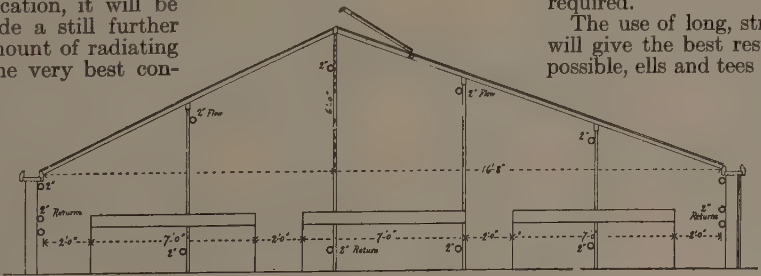
The use of a closed system is also helpful when, owing to local conditions, it is necessary to place the boiler upon or slightly below the level of the walks in the houses. While much can be done to secure a circulation by using overhead flows and keeping the returns as high as possible, the circulation can be still further improved if it is run as a closed system. Still another method of increasing the rapidity of the circulation and the efficiency of the heating-system is to place either upon the main flow- or return-pipe a pump, worked by steam or electricity, by which it will be possible greatly to accelerate the circulation of the water, so that such matters as the relative elevation of the boiler and heating-pipes will need but little consideration and it will be possible to decrease to a considerable extent the size and number of the heating-pipes.



1765. Rose-house, 150 x 20 ft., piped for water.

Estimating hot-water radiation.

Owing to the great variations in temperature and the differences in the construction of greenhouses, and also in their exposures, it is impossible to give any explicit rules regarding the amount of radiation that will be required under all conditions; but experience has shown that in well-built houses any desired temperature can be secured. Knowing the minimum outside temperature and the temperature to be maintained within the house, it is necessary only to install a heating-plant with a radiating surface having a certain definite ratio to the amount of exposed glass and wall surface. It is, of course, understood that there must be a proper adjustment between the size of the boiler and the radiating surface and that the system is so arranged as to give good results. Thus, when a temperature of 40° is desired in sections in which the mercury does not drop below zero, it will be possible to maintain it when 1 square foot of radiating surface is provided for each 5 square feet of glass; if 45° is required there should be 1 foot of radiation for 4½ feet of glass. Under the same conditions, 50°, 55°, 60°, 65° and 70° can be obtained, respectively, by using 1 square foot of radiating surface for each 4, 3½, 3, 2½, and 2 square feet of glass. When the outside temperatures are slightly under or above zero, there should be a proportionate increase or decrease in the amount of pipe used; and, if the houses are poorly constructed or in an exposed location, it will be desirable to provide a still further increase in the amount of radiating surface. Under the very best conditions, the temperatures mentioned can be obtained with a slightly smaller amount of radiation, but the greatest economy so far as coal-consumption and labor are concerned will be secured when the amount of radiation recommended is used.



1766. Violet-house with hot-water heating.

In determining the amount of exposed glass surface, the number of square feet in the roofs, ends and sides of the houses should be added, and to this it will be well to add one-fifth of the exposed wooden, concrete or brick wall surfaces. If the amount thus obtained is divided by the number which expresses the ratio between the area of glass and the amount of radiation which will be required, it will give the number of square feet of heating-pipe which must be installed. The unit of measurement of wrought pipe is its interior diameter, while its radiating surface is determined by its outside circumference, and, although it will vary slightly according to the thickness of the pipe, it is customary to estimate that 1-inch pipe will afford about .344 square feet of radiating surface to the linear foot, while 1¼-, 1½-, 2-, 2½-, and 3-inch pipe will furnish respectively .434, .497, .621, .759 and .916 square feet of radiation for each foot in length of pipe. The following example will perhaps aid in determining the amount of radiating surface and its arrangement in a greenhouse. If a house is 32 feet in width and 200 feet in length, with 30 inches of glass in each side wall and with one end only of exposed glass, and a concrete wall 3 feet high on two sides and one end, there will be about 9,000 square feet of glass. To heat this to 50° in zero weather it will be necessary to use one-fourth as much radiating surface, or 2,250 square feet. In a house of this length it will be possible to supply this amount of radiation by means of five 2½-inch flow-pipes, and the remaining radiation will be provided by means of ten 2-inch returns which will allow two for each of the flow-pipes. These figures are intended to apply when an open system is used but, if a "generator" is attached, not to exceed four flows and eight returns will be required.

The use of long, straight runs of pipe will give the best results and, whenever possible, ells and tees should be avoided, but if they must be employed special hot-water fittings should be secured.

In conservatories with high side walls it is desirable to place the flow-pipes at the plate and the returns on the walls or under the tables. Figs. 1764–1766 illustrate the lay-out of pipes in carnation-, rose-, and violet-houses.

Heating by flues.

When fuel is cheap, and when either a low temperature is desired in the house, or the outside temperature does not drop much below the freezing point, hot-air flues may be used but, while the cost of constructing them is small, the danger of fire is so great that they are often found to be far from economical. A brick furnace is built at one end of the house and from this a 10- or 12-inch flue is constructed to carry the smoke and hot gases through the house to the chimney which may be either at the farther end of the house or directly over the furnace, the flue, in the latter case, making a complete circuit of the house. When the houses to be heated are more than 60 feet long, it is advisable to have a furnace in each end, with the flue from each extending only to the center of the house and returning to the end from which it started. For the first 30 feet the lining of the flue, at least, should be of fire-brick, but beyond that the flue may be constructed of sewer-pipe.

Piping for steam.

Except that it is possible to use smaller flow- and return-pipes, the arrangement of the piping for steam-heating is not very unlike that described for hot water. Unless the houses are more than 30 feet wide and 150 feet in length, only one flow-pipe need be used and that can be carried from 2 to 4 feet below the ridge. In wider and longer houses, it is generally advisable to put in two or more flows. One of these flows can be carried on each wall-plate and in extremely wide houses others may be under the ridge and purlins.

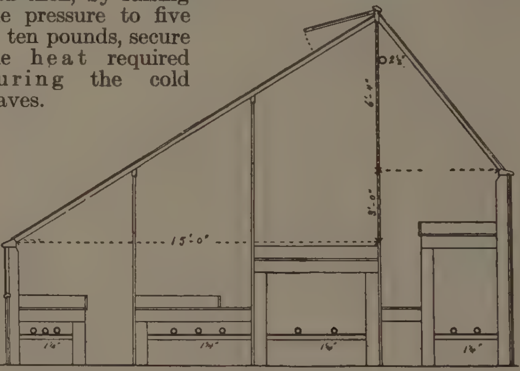
For determining the size of steam mains, a good rule to use is to take one-tenth the square root of the radiation to be supplied and consider this to be the diameter in inches of the main required. Thus for supplying 400 square feet of radiating surface we would take one-tenth the square root of 400 ($\sqrt{400} \div 10 = 2$), which will give 2 inches as the diameter of the main required. As the amount of radiation increases, a slight reduction can be made in the size of the mains and 2½-, 3-, 3½-, and 4-inch supply-pipes will answer respectively for 700, 1,000, 1,400 and 1,900 square feet of radiation. This is intended to apply with low-pressure steam, and as the steam-pressure is increased above five pounds a slight decrease in the size of the mains would be permissible.

The size of the pipes to be used for the coils will also depend upon the length of the house. For ordinary lengths 1¼-inch pipe will be desirable, but, when they are more than 250 feet in length, 1½-inch pipe may be used with low pressure steam and, in those much less than 100 feet, 1-inch pipe will answer. The location and arrangements of the coils will necessarily be determined by the openings in the walls and whether beds or raised benches are used. One of the simplest and most satisfactory ways of piping a greenhouse of moderate size, say from 20 to 30 feet in width and up to 150 feet in length, is to run the flow-pipe, which would be either 2- or 2½-inch, overhead and bring back the coils on the walls, or, if raised benches are used and crops for which bottom heat will be helpful are to be grown, from one-third to one-half of the return-pipes may be distributed under the benches and the remainder may be on the walls. The return-coils should of course be given a slight slope toward the boiler, care being taken that no opportunity is afforded for the air to pocket and prevent the free flow of the water from the condensed steam back toward the boiler. A fall of 1 inch in 10 feet will suffice, and even less will answer if care is taken in grading and supporting the pipes.

In order to prevent the water from backing up in the coils, it is desirable that they should be at least 18 or 20 inches above the level of the water in the boiler, while 3 or 4 feet would be even better and will be necessary in large ranges. Unless this can be secured it will not be possible to return the water of condensation to the boiler by gravity and either a steam trap or pump should be provided for the purpose. By means of these, the water can be carried to a water feed-tank from which it can be fed into the boilers.

There should be an automatic air-valve at the end of each coil and, in order to regulate the amount of steam, a shut-off valve should be placed upon both flow- and return-pipes leading to each house. Unless there are several coils in each house, one or more of which could be cut off by means of valves, it will always be well to have valves upon a number of the pipes in the coils so that all but one or two can be cut off if desired. To prevent the water from being forced out from the boiler when the steam is turned into the houses, there should be a check valve in the main return-pipe near the boiler.

The amount of radiation which will be required to secure a given temperature will vary to some extent with the amount of pressure carried in the boiler, or in the coils, when a reducing-valve is used, but as a rule, this is not much more than five pounds and often it is even less. It will be best to provide a sufficient amount of radiation to furnish the temperature desired in ordinary cold weather without carrying any pressure and then, by raising the pressure to five to ten pounds, secure the heat required during the cold waves.



1767. Rose-house, 150 x 20 feet, piped for steam.

In determining the amount of radiation for a steam-heated house, for zero weather, it will answer if one considers that 1 square foot of pipe will heat 9 square feet of glass when 40° are desired, and will suffice for 7, 5 and 3 where 50°, 60°, and 70°, respectively, are, required. Fig. 1767 illustrates the piping required for heating a rose-house with steam.

L. R. Taft.

Greenhouse management.

Persons usually learn to grow plants under glass by rule of thumb. Such practical knowledge is always essential, but better and quicker results are secured if underlying truths or principles are learned at the same time. Even if no better results in plant-growing were to be attained, the learning of principles could never do harm, and it adds immensely to the intellectual satisfaction in the work. There is no American writing that essays to expound the principles of greenhouse management, although there are manuals giving direct advice for the growing of different classes of plants. There are two kinds of principles to apprehend in greenhouse management,—those relating to the management of the plants themselves, and those dealing primarily with the management of the house.

The first principle to be apprehended in the growing of plants under glass is this: *Each plant has its own season of bloom.* Every good gardener knows the times and seasons of his plants as he knows his alphabet, without knowing that he knows. Yet there are many failures because of lack of this knowledge, particularly among amateurs. The housewife is always asking how to make her wax-plant bloom, without knowing that it would bloom if she would let it alone in winter and let it grow in spring and summer. What we try to accomplish by means of fertilizers, forcing and other special practices may often be accomplished almost without effort if we know the natural season of the plant. Nearly all greenhouse plants are grown on this principle. We give them conditions as nearly normal to them as possible. We endeavor to accommodate our conditions to the plant, not our plant to the conditions. Some plants may be forced to bloom in abnormal seasons, as roses, carnations, lilies (see *Forcing*). But these forcing plants are few compared with the whole number of greenhouse species. The season of normal activity is the key to the whole problem of growing plants under glass; yet many a young man has served an apprenticeship, or has taken a course in an agricultural college, without learning this principle.

The second principle is like unto the first: *Most plants demand a particular season of inactivity or rest.* It is not rest in the sense of recuperation, but it is the habit or nature of the plant. For ages, most plants have been forced to cease their activities because of cold or dry. These habits are so fixed that they must be recognized when the plants are grown under glass. Some plants have no such definite seasons, and will grow more or less continuously, but these are the exceptions. Others may rest at almost any time of the year; but most plants have a definite season, and this season must be learned. In general, experience is the only guide as to whether a plant needs rest; but bulbs and tubers and thick rhizomes always signify that the plant was obliged, in its native haunts, to carry itself over an unpropitious season, and that a rest is very necessary, if not absolutely essential, under domestication. Instinctively, we let bulbous plants rest. They usually rest in our winter and bloom in our spring and summer, but some of them—of which some of the Cape bulbs, as nerines, are examples—rest in our summer and bloom in autumn.

The third principle from the plant side is this: *The greater part of the growth should be made before the plant is expected to bloom.* It is natural for a plant first to grow: then it blooms and makes its fruit. In the greater number of cases, these two great functions do not proceed simultaneously, at least not to their full degree. This principle is admirably illustrated in woody plants. The gardener always impresses on the apprentice the necessity of securing "well-ripened wood" of azaleas, camellias, and the like, if he would have good flowers. That is, the plant should have completed one cycle of its life before it begins another. From immature and sappy wood only poor bloom may be expected. This is true to a degree even in herbaceous plants. The vegetative stage or cycle may be made shorter or longer by smaller or larger pots, but the stage of rapid growth must be well passed before the best bloom is wanted. Fertilizer applied then will go to the production of flowers; but before that time it will make largely for the production of leaf and wood. The stronger and better the plant in its vegetative stage, according to its size, the more satisfactory it should be in its blooming stage.

Closely like the last principle is the experience that *checking growth, so long as the plant remains healthy, induces fruitfulness or floriferousness.* If the gardener continues to shift his plants into larger pots, he should not expect the best results in bloom. He shifts from pot to pot until the plant reaches the desired size; then he allows the roots to be confined, and the plant is set into bloom. Over-potting is a serious evil. When the blooming habit is once begun, he may apply liquid manure or other fertilizer if the plant needs it. The rose-grower or the cucumber-grower wants a shallow bench, that the plants may not run too much to vine.

A carnation-grower writes that there is "little difference in the yearly average as to quality or quantity of flowers, but plants grown on shallow benches come into flower more quickly in the fall. Those grown in solid beds produce an abundance of flowers later in the season. The preference of commercial carnation-growers is for raised benches so that there may be more blooms early in the fall and at the Christmas holidays."

The natural habitat of the plant is significant to the cultivator; it gives a suggestion of the treatment under which the plant will be likely to thrive. Unconsciously the plant-grower strives to imitate what he conceives to be the conditions, as to temperature, moisture and sunlight, under which the species grows in the wild. We have our tropical, temperate and cool houses. Yet, it must be remembered that the mere geography of a plant's native place does not always indicate what the precise nature of that place is. The plant in question may grow in some unusual site or exposure in its native wilds. In a general way, we expect that a plant coming from the Amazon needs a hothouse; but the details of altitude, exposure, moisture and sunlight must be learned by experience. Again, it is to be said that plants do not always grow where they would, but where they must. Many plants that inhabit swamps thrive well on dry lands.

Yet, the habitat and the zone give the hint: with this beginning, the grower may work out the proper treatment. Examples are many in which cultivators have slavishly followed the suggestion given by a plant's nativity, only to meet with partial failure. Because the dipladenia is Brazilian, it is usually supposed that it needs a hothouse, but it gives best results in a coolhouse. Persons often make a similar mistake in growing the pepino warm, because it is Central and South American. Ixia is commonly regarded in the North as only a glasshouse subject because it is a Cape bulb, yet it thrives in the open in parts of New England, when well covered in winter.

The best method of propagation is to be determined for each species; but, as a rule, quicker results and stockier plants are secured from cuttings than from seeds. Of necessity, most greenhouse plants are grown from cuttings. In most cases, the best material for cuttings is the nearly ripe wood. In woody plants, as camellias and others, the cutting material often may be completely woody. In herbaceous plants, the proper material is stems which have begun to harden. Now and then better results are secured from seeds, even with perennials, as in grevillea and *Impatiens Sultani*.

Coming, now, to some of the principles that underlie the proper management of the house, it may be said, first of all, that the grower should *attempt to imitate a natural day.* There should be the full complement of continuous sunlight; there should be periodicity in temperature. From the lowest temperature before dawn, there should be a gradual rise to midday or later. As a rule, the night temperature should be 10° to 15° F. below the maximum day temperature in the shade. A high night temperature makes the plants soft and tends to bring them to maturity too early. It makes weak stems and flabby flowers. The temperature should change gradually: violent fluctuations are inimical, particularly to plants grown at a high temperature.

In greenhouse cultivation, *every plant is to receive individual care.* In the field, the crop is the unit: there we deal with plants in the aggregate. In the greenhouse, each plant is to be saved and to receive special care: upon this success depends. There should be no vacant places on the greenhouse bench; room is too valuable. All this means that every care should be taken so to arrange the house that every plant will have a chance to develop to its utmost perfection. Patient hand labor pays with greenhouse plants. The work cannot be done by tools or by proxy. Therefore, the gardener becomes skilful.

Every caution should be taken to *prevent the plants from becoming diseased or from being attacked by insects.* The greater part of insect and fungous troubles in the greenhouse is the result of carelessness or of mistakes in the growing of the plants. Determine what diseases or pests are likely to attack any plant; discover under what conditions these diseases or pests are likely to thrive; then see that those conditions do not arise. Keep the house sweet and clean. Destroy the affected parts whenever practicable. Then if trouble come, apply the fungicide or the insecticide. Remember that the very protection which is given the plants, in the way of equable conditions, also protects their enemies: therefore, it is better to count on not having the difficulties than on curing them. If uncontrollable diseases or pests have been troublesome, make a complete change of soil or stock before the next season, if practicable. At least once every year there is an opportunity to rid the place of pests. Nematodes may be frozen out. Many gardeners carry their troubles year by year by trying to fight them, when they might succeed by trying to avoid them.

Of course, the greenhouse man must provide himself with the best insecticides and fungicides, and with good apparatus. The efficiency of these materials and appliances has greatly improved in recent years, and most of the old pests may now be controlled.

The higher the temperature and the more rapid the growth, the greater the care necessary to insure good results. Plants grown under such conditions are soft and juicy. They are easily injured by every untoward circumstance, particularly by drafts of cold air. Let a draft of cold air fall on cucumbers or rapid-growing roses, and mildew will result in spite of bordeaux mixture and brimstone.

In dark weather, grow the plants "slow." If given too much heat or too much water, they become soft and flabby, and fall prey to mildew, green-fly and other disorders. A stocky plant is always desirable, but particularly in the dull weather and short days of midwinter: at that time, extra precautions should be taken in the management of the house.

Watering plants under glass requires more judgment than any other single operation. *Apply water when the plants need it,* is a gardener's rule, but it is difficult to follow because one may not know when they need it. Yet, if the gardener will put the emphasis on the word *need* he will at least be cautioned: novices often apply the advice as if it read: Apply water when the plants will stand it. *Water thoroughly at each application.* Mere dribbling may do more harm than good. Many persons water too frequently but not enough. Remember that in benches evaporation takes place from both top and bottom; and in pots it takes place from all sides. *Water on a rising temperature.* This advice is specially applicable to warmhouse stuff. Watering is a cooling process. *The foliage should not go into the night wet,* particularly if the plant is soft-growing or is a warmhouse subject. *Water sparingly or not at all when evaporation is slight,* as in dull weather.

In all greenhouse work, *see that the soil is thoroughly comminuted and that it contains much sand or fiber.* The amount of soil is small: see that it is all usable. In the garden, roots may wander if good soil is not at hand: in pots they cannot. The excessive watering in greenhouses tends to pack the soil, particularly if the water is applied from a hose. The earth tends to run together or to puddle. Therefore, it should contain little silt or clay. The practice of adding sand and leaf-mold to greenhouse soil is thus explained.

Ventilation is practised for the purpose of reducing temperature and of lessening atmospheric moisture. Theoretically, it is employed also for the purpose of introducing chemically fresh air, but with the opening and shutting of doors, and unavoidable leaks in the house, it is not necessary to give much thought to the introduction of mere fresh air. Ventilating reduces the temperature by letting out warm air and letting in cool air. The air should be admitted in small quantities and at the greatest distance from the plants in order to avoid the ill effects of drafts on the plants. Many small openings are better than a few very large ones. Ventilate on a rising temperature.

Most plants require shading in the summer under glass. *Shading is of use in mitigating the heat as well as in tempering the light.* A shaded house has more uniform conditions of temperature and moisture. If plants are grown soft and in partial shade, they are likely to be injured if exposed to bright sunlight. Sunscalding is most common in spring, since the plants are not yet inured to bright sunshine and strong sun heat. The burning of plants is due to waves (not bubbles) in the glass. Other things being equal, the larger the house the easier is the management of it. It is less subject to fluctuations of temperature and moisture. Greenhouses built against residences are specially liable to violent fluctuations; the body of air is small and responds to all external changes. L. H. B.

GREENS, CHRISTMAS. The Christmas greens industry has developed to an enormous extent within a few years. Some thirty years ago, when florists began to use lycopodium, a dozen barrels were all that was used in a single season in many of our larger cities. Today the output in the United States is many full carloads.

The materials now used, mentioned in something like their order of commercial importance, are holly, lycopodium (also known as bouquet green, ground pine, club moss), mistletoe, laurel, and cedar clippings. Other articles of similar utility are wild smilax, hardy ferns, needle pines, outdoor palm leaves, Florida moss, galax leaves and leucothoë sprays: these all come from the South.

Lycopodium is one of the oldest and commonest of decorative materials. During seasons of long-continued "Indian summer," a surplus is frequently gathered by careless pickers and thrown on the market. The choicest picked stock being obtainable only through the regular and well-established trade channels, such sources are usually the only ones in case of early snowstorms, which prevent the gathering of it. Choice stock from eastern Vermont, northern New York and Pennsylvania has usually been handled in large sugar-barrels, tied in carefully arranged bunches, weighing perhaps one-half to one pound each. These bunches are packed in the barrels in layers, with roots toward the center. The quantity is always limited and the price 25 to 35 per cent higher than the Wisconsin and Michigan stock. Lycopodium, as placed on the market from western sources, comes from the north-central part of the state of Wisconsin and is gathered mainly in the section extending from the northwest shores of Lake Michigan three-fifths of the way to the Mississippi River. The activities in this direction are conducted mainly in Oconto, Shawano, Marathon, Langlade, Lincoln, Forest, Oneida, Taylor, Price and Vilas Counties. The section from which lycopodium is picked annually moves northward as the country becomes settled and as the woods and swamps are depleted. This article is also gathered in a few spots in the northern peninsula of Michigan, and in Pine, and Carleton Counties in Minnesota. Surplus stock of this plant is sometimes carried over until the following season when it is soaked and dyed green and made up into wreathing. The same article carried over from

LI. A home greenhouse.

Christmas in the usual 100-pound crates loses its fresh color and dries down to a weight of about fifty pounds. There is some foreign demand for this plant in the German cities for use in the artificial-flower trade. This plant seems to thrive best in moist, shaded localities, and when plucked out by the roots, as is done when gathering, is not replaced by new growth of its kind. More open situations and drier ground produce lycopodium of a lighter and yellowish color, and consequently of less decorative value. Indians pick the best green, but are unreliable when exact dates must be met. The average season's output from Wisconsin is perhaps thirty-five carloads, or 150 to 200 tons.

The use of holly in a commercial way has grown from a very small beginning to its present proportions within fifteen years. Until the last twenty years most of the holly was handled by wholesale seedsmen and florists. Within that time the sale of holly has been taken up by the produce commission houses in large cities, thereby trebling the volume, but reducing the quality. Delaware and Maryland furnish the best stock of what is known as eastern holly, while Tennessee and some other parts of the South ship what is usually an inferior quality. Holly is almost always packed in uniform cases 2 by 2 by 4 feet. Freezing, while packed in cases, damages it but little, provided the holly be allowed to thaw out in a very cool and preferably dark place, where the temperature is not allowed to exceed 45° F. If, however, frozen holly is shipped in warm express cars, the foliage may turn black in a night. English holly has occasionally been imported into the United States and into Canada, but never satisfactorily commercially. For red winter berries, *Ilex verticillata*, a deciduous holly which grows in large quantities in Michigan, is now a much-sought decorative material.

Both holly and lycopodium are becoming more scarce every year, and the market has probably advanced permanently 20 to 30 per cent in the last two or three years.

Mistletoe branches as used in America (a very little is imported from France) are collected chiefly in New Mexico and Oklahoma, and small quantities from Tennessee, Kentucky or Arkansas. It is now usual to ship this in heavy pasteboard cases containing twenty-five to fifty pounds. The western or central states probably use 15,000 to 20,000 pounds from the states mentioned. Mistletoe is easily very seriously injured from freezing in transit.

Cedar clippings are now but little used during the holiday season, but on other occasions, when open-air decorations are desired, they are frequently made into roping or wreaths.

Wild smilax, in light cases, usually in three sizes, is shipped by express mostly from Alabama and Georgia. It is as liable to injury by freezing as mistletoe, but is not damaged if allowed to thaw out gradually before removal from the case. The use of this article by the wholesale cut-flower dealers is increasing. There is probably $20,000 worth used annually and some carload shipments are made. It is readily perishable and the wholesale dealers put it in ice storage where it keeps for two to three weeks. They do not usually keep it in stock except during the holiday season.

Boxwood clippings of lengths from 12 to 18 inches have become quite an article of commerce. These are gathered from Maryland, Virginia, West Virginia and other similar localities and are used mainly in the cut-flower trade for making wreaths and for mixing with fresh flowers. The gathering and shipping of this article for the above purpose was begun four or five years ago. The trade has increased rapidly and perhaps fifty tons or more were used in 1911. It will probably take but a short time to exhaust the old gardens where this plant has been growing in the sections mentioned, as it is not to be had except around old homesteads where it was planted years ago.

The use of laurel is increasing largely during the past five years and it is now shipped from Maryland, Delaware, Virginia and New Jersey, both in bulk in short sprays in cases, similar to those used in holly cases, and in wreathing in coils usually containing 100 yards. Shipments are made from the above sections to the northern and western states.

Hardy ferns are also marketed through the wholesale cut-flower merchants. These are gathered in Massachusetts and Michigan and kept in storage the entire year, not being so perishable as wild smilax. Wisconsin is now producing as many ferns as Michigan, or perhaps more.

Among the most artistic materials for Christmas decoration are galax leaves and leucothoë sprays. Galax grows in the mountains from North Carolina to Georgia, and nowhere else in the world.

For further particulars concerning this industry, see American Florist 14:598–600 (1898). For the artistic side of Christmas decoration, see illustrated articles by F. Schuyler Mathews in American Florist 8:484 and 9:493.

J. C. Vaughan.

GREENS, EDIBLE, or POT-HERBS. This term greens is generally applied in America to any pot-herb, that is to say, to any green herbage which is cooked and served separately from the other principal and secondary dishes of a square meal. The term "greens" is commonly used for the mess of cookery which is brought to the table. It is not so often applied to the plants growing in the garden. In the garden, perhaps, they are herbs—pot-herbs—although this term is not so much employed as it conveniently might be. Greens are served early in the spring, when the appetite craves anything which tastes like out-of-doors.

All sorts of plants are used as pot-herbs. Almost anything which shows a succulent growth in the spring is likely to be tried by somebody. Turnip tops, potato leaves, pig-weeds, purslane, and many other apparently impossible herbs, are often impressed into the service. The really good pot-herbs are comparatively few, however. Probably the best are dandelion, spinach, mustard (various species), endive, chard, beet-top and kale.

The following plants have been more or less used as pot-herbs:

Buck's-horn Plantain, *Plantago Coronopus.*
California Peppergrass, *Brassica japonica.*
Cardoon, *Cynara Cardunculus.*
Chard, *Beta vulgaris.*
Chervil, *Anthriscus Cerefolium.*
Chicory, *Cichorium Intybus.*
Chinese Amaranth, *Amarantus gangeticus.*
Chinense Artichoke, *Stachys Sieboldii* (*S. affinis* or *S. tuberifera*).
Chinese Cabbage, *Brassica Pe-tsai.*
Chinese Cabbage, *Brassica chinensis.*
Chinese Mustard, *Brassica juncea.*
Chives, *Allium Schoenoprasum.*
Corn Salad, *Valerianella olitoria.*
Cress, *Lepidium sativa.*
  Meadow Cress, *Cardamine pratensis.*
  Pará Cress, *Spilanthes oleracea.*
  Upland Cress, *Barbarea vulgaris* and *B. præcox.*
  Other so-called Cresses, as *Lepidium chilense, Lepidium piscidium, Lepidium virginicum, Senebiera pinnatifida, Nasturtium indicum, Gynandropsis pentaphylla.*
Dandelion, *Taraxicum officinale.*
Dock, *Rumex,* several species.
Endive, *Cichorium Endivia.*
Globe Artichoke, *Cynara Scolymus.*
Good King Henry, *Chenopodium Bonus-Henricus.*
Goosefoot, *Chenopodium,* mostly *C. album.*
Ice Plant, *Mesembryanthemum crystallinum.*
Italian Corn Salad, *Valerianella eriocarpa.*
Kale, *Brassica oleracea.*
Lettuce, *Lactuca* (especially the wild species, some of which are excellent).
Malabar Nightshade, *Basella alba* and *Basella rubra.*
Mustard, *Brassica* species.
Nasturtiums, *Tropæolum* species.
Orach, *Atriplex hortensis.*
Parsley, *Petroselinum.*
Pepper-grass, *Lepidium* species.
Pigweed, *Amarantus* species.
Pokeweed, *Phytolacca decandra.*
Quinoa, *Chenopodium Quinoa.*
Rocket Salad, *Eruca sativa.*

Rosella, *Hibiscus Sabdariffa.*
Salad-Burnet, *Porterium Sanguisorba.*
Sorrels, various, *Oxalis crenata, O. tetraphylla.*
Spinach, *Spinacia oleracea.*
Tuberous-Rooted Chinese Mustard, *Brassica napiformis.*
Turnip, *Brassica Rapa.*
Winter Purslane, *Montia perfoliata.*

Culture.—Pot-herbs are wanted at the earliest possible moment in the spring. They are, therefore, often grown in hotbeds, frames, or in greenhouses (see *Spinach, Dandelion, Mustard,* etc.). They must be succulent and tender. It is necessary, on this account, that they be quickly grown in loose, very rich, well-drained soil, with plenty of water. Specific directions for the cultivation of the various plants will be found under the several heads. F. A. Waugh.

GREGÒRIA: *Douglasia.*

GREÌGIA (Major-General Greig, Russian horticulturist). *Bromeliàceæ.* A few species of large Andine, terrestrial or rock-loving herbs, allied to Cryptanthus, from which it differs in its simple rather than panicled infl. Fls. perfect; sepals free or lightly joined at the base, linear or ovate-lanceolate or almost subulate; perianth with free elliptical segms. rounded at apex; stamens shorter than petals or scarcely exceeding them; petals rose-color or white suffused with rose, becoming brownish. **G. sphacelàta,** Regel (*Billbérgia sphacelàta,* R. & S. *Bromèlia sphacelàta,* Ruiz & Pav.). Stout pineapple-like plant, 3 ft., with strong spiny-margined spreading or recurving lvs.: fls. rose-color, in dense heads in the axils of the lvs., the outer bracts spiny and very acute. Summer. Chile.—A showy plant. L. H. B.

GRENADIN or GRENADINE: A type of carnation.

GREVÍLLEA (Charles F. Greville, once vice-president of the Royal Society of England, and a patron of botany). *Proteàceæ.* Trees and shrubs, of about 200 species, mostly Australian, one of which is commonly cultivated in this country as a decorative pot-plant and also in the open in southern California and elsewhere in warm regions.

Leaves alternate, very various: fls. small, perfect, mostly in pairs in the clusters or racemes, apetalous, the calyx with 4 recurved parts; stamens of 4 sessile perfect anthers borne on the sepals; style 1, long and curved: fr. a follicle, with 1 or 2 winged orbicular or oblong flat seeds. The fls., sometimes showy and ornamental, are terminal and axillary, the racemes sometimes umbel-like. The fls. of some species produce honey. Some species yield useful timber.

A. *Racemes secund, many-fld.: lvs. much cut or compounded.*

robústa, Cunn. Silk Oak. Fig. 1768. One of the most popular of all fern-leaved pot-plants. When young (from 2–5 ft. high) it makes a most graceful subject. In glasshouses it is not grown to large plants, and, therefore, little is known of the great size which it attains in its native forest. According to Von Mueller, it is "indigenous to the subtropical part of E. Austral., rising to 150 ft., of rather rapid growth, and resisting drought to a remarkable degree; hence one of the most eligible trees even for desert culture, though naturally a sylvan plant. The wood is elastic and durable, valued particularly for staves of casks, also for furniture. The richly developed golden yellow trusses of fls. attract honey-sucking birds and bees through several months of the year. The seeds are copiously produced and germinate readily. Rate of growth in Victoria, 20–30 ft. in 20 years. In Ceylon it attained a stem-circumference of 5 ft. in 8 years." In Calif. and S. Fla. it is a street lawn tree, although the branches break easily in exposed places. When grown in the open, it will stand some frost. As a glasshouse plant it is grown almost wholly from seeds, and is used in its young state; as the plant becomes old, it loses its leaves and becomes ragged below. It thrives in the temperature suited to geraniums or roses, and it stands much hard usage and neglect. It is popular as a window subject. Best results with grevillea are usually secured by raising a fresh stock every year, from seed sown late in winter or in spring. The following winter or spring they will be in 4–6 in. pots, and will be in their prime. The young plants need frequent repotting to keep them in good condition. *Grevillea robusta* has come to be generally known as a florists' plant within the past thirty years. Lvs. twice-pinnatifid (or the pinnæ deeply pinnatifid), or nearly 3-pinnate under cult., the ultimate divisions narrow and pointed and sometimes lobed, pubescent: racemes 3–4 in. long, solitary or several together on short leafless branches of the old wood; fls. orange, glabrous, the tube ¼in. long, the parts revolute: fr. about ¾in. long, broad, very oblique. B.M. 3184. G. 2:615; 8:680. G.L. 24:40. A.G. 14:115. A.F. 4:413.—In the W. Indies the plant is much grown, and it is often trimmed to desired shape. In exposed places the foliage becomes golden in cast. Var. **compácta,** Hort., is a condensed dwarf form with handsome foliage, G.C. III. 49:375. G.M. 54:452. G. 33:393. F. E. 31:1259. Var. **pyramidàlis,** Hort., is offered abroad. Var. **Fórsteri** (*G. Fórsteri,* Hort.) is a form of *G. robusta.* It has silvery foliage, large trusses of deep bright red fls., and much stronger growth. R.B. 24:3.

1768. Grevillea robusta. (×⅙)

Thelemanniàna, Hueg. (*G. Prèissii,* Meissn.). Spreading shrub, the young growths soft-tomentose: lvs. 1–2 in. long, pale or glaucous, pinnate, the lower pinnæ usually divided, segms. linear: racemes terminal, rather dense, 1½ in. or less long; fls. pink with green tips, few-hairy outside and bearded inside, the tube about ¼in. long: fr. about ½in. long, smooth. B.M. 5837. R.H. 1882:456. J.H. III. 42:497. H.U. 6:193. G.W. 5:499.—Now popular in Calif.

Bánksii, R. Br. Tall shrub or slender small tree, with branches rusty-tomentose: lvs. 4–8 in. long, pinnate or deeply pinnatifid, the segms. 3–11 and broad-linear or lanceolate, margins revolute: racemes terminal, erect and dense, 2–4 in. long; fls. red, tomentose outside and glabrous inside: fr. about 1 in. long, obliquely ovate. B.M. 5870. G.C. III. 16:15.—Offered abroad.

AA. *Racemes not secund, dense and usually short, sometimes panicled: lvs. less divided, often only lobed.*

Hilliàna, F. Muell. Large tree, with minutely tomentose young branches: lvs. 6–8 in. or more long, sometimes entire and obovate-oblong or elliptical and very obtuse, sometimes deeply divided or even pinnatifid: fls. red, small and very many in dense cylindrical racemes 4–8 in. long, silky outside, glabrous or nearly so inside: fr. nearly 1 in. long, slightly compressed. B.M. 7524.—Pink and white varieties are mentioned.

glabràta, Meissn. (*G. Mánglesii*, Hort.). Shrub, glabrous, slender: lvs. 1–1½ in. long, broadly cuneate, shortly and acutely 3-lobed: fls. white, in axillary racemes equaling the lvs. or the upper racemes panicled, the perianth glabrous, the tube much exceeding the globular limb.—Offered abroad as a bright green ornamental foliage plant of drooping habit.

There are no other grevilleas in the American trade, but following are accessible portraits of other species: *G. acanthifòlia*, Cunn. B.M. 2807.—*G. alpéstris*, Meissn. (G. alpina var. Lindl.). B.M. 5007. R.H. 1887:108. R.B. 23:145.—*G. annulífera*, Muell. B.M. 6687.—*G. arendria*, R. Br. (G. canescens, R. Br.). B.M. 3185.—*G. asplenifòlia*, Knight. B.M. 7070. R.H. 1882, p. 245 (as G. longifolia).—*G. bipinnatífida*, R. Br. B.M. 8510.—*G. Càleyi*, R. Br. B.M. 3133.—*G. canéscens*, R. Br.=G. arenaria.—*G. ericifòlia*, R. Br. B.M. 6361.—*G. fasciculàta*, R. Br. B.M. 6105.—*G. Hookeriàna*, Meissn. B.M. 6879.—*G. intricàta*, Meissn. B.M. 5919.—*G. juniperìna*, R. Br. (G. sulphurea, Cunn.). G.C. II. 26:469.—*G. lavandulàcea*, Schlecht. (G. rosea, Lindl.). I.H. 2:61. J.F. 3:288.—*G. lineàris*, R. Br. B.M. 2661.—*G. longifòlia*, R. Br.=G. asplenifolia.—*G. macróstylis*, Muell. B.M. 5915.—*G. pulchélla*, Meissn. B.M. 5979.—*G. punícea*, R. Br. B.M. 6698.—*G. rosmarinifòlia*, Cunn. B.M. 5971. G.C. II. 5:529. G. 35:389.—*G. serícea*, R. Br. (G. dubia, R. Br.). B.M. 3798.—*G. sulphùrea*, Cunn.=G. juniperina.

L. H. B.

GRÈWIA (Nehemiah Grew, of Coventry, 1628–1682, author of a work on anatomy of plants). *Tiliàceæ.* Two or three woody plants slightly cultivated in southern Florida.

A genus of about 70 species of trees and shrubs in the warmer parts of the world, often having stellate pubescence: lvs. entire or serrate, 1–9-nerved: fls. yellow or rarely purple, in axillary, few-fld. cymes or terminal panicles; petals 5, with pits or glands inside at the base; stamens indefinite; ovary 2–4-celled: drupe 1–4-stoned. **G. Cáffra,** Meissn., from Natal, was intro. by Reasoner Bros. in 1891. A bushy plant with young shoots and lvs. glabrous and with purple star-shaped fls. borne during most of the year. **G. denticulàta,** Wall., from India, was never described. Under this name Reasoner cult. a plant "resembling a mulberry in growth, which bears enormous quantities of acid drupes, about the size of cranberries; used for pickling." **G. oppositifòlia,** Roxbg., is a rough, much-branched tree, with distichous, crenate-serrate lvs. and fls. in umbellate cymes, borne opposite the lvs.: fls. yellowish, the oblong petals half the length of the sepals. The species are little known in Amer.

N. Taylor.†

GRÈYIA (after Sir George Grey, once Governor of Cape Colony). Often spelled *Greya*. *Melianthàceæ.* A small tree from Natal, which bears large spikes of pendulous, five-petaled, scarlet flowers, and is cultivated outdoors in southern California and abroad under glass in many botanic gardens.

Species probably 3, but only 1 appears to be in cult.; in R.H. 1894:252 this plant is shown at its best, with a spike 6 in. long and 2–3 in. wide, containing probably over 100 fls., each ¾in. across. In France this tree flowered from the end of autumn throughout the winter. The long-exserted stamens with reddish purple anthers make a striking feature. The structure of the fls. is so peculiar that Harvey referred the genus doubtfully to the saxifrage family. In European greenhouses, greyia is a shrub requiring full sunlight, thorough ripening of the wood and a season of rest before flowering. In Natal it flowers in Aug. or Sept., which is early spring there. Europeans recommend a sandy loam. Prop. by seeds or by cuttings from half-ripened wood.

Sútherlandii, Hook. & Harv. Small tree, with thick, naked branches and light-colored bark: lvs. clustered at the ends of the branches, 2–3 in. long, orbicular, ovate or oblong, deeply cordate at base, toothed; petiole 9–12 lines long: fls. bright crimson; disk cup-shaped, with 10 marginal teeth, each crowned by a peltate gland; stamens 10; ovary laterally 5-lobed, 5-celled; ovules numerous, in 2 series in the inner angle of the cells: fr. capsular, 5-valved; seeds albuminous. B.M. 6040. R.H. 1894:252. G.C. II. 19:625; III. 43:138. J.H. III. 30:101.

N. Taylor.†

GRÌAS (name refers to the fr. being edible). *Lecythidàceæ.* Tall W. Indian trees, with branches short or none and very large alternate simple lvs., one of them known for its edible fr.: fls. large, white or yellow, lateral; calyx entire in bud, but becoming 2–4-lobed or torn; petals spreading, 4 or 5; stamens many, in many or several rows on the disk, the inner ones smaller, the fleshy filaments conniving into a globular involute body, the anthers small and the cells distinct: fr. fleshy, ovoid.—Species about 4. *G. cauliflòra*, Linn., produces the Anchovy pear: lvs. 2–4 ft. long, lanceolate-acuminate, entire, drooping, glossy, borne in palm-like tufts or heads on the top of the st. or ends of branches.: fls. on short branching peduncles from the old st. far below the lvs., fragrant, 2 in. across, yellow: fr. ovoid, 2–3 in. long, 8-grooved, brown, fleshy, with 1 seed, said to be edible. W. Indies. B.M. 5622.

L. H. B.

GRIFFÍNIA (after William Griffin, who brought these plants from Brazil). *Amaryllidàceæ.* Brazilian bulbs, with distinct foliage, and flowers, about 2½ inches across, which are more or less tinged with lilac or rose.

Leaves usually petioled, and with a very broad blade: perianth-tube none or very short, the 3 lower segms. narrower than the upper; ovary 3-celled; stigma capitate, rarely 3-fid; umbel 6–15-fld. Griffinia is distinguished from many other genera by its 2 ovules, which are basal and collateral.—Seven species. Like many other genera of the amaryllis family, bulbs of flowering size are too costly for general use. Very doubtfully in cult. in Amer.

A. *Stigma capitate.*

hyacínthina, Herb. Bulb globose: lvs. 6–9 in. long, 2–3 in. broad, rounded at the base to a channeled petiole as long as the blade: scape 1–2 ft. long; pedicels none or very short; stamens much shorter than the segms. B.R. 163 (as *Amaryllis hyacinthina;* upper segms. tinged blue, lower ones nearly white). J.H. III. 31:371; 55:325. G.M. 47:45. Var. **máxima,** Gn. 50, p. 209, is probably the best garden form. Called "blue amaryllis" in some catalogues.

AA. *Stigma distinctly 3-cut.*

Blumenàvia, Koch & Bouché. Bulb ovoid: lvs. 4–5 in. long, cuneately narrowed to a petiole, shorter than the blade: scape 6–8 in. long; pedicels ½in. long; stamens as long as the perianth. B.M. 5666 (veins rose-colored). R.H. 1867:32. Gn. 50:208 (veined and flushed with rose).

N. Taylor.†

GRINDÈLIA (Hieronymus Grindel, of Riga and Dorpat; died 1836). *Compósitæ.* Hardy plants sometimes cultivated for their showy yellow flowers, which are 1½ to 2 inches across and borne freely all summer.

Herbs, sometimes shrubby, of coarse habit, mostly natives of the U. S. west of the Mississippi: lvs. sessile or partly clasping and usually serrate and rigid: heads terminating the branches, solitary or in cymes or panicles; involucre bell-shaped or hemispheric, the bracts many-ranked. The plants often have a sticky balsam, especially the heads before and during flowering, whence they are called "gum-plants" in Calif., particularly *G. robusta*, which is the common one. The two species first described below have roots that are perennial and short-lived, but sometimes annual. These plants are also glabrous, and have firm or rigid lvs. This genus contains 2 plants from which a fluid-extract is obtained that is used externally as an antidote for poisoning by "poison ivy."—Species about 25.

Grindelias are of the easiest culture. They are propagated by division, cuttings or seed. *G. squarrosa* is hardy in the East: *G. robusta* is sold in California. They are best for wild places and trying situations. *G. squarrosa* grows freely in all soils but it does best in a light, open, moderately rich soil. In California it is common on dry hills. According to John S. Wright, both species grow in salt marshes and on alkaline soil, being indiscriminately gathered for medicinal purposes. The extract is also tonic and sedative, and is used in asthma. The rays are numerous, sometimes thirty, about ½-inch long.

squarròsa, Dunal. Shrubby, smooth, branched from base, 1–2 ft. high: lvs. dark or bluish green with clasping bases: fl.-heads sticky: outer achenes usually squarely truncate and even at summit. Manitoba to Mex. B.M. 1706 (as *Donia squarrosa*). Mn. 10:145.

robústa, Nutt. Gum-Plant. Herbaceous: lvs. larger and more rigid, broadly cordate-oblong, obtuse: achenes all, or some outer ones, 1-toothed or bordered at the summit.—Flowers throughout the Californian winter. Collected stock is offered.

pàtens, Greenm. (*G. robústa* var. *pàtens*, Gray). A stiff erect perennial with many single-headed branches: lvs. rough-hairy, narrowly oblanceolate, toothed: heads about 1 in. wide, the achenes thin, obcordate at the summit. Calif. G.C. III. 27:59.

Wilhelm Miller.
N. Taylor.†

GRISEBÁCHIA: *Howea.*

GRISELÌNIA (after Franc Griselini, Venetian botanist, middle of eighteenth century). Including *Decóstea*. *Cornàceæ*. Woody plants with large, glossy, laurel-like foliage, rarely cultivated in the South, and nearly hardy at Washington.

Trees, shrubs or climbers from New Zeal., Chile and Brazil, with lvs. alternate, often unequal-sided, thick and leathery: fls. minute, in glabrous or pubescent racemes or panicles; calyx very small, 5-toothed, the petals 5, imbricated; stamens 5, with subulate filaments: fr. baccate, 1- or rarely 2-celled.—Six or seven species. Related to Garrya, from which it differs in the alternate lvs. Little cult. in Amer.

littoràlis, Raoul. Tree, 30–50 ft. high, with brown-hairy twigs: lvs. ovate or oblong, wedge-shaped or narrowed into a petiole; veins obscure beneath: fls. in axillary panicles, equaling or slightly shorter than the lvs. New Zeal. G.W. 14, p. 323.

lùcida, Forst. f. Shrub, 3–25 ft. high: lvs. obovate or oblong, very unequal at the base; veins distinct beneath: fls. in axillary panicles, usually shorter than the lvs. New Zeal. Not cult. in Amer. Var. **macrophýlla** (*G. macrophýlla*, Hort.), is a large, more orbicular-lvd. form.—*G. lucida* is prized in Eu. for apartments or residences. Showy. Requires shade and moisture. Sometimes epiphytic. N. Taylor.†

GROMWELL: *Lithospermum.*

GROSSULÀRIA (from *grossulus*, a small fig, from the resemblance of the fruit). *Saxifragàceæ*. An old name for the gooseberries recently (N. Amer. Fl. 22, pt. 3. 1908) reinstated by Coville and Britton as a genus coördinate with Ribes, the currants. As distinguished from Ribes, Grossularia is defined by the flowers having an evident hypanthium or cup-shaped receptacle, the pedicels not jointed and the fruit not disarticulating, different disposition of bractlets on the pedicel, and the plants bearing spines at the nodes. Under this disposition, the English gooseberry becomes *G. reclinàta*, Mill. or *G. Uvacríspa*, Mill., and the native gooseberry of the Downing type is *G. hirtélla*, Spach. See *Ribes*. L. H. B.

GROUND CHERRY: *Physalis;* in the Old World *Prunus Chamæcerasus*. **Ground Hemlock** or American yew: *Taxus canadensis*. **Ground Ivy:** *Nepeta Glechoma*. **Ground Laurel:** Old World name for *Epigæa repens*. **Groundnut:** *Apios* and *Panax;* also Old World name for peanut or goober (*Arachis*). **Ground Pine:** *Lycopodium*. **Ground Pink:** *Phlox subulata.*

GROUNDSEL: *Senecio.* **Groundsel Tree:** *Baccharis halimifolia.*

GRUMICHÀMA: *Eugenia brasiliensis.*

GUÀIACUM (W. Indian name). *Zygophyllàceæ*. Guaiacum (gwaí-a-cum) is kept in drugstores, and the tree which produces the resin used in medicine has a hard, heavy wood. Both the species below are the source of the lignum-vitæ of commerce which is used so extensively for blocks and pulleys, rulers, and the like. It is cult. to a very slight extent in S. Calif. and in Trop. Fla. for ornamental value. The genus has about 4 species of trees or shrubs, Trop. American, and all have hard wood and abundant resin: lvs. opposite, abruptly pinnate, leathery; lfts. 2–14, entire: peduncles borne in pairs between the deciduous stipules, 1-fld.; fls. blue or purple, not showy; sepals 4–5, deciduous, unequal; petals 4–5, broadly obovate; stamens 8–10, inserted in the short, inconspicuous disk.

1769. Cattley guava. (×½)

officinàle, Linn. Middle-sized or low tree, inhabiting arid plains from the Fla. keys to Venezuela: lfts. in pairs, evergreen, ¼–½in. long, obovate or oval, blunt: sepals oval, hairy, thrice exceeded by the petals.

sánctum, Linn. Similar in aspect, but the lvs. obliquely lanceolate-elliptic, and the smooth sepals about half as long as the petals. W. Indies.—Not much cult. in Amer. The wood of both species is very valuable. N. Taylor.†

GUAR. An annual forage plant (*Cyamopsis tetragonoloba*, Taub.), of the Leguminosæ, has been tried somewhat in this country with promise. It appears to be adapted to the warmer parts of the country, requiring about the same conditions as the cowpea. It is from India.

GUAVA. The name guava is applied to the fruit of various species of Psidium, frequently with the addition of a qualifying word such as apple, pear, Cattley, to distinguish different species and varieties. In Spanish it is guayaba, in Portuguese goiaba, and in French goyave (the plant goyavier). In Brazil the name araça, with qualifying words, is applied to a number of wild species.

The common guava of the tropics is *Psidium Guajava*, Linn., of which there are numerous varieties. Although the native home of this species is in tropical America, it is now widely distributed throughout the warmest regions of the globe. Under favorable conditions it becomes a tree 25 to 30 feet in height; its bark is smooth, greenish brown in color, while the leaves are opposite, oval, smooth, light green, the veins depressed above and prominent below. The flowers, which are produced in the axils of the leaves, are about an inch in diameter, with four incurved white petals and a large tuft of white stamens tipped with yellowish anthers.

The fruit varies in shape from spherical to pyriform, and in diameter from 1 to 4 inches. Commonly it is oval or slightly pyriform, and about 2 inches in diameter. The thin light yellow skin surrounds a layer of finely granular pulp, inside of which is a mass of softer pulp in which the small hard seeds are embedded. The color of the flesh varies from white through shades of salmon to deep pink, according to the variety; its flavor when fully ripe is sweet or slightly acid, and nearly always somewhat musky. The aroma is characteristic and rather penetrating; while objectionable to some persons it is very agreeable to others.

The fruit is eaten in many ways,—out of hand, sliced with cream, stewed, preserved, and in shortcakes and pies, but it is most highly valued for the manufacture of jams and jellies. In several tropical countries the manufacture of guava jelly forms quite an important industry. When well made, it is deep wine color, clear, of very firm consistency, and retains something of the peculiar musky flavor which characterizes the fruit, and which gives guava jelly an individuality which is its greatest asset. In Brazil a thick jam, known as goiabada, is made from the fruit and sold in large quantities throughout the country. A similar product is manufactured in the West Indies and Florida under the name of guava cheese.

The plant is cultivated to a limited extent in southern California, where it is frequently listed under the name of lemon guava. It is too tender for the colder sections of the state. In Florida it is not only cultivated in gardens, but is found in a semi-naturalized condition in some sections and has become a pest. The same is true in many other regions; the plant grows so readily from seed that it is sometimes difficult to prevent its spreading to places where it is not desired when the seeds are scattered by birds or other agencies.

The Cattley or strawberry guava, *P. Cattleianum*, Fig. 1769, is also a well-known fruit in this country. In California it is widely cultivated because of its superior hardiness, withstanding temperatures as low as 22° F. without injury. It does not grow to such large size as *P. Guajava*, but under favorable conditions forms an arborescent shrub 15 to 20 feet in height. Unlike *P. Guajava*, its leaves are thick, leathery, and somewhat glossy, in size rarely over 2½ inches in length and in form obovate-elliptical. The fruit, which is usually produced in great abundance, is broadly pyriform to spherical, 1 to 1½ inches in diameter. The skin is deep purplish maroon, the flesh translucent yellowish white, very soft and melting in texture. The seeds are rather numerous, irregularly oval in form. The flavor lacks the pungency of *P. Guajava*, and a resemblance, real or imagined, to that of the strawberry has suggested the common name of "strawberry guava." Jelly made from this fruit, while lacking the pronounced flavor of that made from *P. Guajava*, is nevertheless highly esteemed in California, most of the fruit being utilized for jelly-making.

While rather slow in growth, the plant frequently begins to bear fruit the second or third year from the seed. A horticultural form of this species, *P. Cattleianum lucidum*, generally listed by the trade as *P. lucidum*, is grown both in Florida and California, though not so extensively as *P. Cattleianum* itself. The chief difference between this form and the type lies in the color of the fruit, which in place of maroon is deep sulfur-yellow. The flavor, if anything, is a little milder and less pungent. It is a meritorious form, worthy of wider cultivation.

The "pineapple guava," of California, is *Feijoa Sellowiana*, a South American myrtaceous fruit not properly called a guava, perhaps, but so closely resembling some of the guavas in growth and fruit as to suggest this name. See *Feijoa*. Several other species of Psidium are grown in this country to a limited extent, some of them having been recently introduced. Tropical America is rich in species of Psidium, Brazil alone possessing a large number of economic value. Most of these are still in the wild state and capable of vast improvement by selection and breeding.

The culture of the guavas presents few difficulties. Nearly all species succeed on a variety of soils, requiring only that good drainage be provided. While propagation is nearly always by seed, some vegetative method must be used to perpetuate desirable varieties. This is especially important with *P. Guajava*, in which there is more variation than in *P. Cattleianum*, and desirable forms do not come true from seed. Grafting has been successfully performed but never widely practised. In California, budding has been quite successful, with large stocks an inch or more in diameter and square or oblong patch buds about 1½ inches in length. This method, however, does not seem very suitable for commercial use. Shield budding has been successful in a few instances, the operation being performed as with citrus, and it is this method which probably offers the greatest advantages. Propagation by cuttings is also possible, when half-ripened wood is used and bottom heat is available. All these methods have been practised to a very limited extent, seed-propagation being practically the only method used in most tropical countries. Seeds retain their vitality for some time, but should be planted as fresh as possible, using a light sandy loam and taking care to avoid over-watering when the young plants appear. When the second leaves have formed, the plants should be potted off and carried along in pots until they are transplanted into permanent positions, since they are somewhat difficult to transplant from the open ground. Planting should be done in late spring.

In California *P. Guajava* frequently suffers from the attacks of the black scale (*Saissetia oleæ*), which must be kept in check by fumigation or spraying. In other countries this plant seems remarkably free from insect pests or fungous diseases, and this is true also of the Cattley guava. The fruits are sometimes injured by the Mediterranean fruit-fly, and a scab has been observed in Brazil which affects them prejudicially. As a rule, however, the plants require little attention.

F. W. Popenoe.

GUAZÙMA (name of Mexican origin). *Sterculiàceæ.* A few Trop. American trees, allied to Theobroma, with small white, pink or yellow fls. in short-peduncled, axillary cymes. Calyx mostly 3-parted; petals 5, 2-parted; stamen-cup about 10-lobed, the lobes alternating with petals and bearing 2–3 fertile anthers, the staminodia 3-angled; style 5-parted: fr. a 5-valved nut the size of a filbert: lvs. 2-ranked, serrate: fls. small. Theobroma has a berry-like fr., entire lvs., fascicled or solitary fls., and a different staminal column. G. **ulmifòlia,** Lam., the "guacima" of Mex., is offered in Calif. It becomes a large tree: branchlets powdery: lvs. ovate to oblong-lanceolate, somewhat pointed, oblique at base, powdery beneath when young but becoming glabrous: nut nearly globular, with 5 furrows. Said to yield medicinal preparations. *G. tomentòsa,*, Kunth, is a small tree in W. Indies, apparently not cult. here.

L. H. B.

GUETTÁRDA (J. E. Guettard, 1715–1786, physician, mineralogist and botanist in France). *Rubiàceæ.* Forty to fifty tropical and subtropical shrubs of both the eastern and western hemispheres, chiefly the latter, two of which are offered for ornament in southern California.

Leaves opposite or verticillate, ovate or oblong, petiolate or nearly sessile: fls. in axillary more or less forked cymes, sometimes polygamo-diœcious, 4–9-merous; calyx continued beyond ovary into a cup-shaped or bell-shaped rim; corolla salverform, with long tube and rounded or oblong segms.; stamens 4–9, inserted in the tube or throat, not exserted; ovary 4–9-celled: fr. a thin-fleshed globular or obtusely angled drupe.

uruguénsis, Cham. & Schlecht. Lvs. 2 in. long, half as wide, elliptic-oblong, somewhat pilose above and more or less tomentose beneath; stipules lanceolate-triangular, caducous: corolla-tube ¼in. or less long, the 5 lobes roundish; calyx-limb very short: fr. an oblong 3–4-seeded drupe.—Cent. Brazil, Uruguay, Argentina; a small tree, with sericeous corolla, and fr. the size of a cherry which is said to be edible.

speciòsa, Linn. A littoral evergreen tree: lvs. broadly ovate with an obtuse or cordate base, acute at apex, pubescent beneath, 5–10 in. long: fls. polygamous, white, in long-peduncled cymes that usually arise in the axils of fallen lvs.; calyx villous; corolla pubescent, 1½ in. or less long and the limb (with obovate segms.) 1 in. across: fr. orange, nearly globular, obscurely lobed or angled, said to be edible. Tropics in eastern hemisphere. B.R. 1393.

L. H. B.

GUEVÌNA: *Gevuina.*

GUICHENÒTIA (Antoine Guichenot, French gardener, according to some; from Guichen Bay, New Holland, according to others). *Sterculiàceæ.* A few tomentose shrubs in extra-tropical Austral., little known in cult. as greenhouse shrubs. Lvs. narrow and entire, revolute. with leafy stipules: fls. small, in simple racemes opposite the lvs.; petals 5, small and scale-like; stamens 5; ovary 5-celled, the style simple: fr. a short 5-valved caps. *G. ledifòlia,* Gay, has several white fls. in the raceme: lvs. oblong-linear, obtuse: calyx ⅓in. or less long. *G. macrántha,* Turcz., has much larger purplish fls. in racemes of 2 or 3. B.M. 4651. J.F. 3:279.

L. H. B.

GUILIÉLMA: *Bactris.*

GUIZÒTIA (after Guizot, the celebrated historian). *Compósitæ.* Annual herbs (of about five species) from tropical Africa, one of which has some economic interest from its oil-producing seeds.

The plants have yellow heads, about 2 in. across, with 8 broad, 3-toothed rays and a leafy outer involucre. Seeds can be secured by the pound from S. Fla., and they are listed among miscellaneous agricultural seeds in a few of the largest European catalogues. The plant is cult. in India for the oil.

abyssínica, Cass. (*G. oleífera,* DC. *Verbesìna satìva,* Roxbg.). Erect, annual, nearly smooth: lvs. opposite, lanceolate, clasping, remotely serrate: heads about ¾in. wide in a dense cyme. B.M. 1017.—Doubtfully in cult. horticulturally in Amer.

N. Taylor.†

GUMS AND RESINS. Of the many thousands of vegetable substances falling under the denomination of gums and resins, but a comparatively small number are of such general importance as to warrant mention here. Their economic value depends upon the physical and chemical properties possessed by them and the abundance in which they are produced. A gum, in the ordinary use of the word, is a substance of a more or less sticky nature or which was at one time of a sticky or plastic consistency. The chemist, however, restricts the term gum to certain products having very definite properties, classifying other plant exudations according to their properties and grouping them as resins, gum resins, balsams, and the like. A gum in this restricted sense, is a substance which dissolves or softens in cold water, forming a mucilage, or at least a liquid of gelatinous consistency, and when held in a flame only chars with an odor of burnt sugar. It is insoluble in 60 per cent alcohol, oil of turpentine, benzene or fatty oils. A resin, on the other hand, is a lustrous vegetable substance resembling a gum but which neither dissolves nor softens in cold water and which burns with a bright smoky flame, giving off an aromatic odor. It is more or less soluble in alcohol, oil of turpentine, benzene or warm oils.

Gums are related, chemically, to cellulose and are not secretion products, as was formerly supposed, but are formed directly from the plant tissues by a breaking down of the cells themselves; sometimes this is a perfectly normal process but very often it may be considered pathological and is the result of bacterial action. Humidity appears to be the principal controlling factor in the production of gum. Volatile or essential oils are secreted by the cells of many plants of widely divergent relationships and are often characteristic of certain families, like those to which belong the mints and the pines. The resins are oxidation products derived from certain of the volatile oils and thus may indirectly be considered products of secretion. Some plants yield only gum, others only resin, while others again may yield both, in which case the gum and resin may come from different parts of the same plant or may be exuded as an emulsion or mixture. In many plants the resins occur dissolved in volatile oil and though exuded in a liquid state soon become solid through the evaporation of more or less of the volatile oil. Some resins contain aromatic acids and others consist of certain liquid organic compounds of these acids in which is dissolved a solid resin; such products are called balsams. The camphors constitute another group of oxidation products derived from the volatile oils.

Uses of gums and resins.

Soluble gums, the most typical of which is gum arabic, are used for a great number of purposes in the arts; the varieties having the least color, highest adhesive power and viscosity being the most valuable. They find application in confectionery and pharmacy, in sizing and finishing textile fabrics and paper, in calico printing and dyeing, and in the manufacture of fine water-colors, ink, mucilage, and so on. The gums which are more or less insoluble in water, but which swell with it to form a mucilage, as for example tragacanth, are used as thickening agents in calico-printing and in pharmacy, and for pastes, pills and colored crayons.

Resins are applied to a great variety of industrial purposes but probably the most important of these is the manufacture of varnishes and lacquers. For this purpose they may be roughly divided into two classes: (1) those which after melting can be combined with linseed oil and turpentine to form an "oil varnish," and (2) those which dissolve more or less in alcohol, oil of turpentine or other volatile solvents to form "spirit varnishes." The important resins of the first class are amber and the copals; while those of the second class include rosin or colophony, benzoin, dammar, sandarac, mastic and elemi. Aside from varnish-making, certain resins are employed in medicine and pharmacy, for incense, and in the manufacture of soap, and the like.

The gums and resins of greatest economic importance.

The following list of the plant exudations which are of the greatest economic importance and which comprises one or more typical examples of each of the groups already mentioned may be arranged as follows:

- **True gums**
  - Gum arabic
  - Tragacanth
- **True resins**
  - Amber
  - Copal
  - Dammar
  - Sandarac
  - Mastic
  - Rosin
- **Balsams**
  - Balsam Peru
  - Storax
- **Gum-resins**
  - Gamboge
  - Myrrh
  - Olibanum
  - Galbanum
- **Oleo-resins**
  - Turpentine
  - Canada balsam
  - Copaiba
  - Elemi
- **Camphors**
  - Camphor (Common or Laurel Camphor)
  - Menthol

Gum arabic.—The name still generally applied to the most important gum produced in northern Africa and which has been an article of commerce since the first century of the Christian era. It was shipped from Egypt to Arabia and then thence to Europe and was therefore called "gum arabic." At present the gum is usually known as "Sudan," "Kordofan" or "Senegal" gum, depending upon the region from whence it is shipped to market. The best gum is produced by the gray-barked acacia tree, *Acacia Senegal*, and is collected both from wild or unowned trees and from gardens of acacia trees which are private property. In the gardens the gum is obtained by making incisions in the principal branches of the trees while from the wild trees the naturally exuded gum is collected. Inferior varieties are collected from *Acacia Seyal*, chiefly from the forests of the Blue Nile, and from *Acacia arabica*, *A. stenocarpa* and *A. albida* in Senegal. The gum is cleaned from pieces of bark and other debris before leaving Africa but the bulk of the product is exported without grading and is sorted in Europe, principally at Trieste and Bordeaux.

Tragacanth.—The most important of the so-called insoluble gums, and the only one regularly found in commerce, is obtained from several species of small shrubs of the genus Astragalus, found in Asia Minor, Syria, Armenia, Kurdistan and Persia. It is produced chiefly by the following species: *Astragalus adscendens*, *A. gummifer*, *A. pycnocladus*, *A. kurdicus* and *A. stromatodes*. In order to obtain the greatest quantity of gum, the shrubs are stripped of their leaves in July or August and short incisions or slits are made in the trunks. The gum flows out, forming flat ribbon-like or vermiform pieces depending upon the shape and size of the incision, and is dry enough for gathering in three or four days. Smyrna is an important market for gum tragacanth and it is there sorted into various qualities for the European market.

Amber.—A fossil resin found principally on the shores of the Baltic Sea. The larger and finer pieces are used for jewelry, beads, trinkets, mouthpieces for pipes and cigar-holders, while the smaller pieces and the waste from carving or turning are used for varnish.

Copals.—The term "copal" is now used commercially to designate a group of widely distributed hard resins of high melting point having the common property of being capable of being used for the manufacture of oil varnishes. Aside from amber, Zanzibar, or true copal was the first resin used for this purpose, hence arose the custom of terming as "copal," each new resin which was discovered to be useful for this purpose and distinguishing it from others by prefixing its port of shipment or other geographical name. Copals are obtained in round tears, nodules or flat pieces of varying degrees of hardness, either from living trees (recent or raw copals) or dug from the earth at spots, occupied centuries before by trees long since disappeared (fossil or ripe copals). The most important are yielded by the following plants: Zanzibar copal, *Hymenæa Hornemanniana;* Sierra Leone copal, *Copaifera Guibourtiana;* Gold Coast or Accra copal, *Cyanothyrsus Ogea;* Niger copal, *Daniella oblonga;* Kauri copal, *Agathis* (*Dammara*) *australis;* Manila or East Indian copal, *Agathis* (*Dammara*) *orientalis;* West Indian or Demerara copal, *Hymenæa Courbaril.*

Dammar.—Dammar is the Malay term for all gums and resins which exude from trees and solidify upon exposure to the air, but as used commercially it designates a group of varnish resins obtained from Indian or East Indian trees belonging to the *Dipterocarpaceæ* and *Burseraceæ* and thus does not include the resins from the genus *Agathis* (or *Dammara*,) which are known as copals. Indian dammar, *Shorea robusta;* white dammar, *Vateria indica;* black dammar, *Canarium strictum;* rock dammar, *Hopea odorata.*

Sandarac.—The hard brittle resins produced by several species of coniferous trees in North Africa and Australia. Mogadore sandarac, yielded by a small cypress, *Thuya articulata*, common on the southern slopes of the Atlas Mountains, is shipped principally from the port of Mogadore, Morocco. Australian sandarac is the product of several species of cypress pines, especially the Murray pine, *Callitris verrucosa* and the red or black pine, *Callitris calcarata.*

Mastic.—A soft yellow resin obtained in brittle, yellowish, glassy, rounded drops from *Pistacia lentiscus*, a small tree indigenous to Asia Minor and the Greek Archipelago but cultivated on the island of Chios. Used for varnishing paintings, for incense and as a tooth cement.

Common rosin or colophony.—This is the solid residue obtained as a by-product in the distillation of oil of turpentine from crude turpentine. For a list of the most important sources, see *Turpentine*, below. Rosin is used for cheap furniture varnishes, in the sizing of paper, as a flux for solder, as a coating for the inside of casks, and in the manufacture of laundry-soap. It is the source for rosin-oil and rosin-spirit, which are produced by the destructive distillation of rosin. The first is used in the production of lubricants, printing inks and paints, while the second is a substitute for oil of turpentine.

Gamboge.—A hard brittle yellow gum-resin, composed of a variable mixture of gum and resin, and produced by several species of Garcinia, especially *G. Hanburyi* of Siam and Indo-China and *G. Morella* of India and Ceylon. It is used to color golden lacquers, as a water-color pigment and in medicine as a drastic purgative.

Myrrh.—A fragrant gum-resin obtained in Arabia and northeastern Africa from a burseraceous tree *Balsamodendron Myrrha.* It is used in medicine and for dental preparations.

Olibanum or frankincense.—A fragrant gum-resin obtained from the stem of several species of Boswellia, especially *B. Carterii*, native to northeastern Africa and the southern coast of Arabia. Its principal use is for the incense used in the Roman Catholic and Greek churches.

Galbanum.—A strong-smelling, yellowish brown gum-resin exuded from the stem of certain species of Ferula, especially *F. galbaniflua* and *F. rubricaulis*, natives of Persia. It is mentioned by the earliest writers on medicine and was an ingredient of the incense used in the worship of the ancient Israelites. It is now used only to a small extent in medicine.

Turpentine.—The crude oleo-resin obtained by tapping any one of several species of coniferous trees native to North America, Europe and northern Asia. The most important varieties are yielded by the following species: American turpentine from the long-leaf pine, *Pinus palustris*, and the Cuban pine, *Pinus heterophylla;* French turpentine from the maritime or cluster pine, *Pinus maritima;* Russian turpentine from the Scotch or Swedish pine, *Pinus sylvestris;* and Indian turpentine from the Indian blue pine, *Pinus excelsa*, the Himalayan long-leaf pine, *Pinus longifolia* and the Burma pine, *Pinus khasya.* From these oleo-resins there is distilled oil of turpentine, leaving behind rosin or colophony. Venice turpentine, from the common larch, *Larix europæa*, is about the consistency of clear honey, and is used in fixing colors, enamel painting and firing and in medicine.

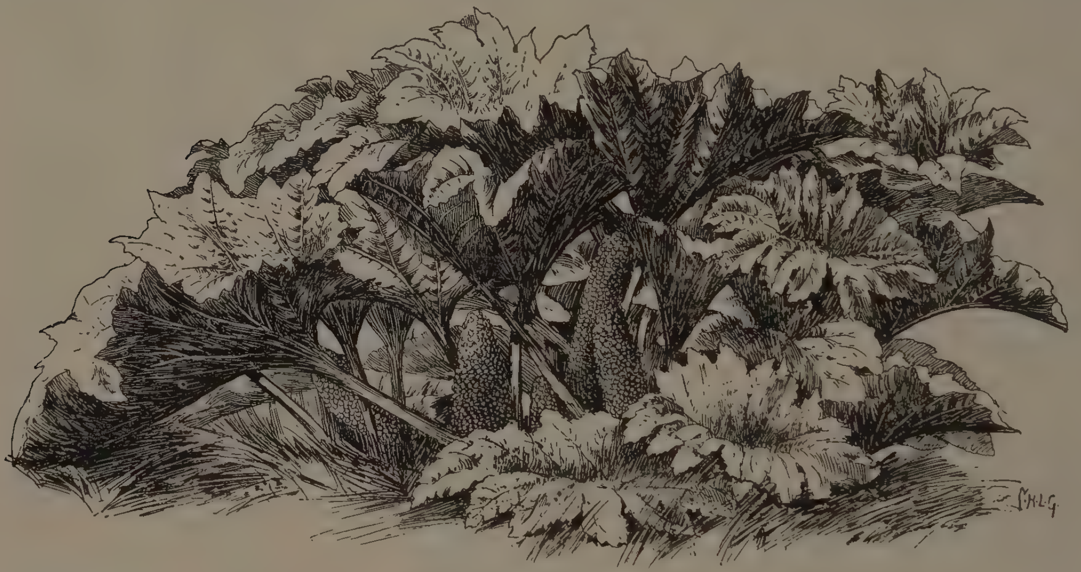
Canada balsam.—A thick, yellow, transparent, liquid oleo-resin obtained in the northern United States and Canada from the balsam fir, *Abies balsamea.* On account of its great capacity for refracting light it is used to cement lenses and for mounting objects for the microscope. It is also used in medicine.

Copaiba balsam.—A thick, transparent, brownish, liquid oleo-resin obtained from several species of leguminous trees belonging to the genus Copaifera and native to northern South America. It is used in medicine as an antiseptic and stimulant.

Elemi.—More or less soft resins yielded by burseraceous trees belonging to the genera Protium and Canarium. Manila elemi from *Canarium luzonicum* is a fragrant resin used for toughening varnishes.

Balsam Peru.—A dark brown molasses-like liquid balsam obtained in Salvador and Guatemala from the stem of a leguminous tree, *Myroxylon Pereiræ.* It is used in medicine, perfumery and chocolate manufacture.

Styrax or storax.—A thick, grayish, sticky, liquid balsam obtained in Asia Minor from the oriental sweet gum, *Liquidambar orientalis.* It is used in perfumery, pharmacy and in medicine.


1770. Gunnera manicata.

Common or laurel camphor.—A white, crystalline, pungent substance obtained by distilling with steam the twigs and chips of the camphor tree, *Cinnamomum Camphora,* native to China and Japan and cultivated in the southern United States. It is used in medicine and for the manufacture of celluloid, lacquers and smokeless powders.

Menthol or peppermint camphor.—The principal constituent of oil of peppermint, the essential oil of *Mentha piperita,* from which it can be crystallized by chilling. It resembles common camphor but has a strong peppermint odor. Used in medicine and perfumery.

Frederick L. Lewton.

GUM-TREE: *Eucalyptus* and *Acacia;* also *Liquidambar.*

GUNNÈRA (J. Ernst Gunner, 1718–1773, was a Swedish bishop and botanist, and wrote a local flora). *Haloragidàceæ.* Perennial herbs, some of them big-leaved and used for subtropical effects; others small and useful for bogs and rockeries.

The family Haloragidaceæ comprises above 100 widely scattered and heterogeneous species in 8 genera. In the northeastern states are the aquatic genera, Proserpinaca, Hippuris, Myriophyllum. These comprise small and mostly inconspicuous water- or bog-plants. In the Australian region are the endemic genera, Loudonia and Meionectes; and there remain Serpicula, Gunnera, and Haloragis, with very wide and disjointed distributions. Gunnera has 25 or more known species in S. Afr., Abyssinia, Java, Tasmania, New Zeal., Hawaii and S. Amer. In general appearance the gunneras are wholly unlike our native haloragaceous plants. The lvs. are radical, ovate or orbicular, in certain species gigantic: fls. perfect or rarely imperfect monœcious or polygamous, small, in simple or branched spikes or panicles, often packed on a great cob-like spike; petals 2–3, or none; calyx none, or with 2–3 lobes; stamens 1 or 2 or 3; ovary 1-loculed, bearing 2 filiform styles: fr. a drupe: plant rhizomatous.

Gunneras are striking herbs, and with protection the two first species may be grown even in some of our northern states. These two are amongst the noblest of lawn foliage plants. To produce satisfactory effects, rich moist ground is indispensable. The plants must never suffer for want of water. Exposure to sun is advisable, but they should be sheltered from severe winds, else the leaves will be damaged. Ample winter protection should be provided. A liberal covering of leaves or litter, held in place by brush or branches, will generally keep them from harm. Apply the covering in December and remove early in spring. Propagate by division. Seeds are also employed, and they can usually be secured.

A. *Lvs. very large and striking.*

manicàta, Lind. Fig. 1770. St. thick and very short, the titanic crown of lvs. rising from the ground: petioles often as tall as a man, prickly: blades becoming 5–10 ft. across, orbicular in general outline, variously lobed, crenate, furrowed and channeled along the great veins: fls. green: spikes dense and tapering, often more than 1 ft. diam. and 3–4 ft. tall. S. Brazil. I.H. 31:531. Gn. 45, p. 21; 50, p. 455; 54, p. 385; 59, p. 327; 63, p. 127; 70, p. 179; 74, p. 451. G.C. III. 14:589; 29, suppl. Jan. 12. G.M. 54:101, 647. G.F. 8:55.—The crown of lvs. sometimes measures 25–35 ft. across, making a magnificent plant. This is the better species.

chilénsis, Lam. (*G. scàbra,* Ruiz & Pav.). Not so robust, the lvs. smaller and less spiny, and the fl.-spikes less tall: fls. reddish. R.H. 1862, p. 310; 1894, p. 397.

Gn. 49, p. 151. G.C. II. 26:425; III. 8:665. G. 18:693; 21:661. G.W.5:367, 571; 12:413.—Thrives in drier soil. Var. **màjor,** Hort., is a very strong-growing form.

AA. *Lvs. of ordinary or even small size.*

arenària, Cheesem. Prostrate and creeping plant making extensive patches in damp sandy land in New Zeal., the rhizome stout and clothed with bases of old foliage: lvs. 2½ in. or less long, thick, only slightly hairy, the blade less than 1 in. and broadly ovate or oblong, crenate or somewhat lobed: male peduncles usually longer than lvs., and female much shorter at flowering time; female fls. densely crowded into a short oblong spike: drupes very small, fleshy, yellowish red.

dentàta, Kirk. More slender, forming extensive patches in wet subalpine places in New Zeal.: lvs. many and tufted, prominently hairy, the blade 1 in. or less long and varying from ovate to oblong and elliptic-lanceolate, coarsely dentate: male spikes about equaling the lvs., the female short and hidden at the base of the lvs., but the spikes in fr. sometimes surpassing the lvs.: drupes minute ($\frac{1}{10}$in. long).

magellánica, Lam. A very small species with dark green lvs.: stoloniferous: lvs. orbicular-reniform, crenate, 2½ in. or less broad: male scape surpassing the lvs., female shorter: fls. apetalous, the male pedicelled, the female sessile. Chile south, and Falkland Isls.

G. brephogèa, Lind. & André. A large species: lvs. tall-petiolate, the limb peltate, concave, orbicular-reniform, rather shallowly 7–9-lobed and the lobes again somewhat lobed or angled, the margin with many small acute inflexed teeth and black-purple: female fls. in a lax spike-like panicle, on a purplish scape. Colombia. I.H. 19:111.—*G. mínima,* Hort.=G. magellanica (?).—*G. perpénsa,* Linn. Lvs. long-petioled (12–18 in.), orbicular-reniform, cordate at base, 6–12 in. across, uniformly and closely crenate-toothed: scape surpassing the lvs., becoming 2–3 ft. high; fls. monœcious, the males in the upper part of the slender spikes. S. Afr. in moist places. B.M. 2376.

L. H. B.

GURÀNIA (Anagram of Anguria). *Cucurbitàceæ.* Tall climbers, perennial herbs or shrubs, with simple tendrils: lvs. entire, lobed, or 3–5-foliolate: fls. diœcious or rarely monœcious, small, bractless, the petals pale yellow; male fls. in long-peduncled clusters, the calyx-tube cylindrical or ventricose and the limb 5-parted, the corolla 5-parted into linear or triangular papillose thickened segms., the stamens 2 and free; female fls. solitary on fascicled or capitate on the top of the peduncle, staminodia none, ovary oblong and bearing a bifid style: fr. oblong, terete, many-seeded, the seeds ovate and compressed. There are about 50 guranias in the American tropics, one of which, *G. malacophýlla,* Rodr. (*G. eriántha,* André, not Cogn.), has recently been mentioned in horticultural literature abroad. This is a strong villous climber with simple broadly ovate sometimes 3- to 5-lobed lvs. 4–8 in. long: male fls. reddish, in a globose head on a peduncle 6–16 in. long; petals linear-subulate, pubescent; female fls. not described. Upper Amazon. B.M. 8085. R.H. 1904:388.

L. H. B.

GUSTÀVIA (Gustavus III, King of Sweden). *Lecythidàceæ.* Trees and shrubs of the American tropics with large showy fls., of which **G. speciòsa,** HBK., is offered in S. Calif. It is a thick-lvd. tree with 6-petaled white fls., suitable for planting in the open. For fuller account, see *Japarandiba.*

GUTHNÍCKIA. Two plants now referred to Achimenes, one of which, *A. foliosa,* is perhaps sometimes cult. (See Vol. I, p. 208.)

GUTIERRÈZIA (personal name). *Compósitæ.* Herbs or subshrubs, often resinous, mostly western North American, rarely planted in borders.

Much branched from the base, and have narrow alternate entire lvs. and clusters of small yellow heads with flat receptacles and hairy achenes.—About 18 species. Easily cult. in Calif.; doubtfully hardy on Atlantic coast north of Washington.

Euthàmiæ, Torr. & Gray. More or less woody at base, seldom to 1½ ft. high: lvs. linear, crowded: involucre turbinate, 2 lines long; rays and disk-fls. each 3–9: achenes silky-pubescent; pappus of about 9 chaffy scales. W. N. Amer.

N. Taylor.†

GUZMÀNIA (A. Guzmann, Spanish naturalist). *Bromeliàceæ.* Includes *Caraguàta* and *Massángea.* Tropical American bromeliads, of which several are fairly well known ornamental glasshouse subjects.

They closely resemble the erect-growing tillandsias, but differ in technical characters: fls. in a simple spike-like terminal cluster, tubular, the outer segms. or calyx oblong and obtuse, the inner or petals shorter than the tube; anthers inserted on the throat of the tube, and united by their edges around the style.—About 75 species. Grown in the warmhouse, along with Billbergia and Tillandsia, which see for culture. Closely allied to Æchmea. Many species are cult. in fanciers' collections in the Old World. For *G. picta,* see *Nidularium.* For *G. Legrelliana,* see *Hohenbergia. G. rosea,* a name which has appeared in the American trade, is probably an Æchmea.

A. *Calyx corolla-like, exceeding the petals.*

musàica, Mez. Lvs. strongly decurved, beautifully and densely marked with undulating, interrupted, irregular brown lines: infl. 3–4 in. long, on a short peduncle, the bracts golden, striped with rose; fls. 1⅔–2 in. long. Colombia. B.M. 6675. I.H. 24:268.

AA. *Calyx not corolla-like, shorter than petals.*

B. *Corolla (or segms.) purple or red.*

lingulàta, Mez (*Caraguàta lingulàta,* Lindl. *C. spléndens,* Bouché. *C. lingulàta spléndens,* Hort.). Epiphyte: lvs. many, lanceolate or ensiform, 1½ ft. long, remotely toothed: spike becoming drooping, showily red-bracted; expanded fl. about as long as the long-pointed bracts, the tube yellowish and the limb blue-purple. W. Indies, Cent. Amer., and S. Amer. B.R. 1068. F.S. 11:1091.—Handsome. Var. **cardinàlis,** André (*Caraguàta cardinàlis,* André). Bright scarlet: very showy. Colombia. I.H. 27:374. R.H. 1883:12.

BB. *Corolla (or segms.) white.*

trícolor, Ruiz & Pav. (*G. fràgrans,* Hort., at least in part. *G. grándis,* Hort., in part. *G. maculàta,* Hort., in part. *G. monostàchya,* Rusby). Lvs. several to many, broad and more or less recurved, entire on the edges, usually shorter than the stout, erect spike: lower bracts green streaked with black, upper ones red-tinged: corolla white. W. Indies, Cent. Amer., S. Amer. L.B.C. 5:462. F.S. 9:918. B.M. 5220. Var. **variegàta,** Hort. Lvs. striped with white. S. Fla.—Interesting because of its combination of green, red and white. Some, at least, of the horticultural plants which pass as *G. fragrans* belong to *Æchmea eburnea,* Baker (*Canistrum Lindenii,* Mez. *Nidularium Lindenii,* Regel). This species is further mentioned under *Nidularium.*

Devansayàna, Morr. (*Caraguàta Devansayàna,* Morr.). Lvs. about 20, narrow linear or ensiform, brown-striped on the back: fls. white, in a dense, oblong spike, the scarlet bracts oval. Ecuador.

BBB. *Corolla (or segms.) yellow.*

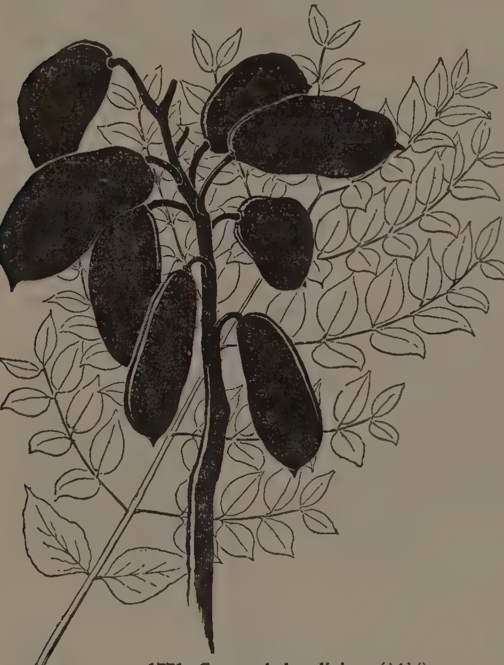
Melinònis, Regel (*Caraguàta Melinònis,* Morr.). Lvs. strap-shaped, green above and brown-tinted beneath: fls. yellow, subtended by oblong red bracts. French Guiana.

George V. Nash.†

GYMNÓCLADUS (from Greek *naked,* plus a branch, which refers to the stout branches with few branchlets). *Leguminòsæ.* Trees, useful for bold planting.

Flowers diœcious or polygamous, regular, not papilionaceous; calyx tubular, 5-cleft; petals 5, oblong, perigynous, resembling the sepals, or slightly larger and paler; stamens 10; filaments pubescent, distinct, short, perigynous; pistil 1; ovary superior, simple, 1-celled; placenta parietal; ovules numerous; style slender: fr. an oblong (2–10-in. long), thick, flat, curved, dark brown legume; seeds lenticular, about 1 in. broad.—The genus contains 2 species, one American, the other E. Asian. The American species, the Kentucky coffee tree, is now frequently planted for ornamental purposes. Its ascending branches, coarse twigs and pods give it a peculiar sturdy aspect, heightened in summer by the immense compound lvs. Prop. by seeds and cuttings. Foliage appears in late spring.

dioìca, Koch (*G. canadénsis*, Lam.). Kentucky Coffee Tree. Fig. 1771. Tree up to 100 ft. high, unarmed: lvs. alternate, unequally twice-pinnate, 1½–3 ft. long; lfts. ovate or oval, acuminate, stalked, entire, glabrous, 1–3 in. long: fls. ½in. long, greenish white, in large panicles, which terminate the branches of the same season: pods persistent through the winter. Rich woods, Cent. N. Y., and Pa. to Minn., Neb., Okla., and Tenn. S. S. 3:123, 124. R.H. 1897, p. 491. B.B 2:261. G. 6:215.—Seeds used for coffee west of the Alleghanies before and during the Revolutionary war.


1771. Gymnocladus dioica. (×⅛)

G. chinénsis, Baill., with smaller more numerous lfts. and much thicker pods, is not cult.

K. M. Wiegand.

GYMNOGRÁMMA. Ferns that belong in several genera, to which they are here referred. The ferns described under Gymnogramma in previous editions are distributed in the present edition as follows:

For *Gymnogramma hispida*, see *Gymnopteris;* for *G. triangularis*, *G. chrysophylla*, *G. sulphurea*, *G. decomposita*, *G. calomelanos*, *G. peruviana*, *G. tatarica*, *G. pulchella*, see *Ceropteris;* for *G. aurea*, see *Ceropteris argentea;* for *G. schizophylla*, see *Anogramma*.

R. C. Benedict.

GYMNOLÒMIA (*naked border*, because the pappus is minute or none). *Compósitæ.* About 20 yellow-fld. herbs or woody plants from Ga. to Mex., much like small-fld. helianthus. Lvs. alternate or opposite on erect branching sts.: fl.-heads on peduncles terminating the branches; involucre hemispherical or bell-shaped, with narrow bracts in 2 or 3 series; receptacle chaffy, more or less conical; ray-fls. pistillate and sterile; disk-fls. perfect, producing 4-angled achenes. Allied to Viguiera, and distinguished by the obsolete or wanting pappus. Probably none of the species is in cult. *G. Pórteri*, Gray, occurs on Stone Mt., Ga.: 1–2 ft. high, slender, with 5–8 oval or obovate rays ½in. or more long, deep orange-yellow. The other species are of the Texano-Mex. region.

L. H. B.

GYMNOPÉTALUM (Greek, *naked petal*). *Cucurbitàceæ.* Six species of tendril-bearing vines of tropical Asia and Java, of which one, *G. cochinchinense*, is cultivated chiefly for its ornamental gourds.

This species is a tender perennial plant, and is said to have small white fls. borne in late summer and autumn, as advertised in the seed catalogues, under the name of *Scotanthus tubiflorus*. Scotanthus was formerly thought to be a closely allied genus, differing in the staminate fls. possessing bracts and 3 bristle-like rudiments of an ovary, while the staminate fls. of Gymnopetalum, by the old definition, have no bracts or minute ones, and but 1 rudiment of an ovary. Coigneaux includes Scotanthus in Gymnopetalum.

cochinchinénse, Kurz (*Scotánthus tubiflòrus*, Naudin). Musk-scented: st. much-branched, slender, grooved, creeping or climbing, 5–7½ ft. long: tendrils filiform, elongated, simple: lvs. about 1½–2½ in. long, 1–2 in. wide: fls. monœcious, white; calyx-teeth long linear-awl-shaped; calyx shortly villous, not tomentose: lvs. ovate, angled or slightly lobed: fr. bright red, ovoid, 10-ribbed, rather acute at the base, produced at the apex into a long point which withers and remains, 2 in. long, more than 1 in. thick.

L. H. B.

GYMNÓPSIS: *Sclerocarpus.*

GYMNÓPTERIS (Greek, *naked fern*). *Polypodiàceæ.* A group of small tropical ferns with once-pinnate hairy lvs. with the sporangia forming long lines along the veins without indusia; the lf.-margins not rolled over as in Cheilanthes, and to which the genus is related.

híspida, Underw. (*Gymnográmma híspida*, Mett.). A low plant, 5–8 in. high, with pentagonal, palmate lvs. 1 in. or more either way, densely covered on both sides, but especially below, with strigose hairs. Has been incorrectly referred to *Gymnogramma Ehrenbergiana*. Texas, Ariz., Mex.—Hardy.

R. C. Benedict.

GYMNOSPÒRIA (*gymnos*, naked and *sporos*, seed; the seed being sometimes without aril). *Celastràceæ.* A genus of about 60 species widely distributed through Trop. and Subtrop. Afr., Asia and Austral., S. Eu. and Subtrop. S. Amer. Closely related to Celastrus, but easily distinguished by their habit, being rigid, often spiny shrubs or small trees with coriaceous rather small lvs. and perfect small whitish fls. in axillary cymes followed by small capsular dehiscent frs.; seeds with or without aril. None of the species is hardy N.; *G. variabilis* being probably the hardiest. They are of little or no ornamental value and only occasionally and rarely cult. in botanical collections. Except *G. serrata* which is cult. in S. Calif., and recommended as a suitable shrub for evergreen hedges. Prop. by seeds and probably by cuttings.

serràta, Loes. (*Celástrus serràtus*, Hochst.). Evergreen shrub; the branches with slender spines or unarmed, puberulous or nearly glabrous at the extremities: lvs. coriaceous, short-petioled, ovate or elliptic to oblanceolate, obtuse, serrulate, glabrous, reticulate beneath, 1½–3 in. long: cymes small on axillary, forked, puberulous peduncles much shorter than the lvs.: caps. 3-valved, smooth. Abyssinia. **G. buxifòlia,** Szyszylowicz (*Celástrus buxifòlius*, Linn.). Usually spiny, several feet high: lvs. obovate, obtuse, crenately serrate, 1–2 in. long:

cymes dense, short-peduncled. Afr. B.M. 2070 (as *Celastrus cymosus*) and 2114 (as *C. buxifolius inermis*). **G. variábilis,** Loes. Lvs. oblong to oblong-lanceolate, acute, serrulate, 2–3½ in. long: cymes slender, much shorter than lvs.: caps. ½–¾in. across. Cent. China.

Alfred Rehder.

GYMNÓSTACHYS (Greek, *naked spike*, the scape being leafless). *Aràceæ.* One interesting tuberous-rooted herb with grass-like radical lvs., from Queensland and New S. Wales, sometimes grown in choice greenhouse collections, *G. ánceps*, R. Br. Scape 1 to nearly 3 feet tall, flattened, slender: spikes 1–3 in. long, slender and curved or drooping, in small clusters near the apex, with a leafy bract subtending each cluster; fls. small and sessile; perianth-segms. 4, obovate and not exceeding the ovary; stamens 4: fr. a berry ⅛ or ¼in. long.

L. H. B.

GYMNOSTÀCHYUM (*naked spike*). *Acanthàceæ.* Some of the plants of this name are Fittonias (which see). *G. ceylánicum*, Arn. & Nees, is by Lindau (Engler & Prantl Pflanzenfamilien) referred to Cryptophragmium, becoming *C. ceylanicum*, O. Kuntze, but by Bentham & Hooker is retained in the former genus. It is an erect herb from Ceylon, suitable for growing in the hothouse for its white-marked lvs. and small whitish fls. in clusters: lvs. opposite, oval or obovate, obtuse, somewhat serrate. B.M. 4706. J.F. 4:405. L. H. B.

GYMNÒTHRIX: *Pennisetum.*

GYNANDRÓPSIS (Greek words: the stamens look as if they were borne on the ovary). *Capparidàceæ.* Annual herbs grown out-of-doors.

This genus includes a tender plant with 5–7 lfts., and fls. resembling the spider flower, or Cleome. It is known to the trade at present as a Cleome, but Gynandropsis is distinguished by having a long torus (or receptacle), which is produced into a slender body (or gynophore) which is elongated at the middle, and bears the pistil to which the filaments are united. Cleome has a short torus, which often has an appendix on the back: stamens about 6 in Gynandropsis: in Cleome 4–6, often 10: lfts. 3–7: fls. white or purplish; sepals deciduous; petals entire or crenulate, obovate, with a slender claw: fr. a silique, usually inclosed within the calyx; seeds kidney-shaped or orbicular, compressed, with a wrinkled or tubercled coat.—The species of Gynandropsis are perhaps a dozen, in the warmer parts of the world. Pedicellaria is an older name for the genus, but it is not accepted by the "nomina conservanda" of the Vienna code. For cult., see *Cleome.*

speciòsa, DC. (*Cleòme speciòsa*, HBK.). Stiff annual, or perhaps a perennial, usually about 2 ft. and rather velvety toward the top: lfts. 5–7, subserrulate, oblong, acuminate: fls. violet, showy. Mex.

Wilhelm Miller.
N. Taylor.†

GYNÈRIUM (Greek, *gune*, woman, and *erion*, wool). *Gramíneæ.* Very large perennial grasses with broad, sword-like blades and plume-like diœcious inflorescence.

Spikelets 2-fld., the florets equal, the rachilla not produced beyond the upper floret; glumes of staminate spikelets equal, of the pistillate spikelets unequal, the upper twice as long as the lower; culms perennial, with extensively creeping rhizomes, the plants growing gregariously in large masses or areas in their native habitat: lvs. rather evenly distributed along the sts., the sheaths about equal, the blades as much as 3 in. wide.—One species in Trop. Amer. Cortaderia of Stapf differs in the 3–6-fld. spikelets, the upper florets more or less reduced, in the equal glumes in both sexes, in the biennial culms with only very short rhizomes, the plants thus growing in large tussocks; in the lvs., scarcely ½in. wide, being crowded at the base of the plant, the sheaths increasing in length from base upward. The difference in appearance between the staminate and pistillate plumes is much more marked in Gynerium than in Cortaderia.

saccharoìdes, Humb. & Bonpl. Uva-Grass. Culms perennial, as much as 40 ft. high: on the sterile shoots the lvs. are aggregated, fan-like at the summit; on the fertile sts. they are scattered along the middle, the basal and upper portions being naked: plume white or tawny. B.M. 7352.—Cult. for ornament, the plumes resembling those of pampas grass. Not hardy outside the tropics. For pampas grasses see *Cortaderia* and *Pampas-Grass.*

A. S. Hitchcock.

GYNÓPOGON (Greek, *bearded stigma*). *Apocynàceæ.* Syn. *Alýxia.* Interesting tropical woody plants, worth cultivating under glass.

The genus was established in 1776 by Forster, based upon *G. stellatus* of Tahiti, and is now known to include at least 50 species distributed in the islands of the Pacific, Madagascar, Austral. and Trop. Asia. Evergreen trees or shrubs, erect or twining, nearly all of which have the agreeable fragrance of coumarin, with entire, short-petioled, glossy, myrtle-like lvs., usually in whorls of 3 or 4, or sometimes opposite: fls. usually fragrant, axillary or terminal, solitary or in umbellate or spicate cymes; calyx 5- or 4-cleft; corolla salver-shaped, its tube cylindrical, swollen above the middle, or slightly contracted at the throat, without scales, the 5 or 4 lobes sinistrose; anthers subsessile, as many as the lobes of the corolla and alternate with them, inserted on the tube; ovary of 2 distinct carpels united by a single style with a capitate, or oblong stigma often bearing hairs on its upper surface; ovules 4–6 in each carpel in 2 series: fr. generally a single ovoid or oblong drupe, usually moniliform, consisting of 2 or more 1-seeded joints placed end to end, sometimes both carpels maturing in the same fl., when the fr. becomes geminate, as in many other Apocynaceæ; seeds ovoid or oblong, furrowed on the ventral side, remarkable for their ruminate endosperm with erect embryo, in which respect they differ from those of other Apocynaceæ and agree with Annonaceæ. Plants of this genus may be prop. by seeds or cuttings. They are worthy of cult. in the conservatory, on account of their dark green lustrous foliage and their fragrant jasmine-like fls.

olivæfórmis, Safford (*Alýxia olivæfórmis*, Gaud.). Maile. A straggling or somewhat twining shrub with opposite and ternate lvs., blades ovate to oblong, obtuse or acuminate at both ends, coriaceous glossy, with evanescent veins and margins usually revolute over an intramarginal nerve: peduncles axillary, 3- or 4-fld.; corolla yellowish, salver-shaped, the tube slightly dilated below the contracted throat, puberulous within along the adnate filaments, limb 4- or rarely 5-lobed: drupes often geminate, fleshy black, elliptic-oblong, sometimes curved, acuminate at each end. Hawaiian Isls., in the woods of the lower and middle regions.—This is perhaps the most cherished plant of the Hawaiians, who weave its fragrant glossy foliage into garlands, or leis, with which to adorn their friends, and with its branches decorate their houses and lanais on festive occasions; and they also celebrate its fragrance in their songs. Other allied species are the *laumaile* of Samoa (*Gynopogon bracteolosus*), the *nanago* or *Loduson lahe* of the island of Guam (*Gynopogon Torresianus*), and the *maire* of Tahiti (*Gynopogon stellatus*).

W. E. Safford.

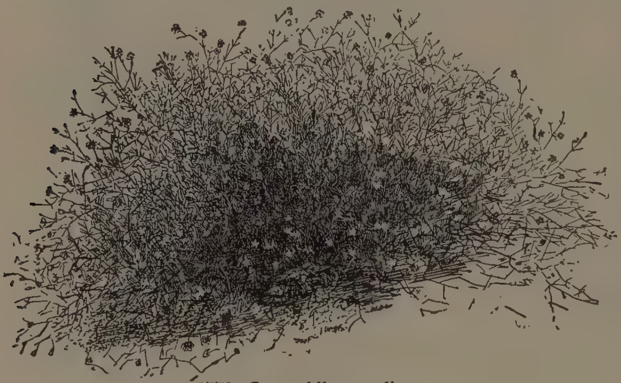
GYNÙRA (name refers to the tailed stigmas). *Compósitæ.* Tropical herbs, sometimes grown under glass for the large showy foliage.

Rarely subshrubby: lvs. alternate, entire or lobed, numerous: heads discoid, the florets commonly all fertile, not very showy; involucre cylindrical or somewhat bell-shaped, the narrow bracts in about 1 series: achene narrow, 5–10-striate, with copious slender white pappus-bristles. The gynuras are attractive glasshouse herbs, usually requiring a moderately high temperature; prop. by cuttings. Genus allied to Senecio and Cineraria; of about 40 species in Trop. Afr., Asia, to Austral.

aurantìaca, DC. VELVET TREE. Stout and branchy, 2–3 ft., with almost succulent sts. densely clothed with violet or purple hairs: lvs. large and soft, ovate, jagged-toothed, hairy, short-petioled or the upper ones clasping, overlaid with iridescent purple: heads in a terminal cluster, yellow or orange. Java. I.H. 28:436.—A handsome foliage plant. In winter it may be grown in the conservatory or warmhouse, but in the summer it may be bedded out in a warm and protected place. It grows rapidly, and makes a most satisfactory display of colored leafage. It is readily prop. by cuttings in the house, as geraniums are.

Other species, but not known to be in the American trade, are: *G. auriculàta*, Cass. (G. ovalis, DC. Cacalia ovalis, Ker). Only slightly villous: lvs. oval, entire or repand, green both sides: fls. yellow, fragrant. China. B.R. 101.—*G. bícolor*, DC. 2–3 ft., of looser growth than the above, glabrous: lvs. lance-ovate, somewhat downy, short-petioled, deep-toothed or pinnatifid, green above and purple beneath: fls. orange. Moluccas. B.M. 5123.—*G. ovàlis*, DC.=G. auriculata.—*G. sarmentòsa*, DC. Climbing, with purple glabrous sts.: lvs. narrow, ovate to lanceolate, acuminate, petioled, remotely small-toothed, green and purple-ribbed. Warmhouse plant from Malayan Isls. B.M. 7244.

L. H. B.



1772. Gypsophila muralis.

GYPSÓPHILA (*gypsum-loving*, because it likes calcareous soils). *Caryophyllàceæ.* European and Asian herbs, bearing a profusion of small flowers, and useful for mist-like effects in mixed borders and as trimming in bouquets.

Sepals 5, united below, but the calyx naked at the base (not bracted, as in some related genera) 5-nerved; petals 5, clawed, very small, usually white, in some horticultural forms pinkish; stamens 10; styles 2: pod 4-valved: lvs. small, entire, opposite.—Perhaps 75 species. Very branchy or spreading, slender herbs, with scant foliage when in bloom. Of easiest cult. in open, rather dry places. They are desirable for rockwork. They make an excellent effect as filling amongst shrubbery; also good for covering unkempt places with a mass of delicate bloom. Hardy.

A. *Plant annual.*

muràlis, Linn. Fig. 1772. One to 1½ ft., very diffuse and branchy, mostly with shorter joints than *G. elegans*, of finer appearance, the st. rough-hairy near the base, smooth above: lvs. linear, spurry-like: fls. small, rosy, the petals almost recurved, crenate. Eu.—Makes a dense little mound when well grown.

élegans, Bieb. Fig. 1773. One foot, repeatedly forked-branched, glabrous: lvs. sessile, the uppermost linear, the lower oblong or spatulate: fls. white or sometimes (*G. ròsea*, Hort., and in rare wild forms) rosy; petals truncate, almost recurved, 2–5 times as long as the calyx. Caucasus.—Much cult., and handsome.

AA. *Plant perennial.*

B. *Lvs. short, spatulate: plant pubescent.*

cerastioìdes, D. Don. Low, densely pubescent: lvs. pubescent, the radical ones long-petioled, the others spatulate or obovate, obtuse or nearly so: fls. large (often ⅖in. across), white or lilac, pink-veined. Himalayas. B.M. 6699. Gn. 47, p. 422. G. 35:433.—Of creeping habit; excellent for rockwork.

BB. *Lvs. perfoliate.*

perfoliàta, Linn. (*G. scorzonerifòlia*, Hort.). A tall, thick and round-stemmed perennial, usually glabrous, but sometimes hairy near the summit: lvs. perfoliate, 5-nerved: fls. purplish, the sepals only slightly shorter than the petals. Medit. region.

1773. Gypsophila elegans. (Natural size)

BBB. *Lvs. long, not perfoliate: plant glabrous or nearly so.*

paniculàta, Linn. BABY'S BREATH. Fig. 1774. Diffuse and rather tall-growing (2–3 ft.), forking: lvs. linear-lanceolate, the largest 3 in. long, but becoming smaller toward the infl., sharp-pointed: fls. white, very numerous; pedicels 2–3 times as long as the calyx. Eu. Gn. 68, p. 162.—A very popular plant, especially for use in the trimming of bouquets. A most graceful subject. Sts. stiff and wiry, therefore excellent for cutting. A picture of its use in floral arrangement will be found in A.F. 6:340. Var. **flòre-plèno,** Hort., with double fls. has been advertised, but is little known in Amer. Gn. 60, p. 103. A.F. 19:767. In places where the double form is difficult of cult., it is recommended that it be grafted on roots of *G. paniculata*.

acutifòlia, Fisch. Very like the last, but the plant greener, the lvs. narrower (indistinctly 3-nerved) and the pedicels scarcely longer than the calyx. Caucasus.—*G. paniculata* seems sometimes to be cult. under this name.

Stèvenii, Fisch. (*G. glaùca*, Hort.). Lower than *G. paniculata*, glaucous-green: lvs. linear-lanceolate and carinate, mostly radical: fls. rather larger, white, the panicles smaller than those of *G. paniculata;* petals shorter than the calyx. Caucasus.

rèpens, Linn. (*G. prostràta*, Hort., not of Linn.). Sts. trailing or prostrate, ascending at the ends, not glaucous: lvs. linear, sharp-pointed, glabrous: fls. rather large, white, the petals about twice longer than the sepals and the pedicels usually much longer. Alps and Pyrenees. B.M. 1448.—Best adapted to the rockery, and the mixed border; blooms from midsummer to autumn. Var. **monstròsa,** Hort., is larger but otherwise the same. Var. **ròsea,** Hort., has rose-colored fls. and is frequently sold as *G. prostrata rosea*, also as *G. carminea*, Hort., which does not seem to differ.

N. TAYLOR.†

1774. Gypsophila paniculata.

H

HABENÀRIA (Greek, *a rein* or *strap;* referring to the shape of parts of the flower). *Orchidàceæ,* tribe *Ophrýdeæ.* REIN ORCHIS. Terrestrial leafy herbs, sometimes grown in bog-gardens and naturalized in moist places.

Tubers usually undivided, rarely lobed: fls. in terminal racemes or spikes, rarely solitary; sepals subequal, free or cohering at base, erect or spreading; petals usually smaller, often 2-lobed; lip spreading or drooping, long- or short-spurred at base, its blade entire or 3–5-fid.; column very short, sessile; rostellum usually 1-toothed or lobed; glands naked; anther-cells parallel or divergent: caps. ovoid or oblong, erect. The lateral lobes are sometimes fringed, giving the fl. a graceful appearance.—Species about 400, very widely distributed in temperate and tropical regions.

Few species of Habenaria are of much horticultural importance, especially in this country. Some of the exotic kinds enjoy some favor as stove plants in England, while there are a number of hardy North American species which can be recommended for outdoor cultivation in boggy places. *H. Susannæ, H. carnea, H. militaris* and other East Indian species are best grown in a moderately warm house, needing good light and a fair amount of water. It is recommended to repot them after the resting season in a compost of peat, moss, loam and crock dust, with the tuber resting upon the crocked-up bottom of the pot and the growing point just beneath the soil. They should then be given a good supply of water until after flowering. These habenarias are much like bletia in their requirements. The most popular species at present seem to be *H. ciliaris, H. fimbriata* and *H. psycodes,* but these give a very imperfect conception of the beauties of the genus, although in the opinion of some persons, *H. ciliaris* is the showiest orchid in temperate North America. The native species are procurable through collectors and dealers in native plants: foreign species through Dutch bulb-growers; and *H. radiata* through dealers in Japanese plants.

1775. Habenaria carnea. (×¼)

INDEX.

bifolia, 29.
blephariglottis, 15.
Bonatea, 19.
bracteata, 24.
carnea, 6.
chlorantha, 20.
ciliaris, 8.
cinnabarina, 10.
conopsea, 1.
cristata, 9.
dilatata, 35.
elegans, 32.
Elwesii, 18.
fimbriata, 4.
gigantea, 17.
gracilis, 33.
Hookeriana, 30.
Hookeri, 30.
hyperborea, 31.
integra, 7.
lacera, 23.
leucophæa, 22.
leucostachys, 14.
longecalcarata, 16.
militaris, 11.
nivea, 13.
nivosa, 6.
obtusata, 27.
odoratissima, 2.
orbiculata, 28.
peramœna, 3.
psycodes, 5.
pusilla, 11.
radiata, 21.
rhodocheila, 12.
Susannæ, 17.
tridentata, 25.
unalaschcensis, 34.
virescens, 26.
viridis, 24.

A. *Fls. purple; lip 3-parted: sts. leafy.*

B. *Segms. of lip entire: bracts nearly equaling the fls.*

1. **conópsea,** Benth. (*Gymnadènia conópsea,* R. Br. *G. conópea,* French authors). DEADMAN'S FINGERS. Fls. violet-purple to flesh-colored, rarely white, fragrant, medium-sized; spur longer than ovary, sometimes twice as long. June, July. Eu., N. Asia. G.C. III. 51:68.—There is an *H. conopsea* of Reichenbach dating from 1854, whereas Bentham's dates only from 1880.

2. **odoratíssima,** Franch. (*Gymnadènia odoratíssima,* A. Rich.). Fls. intensely red-purple, aromatic, only half as large as in the preceding; spur shorter than ovary. May, June. Eu.

BB. *Segms. of lip toothed.*

3. **peramœ̀na,** Gray. Rather tall: fls. large and showy, violet-purple; middle segms. of lip 2-lobed. July, Aug. N. J. to Va. and Ill. B.B. 1:466.

BBB. *Segms. of lip deeply and copiously fringed.*

4. **fimbriàta,** R. Br. Fls. lilac, rarely white, fragrant; petals laterally toothed. Summer. New Bruns. to Mich. and mountains of N. C. A.G. 12:152. G.F. 10:483. B.B. 1:466.

5. **psycòdes,** Gray. Three feet or less high: fls. many, crowded, much smaller than in *G. fimbriata,* lilac, rarely white, fragrant. July, Aug. Newfoundland to Minn. and high mountains of N. C. B.B. 1:466.

AA. *Fls. pink throughout: lvs. all radical.*

6. **cárnea,** N. E. Br. Fig. 1775. Lvs. dull green, spotted with white: fls. few, loosely clustered, light pink, fading nearly white; lip large; spur over 2 in. long. Penang. G.C. III. 10:729; 34:323. Gn. 47:182. G.M. 36:642. O.R. 4:209; 9:297; 11:frontis.; 13:59. G. F. 4:487. J.H. III. 33:319; 49:299. R.B. 21, p. 44.—One of the most beautiful of the genus; apparently not in American trade. Var. **nivòsa,** Hort., white. Gn. 47:182.

AAA. *Fls. orange.*

B. *Color orange-yellow throughout.*

C. *Lip nearly or quite entire.*

7. **íntegra,** Spreng. Two ft. or less high, leafy: fls. small, crowded. July. N. J. to La., near the coast. B.B. 1:463.

CC. *Lip fringed or lacerate.*

8. **ciliàris,** R. Br. YELLOW FRINGED ORCHIS. Fig. 1776. Fls. crowded, brilliant orange; petals fringed at apex; spur about twice as long as lip; lip long-fringed. Aug. E. U. S. B.M. 1668. B.B. 1:464.—A striking species.

9. **cristàta,** R. Br. Smaller: fls. much smaller; petals merely toothed; spur little exceeding the lip. July. N. J. to La. near the coast. B.B. 1:464.

BB. *Color cinnabar-orange, the sepals red-spotted outside.*

10. **cinnabarìna,** Rolfe. Small: st. leafy: lip 3-lobed; spur straight, nearly equaling ovary. Madagascar.—Not in American trade.

AAAA. *Fls. with green sepals and petals; lip brilliantly colored.*

11. **militàris,** Reichb. f. (*H. pusílla,* Reichb. f.). Bluish glaucous: fls. numerous; lip scarlet, trifid, mid-

lobe bifid; spur long and very slender, greenish white. Cochin-China. R.H. 1888:396. J.H. III. 33:53. G.M. 36:436. O.R. 4:209; 9:297.—The author says of this fine plant: "No English soldier can boast a jacket of a deeper scarlet than the lip of our plant." Not in American trade.

12. **rhodocheìla,** Hance. Nearly related to *H. militaris,* but fls. fewer and subcorymbose: petals almost helmet-shaped; lip varying from deep rose-pink to cinnabar and madder; spur dull yellow. China. B.M. 7571.—Not in American trade.

AAAAA. *Fls. white to green or greenish yellow.*

B. *Color pure white.*

C. *Lip entire.*

13. **nívea,** Spreng. Lvs., except 1 or 2 lowest, bract-like: fls. numerous, loosely clustered, small; spur very slender. Summer. Del. to Ala. B.B. 1:462.

14. **leucóstachys,** Wats. Usually tall and stout: lvs. several: fls. many, rather large. Idaho to Ariz., Calif. and Ore. Mn. 6:81.—Nearly related to *H. dilatata,* but distinguished by its spur greatly exceeding the sepals.

CC. *Lip fringed.*

15. **blepharigló̀ttis,** Torr. Fls. much as in *H. ciliaris,* but somewhat smaller; petals fringed or slightly erose at apex; spur about 3 times as long as lip. July. Newfoundland to N. C. and Minn. B.B. 1:465. Mn. 8:113. —One of our finest natives.

CCC. *Lip 3-parted.*

16. **longecalcaràta,** A. Rich. Lvs. all radical: fls. 1–3, large, long-stalked; middle lobe of lip narrow, lateral ones broader, unevenly fringed; spur twice as long as ovary, with pedicel. July, Aug. India. B.M. 7228.—Not in American trade.

17. **Susánnæ,** R. Br. (*H. gigantèa,* Don). St. tall, stout, leafy: fls. 3–5, very large, fragrant; broad, fan-shaped side lobes of lip deeply fringed; midlobe tongue-shaped, entire; spur more than twice as long as ovary and pedicel. India, Malaya, China. B.M. 3374. G.C. III. 16:279. J.H. III. 29:226. O.R. 4:209; 9:297.—This and the preceding species are among the largest-fld. and showiest habenarias. They appear not to be in the North American trade.

BB. *Color partly or wholly green, or greenish yellow.*

C. *Lip deeply 3-lobed or 3-parted.*

D. *Petals cleft or parted into 2 lobes or segms.*

18. **Élwesii,** Hook. Erect, leafy: fls. few, large, greenish yellow; petals cleft almost to base into long, slender, sickle-shaped, hairy segms.; lip smooth, the segms. long and slender. India. B.M. 7478.—A remarkable species.

19. **Bonàtea,** Reichb. f. (*Bonàtea speciòsa,* Willd.). Stout, leafy: fls. rather large, light green and white; lobes of lip, especially central one, tubular toward base. S. Afr. G.C. III. 17:743.—Cult. like *Disa grandiflora,* in a cool greenhouse with plenty of air, in a mixture of fibrous peat and sphagnum with perfect drainage. Requires a liberal supply of water all the year round.

1776. Habenaria ciliaris, c. yellow fringed orchid. (×¼)

DD. *Petals not cleft or parted.*

E. *Spur sac-shaped; lobes of lip entire.*

20. **chlorántha,** Spreng. Lvs. clasping: fls. not exceeding bracts, greenish. Mascarene Isls.

EE. *Spur long and slender.*

F. *Middle lobe of lip entire, the others fringed.*

21. **radiàta,** Spreng. Petals exceeding sepals; spur greenish white, about equaling the ovary. Aug., Sept. Japan.

FF. *All lobes of lip deeply fringed.*

22. **leucophæ̀a,** Gray. Four ft. high or less: fls. large, whitish or greenish, fragrant; petals erose; spur exceeding ovary. July. N.Y. to Minn. and Ark. B.B. 1:465.

23. **lácera,** R. Br. Ragged Orchis. Smaller: fls. greenish yellow; spur not equaling ovary. June, July. Nova Scotia to Ga. and Mo. B.B. 1:465.

CC. *Lip merely toothed or slightly lobed; fls. inconspicuous.*

D. *Fls. much shorter than the conspicuous bracts; spur sac-shaped, short.*

24. **bracteàta,** R. Br. (*H. víridis,* Cham.). Fig. 1777. Fls. greenish; spur often white. Summer. N. E. U. S. to Brit. Col., Eu. B.B. 1:463.

DD. *Fls. nearly equaling or exceeding bracts; spur long and slender.*

E. *Lvs. 1–2 near base of st.*

25. **tridentàta,** Hook. Fls. greenish, loosely clustered; lip wide at apex, 3-toothed; spur incurved. July, Aug. Newfoundland to Minn., Fla. and La. A.G. 12:153. B.B. 1:463. Now known as **H. clavellàta,** Spreng.

EE. *Lvs. 3 or more.*

26. **viréscens,** Spreng. Leafy: fls. greenish; lip only slightly exceeding petals, with 2 lateral teeth and a nearly basal wart. July. Range of preceding. B.B. 1:464. The name is now **H. flàva,** Gray.

CCC. *Lip entire; fls. inconspicuous.*

D. *Large lvs. all basal.*

E. *Lf. solitary.*

27. **obtusàta,** Richards. Spike loosely fld.; fls. yellow-green; lip deflexed; spur about equaling lip. Summer. Across Canada, south to N. Y. and Colo. B.B. 1:461.

EE. *Lvs. 2.*

F. *Spur much exceeding ovary.*

28. **orbiculàta,** Torr. Lvs. orbicular, lying on the ground: fls. numerous, loosely clustered, greenish; lip white, obtuse. July, Aug. Across Canada and Minn. to mountains of N. C. B.B. 1:461. Gn.M. 4:14.

29. **bifòlia,** R. Br. Butterfly Orchis. Lvs. oblong: fls. white, with tips of spur and lip greenish, fragrant in the evening. May, June. Eu.

FF. *Spur about equaling ovary.*

30. **Hookeriàna,** Gray (*H. Hoòkeri,* Lindl.). Lvs. oval, obovate or orbicular: fls. greenish yellow; lip acute. Summer. Nova Scotia to N. J. and Iowa. B.B. 1:461.

DD. *Large lvs. several above the base.*

E. *Spike commonly dense.*

31. **hyperbòrea,** R. Br. Fls. greenish; petals, obtuse lip and slender spur all about equally long. Summer. N. U. S. to Nova Scotia and Alaska. B.B. 1:462.

32. **élegans,** Boland. Large lvs. all on lower part of st.: fls. numerous, small, greenish; sepals 1-nerved, all alike; spur filiform. Vancouver Isl. to Calif.

EE. *Spike commonly loose.*

F. *Spur short, sac-shaped.*

33. **grácilis,** Wats. Three feet high or less: spike long, many-fld.; fls. greenish; spur about equaling lip and sepals. Ore. and Wash.

FF. *Spur not sac-shaped.*

34. **unalaschcénsis,** Wats. Fls. white or greenish; sepals, petals and lip about equal; spur slender, barely to nearly twice longer than lip. Summer. Unalaska to Calif. and Utah.—Near *H. elegans*, but more slender, with a longer and more open spike. It is referred by some to the genus Herminium.

35. **dilatàta,** Gray. Fls. greenish white; lip widened or even auricled at base; spur about as long, incurved. Summer. Cooler parts of N. Amer. A.G. 12:153. B. B. 1:462.—More slender and narrower-leaved than *H. hyperborea.*

H. geniculàta, D. Don. Slender-growing: fls. white with green spur. Burma, Himalayas. —*H. iántha*, Hook. (Platanthera iantha, Wight). Deciduous, about 16 in. high: fls. shortly stalked, creamy white; lip large, rose-purple and white with crimson-purple dots and streaks; crest bright yellow. S. India. G.C. III. 54:300.—*H. Lúgardii*, Rolfe. Lvs. 2, basal: raceme many-fld.; fls. white, the stylodes green; sepals ovate, acute; petals divided into 2 slender lobes. Bechuanaland. B. M. 7798.—*H. Régnieri*. Garden hybrid of H. militaris and H. carnea.—*H. Roebelénii*. Rolfe. Similar to H. militaris but dwarfer: fls. vermilion-scarlet; lip broad, deeply cleft at the sides. Annam. O.R. 1913:39. —*H. triquètra*, Rolfe. Plant somewhat glaucous: racemes about 10-fld.; petals white; sepals light green. Burma.

1777. Habenaria bracteata. (×¼)

T. H. KEARNEY, JR.
GEORGE V. NASH.†

HABÉRLEA (after Karl C. Haberle, professor of botany at Pesth, who died in 1831). *Gesneriàceæ.* One dainty little hardy herbaceous perennial plant, which is tufted and bears in spring a few scapes 4 to 6 inches high, with two to five nodding, violet-colored, five-lobed, tubular flowers, each about 1 inch long and 1 inch across. Allied to Ramondia.

Haberlea has 4 included didynamous stamens and a bell-shaped calyx; the corolla has a conspicuous tube, which is thrust out of the calyx nearly ½in., and 5 lobes, 2 of which are much smaller than the others, while in Ramondia the fl. seems to be wheel-shaped, with 5 equal petals, because the corolla-tube is very short and inconspicuous and the lobes deeply cut. Haberlea was intro. to cult. about 1881 by Leichtlin, and few, if any, of our skilled amateurs know the plant. It is not advertised in Amer. Only 1 species is known, and it is found wild only in a few miles of a single valley in Thrace, where it abounds on the southern slope of the Balkans on shaded schistose rocks. Only 4 species of Gesneriaceæ are found wild in Eu., and 3 of them, are said to be confined each to one spot. The genus Ramondia has the same habit and is equally desirable For cult., see *Ramondia.*

rhodopénsis, Friv. Like a very small gloxinia, and clothed everywhere with soft, spreading hairs, except the corolla: lvs. 2–3 in. long, obovate- or ovate-oblong, obtuse, coarsely crenate, thick, leathery, few-nerved: calyx 5-cleft; corolla pale lilac. B.M. 6651. Gn. 67, p. 71. G.W. 15:428. R.H. 1906, p. 231.

WILHELM MILLER.

HABRÁNTHUS: *Hippeastrum.*

HABROTHÁMNUS: *Cestrum.*

HACKBERRY: *Celtis.*

HACKMATACK, or TAMARACK: *Larix americana.*

HACQUÈTIA (named after Balthasar Hacquet, 1740–1815, author of works on alpine plants). *Umbellíferæ.* Syn. *Dóndia, Dondísia.* A monotypic genus consisting of an herbaceous perennial cult. in the alpine garden and thriving in good stiff loam. Prop. by division in spring, before growth commences. The species is *H. Epipáctis*, DC. From 3–8 in. high: lvs. radical, palmate, deeply lobed: fls. polygamous, in umbels on short pedicels, yellow; involucre of 5–6 large, green lvs. which are much longer than the umbels. Eu. L.B.C. 19:1832. G.W. 14, p. 197.—Blooms in April and May.

HÆMÁNTHUS (*blood flower*). *Amaryllidàceæ.* BLOOD LILY. African bulbous plants, of which the greater part are natives of the Cape region; grown indoors.

Flowers showy, often numerous, in umbels; perianth straight and erect, with a short cylindrical tube; segms. longer than the tube, narrow, equal; stamens 6, inserted in the throat of the perianth, usually exserted, the anthers versatile; style filiform and erect, on a 3-loculed ovary: fr. berry-like, indehiscent. The fls. are red or white, on a solid scape, which is little, if any, longer than the cluster of root-lvs.; they lack the corona of many amaryllidaceous plants.—Probably above 60 species from S. and Trop. Afr.

Hæmanthuses, like most Cape bulbs, are summer- and autumn-flowering; or, when started indoors or in frames, blooming in spring or early summer. The flowers often precede the leaves. The foliage is usually large and luxuriant, and the scape is often handsomely colored. The flowers are sometimes as much as 2 inches across, and produced in great ball-like heads nearly or quite a foot through. Yet the species are essentially curiosities in this country. The culture given nerine suits them well. Their season of growth is usually not more than three or four months, and the remainder of the year they may be laid away in the pots. When growing, give plenty of rather weak liquid manure, keep in an intermediate or warm house, and when in bloom keep them somewhat cooler. Avoid overpotting.

They are increased by offsets, which should be detached from the parent plants in the spring. The bulbs may be potted singly, or several in a pot, in equal parts of peat and loam, with enough sand to make the compost have a gritty feeling when passed through the hands. Cover the lower half of the bulb with soil and pot them firmly. Leaf-mold may be used instead of peat, if that soil is not available. Hæmanthus will grow well in a night temperature of 50° to 55°. However, they are often grown 10° lower, but never with the same success. Water the plants carefully until they get into active growth, after which water may be applied more liberally. Syringe the plants on all bright days, morning and noon during their growing period. During the summer months, shade them slightly; and when they are in flower the shade may be much heavier. This is of great assistance in making them last longer. As soon as the plants show signs of going to rest, withhold water, letting the soil become quite dry. Start them into growth in the spring about the first of March. It is not necessary to pot these plants every year, as they flower much better if not disturbed much at the roots. If they are not repotted, water with weak liquid manure once a week, after they are growing vigorously. These plants are liable to attacks from green-fly and red-spider. Fumigation with tobacco, in any form generally used in greenhouses, will keep the former in check; and on bright days, a careful syringing of the under side of the foliage with clean water will keep the latter from getting a foothold. (George F. Stewart.)

INDEX.

albiflos, 7.
candidus, 8.
Clarkei, 7.
coarctatus, 9.
coccineus, 9.
imperialis, 4.
insignis, 6.
Kalbreyeri, 2.
Katherinæ, 3.
Laurentii, 4.
Lescrauwaetii, 1.
Lindenii, 4.
magnificus, 6.
mirabilis, 4.
multiflorus, 2.
pubescens, 7.
puniceus, 5.
superbum, 2.
tenuiflorus, 2.
tigrinus, 10.

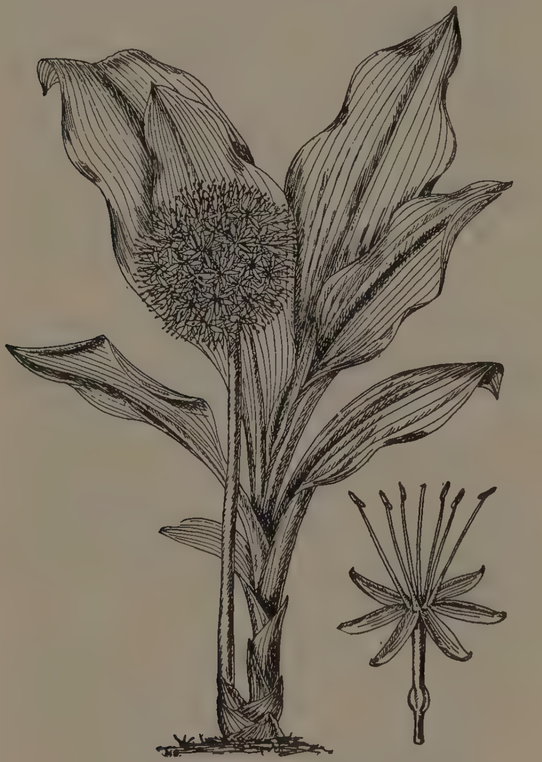
A. *Lvs. membranous, not fleshy.*

B. *Perianth-parts and spathes spreading.*

C. *Peduncle lateral as regards the tuft of lvs.*

D. *Segms. of perianth. ½in. long or less.*

1. **Lescraûwaetii,** Wildem. Lvs. sheathed at the base, 4–8 in a group, about 7–8 in. long, with 8–9 nerves on each side of the midrib: infl. racemose, the ultimate, umbellate clusters almost round, about 4 in. diam.; fls. rose-colored, showy, the tube short, the segms. linear, about ⅓in. long. Congo region. R.B. 30:217.—Intro. in 1904.



1778. Hæmanthus Katherinæ. (×¼)

DD. *Segms. of perianth. ¾–1 in. long.*

2. **multiflòrus,** Martyn (*H. tenuiflòrus,* Herb. *H. Kálbreyeri,* Baker). Bulb globose, 3 in. or less diam.: lvs. 3–4 on a short, separate st., the petiole short and sheathing, the oblong blade 6–12 in. long, with 6–8 veins each side of the midrib: scape straight, 1–3 ft. high, green or red-spotted; umbel often 6 in. diam., containing 30–100 fls., which are usually blood-red, with linear 3-nerved segms. twice or more as long as the tube; red filaments long-exserted, bearing prominent yellow anthers. Trop. Afr. Variable. B.M. 961, 1995, 3870. L.B.C. 10:912; 20:1948 (erroneously as *H. puniceus*). F.S. 1:58; 23:2377. I.H. 26:354. G. 25:445. Gt. 53:1531. G.W. 4, p. 557. G.Z. 25, p. 170. Var. **supérbus,** Hort., is an improved brilliant-colored form.

3. **Kâtherinæ,** Baker. Fig. 1778. Bulb globose, 2–3 in. diam.: lvs. 3–5, on a short, separate st. appearing with the fls., with a short, spotted petiole, the blade oblong, 9–14 in. long and 4–6 in. broad, the lateral veins 8–10: peduncle 1 ft. tall, spotted toward the base; umbel sometimes 9 in. diam., densely many-fld.; fls. bright red, 2–2½ in. long, the lanceolate reflexing segms. little longer than the cylindrical tube; red filaments exserted. S. Afr. B.M. 6778. G. 32:37. G.C. III. 43:72.—Name spelled both *Katherinæ* and *Katherine*; but the former spelling is the original and the proper Latin form. In cult. the lvs. become "about 3 ft. in length and of a bright pale green color—apple-green, as it is usually called—and the venation is more strongly marked than is usual in *H. multiflorus, H. cinnabarinus* and other allied kinds." Burbidge, Gn. 49, p. 160, with figure.

CC. *Peduncle central as regards the tuft of lvs.*

4. **Líndenii,** N. E. Br. Lvs. 6–8, in 2 ranks, arising from a thick, solid rootstock, nearly or quite evergreen; petioles long, winged; blade 10–12 in. long and 3–5 in. wide, long-ovate, lanceolate or ovate-oblong, acute, the base rounded or subcordate, with a longitudinal fold either side of the midrib: scape 1½ ft. tall, arising from the center of the lvs., flattened on one side, more or less spotted: umbel globular, 6–8 in. diam., with 100 or more scarlet fls. opening in succession; fls. 2 in. across, the tube ¾in. long, the lobes longer and linear-lanceolate and acute. Congo. G.C. III. 8:437; 13:483. I.H. 37:112; 40:173, f. 1; 41, p. 18. Gt. 46, p. 217. G.M. 36:220. J.H. III. 28:73.—Many forms are known in the trade, as var. **mirábilis,** Hort., with salmon-colored fls., a magnificent addition intro. in 1901. G. C. III. 29:332. Var. **imperiàlis,** Hort., differing from the type in longer perianth-segms. G.C. III. 31:99. G.M. 45:85. Var. **Lauréntii,** Hort., also with longer perianth-segms., and salmon-colored fls. R. H. 1911, p. 443. There are many other forms of this popular favorite, such as "Fascinator," "Queen Alexandra," and the like.

BB. *Perianth-parts and spathes ascending.*

5. **puníceus,** Linn. Bulb nearly globular, 2–3 in. diam.: lvs. 2–4, from the bulb, the petiole half the length of the blade, the blade 6–12 in. long and 2–4 in. broad, oblong, strongly undulated, the main veins about 6 on each side the rib: scape 6–15 in. tall, spotted; umbel globose and dense, 3–4 in. diam., bearing many scentless, pale scarlet, yellowish red or rarely white fls. 1 in. long; perianth-tube cylindrical, shorter than the lanceolate 3-nerved segms.; filaments red, 1 in. long. S. Afr. B.M. 1315.

6. **magníficus,** Herb. Bulb globose, 3–4 in. diam.: st. leafy, reaching a length of 2 ft., not developed until after flowering time: lvs. 6–8, oblong, 12–15 in. long, narrowed to a clasping base: peduncles stout, about a foot long, the umbel globose, about 5 in. diam.; fls. bright scarlet, the segms. about twice the length of the tube. Perhaps only a variety of *H. puniceus* and so treated in B.M. 3870. B.M. 4745 figures a var. **insígnis,** Hook., with long green bracts.

AA. *Lvs. thick and fleshy.*

B. *Bracts and fls. white.*

7. **âlbiflos,** Jacq. Bulb or tuber compressed sidewise, with thick, 2-ranged scales: lvs. 2–4, appearing with the fls., nearly erect, obtuse, 6–8 in. long and nearly half as broad, narrowed to the base, green and glabrous, but ciliate on the edges: scape less than 1 ft. tall, pale green, bearing a dense, globular umbel 2 in. diam.; fls. ¾in. long, the linear segms. much exceeding the tube. S. Afr. B.M. 1239. L.B.C. 7:602. Var. **pubéscens,** Baker, has lvs. hairy above. L.B.C. 8:702. B.R. 382. *H. Clárkei,* Hort., is a hybrid of this species and *C. coccineus.*

8. **cândidus,** Bull. Bulb large, globose: lvs. 2, appearing with the fls., fleshy, strap-shaped, about 1 ft. long, 4–5 in. wide, hairy on both sides: peduncle as long as

the lvs., very hairy; heads when expanded 5 in. diam., very showy, white; perianth-tube cylindrical. Natal.

BB. *Bracts and fls. red.*

9. **coccíneus,** Linn. Bulb compressed sidewise, 3 in. diam., the scales many, thick, 2-ranged: lvs. 2, suberect, lingulate, reaching 2 ft. long and 8 in. broad, narrowed to the base, green and glabrous, not ciliate: scape 6–10 in. tall, compressed, mottled; bracts large and thick, ascending and forming a cup, in which the red fls. are borne; fls. 1 in. long, with linear segms. and a short tube. S. Afr. B.M. 1075. L.B.C. 3:240. Var. **coarctàtus,** Baker, has smaller lvs. and shorter bracts. B.R. 181.—Odd plants.

10. **tigrìnus,** Jacq. Lvs. ciliate on the margins, 1 ft. or less long, spotted on the lower part of the back: scape 6 in., red-spotted; umbel dense, 2 in. or less in diam.: bracts shorter than in the last (not over 2 in. long), bright red; fls. 1 in. or less long, with very short tube. S. Afr. B.M. 1705.

Many hybrids and forms are known in horticulture. Among the best is *H. Andrómeda* which is H. Katherinæ × H. magnificus. Fls. crimson. Gn. 76, p. 437. G.M. 55:589.—*H. toxicàrius*=Buphane disticha.

L. H. B.
N. TAYLOR.†

HÆMÀRIA (Greek, referring to the blood-red under surface of the leaves). *Orchidàceæ.* Terrestrial orchids, known to the trade chiefly as Goodyera. They are really dwarf stove foliage plants, and are to be cultivated like Anœctochilus.

In Hæmaria the lower lip is swelled above its base into a wide claw and is provided with a pouch-like sac at base, and a blade of 2 divergent lobes; in Goodyera the blade of the lip is small and not clawed. Both genera belong to a large group in which the lip either has no spur or sac, or if the latter is present, it is included between the sepals; while in Anœctochilus the lip has a prominent sac or spur projecting between the lateral sepals.—Four species, in China and Malaya.

The leaves of *H. discolor* are green above and red below. It is, however, not nearly so brilliant as *Hæmaria Dawsoniana,* which has the same red color beneath, and is beautifully netted above with red or yellow. In both species a dozen or more small flowers, chiefly white, are borne on a densely hairy scape. These plants seem much easier to cultivate than anœctochilus and can be grown in large, shallow pans, with the rhizomes creeping in sphagnum.

A. *Lvs. not netted-veined above.*

díscolor, Lindl. (*Goodyèra díscolor,* Ker). Fig. 1779. Blade of lvs. oblong, 3 in. long, ¾in. wide. China (Brazil, according to Loddiges). B.M. 2055. B.R. 271.—Some plants have white longitudinal markings.

AA. *Lvs. brilliantly netted-veined above.*

Dawsoniàna, Hassl. (*Goodyèra Dáwsonii,* Boxall. *Anœctochìlus Dawsoniànus,* Low). Blade of lvs. elliptic, 3 in. long, 1¼ in. wide. Burma, Philippines. B.M. 7486 (veins of 2 lvs. blood-red; of the other almost wholly yellow) G. 34:101. G.C. III. 35:387.

HEINRICH HASSELBRING.

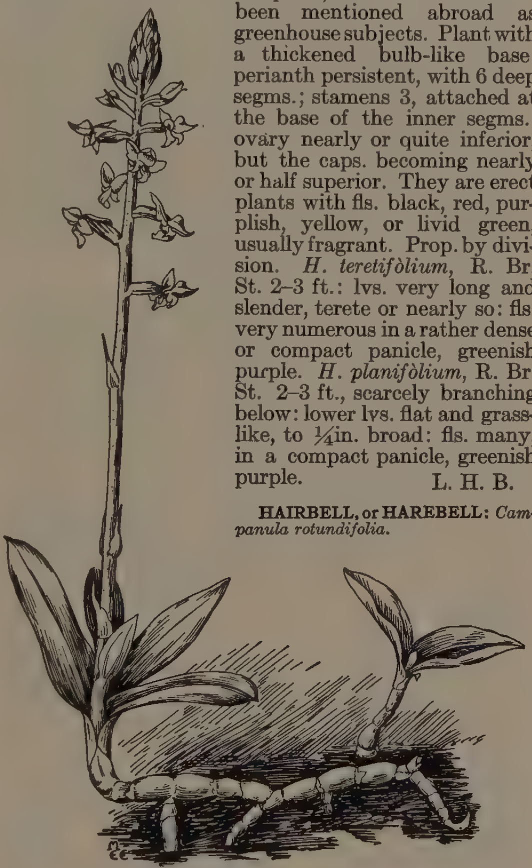
HÆMATÓXYLON (from the Greek for *blood* and *wood,* in reference to the color of the latter). *Leguminòsæ.* Two or 3 species of trees from Mex., Cent. Amer. and W. Indies, of which the most important, *H. campechiànum,* Linn., furnishes the logwood of commerce. It is a medium-sized tree, reaching 30–45 ft., with a short crooked trunk: lvs. abruptly pinnate; lfts. obversely egg-shaped: fls. small, yellow, in axillary racemes; petals 5, oblong, expanding; stamens free, rather upright, with filaments hairy at base; ovary short-stiped, free, with 2–3 seeds: pod lanceolate, flattened, dehiscing along the median valve in 2 boat-shaped pseudo-valves.—The wood is very hard and heavy, the heart-wood, from which the sap-wood has been removed, being used for making the dye. The wood takes on a beautiful brownish red color on exposure to the air. This tree is known as Campeachy wood, logwood, and in Porto Rico as Palo de Campeche.

L. H. B.

HÆMODÒRUM (*blood-gift,* a fanciful name). *Hæmodoràceæ,* which is closely allied to Amaryllidaceæ. Nearly 20 Australian perennial herbs, with sheathing equitant lvs. and different colors of fls. in heads, cymes or spikes, a few of which have been mentioned abroad as greenhouse subjects. Plant with a thickened bulb-like base: perianth persistent, with 6 deep segms.; stamens 3, attached at the base of the inner segms.; ovary nearly or quite inferior, but the caps. becoming nearly or half superior. They are erect plants with fls. black, red, purplish, yellow, or livid green, usually fragrant. Prop. by division. *H. teretifòlium,* R. Br. St. 2–3 ft.: lvs. very long and slender, terete or nearly so: fls. very numerous in a rather dense or compact panicle, greenish purple. *H. planifòlium,* R. Br. St. 2–3 ft., scarcely branching below: lower lvs. flat and grass-like, to ¼in. broad: fls. many, in a compact panicle, greenish purple.

L. H. B.

HAIRBELL, or HAREBELL: *Campanula rotundifolia.*



1779. Hæmaria discolor. (×⅓)

HÀKEA (after Baron von Hake, a German friend of botany). *Proteàceæ.* Australian evergreen shrubs cultivated indoors abroad, much used for ornamental planting in the open in California.

The foliage of the various species of Hakea is exceedingly diverse; in some the lvs. are flat and broad, and then entire or merely toothed, in others they are terete, and then either simple and entire or pinnately parted: fls. in pairs, the pairs commonly crowded in close racemes or globose clusters, these mostly sessile in the lf.-axils; corolla-tube slender, usually recurved beneath the limb, which is mostly globose, the 4 lobes cohering long after the tube has opened; lobes concave and bear sessile anthers; the single style either long or short but always dilated at the end: fr. a hard woody caps. opening in 2 valves and bearing 2 compressed winged seeds.—Ninety-five species are fully described in English, with a key in Flora Australiensis 5:489 (1870). Eleven species grown in Calif. are described and discussed, with a key and 8 illustrations in Univ. Calif. Pub. Botany 4:14–20 (1910).

Hakeas are drought-resistant plants which endure moderate frost and are therefore well adapted to the drier parts of the South and Southwest. In California they are grown as far north as Sacramento. One of these, *H. laurina*, produces strikingly handsome fls.; *H. elliptica* is prized for the bronze color of its young foliage; while the spiny-leaved species are serviceable for planting in public parks or in any place where it is necessary for shrubs to protect themselves from pedestrians or vandals.

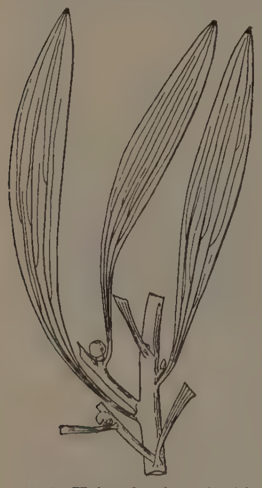
Hakeas may be propagated by cuttings taken from ripened shoots but they are almost universally grown from seeds. These are gathered from year-old capsules which are very hard and must be dried for some time before they will open. The seeds are sown in winter or early spring in the ordinary mixture of sand, leaf-mold, and loam; they germinate easily, even without heat. The young seedlings are pricked off into boxes and held in the lathhouse for a season before planting in the open. For best results hakeas should be grown in light, well-drained soil and need but little water after they are once established; much moisture is injurious except during the summer months.

A. *Lvs. ¼in. or more wide.*

B. *Margins of lvs. flat, entire.*

salígna, Knight. A pale shrub, to 8 ft. high, glabrous except the young shoots: lvs. oblong or lanceolate, 3–6 in. long, obtuse, often callous-tipped, tapering to a short petiole, pinnately veined: fl.-clusters white, small but numerous, dense, sessile; corolla glabrous, recurved: fr. about 1 in. long, ½–¾in. broad, with short incurved beak, roughish.

laurìna, R. Br. (*H. eucalyptoìdes*, Meissn.). Sea Urchin. Fig. 1780. Tall shrub, to 30 ft., and tree-like in Austral.: lvs. elliptic or lanceolate, 5 or 6 in. long, ½–1 in. wide, tapering to a petiole; principal veins 3–7, nearly parallel: fls. crimson, in a globular involucrate head, 1½–2 in. thick, from which the numerous showy golden yellow styles project 1 in. or so in every direction: fr. ovoid, about 1¼ in. long by ¾in. broad, short-beaked. B.M. 7127. G.C. II. 23:149.—The only species with showy fls. here described; equally satisfactory for shrubberies and for hedges; always highly ornamental. In Italy it has been called "the glory of the gardens of the Riviera."


1780. Hakea laurina. (×⅓)

BB. *Margins of lvs. undulate.*

ellíptica, R. Br. Fig. 1781. Erect shrub, 6–15 ft.: lvs. oval or elliptic, nearly sessile, 2–3½ in. long, 1–1¼ in. wide, undulate-margined; veins 5–7, parallel, connected by cross-veinlets: fls. white, in globose sessile clusters: fr. ovoid, 1–1¼ in. long, ¾in. broad, obliquely beaked.—Foliage by far the finest of all intro. kinds, the rich bronze color of the young shoots hardly rivaled among other shrubs. The compact, erect habit makes it eminently suitable for general lawn and shrubbery planting.

AA. *Lvs. or their lobes ⅛in. or less wide, mostly terete.*

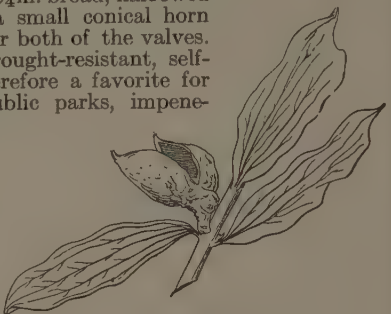
B. *Lf.-veins several: lvs. linear, flat.*

ulícina, R. Br. Shrub with erect branches and dense foliage resembling ulex: lvs. narrowly linear, acute, flat, entire, 1–8 in. long, rarely over ⅛in. wide, prominently 1–3-nerved beneath: fls. very small, glabrous: caps. mostly under ½in. long, the beak short and straight. Var. **carinàta,** F. Muell. (*H. carinàta*, F. Muell.). Lvs. mostly 1-nerved beneath, nerveless above.

BB. *Lf.-veins none.*

suavèolens, R. Br. (*H. pectinàta*, Colla). Rounded shrub, 8–15 ft.: lvs. 2–4 in. long, terete, with rigid spine-like tip, occasionally entire, usually branched into 1–5 rigid terete lobes of unequal lengths: pedicels and perianth glabrous; fls. white, fragrant: fr. ovoid, about 1 in. long by ¾in. broad, narrowed at apex and with a small conical horn near the end of 1 or both of the valves.—Easily grown, drought-resistant, self-protective, and therefore a favorite for depot grounds, public parks, impenetrable hedges, and the like. Makes a suitable covering for dry hillsides, although not deep-rooted and sometimes inclined to become top-heavy.

aciculàris, R. Br. Tall shrub, more slender than the preceding: mature twigs glabrous: lvs. awl-like, simple and entire, 1–3 in. long: pedicels white, silky; the corolla glabrous: fr. ovoid, about 1 in. long, fully ½in. broad, rough, narrowed to a thick beak, each valve with a conic brown horn near apex.—Used for purposes indicated under *H. suaveolens.*


1781. Hakea elliptica. (×⅓)

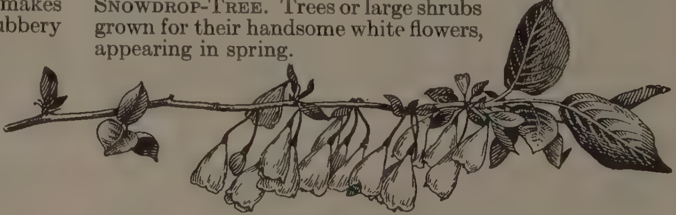
gibbòsa, Cav. Spreading shrub, 6–10 ft., with characters of *H. acicularis* but twigs and young lvs. short-hirsute and fr. larger, about 1½ in. long, nearly 1 in. broad, abruptly narrowed to a short oblique beak, similarly horned. Bot. Cook's First Voy. 266.

pugionifórmis, Cav. Near *H. acicularis* and *H. gibbosa* but to 20 ft. high and corolla as well as pedicels pubescent: fr. much more slender, lanceolate, acuminate, 1 in. long by ¼in. broad, rough around the middle, with an obliquely transverse crest, each valve tapering to a slender point. L.B.C. 4:353. Bot. Cook's First Voy. 265.—Often labeled *H. suaveolens* in nurseries but distinguished from that by the simple lvs. and thicker frs.

H. aquifòlia, is a garden name sometimes applied to H. saligna.—*H. cyclocárpa*, Lindl. Foliage as in H. laurina but lvs. and fr. larger, the fl.-heads not involucrate: corolla silky-pubescent. Once offered by Franceschi.—*H. multilineàta*, Meissn. Related to H. laurina: lf.-veins more numerous: fl.-clusters oblong: fr. only ½in. broad. G.C. III. 19:85 (var.). Reported but apparently never intro.—*H. nítida*, R. Br. Lvs. bright green, oblong, entire or toothed: fls. white, in stalked clusters: fr. 1 in. long by ¾in. broad. B.M. 2246.—*H. undulàta*, R. Br. Lvs. glabrous, obovate or rarely lanceolate: fls. small, in axillary clusters: fr. recurved at base, 1¼ in. long by ¾in. broad, distinctly beaked.—*H. vària*, R. Br. Some lvs. with nearly terete lobes, then resembling H. suaveolens, but varying to flat and holly-like, 1–2 in. long, obscurely veined or veinless, always tapering at the base: fls. in small clusters, the rachis villous, pedicels and small corolla glabrous: fr. ¾in. long by ½in. broad. Offered by Franceschi.

Harvey Monroe Hall.

HALÈSIA (Stephen Hale, 1677–1761, author of a famous work on "Vegetable Statics"). Syn. *Mohrodéndron. Styracàceæ.* Silver-Bell. Snowdrop-Tree. Trees or large shrubs grown for their handsome white flowers, appearing in spring.


1782. Halesia carolina. (×½)

Deciduous and more or less stellate-pubescent: lvs. short-petioled, without stipules, involute in bud, denticulate: fls. in axillary clusters or short racemes on branchlets of the previous year; calyx-tube obconical, slightly 4-ribbed, with 4 minute teeth; corolla campanulate, 4-lobed or nearly 4-parted, white; stamens 8–16; style slender; ovary inferior, 2–4-celled, with 4 ovules in each cell: fr. an oblong, dry drupe with 2–4 longitudinal wings; stone 1–3-seeded.—Three species in N. Amer.

1783. Halesia carolina var. Meehanii. (×½)

The snowdrop-trees are large shrubs or trees with rather large bright green generally oblong and short-stalked leaves and white slender-stalked drooping bell-shaped flowers appearing before or with the leaves and followed by winged light brown fruits. *Halesia carolina* is hardy as far north as Massachusetts and is very handsome in spring when covered with its white flowers. *Halesia diptera* is hardy as far north as Philadelphia and is usually a smaller plant, but has larger flowers and leaves. They thrive in almost any good soil, but prefer a rich well-drained soil and a sheltered position; they are easily transplanted. Propagation is by layers or root-cuttings in spring or autumn; also by greenwood cuttings taken from forced plants. Seed should be sown at once or stratified; if allowed to become dry, it does not germinate until the second or sometimes the third year.

carolìna, Linn. (*H. tetráptera*, Ellis. *Mohrodéndron carolìnum*, Brit.). Fig. 1782. Large shrub or small tree, usually not higher than 40 ft., with spreading branches and often irregular in habit: lvs. ovate or elliptic to ovate-oblong, acute or acuminate, cuneate or rounded at the base, finely serrate, glabrous above, stellate-pubescent below, 2–4 in. long: fls. in clusters of 2–4; corolla 4-lobed, ½–¾in. long; stamens 10–16; ovary 4-celled: fr. 4-winged, 1–1½ in. long. April, May. W. Va. to Fla., west to Ill. and E. Texas. B.M. 910. Mn. 5, p. 194. S.S. 6:257. Gng. 2:247. A.G. 14:211; 18:438. M.D.G. 1899:352, 353. G. 3:526; 10:485. G.C. III. 51: suppl. Feb. 3. Gn. 75, p. 582. Gn.M. 8:22. J.H. III. 44:140. G.W. 5, p. 79. G.M. 55:823. Var. **dialypétala**, Schneid. Corolla divided nearly to the base. Var. **montícola**, Rehd. Pyramidal tree to 90 ft.: lvs. larger, generally oblong-obovate, glabrescent or nearly glabrous below, more sharply serrate: pedicels and calyx glabrous; corolla large: fr. 1½–2 in. long, obcordate at the apex, wings broad. N. C. to Ala., in the mountains. Apparently hardier than the type. Var. **Meèhanii**, Perkins (*H. Meèhanii*, Meehan). Fig. 1783. Bushy upright shrub or small tree: lvs. thicker, smaller, more rugose, darker green, more distinctly serrate, pubescent below: fls. smaller, cup-shaped, shorter pedicelled. A very peculiar form of garden origin; very unlike the species and less ornamental; suggests a hybrid of some kind. G.F. 5:535 (adapted in Fig. 1783).

díptera, Ellis (*Mohrodéndron dípterum*, Brit.). Shrub or small tree, to 30 ft.: lvs. ovate to obovate, rarely oblong, remotely serrate, soft-pubescent beneath, 3–5 in. long: fls. 2–4, in short racemes; corolla deeply lobed nearly to the base, puberulous outside; stamens usually 8; ovary usually 2-celled: fr. oblong with 2 broad wings and often with 2 or sometimes 3 obsolete supplementary ones, 1½–2 in. long. April. S. C. and Tenn. to Fla. and Texas. S.S. 6:259.

H. corymbòsa, Nichols.=Pterostyrax corymbosa.—*H. híspida*, Mast.=Pterostyrax hispida.—*H. parviflòra*, Michx. Shrub, resembling H. carolina: lvs., pedicels, and calyx densely pubescent: corolla ⅓–½in. long: fr. 2-winged. Ga. to Fla.

Alfred Rehder.

HALIMODÉNDRON (Greek, *maritime tree;* referring to its habitat in saline soils). *Leguminòsæ*. Ornamental shrub grown for its handsome profusely produced flowers.

Deciduous: lvs. slender-stalked, with 1 or 2 pairs of lfts. and with the persistent petiole becoming usually spinescent: fls. in lateral slender-stalked, 2–3-fld. racemes; calyx cup-shaped with 5 short teeth; corolla papilionaceous; petals of nearly equal length; standard orbicular with the sides reflexed; keel obtuse, curved; stamens diadelphous; ovary stipitate with many ovules, style filiform, curved: pod stipitate, ellipsoid or obovoid, inflated, tardily dehiscent, with few kidney-shaped glossy brown seeds.—One species in the salt steppes of Cent. Asia from Transcaucasia to the Altai.

This is a wide-spreading shrub with slender branches and small bluish green foliage, covered in early summer with numerous pale violet or rosy purple flowers. The small pale foliage and the slender-stalked drooping flowers combined with the spreading habit give to the plant a gracefulness and airiness of its own and make it a very desirable ornamental shrub. It is perfectly hardy North, resists drought and heat well and thrives in sandy as also in saline and alkaline soils. Propagation is by seeds and by layers which root slowly; it also may be grafted on laburnum or caragana.

halodéndron, Voss (*H. argénteum*, Fisch.). Salt Tree. Fig. 1784. Shrub, to 6 ft.; the young growth silky-pubescent: lfts. 2 or 4, oblanceolate, rounded and mucronate at the apex, grayish or bluish green,

1784. Halimodendron halodendron. (×¼)

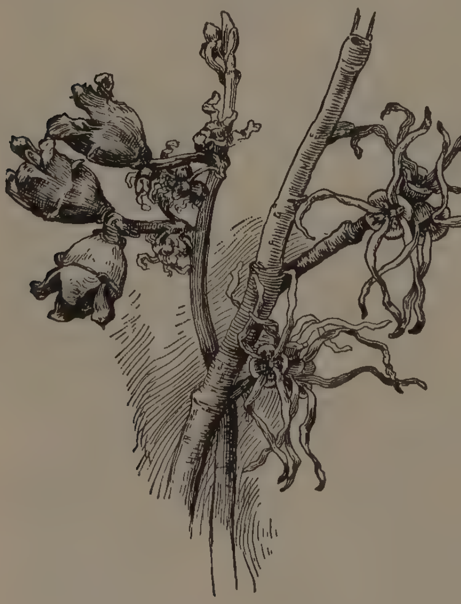
minutely silky, becoming sometimes nearly glabrous with age, ½–1⅓ in. long: fls. 2–3, on slender peduncles about ¾in. long, lilac or pale purple, about ¾in. long: pod ¾–1 in. long; seeds about ⅕in. long. June, July. B.M. 1016. Var. **purpùreum,** Schneid. (*H. argénteum fl. purpùreo,* Hort. *H. speciòsum,* Carr.). Fls. bright rosy purple. R.H. 1876:30. ALFRED REHDER.

HALLÈRIA (Albrecht von Haller, 1708–1777, Swiss physician and naturalist, and professor at Göttingen). *Scrophulariàceæ.* About 6 species of shrubs or small trees from Afr. and Madagascar with opposite, ovate or elliptic, entire or serrate lvs. and axillary, solitary or fascicled fls.: calyx cup-shaped, 3–5-cleft; corolla trumpet- or funnel-shaped with short 4–5-lobed oblique limb; stamens 4, didynamous, inserted about the middle of the tube, about as long as or longer than the corolla; ovary 2-celled; style slender: fr. a berry with several or numerous compressed seeds. Only the following species is sometimes cult. in S. Calif. and as a greenhouse plant abroad for its red fls. and the lustrous nearly evergreen foliage. It is easily prop. by cuttings under glass and by seeds. **H. lùcida,** Linn. Shrub or small tree, to 30 ft., glabrous: lvs. petioled, ovate, acuminate, serrate, 1–4 in. long: fls. in axillary clusters on stalks ¼–½ in. long, tubular, curved and bulged on one side, shortly 2-lipped, red, sometimes yellowish at the base, about 1 in. long; stamens and style exserted: berries subglobose, deep purple, edible. S. and Trop. Afr. B.M. 1744. Sometimes called African honeysuckle.

ALFRED REHDER.

HALOPHŶTUM: *Hoplophytum.*

HAMAMÈLIS (Greek, *hama,* together, and *melon,* apple or fruit: fruits and flowers at the same time). *Hamamelidàceæ.* WITCH-HAZEL. Ornamental woody plants chiefly grown for their yellow flowers appearing late in autumn or in the winter.



1785. Witch-hazel, Hamamelis virginiana, showing flowers and fruits. (Natural size)

Deciduous shrubs or small trees; stellate-pubescent: lvs. alternate, short-petioled, stipulate, sinuate-dentate: fls. in short-peduncled, nodding, axillary, few-fld. clusters, perfect; calyx 4-parted; petals 4, linear, crumpled; stamens 4, very short, alternating with 4 scale-like staminodes; styles 2, short: fr. a dehiscent, woody, 2-celled caps., with 2 shining black seeds. The seeds are shot out with considerable force.—Four species, 2 in E. N. Amer. and 2 in China and Japan. Occasionally writers spell the common name "wych hazel," but there seems to be little historical reason for it. Witch, as used in witch-hazel and witch-elm, is probably allied to "weak," referring to a drooping or straggling habit.

The witch-hazels are hardy ornamental shrubs with medium-sized generally ovate or obovate leaves and yellow flowers with strap-shaped spreading petals in axillary clusters appearing late in fall or in the winter and followed by capsular fruits. *Hamamelis virginiana* is perfectly hardy North, and the other species have proved hardy at least at the Arnold Arboretum.

They are valuable on account of their blooming at a time when hardly any other shrub outdoors is in flower. *H. japonica, H. mollis,* and *H. vernalis* are the only truly winter-blooming shrubs in northern latitudes and are striking objects in the wintry landscape with their bright yellow flowers which are not injured even if the temperature goes down to zero. They are well adapted for shrubberies; of compact, bushy habit and with handsome foliage, turning bright yellow, orange or purple in fall.

They thrive best in somewhat moist, peaty and sandy soil. The Japanese species likes a more sunny position than the American, and is less moisture-loving. Propagation is by seeds, which do not germinate until the second year, or by layers; rarer kinds also by grafting on seedlings of *H. virginiana* in spring in the greenhouse.

A. *Lvs. pubescent below while young, glabrescent or glabrous at maturity.*

B. *Fls. in autumn when the lvs. fall; calyx brownish yellow inside.*

virginiàna, Linn. Fig. 1785. Shrub or small tree, attaining 25 ft.: lvs. oblique and cordate at the base, obovate, coarsely crenate, pubescent on the veins beneath, 4–6 in. long: petals bright yellow, ½–¾in. long; calyx dull brownish yellow inside: fr. surrounded by the calyx to one-half. Sept., Oct. Canada to Fla., west to Neb. and Texas. Em. 472. S.S. 5:198. B.M. 6684. L.B.C. 6:598. A.G. 11:657; 17:771; 44:657 (1890). Gn. 33, p. 589; 39, p. 547.

BB. *Fls. in winter or early in spring; calyx red or purple inside.*

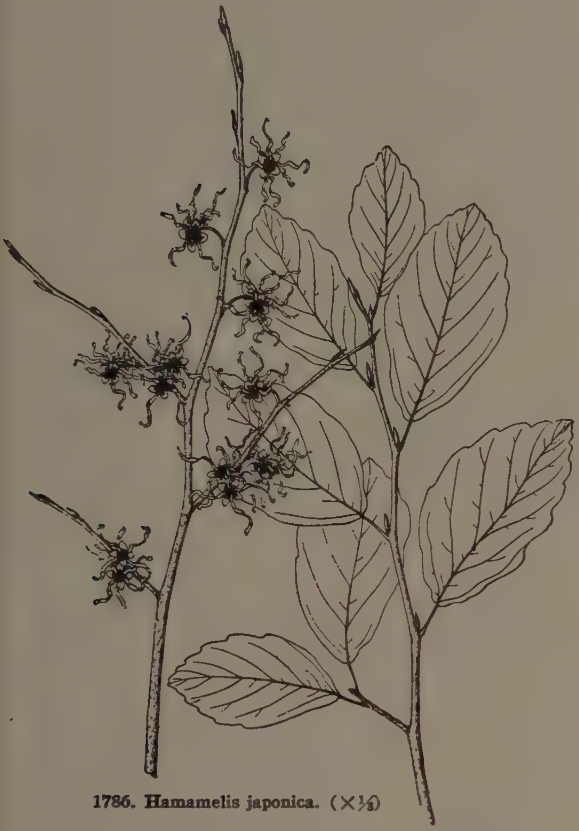
vernàlis, Sarg. Shrub, rarely exceeding 6 ft., suckering: lvs. obovate or oblong-obovate, cuneate and entire below, sinuate-dentate above the middle, pale or glaucescent beneath and glabrous or rusty-pubescent on the veins, only 3–4 in. long: calyx dark red inside; petals light yellow, about ½in. long; ovary one-half superior: fr. surrounded by the calyx about the middle. Jan.–March. Mo. to La. and Okla. S.T.S. 2:156. R.H. 1913, p, 131. B.M. 8573.

japónica, Sieb. & Zucc. Fig. 1786. Shrub or small tree, to 30 ft.: lvs. roundish to oblong-ovate or obovate, sinuately crenate, prominently veined beneath, glabrous or pubescent, 2–4 in. long: petals ¾in. long, yellow; calyx-lobes revolute, purplish or yellow inside; ovary three-fourths superior: fr. surrounded at the base only by the calyx. Jan.–April. Japan. G.F. 4:257 (adapted in Fig. 1786). Gt. 49:1481; 61, p. 136. G.W. 7, p. 405. S.I.F. 2:25. Var. **arbòrea,** Rehd. (*H. arbòrea,* Mast.). Lvs. larger, usually more roundish and of firmer texture: petals golden yellow; calyx deep purple inside: of more vigorous growth. B.M. 6659. R.H. 1891:472. G.C. II. 1:187; 15:205; III. 9:247. G.M. 34:94. Gn. 57, p. 103; 65, p. 59; 69, p. 105. Var. **Zuccariniàna,** Arb. Kew. Differs little from the type; it has pure canary-yellow fls., smaller than those of the preceding variety and opening about 3 weeks later. Gn. 17, p. 251. R.B. 28:62.

AA. *Lvs. densely tomentose below: calyx brownish purple inside.*

móllis, Oliver. Shrub or small tree, to 30 ft.: lvs. orbicular-obovate or obovate-oblong, cuspidate, obliquely cordate at the base, dentate, somewhat rough above, grayish white below, 4–5 in. long: calyx purplish red inside, petals golden yellow, ¾in. long; ovary nearly one-half superior. Jan.–March. Cent. China. B.M. 7884. G.C. III. 52:488. Gn. 75, p. 20. H.I. 18:1742.

Alfred Rehder.



1786. Hamamelis japonica. (×⅓)

HAMÈLIA (Henry Louis Duhamel du Monceau, 1700–1782, prominent French botanical author). *Rubiàceæ.* Ornamental woody plants grown chiefly for their handsome scarlet or yellow flowers and for the attractive black or purple berries.

Evergreen shrubs with terete branches: lvs. membranous, opposite or sometimes in whorls, petioled, entire, with interpetiolar stipules: fls. short-stalked or sessile in terminal forking cymes; sepals 5, upright; corolla tubular or bell-shaped, 5-ribbed, contracted at the base, limb with 5 short lobes; stamens 5, with the filaments connate at the base and inserted above the base of the tube; ovary inferior, 5-celled; style slender with spindle-shaped stigma: fr. a small ovoid or globular berry with numerous minute seeds.—About 13 species, by some reduced to 6, in Trop. and Subtrop. Amer.

These are upright shrubs with herbaceous shoots, rather large, generally ovate-oblong acute leaves and yellow or scarlet flowers in terminal clusters followed by small black or purple berries. They can be cultivated outdoors in subtropical and tropical regions only. Propagation is by seeds and by cuttings of half-ripened wood in early summer under glass.

Of the best-known species much prized in Florida and recommended for northern conservatories under the name of "scarlet bush," E. N. Reasoner writes:

"*Hamelia patens,* a native of the West Indies and Southern Florida, along the coast, a beautiful and almost unknown plant, should become a favorite in greenhouse culture. The leaves have a purplish hue at some seasons of the year, and the flowers are of a bright orange-red color. In Florida it must surely become a favorite for open-air planting, as it is there rarely killed down by frost, and when it is it sprouts up readily from the root, and blooms the following summer. It is in bloom for many months, and without doubt could be forced at any season. With age it becomes a woody shrub, 5 to 12 feet in height. The flowers are succeeded by handsome black berries, which are retained a long while."

A. *Plant glabrous or minutely pubescent.*

pàtens, Jacq. Shrub, to 12 ft.: lvs. opposite or usually in whorls of 3, elliptic-ovate to oblong, acute or acuminate at both ends, minutely pubescent or glabrous, 3–6 in. long; petiole ½–1½ in. long: infl. 2–5 in. across; sepals triangular, short; corolla with narrowly cylindric tube about ¾in. long, scarlet-orange: fr. ovoid, black, ¼in. long. Fla. to Brazil. B.M. 2533.

ventricòsa, Swartz. Shrub or small tree: lvs. usually in whorls of 3, rarely 4, oblong-lanceolate, acuminate, glabrous, 3–5 in. long: fls. yellow, about 1½ in. long, tubular-campanulate, constricted above the base in a terminal few-fld. infl.: fr. ovoid. W. Indies. B.M. 1894. B.R. 1195.—The similar *H. chrysántha,* Swartz (L.B.C. 11:1098) has smaller fls. and smaller more obovate lvs.

AA. *Plant hirsute.*

sphærocárpa, Ruiz & Pav. Shrub, to 12 ft.: lvs. usually in whorls of 3, oblong, acute, undulate, hirsute on both sides, 3–4 in. long: fls. in large terminal cymes, orange-yellow, tubular, about 1 in. long: fr. subglobose, hirsute, purplish black. Peru.

Alfred Rehder.

HAPLOCÁRPHA (probably from Greek for *single chaff,* in reference to the 1-rowed chaffy pappus). *Compósitæ.* Stemless perennials with a woody rhizome: radical lvs. short-petioled, entire or lyrato-pinnatifid, white-tomentose beneath: scapes 1-headed, longer than lvs.: fr. 3–5-ribbed, provided at base with tufts of hairs, naked or hairy above, with a crown of small, pointed pappus-scales.—Four or five species from the Cape region. *H. scapòsa,* Harv., resembles an acaulescent species of Arctotis: lvs. lanceolate to elliptic, 3–9 in. long, green above, white-woolly beneath: peduncles many times longer than lvs., bearing a solitary clear yellow fl.-head, 1½–2½ in. across. G.C. III. 40:124. Sometimes planted in the open, but not hardy N.

L. H. B.

HAPLOPÁPPUS: *Aplopappus.*

HAPLOPHÝLLUM: *Ruta.*

HARDENBÈRGIA (after Franziska, Countess of Hardenberg, sister of Baron Huegel, a well-known traveler.) *Leguminòsæ.* Vines, grown chiefly for their handsome flowers.

Twining herbs or subshrubs: lvs. pinnate with small stipules; lfts. 3 or 5, sometimes reduced to 1, entire, with stipels: fls. papilionaceous, small, on long racemes, ranging from white through pink and rosy purple to violet-blue, often with 1 or 2 green or yellowish spots on the standard; calyx 2-lipped, the upper 2 teeth connate; standard orbicular, with inflexed auricles; keel obtuse, shorter than wings; ovary sessile; style short and thick: pod linear, flat or turgid, with several strophiolate seeds.—Three species in Austral. often referred to Kennedya, which has larger and differently colored fls. solitary or in short racemes, with the keel usually about as long as the wing. The two species in cult. are grown abroad under glass by those who are skilled in managing Australian woody plants; they prefer peaty and porous soil, as they are, like most Australian plants, impatient of too much or stagnant moisture. The species first mentioned is cult. outdoors in Calif. These plants can be trained into bush form. Prop. is by seeds or by greenwood cuttings of lateral shoots under glass in spring.

A. *Lfts. solitary: pods flat, with dry pulp inside.*

monophýlla, Benth. (*Kennédya monophýlla,* Vent. *K. longiracemòsa,* Lindl. *K. cordàta,* Lindl. *K. ovàta,* Sims). Lfts. usually reduced to 1, ovate to narrowly lanceolate, rounded or cordate at the base, obtuse, reticulate, 2–3 in. or sometimes 4 in. long: fls. less than ½in. long, in 2's or rarely 3's, as many as 35 in a raceme, and the upper racemes often forming a terminal panicle. B. 2:84. B.M. 263, 2169. L.B.C. 8:758 and 20:1940. B.R. 944; 1336. R.H. 1896, p. 431. R.B. 22:169.—The fls. range from white through rose and purplish to pure violet, but are never distinctly blue. Var. **álba** and var. **ròsea** are cult.

AA. *Lfts. 3 or 5: pod turgid, without pith or pulp.*

Comptoniàna, Benth. (*Kennédya Comptoniàna,* Link. *K. macrophýlla,* Lindl.). Lfts. 3 or 5, and in the latter case the lateral ones close together in 2 opposite pairs, not opposite in distant pairs, oval to linear-lanceolate, rounded or truncate at the base, obtuse, 1½–3 in. long, rarely longer: fls. similar to those of the preceding species, but usually blue or violet-blue and in pairs or clusters of 3–4 along the racemes. B.R. 298; 1862; 26:60. R.H. 1882, p. 344. J.H. III. 30:361; 44:253. P.M. 8:27, 267. H.U. 5:236. Var. **álba** is cult.

H. retùsa, Benth., is an anomalous species not cult. All other names in this genus are synonyms of the 2 species described above.

ALFRED REHDER.†

HARDHACK: *Spiræa tomentosa.*

HARDY PLANTS. The word "hardy" covers many distinct ideas. It is used to distinguish plants that can be cultivated outdoors the year round from plants that must be grown under glass part or all of the year. For example, in this Cyclopedia plants are spoken of as hardy as far north as Washington, D. C., New York, Boston or Montreal, meaning that the plants are not killed by the winters at these places. In its widest sense, "hardy" indicates resistance to all kinds of unfavorable conditions. Thus, while all the common geraniums are tender plants, one variety may be hardier than another because it withstands intense heat and drought and general neglect. In general, however, the unqualified word "hardy" indicates that the plant is able to withstand the winter of the given place. See the articles *Border* and *Landscape Gardening.* Smaller divisions of the subject of hardy plants are discussed under *Alpine Plants* and *Aquatics.*

HAREBELL: *Campanula rotundifolia.*

HARICOT (French name for *Phaseolus vulgaris*). Same as kidney bean of the English. It is the common garden bean of America, as distinguished from the Windsor or broad bean, lima bean, and others. See *Bean.*

HARÌNA: *Wallichia.*

HARIÒTA: *Hatiora.*

HARLEQUIN FLOWERS: *Sparaxis.*

HARPÀLIUM: *Helianthus.*

HARPEPHÝLLUM (from the Greek for *sickle* and *leaf,* in reference to the falcate lfts.). *Anacardiàceæ.* KAFIR PLUM. Two species, of which **H. cáffrum,** Bernh., is cult. in Fla. and S. Calif. It is a tall, glabrous tree with hard, heavy wood: lvs. thick, lustrous, imparipinnate, alternate, aggregate at top of branches, stalked; lfts. sessile, falcate-lanceolate: fls. small, in compact axillary panicles, diœcious; calyx with obovate segms.; petals 5, narrow-ovate, imbricate the bud; stamens 10 in the male fl., somewhat shor than the petals, inserted below margin of the disk: obovate, with thick woody endocarp, 4-celled, with small, sterile cells, and 2 large fertile cells, dark re size and shape of a large olive, the very thin pulp ha ing a subacid taste; edible. S. Afr.

L. H. B.

HARRÍSIA (named for William Harris, Superinten ent of Public Gardens and Plantations, Jamaica). *C tàceæ.* Upright tall cacti, little planted.

Stems rather slender, sometimes weak: branch fluted and having 8–11 rounded ribs: areoles beari slender needle-like spines: fls. tubular, rather lar growing from near the tips of the branches, nigh blooming: fr. naked, globose, yellow.—About 8 spec known; these confined to the W. Indies.

grácilis, Brit. (*Cèreus repándus* of Cyclo. of Am Hort., not *Cáctus repándus,* Linn.). Sts. said to be 20 long: ribs 8–10: spines in clusters of 9–12: fls. whi the bracts on the tube filled with long white hairs.

J. N. ROSE.

HARTWÉGIA (Theodor Hartweg collected Mex. for the Horticultural Society of London, a found these plants near Vera Cruz). *Orchidàce* Tender epiphytic orchids from Trop. Amer., growi about a foot high and bearing purple fls. The gen has the habit of Epidendrum, section Amphiglott but differs in having the labellum saccate at the ba in which respect the genus approaches Ponera; howev Ponera has a very different habit.—Two speci Rest them in a coolhouse Oct. to March. Growi temperature should be 65–90°.

purpùrea, Lindl. Lvs. solitary, leathery, ovate-lanc late, equally terete with the st., many times shor than the thread-like peduncle: fls. small, purple; sep acute, a little larger than the petals; limb of the white at the base, callous. Mex.

H. gémma, Reichb. f. "This is a most lovely gem," wr Reichenbach, and "much better than its predecessor." Gem therefore, probably does not mean "twin," in this case. I solitary, semi-terete, thick, acute, channelled, blotched w blackish violet: fls. amethyst-purple, in a small, 1-branched pani odd sepal acute, obtusely strap-shaped, equal sepals oblong-ac Cent. Amer.

L. H. B

HASTÍNGSIA (S. Clinton Hastings, San Francis promoter of Californian botany). *Liliàceæ.* Two b bous plants of the Pacific slope, separated by Sere Watson from the genus Schœnolirion (the Oxytria Rafinesque), offered by collectors but little known cultivation.

Plants with white or greenish fls. in many-fld. de panicles or racemes: perianth-segms. distinct, e obscurely 3-nerved; stamens 6; style short; ov oblong-ovate and not deeply lobed (so differing, amo other things, from Schœnolirion, which has a depress globose deeply 3-lobed ovary and fr.). Hastings have strong, nearly naked sts., arising from a tunica bulb: lvs. rather fleshy. Treatment as for camassi

álba, Wats. Mostly stout, 2–3 ft. high: lvs. 1½ or less wide: racemes simple or nearly so, 1 ft. lo densely fld., the fls. ¼in. or less long, white or green white; stamens equaling the segms. Dry hillsides, Calif. northward.

bracteòsa, Wats. Bracts narrow and nearly equal the fls., which are larger than in the other, and wh stamens half as long as segms.: lvs. narrower. S. O in marshes.

L. H. B

HATIÒRA (an anagram of Hariota). *Cactà* Upright cacti, allied to Rhipsalis.

Plants erect, branching: branches short, aris in 2's or 3's from tops of older branches, smooth spineless, bearing several abortive areoles along t sides and each a large woolly terminal one from wh arise the fl. and succeeding branches: fls. terminal; ovary globular, naked or nearly so; sepals usually in 2 rows, the outer ones broader and short, the inner ones larger and more petal-like; petals distinct, narrow toward the base; stamens distinct, erect, borne on the disk; stigmas 5, erect, white. Closely related to Rhipsalis, with which as Hariota it is often united, as it was in the Cyclo. of Amer. Hort.—Some 6 or 7 species of Hariota have been described, but most of these are true species of Rhipsalis; 2 were recognized by K. Schumann. The following is in cult. Hariota, DC. (1834) is a homonym of Hariota, Adans. (1763), and hence the name Hatiora has been substituted.

salicornioìdes, Brit. & Rose (*Hariòta salicornioìdes*, DC. *Rhípsalis salicornioìdes*, Haw.). Plant upright, reaching a height of 18 in., richly branched: areoles hardly setulose or lanate: sts. cereiform, with cylindric or oblong-elliptic joints; mature or fruiting branches with verticillate, club- or flask-shaped joints, with slender base, all apparently, as well as the fls. and fr., growing from the tops of joints: fls. yellow, funnelform, ½in. long: berry small, whitish. Brazil. B.M. 2461.

J. N. Rose.

HAW, or HAWTHORN: *Cratægus*. **BLACK HAW:** *Viburnum prunifolium*.

HAWKWEED: *Hieracium*. Various species of Crepis are known as Hawksbeard.

HAWÓRTHIA (A. H. Haworth, an English botanist of the beginning of the last century, who wrote much and well on succulents). *Liliàceæ*, tribe *Aloìneæ*. Acaulescent or shortly caulescent small succulents.

Leaves usually small, crowded on the st. or in mostly somewhat elongated rosettes: fls. white, green or rosy-striped, tubular with somewhat irregular recurving limb and included style and stamens; segms. of perianth 6, oblong, nearly equal; stamens 6, shorter than perianth; ovary sessile, 3-angled: fr. a loculicidally 3-valved caps., bearing many compressed angled seeds. S. Afr. Monograph by Berger in Engler, Das Pflanzenreich, hft. 33, 1908.—Species 60, occurring in S. Afr. They are interesting condensed or cespitose plants with thick and succulent keeled often tuberculate and sometimes toothed lvs., and fls. in simple or panicled racemes.

Cultivation, propagation and decorative uses as for Aloe, under which, with Apicra and Gasteria, the species were formerly placed. See *Aloe* and *Succulents*.

INDEX.

albicans, 13.
altilinea, 22.
arachnoides, 24.
argyrostigma, 11.
aristata, 22.
asperula, 17.
attenuata, 11.
cæspitosa, 8.
clariperla, 11.
coarctata, 6.
concava, 20.
concinna, 1.
corallina, 7.
cuspidata, 23.
cymbiformis, 20.
erecta, 7.
expansa, 4.
fasciata, 5, 8.
granata, 7.
hybrida, 3.
indurata, 1.
inflexa, 14.
lævis, 13.
limpida, 22.
major, 2, 7.
margaritifera, 7.
minima, 7.
minor, 5, 7.
mirabilis, 16.
mucronata, 22.
mutica, 18.
obtusa, 20.
parva, 14
perviridis, 9.
polyphylla, 22.
pseudorigida, 2.
pseudotortuosa, 1.
radula, 9, 10, 12.
ramifera, 13.
recurva, 15.
Reinwardtii, 5, 6.
reticulata, 21.
retusa, 18.
rigida, 4.
rugosa, 9.
semimargaritifera, 7.
subalbicans, 7.
subfasciata, 11.
subrigida, 2.
subulata, 10.
tesselata, 14.
torquata, 1.
tortella, 2.
tortuosa, 2.
turgida, 19.
virescens, 13.
viscosa, 1.

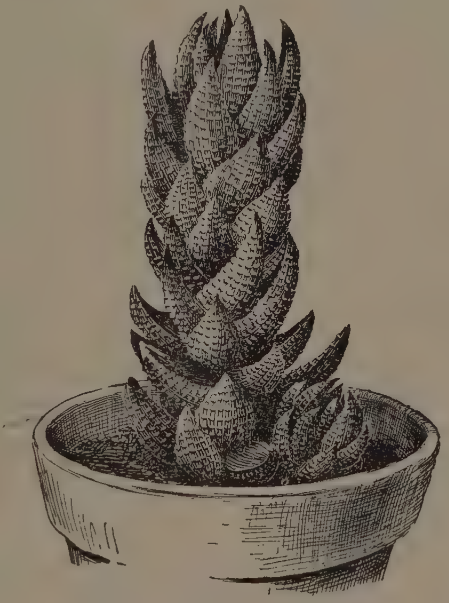
A. *Foliage crowded on an elongated st. (aspect of Apicra).*

B. *Lvs. never coarsely white-dotted.*

C. *The lvs. 3-ranked, concave.*

1. **viscòsa**, Haw. (*Alòe viscòsa*, Linn. *A. triangulàris*, Lam. *Apìcra viscòsa*, Willd.). St. with lvs. 1¼ x 4–8 in., occasionally forked, clustered: lvs. dull green, ½ x 1 in., appressed with spreading tips, minutely scabrous: infl. 1 ft. high, slender and curving, simple; fls. green-lined. Cape. DC., Pl. Gr. 16. B.M. 814. Salm, Aloe §3, f. 3.—The type, with straight ranks of lvs., varies into a form with larger less-crowded lvs., var. **induràta** (*H. induràta*, Haw., *Alòe induràta*, R. & S., *A. viscòsa induràta*, Salm), Salm, Aloe §3, f. *3b;* a small form with more spreading lvs. in somewhat spiral ranks, var. **pseudotortuòsa**, Baker (*H. pseudotortuòsa*, Haw., *Alòe pseudotortuòsa*, Salm, *A. subtortuòsa*, R. & S., *Apìcra tortuòsa*, Willd.), Salm, Aloe §3, f. 5; a dwarf form with straight-ranked, longer, more spreading, nearly smooth lvs., var. **concínna**, Baker (*H. concínna*, Haw., *Alòe concínna*, R. & S., *A. viscòsa màjor*, Salm), Salm, Aloe §3, f. 4. Berger 24; and a taller form with more or less spiral ranks of outcurving lvs. 2 in. long, var. **torquàta**, Baker (*H. torquàta*, Haw., *Alòe torquàta*, Salm), Salm, Aloe §3, f. 6.

2. **tortuòsa**, Haw. (*Alòe tortuòsa*, Haw.). St. 4–5 in., more or less clustered: lvs. dull green, ¾ x 1½ in., ascending in 3 irregularly oblique crowded ranks. somewhat rough on the back: infl. about 1 ft. high, slender, occasionally forked; fls. rosy-lined. Cape. Salm, Aloe §4, f. 2. B.M 1337. Berger 25.—Varies in a form with fleshier lvs., 2 in. long, rough on both faces, var. **pseudorígida**, Berger (*H. subrígida*, Baker, *Alòe pseudorígida*, Salm, *A. subrígida*, R. & S., *Apìcra pseudorígida*, Haw., *Apìcra rígida*, Willd.), Salm, Aloe §4, f. 1. Jacq. Fragm. 108; a still larger, greener, rougher, and more succulent form, var. **màjor**, Berger (*A. pseudorígida màjor*, Salm), Salm, Aloe §4, f. 2β; and a smaller form with the more spirally arranged lvs. smooth above, var. **tortélla**, Baker (*H. tortélla*, Haw.).



1787. Haworthia Reinwardtii. (× ½)

CC. *The lvs. more or less irregularly 5-ranked, spreading.*

3. **hýbrida**, Haw. (*Alòe hýbrida*, Salm). St. with lvs. 2½ x 4–5 in., more or less cespitose: lvs. dull green, ¾ x 1½ in., plump, wrinkled above and roughened: infl. 2 ft. high, branched; fls. brown or rosy lined. Cape (?). Salm, Aloe §4, f. 4.—Possibly a hybrid between the preceding and following species.

4. **rígida**, Haw. (*H. expánsa màjor*, Haw. *Alòe rígida*, DC. *A. cylíndrica rígida*, Lam. *Apìcra expánsa*, Willd.). St. with lvs. 4 x 3–5 in., more or less cespitose: lvs. green or browning or rosy-margined, ½–¾ x 2–2½ in., concave, wrinkled beneath: infl. 2 ft. high, more or less branched; fls. striped with brownish green. Cape. Salm, Aloe §4, f. 3. DC., Pl. Gr. 62. Berger 26. L.B.C. 15:1430.—Varies into a smaller form with slightly glossy, smoother, very spreading lvs., var. **expánsa**, Baker (*H.*

expánsa, Haw., *Alòe expánsa*, Haw. *A. rigida expansa,* Salm. *Apìcra pátula*, Willd.), Salm, Aloe §4, f. 3*b*.

BB. *Lvs. spirally many-ranked, erect, biconvex, white-warty.*

5. **Reinwárdtii,** Haw. (*H. fasciàta,* Haw. *Alòe Reinwárdtii,* Salm). Fig. 1787. St. with lvs. 1½–2 x 4–6 in., somewhat cespitose: lvs. lanceolate, ½ x 1–1½ in., coarsely white-warty in rows on the back: infl. 1–1½ ft. high, somewhat nodding, simple; fls. lined with rose. Cape. Salm, Aloe §6, f. 16. Berger 27. J.H. III. 59, p. 628.—A smaller form is var. **mìnor,** Baker.

6. **coarctàta,** Haw. (*Alòe coarctàta,* R. & S. *H. Reinwárdtii víridis,* Hort.). St. with lvs. 3 x 6–8 in., somewhat cespitose: lvs. triangular, ½ x 2 in., sparingly and finely white-dotted in lines beneath: infl. 1 ft. high, nodding, simple; fls. lined with red. Cape. Salm, Aloe §6, f. 17. Berger 27.

AA. *Foliage in a spirally subradical rosette.*

B. *Lvs. not pellucid, dull and firm.*

C. *The lvs. not hard-margined, with prominent white tubercles.*

7. **margaritífera,** Linn. (*H. màjor,* Duval. *Alòe margaritífera,* Mill. *A. pùmila margaritífera,* Linn. *A. margaritífera màjor,* Haw. *Apìcra margaritífera màjor,* Willd.). Somewhat cespitose: lvs. upcurved-spreading, biconvex, ¾–1 x 3 in., with scattered large pearly tubercles often turning green in age: infl. 2 ft. high, branched; fls. sessile, green-lined. Cape. DC., Pl. Gr. 57. Salm, Aloe §6. f. 5. Berger 28.—The type, with green lvs. coarsely warty on both faces, varies into a form with smaller more spreading lvs., var. **granàta** (*H. granàta,* Haw., *H. mínima,* Haw., *Alòe margaritífera mínima,* Ait., *A. granàta,* R. & S., *A. pùmila margaritífera,* Linn., *A. brèvis,* R. & S.), Dill., Eltham. 16, f. 18. Salm, Aloe §6, f. 6; a large form with smaller closer warts, var. **erécta,** Baker (*H. erécta,* Haw., *H. mìnor,* Duval, *Alòe margaritífera mìnor,* Haw., *A. margaritífera mèdia,* Ait., *A. mìnor,* R. & S., *A. erécta,* Salm), Dill., Eltham. 16, f. 17. B.M. 815. Salm, Aloe §6, f. 7; also into forms with little if any roughening on the upper face, var. **semimargaritífera,** Baker (*H. semimargaritífera,* Haw., *Alòe semimargaritífera,* Salm), otherwise resembling the type; var. **corallìna,** Baker, with smaller tubercles; and var. **subálbicans,** Salm, with whitened lvs., Salm, Aloe §6, f. 1.

8. **fasciàta,** Haw. (*Alòe fasciàta,* Salm. *Apìcra fasciàta,* Willd.). Cespitose: lvs. erect, flattened above, ½ x 1–1½ in., somewhat glossy, with the coarse white tubercles in cross-bands: infl. scarcely 1 ft. high, branched; fls. rosy-lined. Cape. Salm, Aloe §6, f. 15. Berger 28.—A supposed hybrid with *H. attenuata,* which it approaches, is var. **cæspitòsa,** Berger.

9. **rugòsa,** Baker (*H. rádula aspérior,* Haw. *Alòe rugòsa,* Salm., *A. rádula mìnor,* Salm). Somewhat clustered: lvs. ascending, long-pointed, flattened above, ¾–1 x 3–4 in., dull green with smaller white tubercles: infl. 2–3 ft. high, branched; fls. rosy with green veins. Cape(?). Salm, Aloe §6, f. 9.—A deeper green form is var. **pervíridis,** Salm.

10. **subulàta,** Baker (*H. rádula lævior,* Haw. *Alòe subulàta,* Salm. *A. rádula màjor,* Salm). Somewhat clustered: lvs. ascending or outcurved at end, long-attenuate, flattened above, ¾–1 x 4–5 in., green with numerous very small white tubercles beneath: infl. 3 ft. high, somewhat secundly branched; fls. green-nerved. Cape(?). Salm, Aloe §6, f. 10.

11. **attenuàta,** Haw. (*Alòe attenuàta,* Haw. *Apìcra attenuàta,* Willd.). Cespitose: lvs. falcately spreading, pointed, biconvex, ½ x 2–3 in., green with the upper face rough with minute often green points and the back with larger white often banded tubercles or ridges: infl. 2 ft. high, somewhat branched: fls. rosy. Cape. Salm, Aloe §6, f. 12. B.M. 1345 (as *A. radula.*).—Varies into a form with smaller more scattered tubercles, var. **argyrostígma,** Berger (*H. subfasciàta argyrostígma,* Baker), and one with larger and more confluent tubercles, var. **claripérla,** Baker (*H. claripérla,* Haw., *Alòe attenuàta, claripérla,* Salm), Salm, Aloe §6, f. 12 $^{\beta}$.

12. **rádula,** Haw. (*H. rádula multipérla,* Haw. *Alòe rádula,* Jacq. *A. rádula mèdia,* Salm. *Apìcra rádula,* Willd.). Cespitose: lvs. upcurved-spreading, very long-acuminate, flattened above, ¾ x 2½–3 in., green, with irregularly crowded minute tubercles on both faces: infl. 1½ ft. high, branched; fls. green- and rosy-lined. Cape. Jacq., Schoenbr. 422. Salm, Aloe §6, f. 8. Berger 28.

CC. *The lvs. with cartilaginous margin and keel not tuberculate.*

13. **álbicans,** Haw. (*H. lævis,* Haw. *H. ramífera,* Haw. *Alòe álbicans,* Haw. *A. marginàta,* Lam. *Apìcra álbicans,* Willd.). Simple: lvs. ascending or outcurved, pungently acute, concavely triquetrous, 1½ x 3–4 in., glossy, pale, neither roughened nor mottled: infl. 1 ft. high, branched; fls. green- and rosy-lined. Cape. B.M. 1452. Salm, Aloe §5, f. 1. Berger 29.—A greenish form, less margined than in the nearly white type, is var **viréscens,** Baker (*H. viréscens,* Haw. *Alòe viréscens,* R. & S.).

BB. *Lvs. thick, watery-pellucid.*

C. *The lvs. rigid, veiny above, scabrous on the back.*

14. **tesselàta,** Haw. (*Alòe tesselàta,* R. & S.). Little clustered: lvs. bristly toothed, spreading, mucronately short-pointed, ¾ x 1½ in., glossy dull green or reddening above, 5-nerved with an open network of veins, the back scabrous with whitish points: infl. 1–1½ ft. high, simple; fls. nerved with green. Cape. Salm, Aloe §8, f. 1.—Two varieties are distinguished: var. **párva,** Baker (*Alòe párva,* R. & S.) smaller, with the broad lvs. 7-nerved. Salm, Aloe §8, f. 12. Berger 31; and var. **infléxa,** Baker, differing from it chiefly in its more concave lvs. with incurved margin.

15. **recúrva,** Haw. (*Alòe recúrva,* Haw. *A. anómala,* Haw. *Apìcra recúrva,* Willd.). Cespitose: lvs. denticulate, recurved, gradually acute, ¾ x 1½ in., olive-green or purplish, 3- or 5-nerved, the back scabrous with green points: infl. 1 ft. high, simple; fls. red-lined. Cape. B.M. 1353. Salm, Aloe §7, f. 3. Berger 31.

CC. *The lvs. softer, scabrous on the back of the first only.*

D. *Upper face of lvs. abruptly truncately spreading.*

16. **mirábilis,** Haw. (*Apìcra mirábilis,* Willd.). Somewhat clustered: lvs. denticulate, erect, the smooth acute tip almost truncately 3-sided, ¾ x 1½ in., light green or the back purplish, 3- or 5-nerved: infl. 1 ft. high, simple; fls. red-keeled. Cape. B.M. 1354. Salm, Aloe §9, f. 1. Berger 32.

17. **aspérula,** Haw. (*Alòe aspérula,* R. & S.). Little clustered: lvs. denticulate, erect, the 7- to 9-nerved tip scabrid above, ¾ x 1½ in., green: infl. 1 ft. high, nodding; fls. rosy-keeled. Cape. Salm, Aloe §9, f. 2.

18. **retùsa,** Haw. (*Alòe retùsa,* Linn. *Apìcra retùsa,* Willd.). Little clustered: lvs. subentire, spreading in age, the 5- to 8-nerved mucronate tip smooth, ¾ x 1½–2 in., light green: infl. 1 ft. high, simple; fls. nearly sessile, green-keeled. Cape. DC., Pl. Gr. 45. B.M. 455. Salm, Aloe §9, f. 3.—With scarcely mucronate less regularly nerved lvs. it is var. **mútica,** Haw.

19. **túrgida,** Haw. (*Alóe túrgida,* R. & S.). Cespitose: lvs. subentire, ascending, the acute smooth biconvex or 3-sided lvs. truncately spreading, tip 3- to 7-nerved and somewhat dotted, ¼ x ½–¾ in., glossy light green. infl. 8–10 in. high, simple; fls. green-nerved. Cape. Salm, Aloe §9, f. 5. Berger 32.

DD. *Upper face of lvs. obliquely or obscurely if at all subtruncate, not aristate.*

20. **cymbifórmis,** Haw. (*H. concàva,* Haw. *Alòe cymbifórmis,* Haw. *A. cymbæfòlia,* Schrad. *Apìcra cymbæfòlia,* Willd.). Cespitose: lvs. entire, smooth, ascending, oblong, the point often abruptly deciduous, leaving a scar, about 7-nerved with cross-veins, ¾ x 1½ in., pale and glaucescent: infl. 1 ft. high, simple; fls. red-keeled. Cape. Icon. Sel. Horti Thenensis, 105. B.M. 802. Neues Journ. Bot. 2:2. Jacq., Fragm. 112, f. 1. Salm, Aloe §11, f. 1. Berger 33.—A smaller form with blunter more conspicuously lined lvs. 1 in. long is var. **obtùsa,** Baker (*H. obtùsa,* Haw. *Alòe hèbes,* R. & S.).

21. **reticulàta,** Haw. (*Alòe reticulàta,* Haw. *A. arachnoìdes reticulàta,* Ker. *A. herbàcea,* DC. *Apìcra reticulàta,* Willd.). Cespitose: lvs. smooth, finely denticulate, acute, with about 10 connected nerves, ⅜ x 1 in., light green: infl. 1 ft. high; fls. rosy-lined. Cape. Salm, Aloe §10, f. 1. B.M. 1314.

DDD. *Upper face not truncately spreading at end, aristate.*

E. *Shape of lvs. broad, acute, not scabrous, denticulate or ciliate.*

22. **altilínea,** Haw. (*H. mucronàta,* Haw. *H. límpida,* Haw. *H. aristàta,* Haw. *H. polyphýlla,* Baker. *Alòe altilínea,* R. & S.). Cespitose: lvs. upcurved, biconvex, reticulated, ¾ x 2 in., light green: infl. 1 ft. high, simple; fls. green-lined. Cape. Salm. Aloe §11, f. 3.

23. **cuspidàta,** Haw. (*Alòe cuspidàta,* R. & S.). Nearly simple: lvs. ascending, abruptly pale-tipped, turgid, with 3 connected nerves, ½ x 1 in., pale green: infl. 1 ft. high, simple. Cape.

EE. *Shape of lvs. narrow, long-pointed.*

24. **arachnoìdes,** Haw. (*Alòe arachnoìdes,* Ait. *A. pùmila arachnoìdes,* Linn. *Apìcra arachnoìdes,* Willd.). Simple: lvs. upcurved, rather 3-sided, toothed on the keels, with 8 or 9 somewhat connected nerves, ½ x 2–3 in., glaucescent: infl. 1–1½ ft. high, simple; fls. sessile, rosy-lined. Cape. DC., Pl. Gr. 50. B.M. 756. Salm, Aloe §12, f. 2. Jacq., Schoenbr. 421(?).

H. atróvirens, Haw. Leafy st. very short, the rosettes stoloniferous: lvs. 30–40, dense, oblong-lanceolate, ½–¾ in. long, dull green, reddish brown when old, with 3–5 vertical green lines: scape simple, 6 in. S. Afr. B.M. 1361.—*H. Pèarsonii,* C. H. Wright. Stemless: lvs. crowded, ½ x 1¼ in., pale green, with 2 rows of cilia on back, each with bristle on apex: scape 10 in. long. S. Afr.

William Trelease.

HAWTHORN: *Cratægus.* **Hawthorn, East Indian:** *Raphiolepis.*

HAYLÓCKIA (Matthew Haylock, gardener to Dean Wm. Herbert, the latter authority on amaryllids). *Amaryllidàceæ.* A small bulb, not unlike a crocus in habit, blooming in spring; allied to Zephyranthes.

South American: lvs. linear, all radical: scape very short bearing a solitary fl., with a slender tube 1–1½ in. long and a limb of about equal length; stamens affixed in the throat and shorter than the lobes; ovary 3-celled, with the filiform style included in the perianth-tube and the stigmas short-linear. *H. pusílla,* Herb., the only species, is likely to appear in the American trade. The fl. has a greenish tube, the limb whitish or straw-colored and stained outside with purple, apparently somewhat variable in color (sometimes pale rose): bulb globose, with brown appressed scales: lvs. appearing after the fls., the latter coming in England in July to Sept. and ephemeral. Extra-trop. S. Amer., in the region of Montevideo and Buenos Ayres. B.R. 1371. B.M. 7693. From Zephyranthes it differs in the very short or almost wanting scape, the ovary being practically in the bulb-neck. L. H. B.

HAZÁRDIA (Barclay Hazard, Californian botanist). *Compósitæ.* Small shrubs, with silvery leaves and peculiar, not pretty, heads of flowers, borne in August. One is suitable for rockeries and bedding out, but there are better woolly-leaved plants in cultivation.

The genus has about 4 speces of stout, tomentose, deciduous subshrubs of Calif., and at least 1 species from the islands off the coast: heads white-tomentose, numerous, in large cymose panicles, which terminate the branches; rays 5–8, neutral, very short, ligulate or irregularly 5-toothed or lobed, pale yellow changing to brownish purple. In 1887, E. L. Greene made this new genus, remarking that it differs from Diplostephium mainly in habit, the paucity, reduced size, and different color of its rays. It also lacks the tuft of hairs characteristic of the style-tips of Corethrogyne.

detónsa, E. L. Greene (*Corethrógyne detónsa,* Greene). Branches very leafy up to the base of the loose panicle: lvs. of firm texture, 2–4 in. long, obovate-oblong, coarsely serrate; upper surface of older lvs. partly divested of the white tomentum which covers all other parts of the plant. G.C. III. 28:470.

N. Taylor.†

HAZEL-NUT. The nuts of Corylus (which see). In North America, the term is mostly applied to the native species of Corylus, and the word filbert is used more or less indiscriminately for the nuts of the Old World species. (See *Filbert.*) In the present article, the term hazel-nut is used generically for the fruits of all the species. Fig. 1788.

The three native hazels, *Corylus americana, C. californica* and *C. rostrata,* have been sparingly introduced to cultivation, but have not developed varieties worthy of naming or propagating. The foreign species, *C. Avellana, C. pontica* and *C. maxima,* and perhaps others, were introduced along the Atlantic seaboard at an early day and are maintained in gardens throughout the New England and Middle Atlantic States. Efforts to make extensive culture profitable in the eastern United States have hitherto failed, probably from attacks of a fungous disease, *Cryptosporella anomala,* common on *C. americana,* but not specially injurious to that species. It attacks and destroys the young branches, and later the older branches and trunk, without killing the root. Bordeaux mixture has been suggested as a preventive, but recorded successful experiments are lacking. Experimental plantings on the Pacific slope indicate greater success with imported hazels there than in the East, but they have not developed commercial importance.

The requirements of the filbert in America, so far as known, are: moderately rich, well drained soil; absence of *Corylus americana* from vicinity; freedom from mild periods in winter and late frosts in spring. It is specially subject to frost-injury, as both staminate and pistillate catkins develop in fall and quickly swell and open under the influence of mild weather in winter. The staminate catkins commonly bloom first. If they are destroyed by frost, fertilization can be accomplished by suspending branches from other localities, even of other species.

Propagation by seeds is easily done by stratifying in fall and planting in nursery rows in early spring. Seedlings vary exceedingly, and varieties are perpetuated by budding, grafting, suckers or layers, commonly by the last two methods. A considerable supply of well-rooted suckers can be secured from fruiting trees by banking in summer with rich soil or stable manure to promote root-formation. Stools for layering should be heavily manured to force long and slender shoots suitable for bending. These should be staked down in winter or spring and covered with earth. They may be removed to nursery rows or orchard at end of first season.

Planting should be at a distance of 10 to 20 feet in well-prepared soil, in fall or spring. Ground may be cropped with low-growing, cultivated plants while trees are young, but should be maintained in good tilth and fertility.

Pruning is of special importance with this nut. Trees are usually headed at height of 1 or 2 feet, though often permitted to take natural form, which is that of a many-stemmed bush, designated a "stool." Trees are classified according to height of clear trunk into "standard," "half-standard," and "dwarf standard." A short trunk, with vaseform head of six or more branches, is preferred. Suckers should be kept down, unless desired for propagation. Both sexes of blossoms are borne on one-year-old lateral twigs or spurs. March or April, after flowers of both sexes have bloomed, is considered best time for pruning, as unnecessary sacrifice of pollen can thus be avoided. Strong shoots should be headed back to promote spur-formation, and old wood that has borne fruit should be removed annually.

The nuts should not be gathered until ripe, a condition indicated by the browning of the edges of the husk. If left until fully ripe, many of the fruits will rattle out and be lost. The highest prices are obtained for freshly gathered nuts in the husks. To prevent husks from molding, they should be well dried or slightly sulfured. Hazelnuts may be held for considerable periods in tight receptacles, as casks or jars by sprinkling salt over them and storing them in a cool, dry place, or in a refrigerated compartment.

Few insects trouble the European hazel-nuts in America, the nut-weevil of Europe, *Balaninus nucum*, not having yet been naturalized. *B. nasicus* sometimes does considerable injury to the native species.

Nuts and filberts are terms loosely used abroad, especially in England, to designate certain rather indefinite forms of *Corylus Avellana* and *C. maxima*. In general, such varieties as have husks shorter than their fruits are termed nuts, while such as have husks as long as or longer than their fruits are designated filberts.

But few varieties are known in America, most of the hazels grown being seedlings from imported nuts. Varieties of *Corylus Avellana* and *C. maxima* are not clearly distinguishable, but in general those with husks longer than the nuts are assigned to *C. maxima*, and those with short husks to *C. Avellana*.

Alba (White Filbert).—Regarded in England as one of the best varieties. Can be kept in husk longer than most others because of constricted form of husk. Kernel covered with a white skin. Known as Avelinier Blanche, Wrotham Park, etc. Succeeds in California.

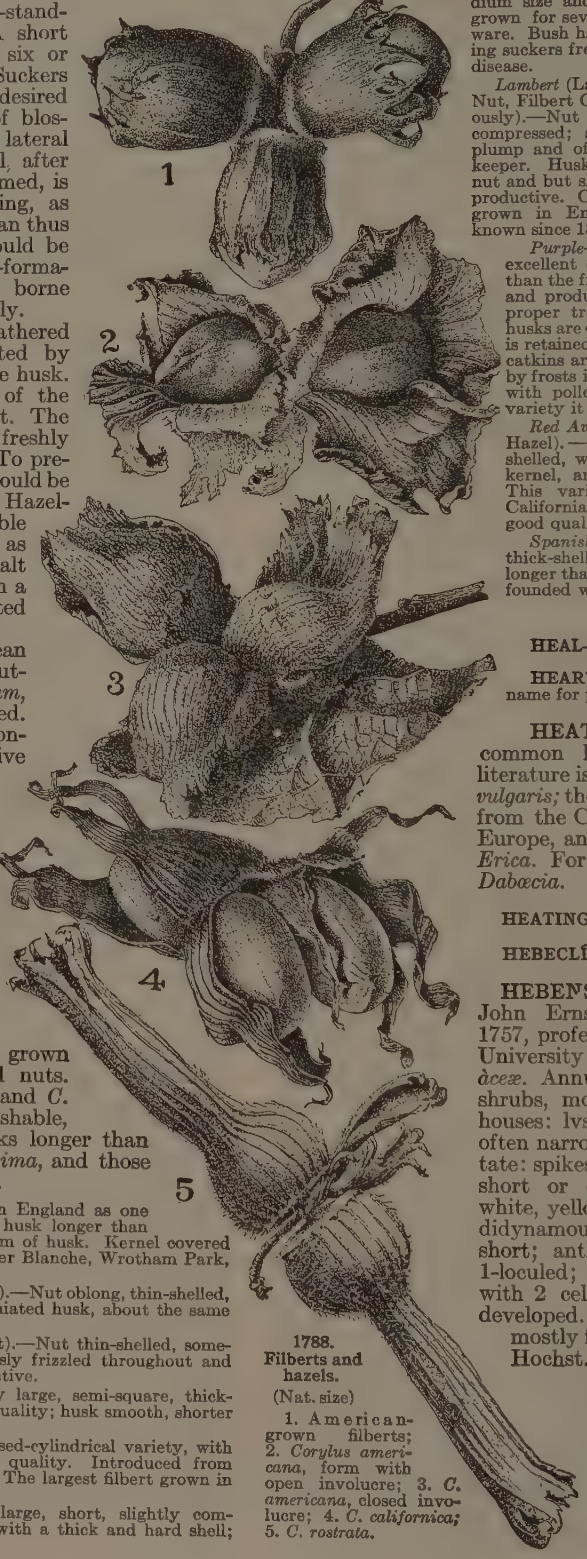
Cosford (Miss Young's, Thin-shelled).—Nut oblong, thin-shelled, of excellent quality; in a hirsute, laciniated husk, about the same length as nut.

Crispa (Cape Nut, Frizzled Filbert).—Nut thin-shelled, somewhat flattened, late; in husks curiously frizzled throughout and wide open at the mouth. Very productive.

Downton Large Square.—Nut very large, semi-square, thick-shelled and well filled, of the highest quality; husk smooth, shorter than nut.

Du Chilly.—A fine, large, compressed-cylindrical variety, with moderately thick shell, and of fine quality. Introduced from France by Felix Gillet, of California. The largest filbert grown in America so far as known.

Grandis (Round Cobnut).—Nut large, short, slightly compressed, of good quality when fresh, with a thick and hard shell; in a short husk, much frizzled and hairy. One of the best varieties; considered the true Barcelona nut of commerce. Also known as Downton, Dwarf Prolific, Great Cob, Pearson's Prolific and Round Cob.



1788. Filberts and hazels. (Nat. size)
1. American-grown filberts; 2. *Corylus americana*, form with open involucre; 3. *C. americana*, closed involucre; 4. *C. californica*; 5. *C. rostrata*.

Jones.—A short, roundish nut, of medium size and good quality, somewhat grown for several years in central Delaware. Bush hardy and vigorous, producing suckers freely, and thus far free from disease.

Lambert (Lambert's Filbert, Lambert's Nut, Filbert Cob; Kentish Cob, erroneously).—Nut large, oblong, somewhat compressed; shell rather thick; kernel plump and of rich flavor; an excellent keeper. Husk quite smooth, longer than nut and but slightly cut in margin. Tree productive. Considered the best variety grown in England, where it has been known since 1812.

Purple-leaved.—Nut large and of excellent quality; in a husk longer than the fruit. Planted for ornament, and productive of good nuts under proper treatment. The leaves and husks are of a deep purple color, which is retained until frost. The staminate catkins are tender and often injured by frosts in winter, but when supplied with pollen from some more hardy variety it yields large crops.

Red Aveline (Avelineer Rouge, Red Hazel).—Nut large, ovate, thin-shelled, with a smooth, red-skinned kernel, and of sweet nutty flavor. This variety is prized in eastern California as a productive sort of good quality.

Spanish.—Nut very large, oblong, thick-shelled, with a smooth husk longer than the fruit. Sometimes confounded with Grandis.

W. A. TAYLOR.

HEAL-ALL: *Brunella.*

HEART'S EASE: Old English name for pansy, *Viola tricolor.*

HEATH, HEATHER. The common heather of Old World literature is a hardy plant, *Calluna vulgaris;* the greenhouse heaths are from the Cape of Good Hope and Europe, and belong to the genus *Erica.* For St. Dabeoc's heath, see *Dabœcia.*

HEATING: *Greenhouse heating.*

HEBECLÍNIUM: *Eupatorium.*

HEBENSTREÌTIA (named for John Ernst Hebenstreit, 1703–1757, professor of medicine in the University of Leipzig). *Selaginàceæ.* Annual herbs, subshrubs or shrubs, mostly grown in greenhouses: lvs. alternate or opposite often narrow, entire or often dentate: spikes terminal, often dense, short or elongated; fls. sessile, white, yellow or pink; stamens 4 didynamous, included, filaments short; anthers oblong or linear, 1-loculed; ovary 2-loculed: fr. with 2 cells, often one not well developed.—About 30 species, mostly from S. Afr. **H. comòsa,** Hochst., is grown as a half-hardy annual (plant perennial). One to 4 ft. high: lvs. numerous, lanceolate or elliptic-lanceolate, glabrous, ½–2 in. long; spikes elongate, 2–6 in. long, mignonette-like; cor-

olla yellow or white, with an orange-red blotch on the limb; tube slender; lobes oblong, inner pair much narrower and scarcely longer than the outer. B.M. 7895. May be safely sown outdoors in April. Fls. fragrant.
L. H. B.

HÉCHTIA (J. G. H. Hecht, who died in 1837). *Bromeliàceæ.* Mexican succulent plants, one species of which is perhaps cult. in a very few fanciers' collections of tender plants for its dense rosettes or recurved spiny lvs., which are purple above from the middle to the tip and silvery beneath. The genus is distinguished by having diœcious fls. The fls. have no decorative value, being ⅛in. across, white, in small sessile, axillary, yellow-bracted heads, borne at intervals of an inch or so on a very slender scape 2 ft. long.—Fifteen species. Give perforated pots and high temperature.

glomeràta, Zucc. (*H. Ghièsbreghtii,* Lem.). Lvs. 10–18 in. long, rigid, leathery, 9–12 lines wide at base, narrowed gradually to the sharp-pointed apex: bracts sheathing, acuminate: corolla 3-lobed nearly to the base; stamens 6; ovary 3-celled. B.M. 5842. I.H. 10:378.—Soil of chopped moss, old manure and charcoal.

argéntea, Baker. Lvs. about 1 ft. long, stiff and spiny, more or less shining silvery: infl. many-fld.; fls. subsessile; petals elliptic, white, concave; style wanting. Habitat doubtful, perhaps Mex.—Well worth growing as a foliage plant in choice collections.
L. H. B.

HECKÈRIA (named for a German botanist). *Piperàceæ.* About 8 S. American and 1 Old World woody plants, distinguished in Piper (with which it is often united) by the many more or less umbellate elongated dense spikes, perfect sessile fls., 2–3 stamens, small anthers with confluent 2-valved cells, obtuse ovary, 3 stigmas: lvs. large, sometimes peltate. *H. umbellàta,* Kunth (*Piper umbellàtum,* Linn. *Pothomórphe umbellàta,* Miq.), is probably not now in the trade. It is a shrub with roundish-reniform not peltate 11–13-nerved petioled lvs., and 4–7 spikes in an umbel; it occurs from Cuba to Brazil. G.W. 9, p. 445.
L. H. B.

HEDEÒMA (Greek, *sweet smell*). *Labiàtæ.* AMERICAN PENNYROYAL. Small aromatic annuals, not of horticultural importance.

Leaves opposite, small: fls. very small, blue or purple, in loose clusters in the axils, the clusters becoming terminal; calyx tubular or ovoid, 13-nerved, the mouth contracted in fr.; corolla 2-lipped, the upper lip erect and entire or lobed; perfect stamens 2, ascending under the upper lip; staminodia 2 or 0.—The genus has about 16 species, all American. The pennyroyal of the Old World is *Mentha Pulegium,* sometimes cult. for its lvs. and tops, which are used as culinary herbs.

pulegioìdes, Pers. AMERICAN PENNYROYAL. Annual, 6–18 in, high: st. very slender, much branched, pubescent: lvs. opposite, ovate to oblong-obovate, sparingly serrate in the upper portion, mostly obtuse at the apex and narrowed at the base, ½–1½ in. long: fls. in axillary clusters; corolla purple, 2-lipped, the lower one with 3 large lobes. July–Sept. B.B. 3:106.—This is of no ornamental value, but the seeds are offered by dealers to those who desire to cult. the plant for its medicinal oil, which is sold in drugstores. It is said to be offensive to mosquitos. The plant can be easily naturalized in dry, sandy spots. It is common in woods and along roads.
L. H. B.

HÉDERA (ancient Latin name of the ivy). *Araliàceæ.* IVY. Ornamental woody root-climbing vines grown for their handsome persistent foliage.

Evergreen shrubs, climbing by aërial rootlets: lvs. alternate, long-petioled, entire or coarsely dentate or 3–7-lobed: fls. perfect, pedicelled, in umbels arranged in terminal racemes or panicles; calyx 5-toothed; petals and stamens 5; ovary 5-celled; style short, cylindric: fr. a 3–5-seeded berry.—Five species (or 6, if *H. helix chrysocarpa* is considered a distinct species) in Eu., N. Afr. and from W. Asia through Cent. Asia to Japan. Monograph by Fr. Tobler, Die Gattung Hedera (1912); a good popular monograph is Shirley Hibberd's "The Ivy: A monograph, comprising the history, uses, characteristics, and affinities of the plant, and a descriptive list of all the garden ivies in cultivation." London, 1872. Many araliads have been described formerly as species of Hedera which are now referred to other genera.

The ivies are climbing shrubs, with inconspicuous greenish flowers appearing in fall, and black, rarely yellow, red or whitish berries ripening the following spring. *Hedera helix* is hardy in sheltered places as far north as Massachusetts; at the Arnold Arboretum a form introduced from the Baltic provinces, Russia, under the name *H. helix baltica* has proved hardier than any other form. All other species, also most of the variegated forms of *H. helix* and its var. *hibernica,* are tender, but the Japanese species has not yet been sufficiently tested.

The ivy is a very valuable plant for covering walls, rocks, trunks of trees and trellis-work, and sometimes climbs very high. It may also be used for covering walls in cool greenhouses, for screens in drawing-rooms and for hanging-baskets. It is a popular window-garden plant, enduring many uncongenial conditions and thriving without bright sunlight. In shady places under trees it makes a handsome evergreen carpet, and is also often used for borders of shrubberies or flower-beds.

It grows in almost any soil, but best in a somewhat moist and rich one, and in shaded positions. The climbing or creeping branches do not flower; flowers are produced on erect, bushy branches, appearing on old, high-climbing plants only. Propagation is by cuttings of half-ripened wood at any time of the year in the greenhouse or in frames, or, in more temperate regions, in the open ground in fall; gentle bottom heat will hasten the development of roots considerably; also increased by layers and by seeds which must be sown soon after ripening and germinate slowly, usually not until the second year. The slow-growing forms, especially the shrubby ones, are often grafted on cuttings of strong-growing varieties, as they do not grow readily from cuttings.

A. *Pubescence of the infl. and the young growth grayish, stellate.*

hèlix, Linn. IVY. ENGLISH IVY. Fig. 1789. High climbing or creeping: lvs. usually 3–5-lobed, dark green above, pale or yellowish green beneath,—those of the flowering branches entire, generally ovate: calyx with minute teeth; calyx, pedicels and tips of young branches covered with grayish white stellate hairs with 5 or 6 rays: fr. black, sometimes yellow. Eu., Canaries, N. Afr., Asia.—A very variable species, of which more than 60 varieties are cult. in European gardens. The first 3 varieties enumerated below are geographical varieties found growing wild, while the others are merely horticultural forms of garden origin. Var. **hibérnica,** Kirchn. (var. *scòtica,* Hort., var. *irlándica,* Hort.). Lvs. larger and broader, of lighter color and thinner texture, with short and broad lobes, often subcordate at the base: umbels and frs. larger; stellate hairs more often with 8 or occasionally 12 rays. Ireland. Var. **chrysocárpa,** Tenore (*H. poetàrum,* Bertol. *H. chrysocárpa,* Walsh). Lvs. less deeply lobed, bright or yellowish green, often undulate, those of the flowering branches narrower: fr. yellow. Turkey, Greece, Asia Minor. Var. **taùrica,** Rehd. (*H. poetàrum* var. *taùrica,* Tobler. *H. taùrica,* Hort.). Lvs. narrower, usually undulate, bright green, those of the sterile shoots usually sagittate, with elongated middle lobe and 1 or 2 short spreading lobes on each side at the base: rather more pubescent, stellate hairs with about 8 rays. Crimea. Possibly hybrid of *H. helix* and *H. colchica.*—The following are some of the most remarkable of the horticultural forms: Var. **arboréscens,** Loud. (*H. arbòrea,* Hort.). Not climbing, forming an erect, low shrub: lvs. ovate to elliptic, entire. This variety is gained by using flowering branches for prop. There are also some variegated forms, as Silver Queen, with silvery variegated lvs. Var. **bàltica,** Hort. A small-leaved form hardly differing from the type; the hardiest or one of the hardiest of the forms in cult. Var. **Cávendishii,** Koch (var. *marginàta mìnor,* Hort.). Slow-growing, with rather small dull green lvs., edged creamy white, striped red or pink in fall. Var. **conglomeràta,** Nichols. Slow-growing: lvs. crowded, small, entire or 3-lobed, undulate. R.H. 1890, p. 163. Var. **crenàta,** Hibberd (*H. vitifòlia* and *H. digitàta nòva,* Hort.). Similar to var. *digitata,* but lobes shorter and broader, crenate at the margin, light green. Var. **deltoídea,** Hibberd (var. *hastàta,* Hort.). Lvs. rather small, bluntly deltoid, almost entire, blackish green, changing to dull purplish bronze in fall. Gn. 25, p. 141; 34, p. 493 (as *A. hastata*). Var. **digitàta,** Loud. Lvs. rather large and broad, digitately lobed with 5 triangular-oblong lobes, sometimes with 2 small additional basal lobes, truncate at the base, dark green. Gn. 25, p. 141; 34, p. 493. Var. **grácilis,** Hibberd. Lvs. rather small, with broad, short lobes, dull green, bronzy in fall. Gn. 59, p. 154. Var. **lobàta màjor,** Hibberd. Similar to var. *hibernica,* but lvs. somewhat smaller, more deeply lobed and lobes narrower. Var. **lùcida,** Hibberd. A form of var. *chrysocarpa,* with large deltoid lvs. not lobed or partly or slightly 3–5-lobed, glossy above: a vigorous grower. Gn. 25, p. 141; 34, p. 492. Var. **lusitánica,** Hesse. Similar to var. *palmata.* Lvs. large, to 5 in. across, light green, palmately 5-lobed with triangular lobes. Var. **maculàta,** Hort. (*H. latifòlia maculàta,* Hort.). Similar to var. *hibernica:* lvs. spotted and striped yellowish white. Var. **marginàta,** Hort. Lvs. broadly triangular-ovate, irregularly bordered yellowish white, striped red or pink in fall: of somewhat slow growth. F.E. 31:318. Var. **marmoràta,** Hort. Similar to var. *hibernica,* but lvs. irregularly blotched yellowish white. Var. **mínima,** Hibberd (var. *donerailénsis,* Hort.). Lvs. small, 3-lobed or pedately 5-lobed, with short and spreading basal lobes, dull purplish brown in winter. Gn. 59, p. 154. M.D.G. 1897:229 and S.H. 2:237 (as var. *digitata*). Var. **palmàta,** Hort. Similar to var. *digitata,* but lvs. 3–5-lobed with broader distinctly triangular lobes, the lateral ones more spreading, dull green. Var. **pedàta,** Hibberd. Lvs. pedately 5-lobed, the middle lobe long and narrow, the lateral lobes much shorter, dark green with whitish veins. Gn. 25, p. 141; 34, p. 493; 59, p. 154. Var. **sagittifòlia,** Koch. Lvs. rather small, with triangular middle lobe and short, broad and obtusish lateral lobes, deeply cordate at the base, dull dark green. Var. **tesselàta,** Nichols. Lvs. 3-lobed with short and broad lobes, with a distinct reticulate variegation. J.H. III. 28:209; 45:99. Var. **tortuòsa,** Hibberd. Lvs. ovate or rhombic, entire or obscurely 3-lobed, more or less curled and twisted, the curling increasing during cold weather. Gn. 55, p. 336. Var. **trícolor,** Hibberd (var. *marginàta rùbra,* Hort., var. *elegantíssima,* Hort., var. *Cúllisii,* Hort.). Like var. *marginata,* but edges of lvs. becoming red in fall.

1789. Hedera helix. Form with white-ribbed leaves. (×⅓)

canariénsis, Willd. (*H. hèlix* var. *canariénsis,* DC. *H. algeriénsis,* Hort. *H. maderénsis,* Hort. *H. azòrica,* Hort.). High-climbing: pubescence more scaly, hairs with 12–20 rays: lvs. large, bright green, roundish ovate, usually cordate at the base, entire or with 3–7 rather short lobes of almost equal size: umbels larger, often solitary or few; calyx-lobes broader: frs. black, sometimes ½in. thick. Canary Isls., Madeira, N. Afr. Gn. 25, p. 141; 34, pp. 492, 496. G.M. 54:319. Var. **arboréscens,** Koch. Not climbing, forming an upright low shrub. G.M. 54:957. Var. **variegàta,** Hort. (*H. maderénsis variegàta,* Hort.). Lvs. entire or slightly 3-lobed, edged yellowish white. G.C. II. 15:657. G.M. 54:320.

AA. *Pubescence scaly, golden yellow.*

cólchica, Koch (*H. Rægneriàna,* Hort. *H. coriàcea,* Hibberd). High-climbing: lvs. large, broadly ovate, cordate, almost entire, rarely slightly 3-lobed, bright green, of firm texture, those of flowering branches generally oblong-ovate: calyx-lobes triangular-ovate, conspicuous; calyx, pedicels and tips of young branches coated with golden yellow scales with about 20 or 25 rays: fr. black. Asia Minor, Caucasus, Persia. Gn. 25, p. 141; 34, p. 492. Gt. 11:360. Var. **dentàta,** Hibberd (*H. dentàta,* Hort.). Lvs. with remote small teeth, of somewhat thinner texture. G.M. 30:388; 54:318. Gn. 36, p. 7. Var. **purpùrea,** Hibberd. Lvs. purplish. Var. **arboréscens,** Koch. Not climbing, of upright shrubby habit. Gn. W. 20:467.

H. glomerulàta, DC., belongs to the genus Brassaiopsis and its correct name is B. glomerulata, Regel (B. speciosa, Decne. & Planch.). A glabrous tree, with large digitate lvs.; lfts. 5–7, oblong-lanceolate, stalked: fls. in long pendulous panicles consisting of long-stalked globular heads of small fls. S. Asia. B.M. 4804. Gt. 12:411. G.M. 32:367.—*H. himalàica,* Tobler (H. helix aurantiaca, André). High-climbing: pubescence scaly, gray or yellowish, the scales with many rays: lvs. of the sterile branches pinnately lobed with 2–5 lobes or teeth on each side, those of the flowering branches oblong-ovate to oblong-lanceolate, cuneate at the base: fr. yellow. Himalayas. R.H. 1884:84. Var. *sinénsis,* Tobler. Lvs. of sterile shoots entire or 3-lobed, of fertile branches elliptic or elliptic-oblong. W. China.—*H. japónica,* Tobler (H. helix var. rhombea, Sieb. & Zucc.). Not high-climbing: scales of pubescence with many rays: lvs. elliptic-ovate to rhombic-ovate, those of the sterile shoots 3- or rarely 5-lobed, with broad middle lobe and small lateral lobes: fr. black, about ⅓in. or less across. Japan, Korea.

ALFRED REHDER.

HEDGES. Living green fences are used for two distinct purposes—defense and ornament. Ornamental hedges may be rendered defensive by stretching tightly two or three strands of barbed wire through the center of the hedge. So far, no plant has yet been tested that meets all the requirements of the farmer for a truly impassable barrier, although the Osage orange (*Maclura pomifera*) possesses more recommendable features than any other hardy tree. This tree, however, is not hardy in the northernmost states. For regions south of Washington, D. C., Kentucky, and Missouri, *Poncirus* (or *Citrus*) *trifoliata* is of equal value. Both have the serious drawback of being subject to the attacks of the San José scale, but no satisfactory substitute has yet been found.

Next to these, perhaps, ranks the honey locust

(*Gleditsia triacanthos*), with many warm admirers and advocates. The hawthorn of Europe (*Cratægus Oxyacantha*) may not be planted in this country with much chance of success, owing to fungous enemies.

Cratægus Crus-galli is fairly satisfactory, but is not likely to make a tight hedge close to the ground. Other large thorny shrubs also fail in important particulars.

A perfect thorn hedge requires unremitting care, and must conform to an established rule, the most important being entire freedom from weeds and a systematic pruning. The preparation of the soil for a hedge consists of thoroughly plowing and cultivating an area 6 feet wide and the length the hedge is proposed to extend; or else to dig a trench 2 feet deep and 2 or 3 feet wide, and fill it with good top-soil thoroughly enriched. If this space should be fertilized and cropped the year previous growth will be greatly accelerated.

Deciduous plants must have the tops well shortened, and the root-tips of all plants should be given a clean cut, as they are planted. The plants should be set in a single row as close together as they can be set. For hedges a foot high or less, the plants should not be over 4 inches apart. For hedges 3 or 4 feet high, the plants should be 6 inches to a foot apart.

The double row, as formerly advised by some growers, is now practically obsolete and justly so, being difficult to cultivate and preserve free from weeds. The single row gives the plants a chance to be somewhat balanced, as the two opposite sides will have nearly equal freedom to develop.

A trench or furrow is opened through the center of the cultivated strip of a sufficient depth to admit the roots without bending. In setting, the soil must be made firm with the aid of a rammer, a practice unexcelled for aiding growth, and, indeed, preserving plant-life after removal. Pruning is simply an annual necessity from the first, excepting when the hedge is intended to be plashed, and even in such cases, after the laying process, pruning must never be omitted during summer. This work is greatly accelerated and consequently cheapened by shearing when the plants are young and tender, say during the month of July.

As to the best outline, a plain triangle, or what may be more sightly, the curvilinear or Gothic arch, is desirable, and a flat top is to be discouraged, as a body of snow lodged on it invariably injures the symmetry and beauty of any hedge. Another advantage of the triangular and Gothic arch types is that the sun can better reach the bottom of such hedges and keep them covered with foliage down to the ground. A rectangular hedge is liable to have bare spots at the base, while a hedge wider at the middle or top than at the bottom, is almost sure to be without foliage near the ground

Material available for defensive hedges has already been discussed. For ornamental hedges, there are a large number of plants available, both deciduous and evergreen. Of these the half-evergreen California privet (*Ligustrum ovalifolium*) is probably more largely used than anything else, and in the eastern United States possibly more largely used than all other material combined. Its advantage over its competitors is its low first cost, and its responsiveness to pruning and training. These are offset by its liability to kill to the ground every few years, even toward the South. Probably the best hedge plant, all things considered, is Thunberg's barberry (*Berberis Thunbergii*).

Of the evergreen hedges, the arbor-vitæ (*Thuya occidentalis*) is one of the most widely adaptable and deservedly popular. Hemlock (*Tsuga canadensis*) makes one of the handsomest but it succeeds in a comparatively restricted area. Its reputation as a slow grower should not prevent the box being more largely planted than it is. The Monterey cypress is much used as a hedge in California (Fig. 1790). There are many other evergreens that may be used to advantage.

Among the deciduous flowering plants are a great many that are desirable. A discussion of a few of these is included in the list that follows.

Where room at all permits, mass plantings or even untrimmed tree rows are better than a high hedge for barriers and screens. Plants with variegated or unusually colored foliage should be avoided for hedges.

The most serious annoyance to the hedge-grower is the presence of unwelcome woody vines, such as poison ivy (*Rhus Toxicodendron*), Japan evergreen honeysuckle (*Lonicera japonica*), and so on, and the only remedy is persistently to remove them by hand as soon as discovered. The attacks of insects may be treated similarly to those which injure other trees and shrubs.

Material especially adaptable for hedges.

Abelia grandiflora. Broad-leaved evergreen. Suitable for hedges up to 4 feet. Not hardy north of Washington and St. Louis.

Acer campestre. Deciduous. Adapted for hedges from 4 to 10 feet high in the northern half of the United States.

Azalea (*Rhododendron*) *amœna.* Evergreen. Good for hedges up to 2 feet. Good as far north as New York, Philadelphia, Cincinnati, and St. Louis. Attractive foliage and showy flowers.

Berberis Thunbergii. Deciduous, thorny, slow-growing. Cannot be relied on for hedges over 4 feet high. Adapted to all sections of the United States, except the non-irrigated arid regions. Responds to pruning, but makes a more attractive hedge when shears are not used. Naturally makes a tight bottom. Foliage small and most attractive. Bears annual crops of scarlet berries that hang on all winter, even in the South. Will grow within reach of salt-water spray. The best of the deciduous ornamental hedge plants, and has no superior in any class.

Berberis vulgaris. Deciduous, thorny. Useful for hedges from 3 to 6 feet high. Adapted to the northern half of the United States. Not so tight and compact as the foregoing. Bears berries that hang on half the winter. There is also a purple-leaved variety.

Buxus sempervirens (boxwood; tree box). The box of colonial gardens. Evergreen; slow-growing; adapted for hedges up to 20 feet. Thrives as far north as central New York, southern Ohio, and Missouri. Stands shearing well. Probably the best evergreen hedge-plant in the regions in which it grows.

Buxus suffruticosa (dwarf box). Evergreen. Suitable for use where a small hedge of the last-mentioned could be used.

Carpinus caroliniana (hornbeam). Deciduous. Good for hedges up to 10 feet. Makes a dense, strong hedge. Suitable for use as far south as Virginia and Kentucky.

Carpinus Betulus. Same adaptabilities as the last.

Chænomeles japonica (Japonica; Japan quince). Deciduous; somewhat spiny. Grows North and South and even in comparatively dry regions. Boy- and dog-proof, with handsome flowers. Somewhat subject to San José scale. Excellent.

Cinnamomum Camphora (camphor tree). Broad-leaved evergreen for high or low hedges. Hardy only near the coast from Charleston, South Carolina to Texas.

Cratægus Crus-galli (cockspur thorn). Deciduous. Has long spines. Can be used all over the country, except in the arid regions, but it is best adapted to the North. Flowers and fruits both attractive. Needs careful pruning when young to keep sides clothed to the ground.

Cratægus Oxyacantha. Similar to above. Not quite so dense a grower, but rather more showy flowers and fruits.

Deutzias. Deciduous, flowering shrubs of various heights from 30 inches to 6 feet, making rather loose hedges. Especially handsome when in flower. Some varieties hardy as far north as Chicago and northern New York; others only as far as St. Louis and New York City.

Elæagnus angustifolia. Deciduous. Adapted for hedges or low windbreaks to a height of 20 feet. Thrives in all parts of the United States. One of the best for the semi-arid regions. Summer fruits attractive.

1790. Monterey cypress hedge.

Elæagnus parvifolia. Deciduous. Similar to the preceding, but not so widely adaptable.

Evonymus japonica. Broad-leaved evergreen. Useful for hedges up to 3 or 4 feet at its northern limits and double that height in the South. Occasionally winterkills as far north as Philadelphia and Cincinnati but well adapted for regions farther south. There is a variety with yellow-edged leaves.

Fagus sylvatica (beech). Deciduous. Suitable for high hedges or screens. Thrives in the northern half of the country.

Gardenia jasminoides (Cape jessamine). Evergreen. Flowering. Used for hedges up to 5 feet. Hardy in South Carolina, Georgia and the states bordering on the Gulf of Mexico.

Gleditsia triacanthos (honey locust). Deciduous. Thorny. A good defensive hedge; succeeds over the whole United States. Especially valuable in the semi-arid regions and beyond the northern limits of the Osage orange (*Maclura maculata*).

Hibiscus syriacus (rose of Sharon). Deciduous. Flowering. Useful for hedges and screens under 10 feet where an open bottom is not objectionable. Will grow successfully except in the most northern tier of states. Transplant only in spring where the ground freezes in winter.

Ilex Aquifolium (English holly). Broad-leaved evergreen with spiny leaves. Useful for hedges from 2 to 6 feet. Desirable south of Philadelphia and St. Louis. There are many varieties. Handsome.

Ilex crenata (Japanese holly). Broad-leaved evergreen. Leaves smaller than either the preceding or following species and without spines on the leaves. Good for hedges not exceeding 4 feet. Hardy except in the extreme northern states.

Ilex opaca (American holly). Broad-leaved evergreen with spiny leaves. Useful for hedges and screens up to 30 feet. Native near the coast from New Jersey southward and along the Gulf of Mexico. Will grow inland on light soils and thrives on poor ground. Pistillate plants filled with scarlet berries all winter.

Juniperus virginiana (red cedar). Coniferous evergreen. Adapted for hedges and screens up to 30 feet. Thrives almost everywhere. There are several forms in cultivation, but the type is most suitable for hedges.

Ligustrum amurense (Amoor River privet). Broad-leaved evergreen. Leaves smaller than *L. Japonica* or *L. ovalifolium.* Better for hedges than *L. ovalifolium.* Hardy as far north as Virginia and Missouri.

Ligustrum Ibota. Deciduous. Adapted to hedges 10 feet and under. Hardy except in the most northern sections. Var. *Regelianum.* Dwarf. Makes hedges 4 feet and under. Filled with blue berries all winter.

Ligustrum japonicum. Broad-leaved evergreen. Useful for hedges up to 6 feet. Not reliably hardy as far north as Washington, D. C., and St. Louis.

Ligustrum ovalifolium (California privet). Broad-leaved half-evergreen shrub. Useful for hedges from 6 inches to 12 feet. Tops liable to freeze to the ground every few years as far south as North Carolina and Oklahoma. Rapid grower. Stands pruning well and needs it frequently. Ranks with dwarf box as a low edging for flower-beds, except it requires weekly or fortnightly pruning. Its low first cost has led to its use in many places where other plants would have been more attractive and more economical. Thrives near salt-water, even within reach of the spray.

Maclura pomifera (Osage orange). Deciduous. A defensive hedge. Hardy as far north as central New York and Nebraska. Subject to attacks of San José scale.

Osmanthus (Olea) fragrans (sweet olive). Broad-leaved evergreen, bearing sweet-scented flowers. Adapted to low hedges in the Gulf states and as far north as Wilmington, North Carolina, on the Atlantic coast.

Osmanthus Aquifolium. Broad-leaved evergreen. Much like *Ilex Aquifolium* in general appearance, but blooms in late summer. Has showy winter berries on pistillate plants. Sometimes winterkills as far north as Washington, D. C., and St. Louis.

Picea alba (white spruce). Coniferous evergreen. Formal in habit. Good for high hedges and screens. More pleasing in color than the next species. Good for the northern half of the country even in comparatively dry regions.

Picea excelsa (Norway spruce). Coniferous evergreen. Same adaptability as the last and more used than it, but not so desirable.

Pittosporum Tobira. Broad-leaved evergreen. Thrives in the South Atlantic and Gulf states.

Poncirus trifoliata (hardy orange). Almost evergreen South; deciduous in its northern range. Spiny. Good for defensive hedges from 3 to 10 feet high. Large glossy foliage. Attractive. Succeeds as far north as Philadelphia and Cincinnati. Subject to San José scale.

Populus nigra var. *fastigiata* (Lombardy poplar). Deciduous. Adapted for hedges and screens up to 30 feet. Useful in the northern half of the United States.

Prunus caroliniana (mock orange of the South). Broad-leaved evergreen adapted to the southern states from Norfolk south. Excellent.

Retinosporas. Coniferous evergreens adapted to hedges under 6 feet. Suitable for use south of the 40th parallel and in special localities north of it. Not suitable for the semi-arid regions.

Rhamnus cathartica. Deciduous. Good for hedges to 6 feet. Most useful in the northern half of the country.

Rosa rubiginosa (sweetbriar rose). Deciduous, thorny. Adapted for hedges up to 3½ feet. Thrives everywhere except in the most arid sections. It bears attractive flowers and hips, but does not make so close a hedge as many other plants.

Rosa rugosa. Deciduous, thorny. Adapted for hedges of 5 feet and under. Will grow both North and South and is promising for use in the semi-arid regions. Flowers and hips both attractive. For a summer hedge it is excellent, but its winter appearance is not hedge-like although quite effective as a deterrent to intruders.

Spiræas. Deciduous shrubs. A group of beautiful flowering shrubs adapted for use as low hedges North and South and promising for use in the semi-arid regions. *Spiræa Bumalda* var. *Anthony Waterer* would make a hedge 2 feet high with flat-topped pink blossoms in early summer. *Spiræa Thunbergii* grows 5 feet high with white flowers in early spring. It has fine foliage, but the tips of the branches are apt to winterkill even as far south as Virginia and Missouri. *Spiræa Van Houttei* is white, about intermediate between the other two in season. The finest of the spireas in flower. It has beautiful foliage and is adapted for hedges.

Syringas (lilacs). Deciduous shrubs. A group of beautiful flowering shrubs adapted to all parts of the United States, some species being especially promising for the semi-arid regions. *Syringa amurensis* is especially well adapted for use on the Great Plains. It grows 10 feet high. *Syringa persica* is about as adaptable as the last but more dwarf, growing but 5 feet high. *Syringa vulgaris* has many named varieties, both double and single, in a wide range of colors and habit of growth.

Thea Bohea (Chinese tea plant). Broad-leaved evergreen. Low-growing. Blooms in winter. Useful near the seacoast from Charleston, South Carolina, to Texas.

Thuya occidentalis (arbor-vitæ). A coniferous evergreen with many forms, of which the type is as useful as any for hedge purposes. Adapted to all sections of the United States. Much used and deservedly so.

Thuya orientalis (Chinese arbor-vitæ; Biota). Coniferous evergreen with many forms. Useful over nearly the same range as the foregoing.

Tsuga canadensis (hemlock). Coniferous evergreen. Useful for low and high hedges and screens to 50 feet. Adapted to moist and medium soils in the northern half of the United States. One of the handsomest in the regions in which it thrives.

Viburnums. Deciduous and evergreen shrubs. Many-berried and handsome. Among the desirable deciduous species that thrive all over the United States except in the extreme South and the drier regions are *V. cassinoides*, *V. dentatum*, *V. nudum*, *V. Opulus*, *V. plicatum*, and *V. prunifolium*. The handsome evergreen species *V. Tinus* is tender and not likely to succeed north of the Carolinas and the Gulf States, but where it succeeds it is most desirable.

F. L. MULFORD.

HEDRÆÁNTHUS, HEDRÁNTHUS: *Wahlenbergia.*

HEDÝCHIUM (Greek, *sweet snow;* the large white flowers are sweet-scented). *Zingiberàceæ.* BUTTERFLY LILY. GINGER LILY. GARLAND FLOWER. Leafy, rhizomatous herbs allied to Kæmpferia and ginger, grown under glass and in the open far South.

Flowers in a terminal spike or thyrse; calyx tubular, more or less 3-lobed at the summit; corolla-tube slender, scarcely longer than the calyx, all half concealed by the usually showy bracts; upper corolla-segm. often enlarged and lip-like; stamen 1, with a 2-loculed anther surrounding the style; staminodia always present, usually well developed.—Thirty-eight tropical species, Asian and one Madagascar. From the ginger Hedychium differs in having broad, almost petal-like staminodia, which in Zingiber is minute or lacking. The best botanical account is by K. Schumann in Engler's Pflanzenreich, hft. 20 (1904).

Hedychiums are strong-growing plants, very ornamental, both in foliage and in flower. They are essentially fall bloomers, although they may be made to bloom more or less continuously under glass. After blooming, gradually dry off the rhizomes, and let them rest for a time. Pot them up in spring or early summer, and give them rich soil and plenty of water and an occasional supply of liquid manure. The rhizomes may be divided every two or three years. They need an abundance of water. In fact, the pots may be set half their depth in water, and *H. coronarium* is often immersed until only the crown is emersed. The common white-flowered species is *H. coronarium.* This requires warmhouse treatment for best results, although it often flowers well when plunged in a warm, half-shady place in the open. The species do not stand frost, but they may be left out in the South if well protected. The flowers are very fragrant; in fact, their odor may be too heavy for a small room.

A. *Fls. white.*

coronàrium, Koenig. Three to 6 ft.: lvs. canna-like, green, pointed, smooth above, hairy beneath: fls. very large (3–4 in. across), long-tubed, pure white or the lip sometimes blotched green, the 3 outer segms. narrow, the lip large and erect and more or less lobed. Trop. Asia, and naturalized in some parts of Trop. Amer. B.M. 708. L.B.C. 6:507.—Handsome and worthy. Needs warm quarters. Said to have been sold as *Myrosma carnæfolia*, but that name belongs to a wholly different plant.

thyrsifórme, Hamilton. Usually 5 ft. tall: lf. sometimes 1 ft. long and 3–4 in. wide, finely hairy and pale beneath: spike very dense, the lower empty bracts ovate, the upper and fl.-bearing cylindric, green, about 1½ in.; corolla-tube not much longer than the bract, its segms. linear, white; lip distinctly clawed. Trop Himalaya. B. R. 767 (as *H. heteromallum*).—Not much known, but advertised (1914) by Montarioso Nursery.

AA. *Fls. yellow or red.*

B. *Infl. usually broader than long.*

flàvum, Roxbg. About 5 ft. tall: lvs. sessile, oblong, glabrous above, pale and hairy beneath: spike dense, the bracts broadly ovate or elliptic; fls. large, orange; corolla-tube cylindrical, 2½ in. long; segms. spreading, the outer ones linear and acute and an inch or so long, the lip very large and rounded, retuse; stamen not exserted. India. B.M. 3039 (and 2378?).

BB. *Infl. usually much longer than broad.*

Gardneriànum, Roscoe. Tall: lvs. sessile or the upper petioled: fls. light yellow, odd, short-stalked in the terminal spike, but the red filament long-projected beyond the segms.; lip oval and short, 3-toothed, the other segms. narrow: fr. red and showy. India. B. M. 6913. B.R. 774. J.H. III. 32:239 (in fruit). G.C. III. 11:176 (plate erroneously labeled *H. coronarium*); 46:126. G.W. 12, pp. 649, 650.—The best of the genus, and hardier than *H. coronarium.*

coccíneum, Buch.-Ham. St. about 6 ft. tall: lvs. all sessile, linear-lanceolate and sharp-pointed, glabrous above, glaucous beneath: fls. rather small, scarlet, the filament long-projected; lip nearly or quite entire; fl.-bracts conspicuous, acute or obtuse, triangular. India. L.B.C. 8:705.—A hybrid between this and *H. Gardnerianum* has been advertised as *H. Moòrei.*

H. Bousigoniànum, Pierre. A species from Cochin-China with sts. about 3 ft., with small bright green lvs. and about 18–25 pale yellow fls. and red anthers has been recently intro. It is scarcely known outside England. R.H. 1906:400.—*H. cárneum*, Carey. Fls. flesh-colored, scentless: height 3–4 ft.: lvs. over 1 ft. long, acuminate. E. Indies. B.M. 2637. L.B.C. 7:693.

N. TAYLOR.†

HEDÝSARUM (Greek for *sweet smell*). *Leguminòsæ.* Perhaps a dozen North American herbs, and about sixty in the Old World, sometimes planted for ornament.

Perennial herbs or subshrubs, with odd pinnate lvs., and often showy racemes of red, purple or white, small pea-like fls.: calyx 5-cleft, the teeth nearly equal and pointed; standard obcordate or obovate; keel nearly straight and longer than the wings; stamens 9 and 1: fr. a flattened jointed pod.—Very closely allied to Desmodium, but the latter genus has 3-foliolate lvs. Many of the hedysarums are attractive border plants. They are of easiest cult. in a light and open, well-drained soil. Give a sunny place; hardy. Prop. by division and seeds. For the sainfoin, sometimes known as *H. Onobrychis*, see *Onobrychis*.

A. *Fls. normally red (varying to white).*

coronàrium, Linn. FRENCH HONEYSUCKLE. Perennial or biennial, 2–4 ft. tall, branchy: an old garden plant with deep red, fragrant fls., crowded in axillary spikes or racemes: lvs. with 3–7 pairs of elliptic or roundish, somewhat pubescent lfts. Eu. Summer. Var. **álbum,** Hort., has white fls.—*H. hùmile*, Linn., is by some regarded as a form of this species, with rather more and narrower lfts., and wings only half as long as the keel.

AA. *Fls. normally purple (varying to white).*

multìjugum, Maxim. Hardy perennial of angular, straggling growth, 2–5 ft. high, very showy, and worthy of general cult.: fls. violet or purplish magenta, with yellow blotches, in racemes 8–18 in. long, all summer: lvs. 4–6 in. long, containing 6–12 pairs of grayish green oval, small lfts. Mongolia. Gn. 53:408. G.C. III. 18:8, 9. Excellent for rockwork. Var. **apiculàtum,** Sprague, has fewer lfts., which are apiculate, and glabrous above: perhaps the plant cult. as *H. multijugum.* B.M. 8091.

boreàle, Nutt. (*H. americànum*, Brit.). Erect or half-decumbent herb: sts. simple or nearly so, 1–3 ft.: lfts. 5–10 pairs, glabrous, oblong or oblanceolate: fls. violet-purple, varying to white, the calyx-teeth ovate-acute and shorter than the tube. Labrador and N. New England across the continent.

Mackénzii, Richards. Much like the last, but somewhat pubescent: fls. larger, violet-purple; calyx-teeth awl-like and acuminate, and longer than the tube, or at least equaling it: lfts. 5–9 pairs. Colo., north and west.

sibíricum, Poir. Height 3–4 ft.: lfts. ovate-lanceolate, glabrous, apiculate: fls. purple, drooping in long axillary racemes. Siberia. B.M. 2213 (as *H. alpinum*).

obscùrum, Linn. (*H. negléctum*, Ledeb.). Small, usually about 6–12 in. high: lfts. 5–9 pairs, ovate, glabrous: fls. purple, pendulous in long spikes. Eu. B.M. 282.—It is said to vary to white. L. H. B.

HEDYSCÈPE (Greek, *sweet covering*). *Palmàceæ*, tribe *Arèceæ*. UMBRELLA PALM. A tall hothouse palm known to the trade as a Kentia, and resembling that genus in habit and foliage, but distinct in flower. In Kentia the fls. are arranged in 4 ranks, and the ovule is fastened at the bottom of the cell, while in Hedyscepe (and its cult. allies, Kentiopsis, Veitchia, Nenga, Archontophœnix, Rhopalostylis and Dictyosperma) the fls. are spirally arranged in the branches of the spadix, and the ovule is fastened at the side. From the allies above mentioned Hedyscepe is distinguished by the following characters: staminate fls. with narrowly lanceolate sepals, 9–12 stamens, with long filaments; pistillate fls. with petals like the sepals and valvate at the apex. As a house plant, *H. Canterburyana* is dwarfer and more spreading than the two howeas, and has a lighter shade of green. G.C. II. 24:587.

H. Canterburyana, a very handsome palm, is the only species belonging to the genus, and, like the important howeas (or kentias of commercial horticulture), is known in a wild state only on Lord Howe's Island, where it is known as the "umbrella palm" from the recurving habit of its foliage. It grows at a greater altitude than the howeas, not appearing below the 900-feet level, and from this it may be inferred that a slightly lower temperature is more suitable for this palm; but in a general way the same conditions as those required by the so-called kentias will give good results with this subject, namely, a night temperature of 60° to 62° F., moderate shading throughout nearly the whole year, plenty of water, and a rich and rather heavy soil. These palms respond freely to generous treatment. As a commercial palm, *H. Canterburyana* is not very popular as yet, partly owing to the higher cost of seeds and the frequently low percentage of germination, and partly from the fact that in a young state this palm is by no means a rapid grower. In regard to hardiness of foliage, it is fully equal to the kentias, and for gracefulness and symmetry of growth will compare favorably with any of the commercial species. In southern California it is cultivated outdoors. (W. H. Taplin.)

1791. Hedyscepe Canterburyana.

Canterburyàna, Wendl. & Drude (*Kéntia Canterburyàna*, F. Muell. *Veìtchia Canterburyàna*, Hort.) UMBRELLA PALM. Fig. 1791 (adapted from Martius). Tall, spineless palm, with a thick, stout caudex: lvs. terminal, dense, equally pinnatisect, the numerous segms. linear-lanceolate, acuminate, the lower nerves recurved at the base, rather remote from the margin; rachis arched, recurving: spadix with a short peduncle, and thickened, flexuose branches; areoles lax: fls. medium: fr. ovoid, large. R.H. 1873, p. 218. F.R. 1:85. G. 2:418; 5:592; 16:414. G.W. 12, p. 207 (the last four all as Kentia). N. TAYLOR.†

HEÈRIA: *Heterocentron.* **H. elegans:** *Schizocentron.*

HEÌMIA (Geheimerath. Dr. Heim, Berlin, died 1834). *Lythràceæ*. Two shrubs of the New World, differing from Decodon in the yellow mostly 6-merous trimorphous fls. borne in spikes: stamens 10–18. **H. salicifòlia,** Link (*Nesæa salicifòlia*, HBK.), native from Mex. to Buenos Ayres, is offered abroad: subshrub, about 5 ft.: lvs. opposite or in 3's, or the upper alternate, lanceolate and acute: fls. yellow, with obovate petals. This is said to be prized as an antisyphiitic and for other purposes. L. H. B.

HELENIÓPSIS: *Heloniopsis.*

HELÈNIUM (possibly from Helenus, the son of Priam, but there is no clear record of the application of the name). *Compósitæ*. SNEEZEWEED. Hardy annual and perennial herbs, bearing yellow flowers from early summer to late autumn; only the perennials are in cultivation.

Stem erect, usually branching above: lvs. alternate, narrowly to broadly lanceolate, entire or toothed, glandular-dotted; the frequently decurrent petiole and st. sometimes winged: heads solitary or corymbose, yellow or brownish; disk-fls. perfect, fertile, their corollas 4–5-toothed; the ray-fls. pistillate or neutral, the rays wedge-shaped, 3–5-lobed.—About 30 species, N. Amer., Mex. Closely resembles Helianthus, but differs in having elongated, often top-shaped frs., which are never compressed and are usually silky villose; while the frs. of Helianthus are generally more or less 4-sided and are smooth. In Helenium the receptacle is naked; in Helianthus it bears paleaceous bracts.

Heleniums thrive best in a rich, moist soil, with a sunny aspect, and are propagated by seeds, cuttings or division. All the species are very easily grown, the only serious difficulty being a white aphis which sometimes attacks the roots. If plants look unhealthy they should be lifted, washed with an insecticide and reset in a new place. The commonest species in cult. is *H. autumnale*, but perhaps the most valuable species for general planting is *H. Hoopesii*, which is one of our earliest blooming composites, and is also desirable for the border or for cut-flowers. *H. Hoopesii*, *H. Bolanderi* and *H. autumnale* will give bloom in succession from May to October. The first two are also attractive when grown in pots, but they do not flower from seed the first year, either in pots or in the open.

A. *Heads rayless.*

aromáticum, Bailey, n. comb. (*Grahàmia aromática,* Hook. *Grahàmia aromática,* Spreng. *Cephalóphora aromática,* Schrad.). Erect, glaucous: st. herbaceous, much branched: lvs. alternate, linear-lanceolate, somewhat undulate and partially amplexicaul, the lower ones pinnatifid but the upper ones scarcely toothed: head discoid, terminating leafless branches; receptacle naked; florets yellow. Chile, in pastures and shrubby hills.—Offered abroad; fragrant. Listed in the trade as *Grahamia aromatica,* but all agree in referring Grahamia to Cephalophora; and Hoffmann now refers Cephalophora to Helenium. Whether the present species should really go under Helenium, is to be determined.

1792. Helenium autumnale. (×½)

AA. *Heads with rays.*

B. *St. and branches winged.*

C. *Disk yellow.*

autumnàle, Linn. (*H. grandiflòrum,* Nutt.). SNEEZEWEED. Fig. 1792. St. 2–6 ft. high, roughish, leafy: lvs. mostly toothed, smooth: heads 1–1½ in. across, numerous, borne at the end of short, very leafy stalks; rays drooping, 3-cleft, lemon-yellow to bright yellow; disk yellow. July–Oct. Moist places, Canada to Fla. and west to S. D., Kans. and Ala. B.M. 2994. Gn. 29:190; 55:218. A.G. 12:682. G.C. III. 10:433; III. 32:405.—Very showy. It has distinct merit for the back of borders, but is more appreciated in Eu. than in Amer. There are several garden forms: var. **pùmilum** is 1–2 ft. high, a very free bloomer, and is largely grown for cut-fls. in some places. J.H. III. 59:109. Var. **grandiflòrum** and var. **supérbum,** (*H. supérbum,* Hort.), are unusually vigorous and large-fld.; var. **striàtum,** has a maroon and gold disk, with yellow rays variously striped and splashed with rich crimson. J.H. III. 31:293. This should be distinguished from the striped forms of *H. nudiflorum.* Var. **grandicéphalum atropurpùreum** has almost entirely crimson fl.-heads. Var. **rùbrum** has deep red fls. A form known in the trade as *H. grandicephalum compactum bicolor* is also advertised. It seems to belong here.

CC. *Disk brown or purplish.*

D. *Lvs. all entire: heads solitary or few, long-stalked.*

Bígelovii, Gray. St. 2–3 ft. high, nearly smooth: upper lvs. narrow to oblong-lanceolate, lower spatulate: heads commonly 1½–2½ in. broad; rays ¾ in. long; fl.-stalk slender. Aug. Wet ground, Calif. S.H. 1:373.

Bolánderi, Gray. St. 1–2 ft. high, stout, somewhat pubescent: lvs. oblong to ovate-lanceolate, the lower obovate: heads commonly 3 in. wide; rays often 1 in. long; fl.-stalks thick, hollow. June–Sept. Low ground, N. E. Calif. Gn. 24, p. 157; 29, p. 191. R.H. 1891, p. 377.—Sometimes grown as *H. grandiflorum.*

DD. *Lower lvs. toothed: heads numerous, corymbose, short-stalked.*

nudiflòrum, Nutt. St. 1–3 ft. high, roughish, leafy: lower lvs. spatulate, toothed: heads 1–1½ in. across; rays wedge-shaped, drooping, yellow, brown-purple or striped with both colors. July–Oct. Moist soils, N. C. to Fla., west to Ill. and Texas.—A garden form, var. **grandicéphalum striàtum,** has fls. over 2 in. across. This form is also sold under the trade name *H. cupreum,* a name of no botanical significance.

BB. *St. and branches not winged.*

Hoòpesii, Gray (*Dugáldia Hoòpesii,* Rydb.). St. 1–3 ft. high, stout, slightly tomentose when young, but soon smooth, branching above into an umbel of several to many fls.: lvs. thickish, entire: heads usually borne singly on long stalks, commonly 3 in. wide; rays but slightly drooping; disk yellow. May–Sept. Rocky Mts.—A very fine border plant, and especially valuable for cut-fls.

H. Doùglasii, Hort.=Monolopia major.—*H. tenuifòlium,* Nutt. Annual. A weed in the S. Atlantic and southwestern states. St. 8 in. to 2 ft. high, very leafy: lvs. thread-like, entire, sessile, often whorled. Va., Fla., west to Mo. and Texas. B.M. 7721.

S. W. FLETCHER.
N. TAYLOR.†

HELEÓCHARIS: *Eleocharis.*

HELIAMPHÒRA (Greek compound, meaning *sun pitcher*). *Sarraceniàceæ.* One of the three genera comprising this singular family, consisting of a single species from the upper lands of British Guiana, and rarely grown in choice glasshouse collections.

Heliamphòra nùtans, Benth., is a perennial, 1–2 ft. high: lvs. all radical and pitcher-form; pitcher tubular and enlarging above, with a flaring open erect oblique mouth and a very small rudimentary lid terminating the midrib, hairy inside and winged down the front, in its native habitat conspicuously veined with red: fls. several on a slender scape, nodding, white or pale rose, each pedicel subtended by a prominent bract; perianth in 4–6 parts which are ovate-pointed; style straight, scarcely enlarging at the stigma. B.M. 7093. G.C. III. 37:194.—This unusual plant was first discovered in 1839 by the brothers Schomburgk, and was rediscovered in 1881 by Burke, an English orchid-collector who brought plants to England. It is a rhizomatous plant, and is prop. by single crowns. The plant is described as growing well in small pots in a mixture of peat, sphagnum and sand, surfaced with sphagnum, the pot plunged to the rim in moss and kept under a bell-glass. It requires much moisture. L. H. B.

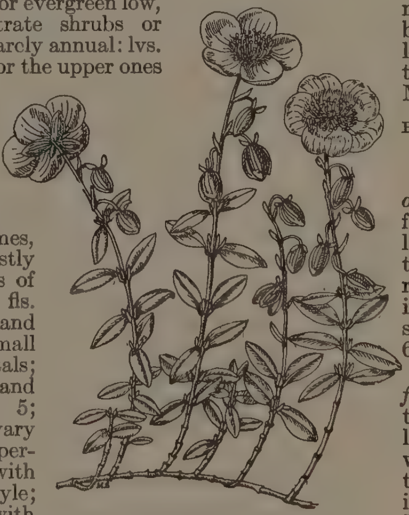
HELIANTHÉLLA (the plant resembles Helianthus). *Compósitæ.* Hardy perennial herbs from North America, with showy yellow heads borne in autumn.

Stem commonly unbranched: lvs. mostly scattered and sessile, linear or lanceolate, entire: heads solitary or few, with yellow infertile rays and a yellow or brownish disk.—Thirteen species. Helianthella belongs to a group of genera distinguished from Helianthus by having the frs. laterally compressed instead of thick and obtusely angled. Other cult. genera of this group are Actinomeris, Encelia and Verbesina, which are distinguished from one another by combinations of fr. and pappus characters.

The single species in cultivation is easily grown in a variety of soils, and is propagated by seeds or by dividing the rootstocks.

quinquenérvis, Gray. St. 2–4 ft. high, nearly smooth: lvs. mostly opposite, 4–9 in. long, the upper sessile: heads 3–5 in. broad, long-stalked, solitary or a few below in the axils of the lvs., with an involucre of large, leafy bracts; rays 15–20, pale yellow, 1½ in. long. June–Sept. Rocky Mts. S. W. Fletcher.

HELIÁNTHEMUM (Greek for *sun flower*). Including *Halímium, Tuberària* and *Fumàna. Cistàceæ.* Sun Rose. Ornamental woody or herbaceous plants grown chiefly for their showy flowers.



1793. Helianthemum Chamæcistus. (×¼)

Half-evergreen or evergreen low, upright or prostrate shrubs or perennial herbs, rarely annual: lvs. usually opposite, or the upper ones alternate, rarely all alternate, small, entire, with or without stipules: fls. in terminal racemose, umbellate or subcapitate cymes, rarely solitary, mostly yellow, sometimes of 2 kinds, earlier fls. with large petals and later fls. with small or without petals; sepals 3, or 5 and unequal; petals 5; stamens many; ovary 1-celled or imperfectly 3-celled, with slender or short style; caps. 3-valved with many or several seeds; embryo curved like a ring or hook (subgen. Halimium), or straight or folded (Helianthemum proper).—About 110 species in N. Amer. (and 3 in. S. Amer.), Eu., N. Afr. and W. Asia. Monograph by Grosser in Engler, Das Pflanzenreich, hft. 14. Cistaceæ, pp. 33–131 (1903); another important work is Sweet's Cistineæ (1825–30) where many species are figured, quoted below as S. C.

The helianthemums are mostly suffruticose or shrubby, less often herbaceous plants, either upright and low, or cespitose or prostrate, with small and usually narrow, often grayish foliage and with yellow or white, less often pink or red, usually profusely produced flowers in terminal racemes or clusters, rarely solitary, appearing during the summer and followed by a capsular fruit inclosed or surrounded by the persistent sepals; the flowers open only in the sun and the delicate petals soon drop. Most of the species are not hardy North without protection and are particularly suited to warmer and drier climates, but *H. Chamæcistus* is fairly hardy North, though in exposed situations it also profits by a protection of mulch: the hardiest of the species mentioned below is *H. canadense*, but it is at the same time the least attractive. They all thrive well in poor sandy or rocky soil, most of them being partial to limestone soil, and demand a sunny position to bloom profusely. They are especially adapted for rockeries and borders particularly the numerous forms of *H. Chamæcistus* which form dense mats; most of the other species are of low twiggy habit. Propagation is mostly by division, also by greenwood cuttings and by seeds which germinate readily, but if several species are grown together the seeds are liable to produce hybrids.

INDEX.

algarvense, 2.
angustifolium, 7.
appeninum, 6.
canadense, 1.
Chamæcistus, 7.
cupreum, 7, 8.
diversifolium, 7.
formosum, 3.
grandiflorum, 7.
hyssopifolium, 7.
lasianthum, 3.
macranthum, 7.
multiplex, 7.
mutabile, 7.
ocymoides, 2.
pilosum, 5.
polifolium, 6, 7.
pulverulentum, 6.
rhodanthum, 6.
roseum, 6, 7, 8.
stramineum, 7.
sulphureum, 8.
tomentosum, 7.
umbellatum, 4.
variabile, 7.
venustum, 7.
vulgare, 7.

A. *Style short and straight, or almost wanting: lvs. without stipules.* (*Halimium.*)

B. *Fls. of 2 kinds, the larger solitary or rarely in 2's, the smaller apetalous ones clustered on lateral branchlets; sepals 5.*

1. **canadénse**, Michx. (*Halímium canadénse*, Grosser). Frostweed. Upright, 1–2 ft., hoary pubescent: lvs. nearly sessile, oblong to linear-lanceolate, acutish, pale beneath, ½–1⅓ in. long: the larger fls. 1 in. across, yellow; sepals 5, the outer linear, the inner ovate, tomentulose. June–Aug. Maine to Mich., south to N. C. and Miss.—Occasionally offered by dealers in native plants.

BB. *Fls. all large and showy, 1½–2 in. across; sepals 3.*

C. *Color of fls. yellow.*

2. **ocymoìdes**, Pers. (*H. algarvénse*, Dun. *Cístus algarvénsis*, Sims). Nearly erect, twiggy shrub, 2–3 ft., hoary-pubescent: lvs. short-petioled, oblong-lanceolate to oblong-spatulate, recurved at the apex, grayish, those of the flowering branchlets sessile, green, ¼–½, rarely to 1½ in. long: fls. yellow with purple eye, 1½ in. across, in loose, long-stalked corymbose clusters; sepals ovate-lanceolate. Spain and Portugal. B.M. 627, 5621. S.C. 40, and vars. 26, 65, 96.

3. **lasiánthum**, Pers. (*H. formòsum*, Dun. *Cístus formòsus*, Curtis). Spreading upright shrub, tomentose: lvs. short-stalked, oval to ovate-oblong or lanceolate, obtuse or acutish, often revolute on the margin, white-tomentose while young, ½–1 in. long: fls. yellow, the petals often spotted purple at the base, 2 in. across, in 1–5-fld. cymes; sepals ovate. Spain and Portugal. B.M. 264. S.C. 50. Gn. 26:420; 53, p. 131. G.M. 34:246. F.S.R. 2, p. 45. G. 16:382.—The most showy species of the genus.

CC. *Color of fls. white.*

4. **umbellàtum**, Mill. (*Cístus umbellàtus*, Linn.). Low shrub, upright or procumbent, 1–2 ft.: lvs. sessile, linear or linear-lanceolate, grayish tomentose beneath, pubescent above, later glabrescent, more or less viscid, ¾–1¼ in. long: fls. about 1 in. across, in whorls or racemose whorls; sepals ovate. Cent. S. Eu. N. Afr. S.C. 5.

AA. *Styles slender, often curved; sepals 5, the 2 outer ones smaller.* (*Helianthemum proper.*)

B. *Stipules subulate, the lower and middle ones about as long as petioles: fls. white or pink.*

5. **pilòsum**, Pers. Low nearly upright or ascending subshrub: lvs. short-petioled, linear or oblong, revolute,

grayish tomentose on both sides or green above, ⅓–¾in. long: fls. white, the petals with yellow blotch at the base, about 1 in. across, in 4–8-fld. cymes; outer sepals oblong or linear, inner ones broadly oval, ⅙–⅕in. long. S. W. Eu., N. Afr. S.C. 49.

6. **apennìnum,** Lam. (*H. polifòlium,* Pers.). Upright or procumbent subshrub, hoary-pubescent: lvs. petioled, elliptic to linear-oblong, grayish tomentose on both sides or green above, ⅓–¾, rarely to 1½ in. long: fls. white, the petals with yellow blotch at the base, 1 in. across in 3–10-fld. cymes; outer sepals linear-oblong, inner ones broadly oval, about ⅓in. long. W. and S. Eu., W. Asia. S.E.B. 2:159. S.C. 62. R.F.G. 3:33 (4554). Var. **ròseum,** Grosser (*H. rhodánthum,* Dun. *H. pulveruléntum* var. *ròseum,* Willk.). Lvs. lanceolate, acutish, ¾–1½ in. long: fls. over 1 in. across, pink to crimson. S.C. 7.

BB. *Stipules lanceolate or subulate, all longer than the petioles: fls. normally yellow, also white or pink.*

7. **Chamæcístus,** Mill. (*H. vulgàre,* Gärtn. *H. variábile,* Spach). Fig. 1793. Low procumbent subshrub, rarely upright: lvs. petioled, usually flat, ovate to linear-lanceolate, green on both sides, hairy or nearly glabrous, ½–1½ in. long: stipules lanceolate: fls. normally yellow, about 1 in. across, in many-fld loose racemes; outer sepals much shorter than the inner broadly oval ones. Eu., W. Asia., N. Afr. L.B.C. 3:202. R.F.G. 3:30 (4547, as var. *concolor*). G.W.H. 111.—This is an exceedingly variable species and numerous forms are cult. in European gardens; the following are perhaps the most noteworthy: Var. **grandiflòrum,** Fiek (*H. grandiflòrum,* Lam.). Lvs. ovate to oblong, green on both sides: fls. yellow, 1¼ in. long. Var. **cùpreum,** Grosser (*H. hyssopifòlium* var. *cùpreum,* Sweet). Lvs. oval to lanceolate, green on both sides: fls. copper-colored, darker toward the base, 1¼–1⅓ in. across. S.C. 58. Var. **tomentòsum,** Grosser (*H. tomentòsum,* Dun. *H. angustifòlium,* Pers. *H. polifòlium,* Hort.). Lvs. oblong to oblong-lanceolate, flat or revolute at the margin, white-tomentose beneath, ¼–¾in. long: fls. yellow. S.E.B. 2:158 and S.C. 34 (as *H. vulgare*). R.F.G. 3:30 (4547, as var. *discolor*). There is a double-fld. form, var. *tomentòsum múltiplex,* Grosser. S.C. 64. Var. **ròseum,** Grosser (*H. ròseum,* Sweet). Lvs. lanceolate, white-tomentose beneath: fls. pink, 1¼ in. across. A form with semi-double fls. is var. *ròseum múltiplex.* S.C. 86. Var. **venústum,** Grosser. Lvs. lanceolate, revolute, white-tomentose beneath: fls. crimson with yellow eye, over 1 in. across. S.C. 10. Var. **mutábile,** Grosser. Lvs. ovate-oblong, flat, grayish tomentose beneath: fls. at first light rose, changing to lilac, finally nearly white. S.C. 106. R.F.G. 3:35 (4556). Var. **stramíneum,** Grosser. Lvs. oval to oblong-lanceolate, flat, white-tomentose below: fls. bright straw-yellow, over 1 in. across. S.C. 93. There is a double-fld. form, var. *stramíneum múltiplex.* S.C. 94. Var. **diversifòlium,** Grosser. Lvs. oval to oblong- or linear-lanceolate, white-tomentose beneath: fls. purplish pink, the petals with a darker copper-colored blotch at the base. S.C. 95. A double-fld. form with purplish red fls. is var. *diversifòlium múltiplex.* S.C. 98. Var. **macránthum,** Grosser. Lvs. ovate-oblong, rather large, thinly grayish tomentose beneath: fls. white, nearly 1¾ in. across, the petals blotched yellow at the base. S.C. 103. There is a form with very double fls., var. *macránthum múltiplex.* S.C. 104.

8. **sulphùreum,** Willd. (*H. apenninum* × *H. Chamæcistus*). Procumbent sub-shrub: lvs. petioled, lanceolate, hairy on both sides, dark green above, grayish beneath, ½–¾in. long; stipules subulate: fls. sulfur-yellow, darker toward the base, about 1 in. across; the 2 outer sepals very small, narrow-lanceolate, the inner ovate. S.C. 37. There is a form with pink fls., var. **ròseum** (S.C. 51 as *H. canescens*), and one with copper-colored fls., var. **cùpreum** (S.C. 66).

H. alpéstre Dun. (H. oelandicum var. alpestre, Benth.). Cespitose subshrub: lvs. ovate-lanceolate to lanceolate, hairy or glabrescent, ½–¾in. long: fl. yellow, ½in. across. Mountains of S. Eu. S.C. 2.—*H. globulariæfòlium,* Pers. (Tuberaria globulariifolia, Willk.). Perennial; lvs. mostly radical, long-stalked, ovate, hairy, 1–2 in. long: fls. in simple or branched racemes, yellow with purple eye, 1¾ in. across. S. Eu., N. Afr. B.M. 4873 (as H. Tuberaria).—*H. lunulàtum,* Lam. Cespitose subshrub: lvs. elliptic-oblong, green on both sides, glabrescent or sparingly hairy, ⅓–½in. long: fls. solitary, yellow, ½in. across; petals with crescent-shaped spot at the base. Italy. R.F.G. 3:26 (4529).—*H. Tuberària,* Mill. (Tuberaria vulgaris, Willk.). Perennial: lvs. mostly radical, oval-lanceolate to obovate, grayish tomentose beneath, 1–3 in. long: fls. in simple or branched racemes, yellow, 1½ in. across. S. Eu., Afr. S.C. 18.—*H. Tuberària,* Hook. f.=H. globulariæfolium.

Alfred Rehder.

HELIÁNTHUS (Greek, *helios,* the sun, and *anthos,* a flower). *Compósitæ.* Including *Harpàlium.* Sunflower. Hardy herbaceous perennial and annual plants, rather coarse in habit, with yellow flowers which are mostly large, numerous and borne in autumn.

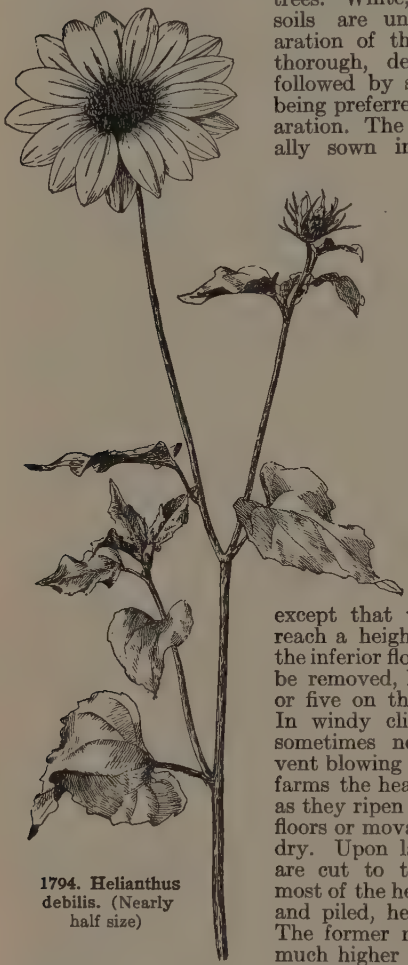
Leaves generally opposite below and alternate above, but this is not a constant character: heads pedunculate, solitary or corymbose, terminating the st. or branches; disk-fls. perfect, yellow, brown or purplish, with a tubular 5-limbed corolla; rays neutral, yellow.—Altogether there are about 60 species, mostly N. American, and many of the plants grown for sunflowers are now considered as belonging to other genera. The genus is very variable, and there are also many natural hybrids; hence the species are difficult to delimit. The old notion that the flower-heads follow the sun from east to west has been substantiated for *H. annuus.* (See Botanical Gazette, vol. 29:197.) Garden monographs are found in Gn. 27, p. 66; 45, p. 372; 49, p. 326 and 55, p. 146.

Sunflowers are of the easiest culture, and are adapted to a variety of soils. They are seen to best advantage when planted in masses, rather than as solitary specimens, and should be given plenty of room, being gross feeders. Most sunflowers, especially *H. annuus,* are too coarse to be harmonious near the house, but find an effective setting in the background, against the shrubbery border. A few species, however, especially *H. orgyalis* and *H. debilis,* are worth growing for their foliage alone. The annual species are propagated by seeds or cuttings; the perennial chiefly by division. All varieties of *H. multiflorus* root readily from both soft and hardwood cuttings. The double forms rarely produce fertile seeds and must be propagated by division. The seeds of annuals may be planted directly in the border, but it is best to start them indoors in March. Perennial kinds, particularly forms of *H. multiflorus,* should be taken up in late fall or early spring, every two years, and the rootstocks divided and replanted; otherwise the roots will ramble away, and the flowers will deteriorate. All thrive in a light, dry soil; but *H. annuus* and *H. giganteus* may be used to advantage for drying malarial spots. Sunflowers do not thrive in very shady places.

Commercial uses and cultivation of the common sunflower. (M. G. Kains).

Sunflowers (*H. annuus*) are cultivated extensively in Russia, India and Egypt; less widely in Turkey, Germany, Italy and France. The seeds from the large-seeded variety are sold upon the streets in Russia as we do peanuts, except that they are eaten raw. The small-seeded variety is preferred for the manufacture of oil. When cold-pressed, a citron-yellow sweet-tasting oil, considered equal to olive or almond oil for table use, is produced. The resulting oil-cake, when warm-pressed, yields a less edible fluid, which is used for lighting, and in such arts as woollen dressing, candle- and soap-making. The oils dry slowly, become turbid at ordinary temperatures and solid at 4° F. For stock and poultry feeding, and for other purposes, sunflower oil-cake is about equal in value to that of flax- and cotton-seed. The cake is largely exported by Russia to Denmark and

Sweden, and to some extent to other European markets. Sunflower stems and heads make an excellent paper, and the stems furnish a fine fiber that compares favorably with silk. They are, however, generally used for fuel, since the above industries have not been developed. —Sunflowers grow readily in many soils, but best results are secured upon light, rich, calcareous or alluvial land, well supplied with moisture and unshaded by trees. White, clayey and poor soils are unfavorable. Preparation of the soil should be thorough, deep fall plowing followed by spring harrowing being preferred to spring preparation. The seeds are generally sown in drills running north and south, 30 inches apart, 9 inches asunder in the drill, and 1 inch deep. Sometimes they are transplanted from nursery beds when 4 to 6 inches tall. About a week after the plants appear they are thinned to 18 inches apart. From four to six pounds of the seed will sow an acre. Cultivation is the same as for corn, except that when the plants reach a height of 3 to 4 feet, the inferior flower-heads should be removed, leaving only four or five on the principal stem. In windy climates hilling is sometimes necessary to prevent blowing down.—On some farms the heads are harvested as they ripen and placed upon floors or movable pole-racks to dry. Upon larger areas they are cut to the ground when most of the heads have ripened and piled, heads up, to cure. The former method insures a much higher grade of oil, and is therefore preferred. Every effort is made to prevent fermentation, either in the heads or in the pile of seeds, since this injures the quality of the oil. When thoroughly dry the heads are either placed on racks or piled, face downward, on a floor and beaten with flails. The seeds are then spread thinly, shoveled over occasionally, and allowed to become perfectly dry before being sent to the mill. The average yield is about fifty bushels to the acre. The percentage of husks ranges from 40 to 60; and the oil from 15 to 28. As a general rule, 100 bushels of seed will yield 33 bushels of kernels, 100 bushels of kernels from 280 to 320 gallons of oil of both qualities. Russian sunflower, a large-seeded variety, producing a single head, grows 8 feet tall, but is less esteemed for oil-production than the small-seeded varieties. In America the sunflower industry is small.



1794. Helianthus debilis. (Nearly half size)

The red sunflower. (T. D. A. Cockerell.)

In the summer of 1910 Mrs. Cockerell found a red sunflower growing by the roadside close to her home at Boulder, Colorado. It was a variation of the native sunflower of the plains (*Helianthus annuus* var. *lenticularis*, or *H. lenticularis*), having the rays suffused with chestnut-red. It was named var. *coronatus*, the arrangement of the red, with the black disk, suggesting the sun in eclipse, with its corona. Since the sunflower is sterile with its own pollen, it was necessary to cross the red one with yellow-rayed kinds, such as the garden *H. annuus*, and the yellow-rayed wild plant. The next summer, it was found that about half the progeny had red rays: it was determined that red was dominant, and assumed that the plant originally found was heterozygous for red, through variation occurring in a germ-cell. Crossing red with red, homozygous or pure-bred reds were obtained, with very rich colors. Most sunflowers carry a factor for marking, which affects the distribution of red, so that many of the flowers were bicolored with the ends of the rays yellow (var. *bicolor*) while others had a ring of red (var. *zonatus*). Some had the rays entirely chestnut-red (var. *ruberrimus*). A variety obtained in 1914 had the rays practically black. So far, the red of the red sunflowers was a chestnut, or brown-red. The pigment, however, belongs to the anthocyan group, and is chestnut only because seen on a background of orange. In order to obtain a new color, the homozygous red was crossed with Sutton's primrose variety (var. *primulinus*, Ckll., "Science," August 29, 1913, page 312). In the first generation (raised in the greenhouse during the winter) the flowers were all red on orange, or chestnut-red. These crossed together gave seventy-one chestnut-red, nineteen yellow, twenty-five wine-red and eight primrose; theoretical expectation, according to Mendel's law, being sixty-nine, twenty-three, twenty-three, and eight. The wine-red is due to the same anthocyan pigment, but on a primrose-yellow (pale yellow) background. In good examples, the color is nearly that known as "old rose." The various patterns are as in the chestnut-red forms. The wine-red sunflower was named var. *vinosus*. In addition to the above, various other varieties have been developed, including red and wine-red semi-doubles and doubles. There are also hybrids with *Helianthus cucumerifolius*, of relatively small stature and with shiny foliage. One of these hybrids, represented in the 1914 cultures by a number of plants, may be described as follows: About 4 feet high, spreading, much branched: stems speckled with purple: leaves dark green, very shiny, blades broad and short, strongly dentate: involucral bracts with long tapering ends (but not so long as in true *H. cucumerifolius*); disk small (about 1 inch diameter); rays ample, broad, numerous, with basal half rich chestnut, apical half bright lemon; disk very dark. This is a plant of the second generation from the original cross. For further details see "Popular Science Monthly," April 1912; "Science," August 29, 1913, pages 312, 313; August 21, 1914, pages 283–285, November 13, 1914, pages 708, 709 and January 1, 1915, pages 33, 34. "Garden Magazine," July, 1914. The red sunflower is now offered by the trade in America, England, Germany and Italy. It has also been grown successfully in Australia and New Zealand.

INDEX.

æstivalis, 6.
angustifolius, 5.
annuus, 1.
argophyllus, 2.
atrorubens, 7.
bicolor, 1.
californicus, 1, 19.
citrinus, 1.
cordatus, 17.
cucumerifolius, 3.
debilis, 3.
decapetalus, 11.
divaricatus, 12.
doronicoides, 16.
duplex, 11.
flore-pleno, 11.
giganteus, 13.
globosus, 1.
grandiflorus, 6, 11.
grosse-serratus, 9.
hirsutus, 21.
lætiflorus, 20.
lævigatus, 8.
lenticularis, 1.
macrophyllus, 10.
major, 11.
Maximilianii, 14.
maximus, 11.
missouriensis, 6.
mollis, 17.
multiflorus, 11.
nanus, 1.
niger, 1.
orgyalis, 4.
plumosus, 3.
primulinus, 1.
pumilus, 18.
purpureus, 3.
rigidus, 6.
ruberrimus, 1.
scaberrimus, 6.
sparsifolius, 7.
semi-plenus, 6, 20.
simplex, 11.
strumosus, 10.
subtuberosus, 13.
texana, 2.
trachelifolius, 22.
tuberosus, 15.
variegatus, 1.
vinosissimus, 1.
vinosus, 1.
zonatus, 1.

KEY TO THE SPECIES.

A. *Plants annual: lvs. long-petioled: disk brown or purplish.*
B. *St. erect, stout, simple or branching above.*
C. *Pubescence rough* .... 1. **annuus**
CC. *Pubescence usually silky* .... 2. **argophyllus**
BB. *St. diffuse, slender, branching freely from the base* .... 3. **debilis**
AA. *Plants perennial by creeping rootstocks: lvs. sessile or short-petioled.*
B. *Disk brown or purplish.*
C. *Lvs. linear, entire (except the lower), sessile.*
D. *St. rough* .... 4. **orgyalis**
DD. *St. usually smooth* .... 5. **angustifolius**
CC. *Lvs. ovate to broad-lanceolate, mostly toothed, narrowed at the base into a winged petiole.*
D. *Rays numerous, the fls. 2½–4 in. broad* .... 6. **scaberrimus**
DD. *Rays 10–16, about 1 in. long*.. 7. **atrorubens**
BB. *Disk yellowish.*
C. *St. smooth below, the branches often slightly rough or pubescent.*
D. *Foliage pale beneath.*
E. *Lvs. prevailingly lanceolate.*
F. *The lvs. glabrous on both sides* .... 8. **lævigatus**
FF. *The lvs. roughened beneath* .... 9. **grosse-serratus**
EE. *Lvs. prevailingly ovate*.....10. **strumosus**
DD. *Foliage green on both sides*
E. *Lvs. stalked*..............11. **decapetalus**
EE. *Lvs. sessile or nearly so*....12. **divaricatus**
CC. *St. rough or hairy below.*
D. *Rootstocks thickened into one or more fleshy tubers.*
E. *Lvs. prevailingly lanceolate.*
F. *The lvs. rough only above.*13. **giganteus**
FF. *The lvs. rough both sides.*.14. **Maximilianii**
EE. *Lvs. prevailingly ovate* .....15. **tuberosus**
DD. *Rootstocks all slender.*
E. *Lower lvs. sessile or with a clasping base.*
F. *Lvs. sessile*.............16. **doronicoides**
FF. *Lvs. cordate, clasping*....17. **mollis**
EE. *Lower lvs. short-petioled.*
F. *St. 1–2 ft., not branching*..18. **pumilus**
FF. *St. usually over 3 ft., branching.*
G. *The st. smooth and glabrous*...........19. **californicus**
GG. *The st. usually rough and hispid.*
H. *Foliage equally rough on both sides*......20. **lætiflorus**
HH. *Foliage rougher above than beneath.*
I. *The lvs. short-petioled*...........21. **hirsutus**
II. *The upper lvs. narrowed at the base.*22. **tracheliifolius**

1. **ánnuus,** Linn. COMMON SUNFLOWER. St. 3–12 ft., rough-hairy, often mottled: lvs. 4–12 in. long, broadly ovate, acute, the lower cordate, coarsely serrate, rough on both sides, 3-nerved: fls. 3–6 in. wide in wild specimens, often 14 in cult. July–Sept. Minn. to Texas, west to Wash. and Calif. Gn. 27, p. 68. Gt. 43, p. 95 and B.R. 1265 (as *H. lenticularis*).—A valuable economic and ornamental plant. The lvs. are used for fodder, the fls. yield a yellow dye, the seeds furnish an oil and are used for food. It is grown for food chiefly in Russia. *H. annuus* has long been in cult. as an ornamental, and has varied into many distinct forms. Common varieties are: Var. **califórnicus,** Hort., very large and double; var. **citrìnus,** Hort., with primrose-colored rays (Gn. 49, p. 327); var. **globòsus fistulòsus,** Hort., enormous globular heads (Gn. 27, p. 68); var. **nànus fl. pl.,** Hort., (Globe of Gold), dwarf and double, valuable for borders; **Russian Giant,** 10–12 ft. high, single, grown mostly for seed; var. **variegàtus,** Hort., with variegated lvs.

The *H. lenticulàris,* Douglas, is commonly referred to *H. annuus.* Cockerell supposes, however, that *H. lenticularis* is the wild species from which the cultivated forms of *H. annuus* are derived. Even so, *H. annuus,* being a Linnæan name, must stand. The many interesting mutations and hybrids observed and produced by Cockerell are based on the wild *H. annuus* (or *H. lenticularis*). Placing his variants under *H. lenticularis,* he names them as follows: Var. *bícolor,* Ckll., rays red, tipped yellow; var. *zonàtus,* Ckll., rays red-banded; var. *rubérrimus,* Ckll., rays chestnut-red throughout; var. *primùlinus,* Ckll., primrose-yellow; var. *vinòsus,* Ckll., rays wine-red; var. *vinossíssimus,* Ckll., rays entirely dark wine-red; var. *nìger,* Ckll., rays practically black above and slightly red at tip. This group of variants comprises the red sunflowers, now in cult. (See account also by Cockerell, page 1446.)

2. **argophýllus,** Torr. & Gray. SILVERY-LEAVED SUNFLOWER. St. usually solitary, 4–5 ft. high, soft gray, with a dense, silky pubescence, especially the upper branches. Otherwise like *H. annuus,* into which it seems to vary under cult. if the seedlings are not constantly selected for their silky character. Texas. The

1795. Clump of Helianthus orgyalis.

var. **texàna,** Hort., which does not differ botanically from the type, is an attractive form of this species. R.H. 1857, p. 431. Gn. 12, p. 280; 27, p. 67; 55, p. 147.

3. **débilis,** Nutt. (*H. cucumerifòlius*, Torr. & Gray). Cucumber-leaved Sunflower. Fig. 1794. St. 1–4 ft. high, usually several together, hairy throughout: branches often mottled with purple or white, each one bearing a fl.: lvs. 1–4 in. long, ovate to triangular, generally with a cordate base, thin, glossy, irregularly toothed or entire: fls. 2–3 in. wide, on slender peduncles. July–Sept. Fla. to Texas and westward. G.C. III. 17: 167. Gt. 44, p. 571. B.M. 7432. Gn. 49:326.—This is one of the best for cut-fls. It needs a sandy soil. Var. **plumòsus,** Hort. Disk-florets ligulate, from pale to deep yellow. Var. **purpùreus,** Hort. Ray-florets varying in color from light pink to deep purple.

1796. **Helianthus decapetalus var. multiflorus.**
(See species No. 11)

4. **orgyàlis,** DC. Fig. 1795. St. 8–10 ft. high, strict, smooth, very leafy to the top: lvs. 8–16 in. long, acuminate, slightly rough, drooping: fls. numerous, lemon-yellow. Sept., Oct. Dry plains, Neb. to Texas and westward. Gn. 27, p. 67; 55, p. 147. F.R. 2:146.—This species has distinct and attractive foliage, which is not at all coarse. A well-grown plant will produce spikes of fls. nearly 4 ft. long.

5. **angustifòlius,** Linn. Swamp Sunflower. St. 2–6 ft. high, simple or branching above, slightly rough: lvs. 2–7 in. long, somewhat tufted, drooping, in dried-up specimens with rolled edges, smooth or slightly rough: fls. 2–3 in. wide, few or solitary. Aug.–Oct. Wet land, N. Y. to Fla., west to Ky. and Texas. B.M. 2051.

6. **scabérrimus,** Ell. (*H. rígidus*, Desf. *H. missiouriénsis*, Schwein.). St. 1–3 ft. high (rarely 5–8 ft.), strict, sparingly branched, rough or hairy: lvs. 6–12 in. long, oblong to ovate-lanceolate, firm, thick, rough-hairy, entire or slightly toothed: fls. 2½–4 in. wide, showy, long-stalked; rays numerous, about 1½ in. long; disk sometimes yellow at first, turning brown. Aug.–Oct. Minn. to Ill., Ga., and Texas prairies. B.R. 508 (as *H. atrorubens*). B.M. 2020 (as *H. diffusus*); 2668 (as *H. atrorubens*). Gn. 27, p. 68. G. 3:391; 17: 544 (both as *Harpalium rigidum*).—After *H. decapetalus* this species is one of the best perennial sunflowers. It varies under cult. chiefly in the direction of doubling and in lengthening the blooming period. Some of the best garden varieties are **æstivàlis, grandiflòrus, semiplènus** and **Miss Mellish.**

7. **atrórubens,** Linn. (*H. sparsifòlius*, Hort.). Purple-disk Sunflower. St. 2–5 ft. high: lvs. usually thin, sometimes hoary beneath: fls. about 2 in. across; rays few (10–16), rarely over 1 in. long; disk dark red. Otherwise like *H. rigidus*, to which it is inferior. Va. to Fla., west to Ohio and La. G.M. 52:827 (as *H. sparsifolius*).—Suitable for dry shady places.

8. **lævigàtus,** Torr. & Gray. St. 2–5 ft., simple or branched above: lvs. 3–6 in. long, lanceolate, smooth, entire or slightly toothed: fls. 1–1½ in. broad, few or solitary; rays 6–10, usually less than 1 in. long. Aug.–Oct. Va. to N. C.

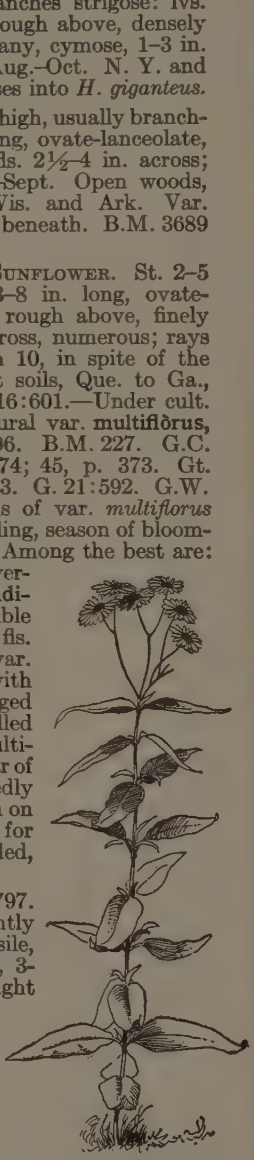
9. **gròsse-serràtus,** Mart. St. 6–10 ft. high, very smooth, glaucous, the smaller branches strigose: lvs. long-lanceolate, slender-petioled, rough above, densely hairy or canescent beneath: fls. many, cymose, 1–3 in. broad; rays 10–20, deep yellow. Aug.–Oct. N. Y. and Pa. to Mo., south to Texas.—Passes into *H. giganteus.*

10. **strumòsus,** Linn. St. 3–7 ft. high, usually branching, often glaucous: lvs. 3–8 in. long, ovate-lanceolate, rough above, entire or toothed: fls. 2½–4 in. across; rays 8–15, 1–1½ in. long. July–Sept. Open woods, Canada to Ga. and west to Wis. and Ark. Var. **macrophýllus,** Britt. Lvs. downy beneath. B.M. 3689 (as *H. mollis.*).

11. **decapétalus,** Linn. Wild Sunflower. St. 2–5 ft. high, branched above: lvs. 3–8 in. long, ovate-lanceolate, sharply serrate, thin, rough above, finely pubescent beneath: fls. 2–3 in. across, numerous; rays light yellow, generally more than 10, in spite of the specific name. July–Sept. Moist soils, Que. to Ga., west to Mich. and Ky. G.C. II. 16:601.—Under cult. it has given rise to the horticultural var. **multiflòrus,** (*H. multiflòrus*, Hort.). Fig. 1796. B.M. 227. G.C. III. 10:421. Gn. 27:66, pp. 71, 74; 45, p. 373. Gt. 43, p. 554. Gng. 3:83. F.R. 2:413. G. 21:592. G.W. 47:627.—The many garden forms of var. *multiflorus* differ mainly in the extent of doubling, season of blooming, habit of plant and size of fl. Among the best are: Var. **flòre-plèno** (sometimes advertised as var. **dùplex**) and var. **grandiflòrus,** almost completely double (G. 4:427; 11:231); var. **màjor,** fls. larger than common (G. 4:163); var. **máximus,** very large, single fls. with pointed rays; var. **símplex,** an alleged single form; **Soliel d'Or,** with quilled florets, like a cactus dahlia. Multiflorus varieties are the most popular of perennial sunflowers, and deservedly so. If the double forms are grown on poor soil, or are allowed to remain for several years without being divided, they become single.

12. **divaricàtus,** Linn. Fig. 1797. St. 1–6 ft. high, glabrous or slightly rough at the summit: lvs. sessile, rough above, pubescent beneath, 3-nerved, standing out nearly at right angles to the st.: fls. few or solitary, 2 in. across; rays 8–15. July–Sept. Dry woodlands, Canada to Fla., west to Neb. and La.

13. **gigantèus,** Linn. Indian Potato. St. 3–12 ft. high, stout: lvs. 3–7 in. long, lanceolate, very rough, serrate or nearly entire: fls. usually several, 1½–3 in.



1797. **Helianthus divaricatus.**

broad, mostly long-stalked; rays 10–20, barely 1 in. long, cupped, pale yellow: seeds smooth. Aug.–Oct. Wet ground, Canada to Fla., west to Neb. B.M. 7555. G.W. 2, p. 44; 7, p. 451; 8, p. 469. Var. **subtuberòsus,** Brit. A northern form with unusually fleshy roots, which were formerly collected by Indians for food; hence "Indian potato."

1798. Helianthus mollis var. cordatus.

14. **Maximílianii,** Schrad. St. generally 2–4 ft. high, sometimes 8–10: lvs. inclined to be trough-shaped: fls. on short, densely pubescent peduncles; rays 15–30, generally 1½ in. long, deep yellow. Otherwise like *H. giganteus*, of which it is probably the western form. Aug.–Oct. Dry plains, west of Mississippi River. V. 20:169.

15. **tuberòsus,** Linn. Jerusalem Artichoke. St. 5–12 ft., branched above: lvs. 4–8 in., usually ovate, acuminate, serrate, rough above, finely pubescent beneath: fls. several or numerous, 2–3 in. across; rays 12–20: seeds pubescent. Gn. 27, p. 68. B.M. 7545.—Frequently cult. for its edible tubers. See *Artichoke, Jerusalem.*

16. **doronicoìdes,** Lam. St. 3–7 ft. high: lvs. 4–8 in. long, ovate-oblong, narrowed toward both ends, rough on both sides, finely toothed: fls. numerous, in loose panicles; rays 12–20, broad. Otherwise as *H. lætifolius.* Aug., Sept. Dry soils, Ohio to Mich., Mo., and Ark. B.M. 2778 (as *H. pubescens*).

17. **móllis,** Lam. St. 2–5 ft. high, stout, very leafy, hoary villose, at least when young: lvs. 3–5 in. long, ovate-lanceolate, white-pubescent or rough on upper side: fls. solitary or few, 2–3 in. broad; rays 15–25. July–Sept. Barren soils, Ohio to Ga., west to Iowa and Texas; also on L. I. Gn. 55:146. Var. **cordàtus,** Fig. 1798, has recently been discovered. It has broader, thicker and cordate lvs. G.F. 2:137 (adapted in Fig. 1798).

18. **pùmilus,** Nutt. St. rough and hairy throughout: lvs. only 5–7 pairs, 1–4 in. long, ovate-lanceolate: heads few, short-peduncled; disk yellow. E. Rocky Mts. and adjacent plains.

19. **califórnicus,** DC. St. 3–8 ft. high: lvs. lanceolate, serrate, rough on both sides: fls. loosely paniculate, about 2½ in. wide. Calif.—Very suitable for low moist situations. Most of the plants grown under this name are garden forms of *H. annuus.*

20. **lætiflòrus,** Pers. Showy Sunflower. St. 4–8 ft. high, leafy and rough-hairy: lvs. 4–10 in. long, ovate-lanceolate, more or less serrate, rough on both sides: fls. several, 2–4 in. broad, short-peduncled; rays 15–25, about 1½ in. long, showy. Prairies, Ind., Ill., Wis. Gn. 45:372. G.M. 31:204.—A desirable helianthus. The garden form *H. semi-plenus* is better than the type. Resembles tall-growing forms of *H. rigidus*, but disk yellow.

21. **hirsùtus,** Raf. St. 2–4 ft. high, densely hairy: lvs. ovate-lanceolate, thick, very rough, pubescent and pale beneath: fls. several, 2–3 in. across; rays 12–15. July–Oct. Dry soils, Pa. to Ga., west to Wis. and Texas.

22. **tracheliifòlius,** Mill. Resembles *H. strumosus*, but st. and fl.-stalks usually rough-hairy and lvs. thinner, green on both sides: branches and fl.-stalks rough-hairy. Aug., Sept. Dry soil, Pa. to Wis.

H. ciliàris, DC. Fl.-heads large; rays bright golden-yellow; disk-florets dark brown. A pretty floriferous species. Texas, Ariz., Mex.—*H. coloradénsis*, Ckll. Allied to H. fascicularis and H. grosseserratus: 6 ft., in clumps: sts. strict, reddish and glaucous: lvs. elongate-lanceolate, rough, margins remotely dentate, the upper ones alternate and the lower opposite: bracts of involucre very long and slender, long-ciliate at base: disk yellow, and rays bright orange. Colorado. Var. *Andrèwsii*, Ckll. Rays deep orange, much richer in color.—*H. macrophýllus satìvus* of horticultural literature, with tubers edible and in taste resembling Jerusalem artichoke, is probably H. strumosus var. macrophyllus, Britt., or possibly H. giganteus var. subterosus, Britt. There are many forms of wild sunflower that may come into cult., through dealers in native plants. These should be sought in the regular manuals of botany. The genus allows of different botanical interpretations.

S. W. Fletcher.
N. Taylor.†

HELICHRỲSUM (Greek for *sun* and *gold;* referring to the flower-heads). Syn., *Elichrỳsum. Compósitæ.* Old World herbs or shrubs, mostly African and Australian; some of them are grown for everlastings, being, with Helipterum, amongst the most important plants for that purpose; annuals and perennials.

Flower-heads large, solitary, with fls. of 2 kinds, the outermost ones with pistils only; involucre dry and chaff-like, the stiff overlapping scales glabrous, often colored; heads large, terminating the branches, normally yellow, but now varying into many colors in long-cult. forms.—Probably 400 species. Easily grown as hardy annuals in any garden soil but doing best in a rich loamy soil. Very few are grown in U. S., except *H. bracteatum.*

A. *Lvs. oblong or narrow: grown for everlastings.*

B. *Heads large, solitary.*

bracteàtum, Andr. Fig. 1799. Stout annual, 1½–3 ft. tall, somewhat branched, the terete sts. nearly or quite glabrous: lvs. many and rather large, oblong-lanceolate, narrowed to a short petiole, entire, green: heads terminating the branches, 1–2½ in. across, yellow or orange, the short and obtuse involucre-scales imbricated. Austral.—Perhaps the most important single everlasting fl. grown in this country, particularly for bold or heavy design work. It is very variable, particularly in color. R.H. 1896:551. The heads are pure white in var. **álbum,** Hort. (*H. álbum*, Hort. *H. níveum*, Graham. B.M. 3857); scales tipped with red in var. **bícolor,** Hort. (*Elichrỳsum bícolor*, Lindl. B.R. 1814); dark scarlet in var. **atrococcíneum,** Hort. (*H. atrococcíneum*, Hort.); dark blood-red in var. **atrosanguíneum,** Hort. The forms with very large heads are often known as *H. macránthum*, Hort. The double forms are often known as *H. monstròsum*, Hort. Other portraits of this species will be found in B.R. 24:58. R.H. 1851:101.

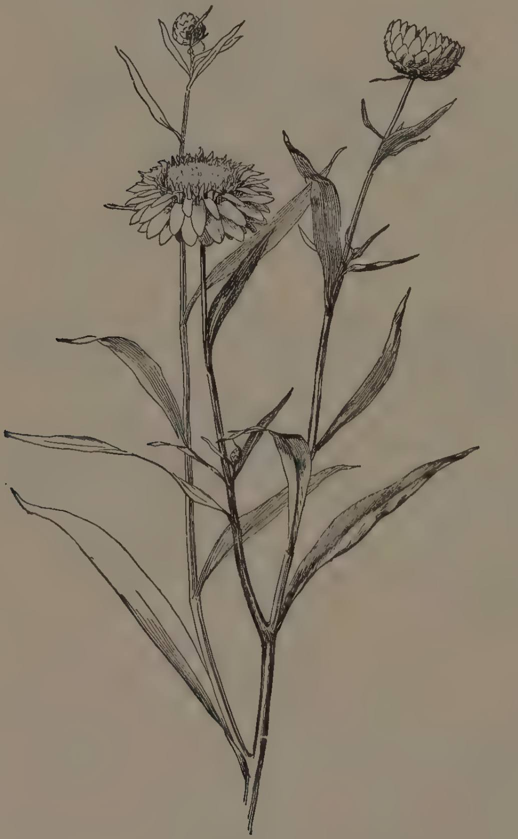
BB. *Heads medium to small, in clusters.*

C. *Color yellow or orange.*

arenàrium, DC. Yellow Everlasting. A foot or less high, herbaceous: lvs. plane, white-woolly, the lower ones oblong-obovate and long-attenuated into a petiole, the upper ones linear-lanceolate and acute: heads globular, in compact little corymbs, bright yellow. Perennial, in sand, France.—Apparently not cult. in this country. See *Everlastings*, p. 1183.

orientàle, Gaertn. (*Gnaphàlium orientàle*, Linn.). St. simple, 1½ ft. or less tall: lvs. oval-oblong to lanceolate, obtuse, sessile, rather small: heads bright yellow, small, globular, in corymbs. S. Eu. to Asia Minor. G. 1:805.—Much cult. in Medit. regions, but little known in this country.

apiculàtum, D. Don. Perennial, 1–2 ft., tomentose, leafy below: lvs. lance-spatulate, the base more or less spatulate: beads ½in. across, in small heads or clusters, orange-yellow, the scales sharp-pointed. Austral. —Little known in this country, and doubtfully hardy north of Philadelphia.



1799. Helichrysum bracteatum. One of the choicest everlastings. (×⅓)

CC. *Color white or nearly so.*

grandiflòrum, Less. Perennial, somewhat woody, decumbent at the base: lvs. crowded near the base, sessile, obovate to oval or oblong, obtuse, woolly on both sides: heads hemispherical, in corymbose clusters, glossy, cream-color, ¼in. across. S. Afr.—Greenhouse plant north of Washington.

diosmæfòlium, Sweet (*Ozothámnus rosmarinifòlius*, Hort.). Tall, upright: lvs. very small, narrow-linear (½in. or less long), the margins revolute: heads small and numerous, white. Austral., sometimes grows 20 ft. high. Gn. 34:409; 55:222.—Cult. in S. Calif. by Franceschi.

AA. *Lvs. ovate or broader: border and vase plants.*

bellidioìdes, Willd. Slender-stemmed, trailing, nearly woody perennial: lvs. light green above, woolly beneath, ovate-spatulate, ¼–½in. long, flat: heads solitary, about ½in. diam., of the "everlasting" type; receptacle convex or nearly conical. New Zeal. G.C. III. 53:266, 436. Gn. 77, p. 253. G. 35:341. G.M. 56:286. —Not common in cult. but useful as a prostrate perennial; not hardy N.

hùmile, Andr. (*Aphelèxis hùmilis*, Don). A low spreading, greenhouse perennial, with lvs. lacking tomentum, but sometimes woolly in the axils: lvs. round-backed, usually ⅛–¼in. long: scales of the involucre rosy. S. Afr.—A showy, but little-known species.

petiolàtum, DC. (*Gnaphàlium lanàtum*. Hort.). Tender perennial, cult. for its long, woolly sts. and woolly lvs., either as an edging in ribbon borders or as an ornament in lawn vases: lvs. petiolate, ovate and broad at the base, obtuse: heads (not often seen in cult.) in branched cymes, the involucre scales obtuse, cream-white. S. Afr.—An old garden plant. Prop. by cuttings from stock plants carried over winter.

H. Coòperi, Harvey. Bush with golden yellow fl.-heads. Afr.—*H. Guilélmii*, Engler. A robust perennial covered with white wool except the fl.-heads. E. Trop. Afr. B.M. 7789. Var. *Mèyeri*, G.C. III. 31, p. 4, note. Fls. arranged more loosely.—*H. Selàgo*, Benth. & Hook. f. Small, much-branched shrub: fl.-heads small, terminal, sessile, ¼in. across. New Zeal.—*H. Vólkensii*, O. Hoffm. Shrubby, with sts. and branches covered with white shaggy hairs: outer bracts bright rose, inner whitish and longer. E. Afr. G.C. III. 31:169, desc.

L. H. B.
N. Taylor.†

HELICÒDEA: *Billbergia.*

HELICODÍCEROS (Greek, *spirally 2-horned*). *Aràceæ.* Odd spathe-bearing plant, from a tuber, sometimes grown as pot specimens; odor offensive.

The extraordinary plant shown in Fig. 1800 is known as the "hairy arum" and sold by the bulb-dealers as *Arum crinitum.* When in flower it has a disgusting odor which attracts carrion flies and bright green insects as uncanny as the plant itself. The plant is the only species in its genus, the hairiness of the spadix being a very distinct character. Helicodiceros and Dracunculus are alike in having few ovules, which are fastened at the top and bottom of the cell, but in the latter the staminate and pistillate fls. are close together, while in the former they are separated by a sterile portion. Arum differs from both genera in having the ovules fastened in 2 series at the side of the cell. The lvs. of Arum are spear- or arrow-shaped, while in the other two they are pedately cut.

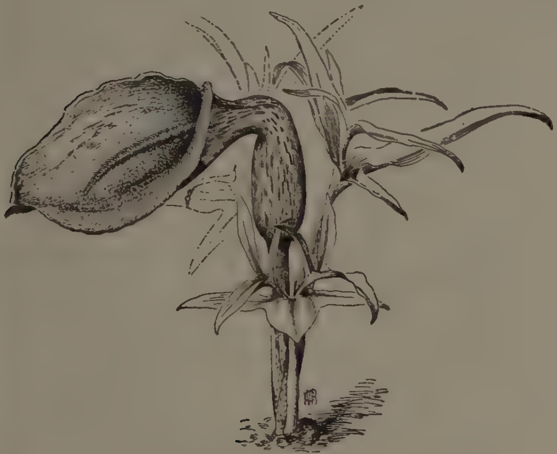
This plant is worth growing once, since it is one of the curiosities of horticulture. It may be secured from bulb-dealers in the autumn and flowered under glass in the spring. It is a most vile-smelling plant when in full flower. The plucky artist who drew the accompanying picture of this arum wrote at the bottom of his drawing, "Air 'em."

muscívorus, Engler (*H. crinìtus*, Schott. *Árum crinìtum*, Ait. *Dracúnculus crinìtus*, Schott.). Fig. 1800. Height 1½ ft.: spathe-limb purple, covered with purple hairs. Corsica. B.R. 831. F.S. 5:445. G. 11:585; 19:515.

Wilhelm Miller.

HELICÒNIA (Mt. Helicon, in Greece, seat of the Muses). *Musàceæ.* Foliage plants allied to Musa, grown in a warmhouse along with alocasias, anthuriums and calatheas.

From Musa, Heliconia differs chiefly in having a dry, often dehiscing, 3-loculed, 3-seeded fr.: fls. in clusters below the lvs., subtended by bracts after the way of Musa; sepals 3, linear, free or somewhat joined to the corolla; corolla short-tubed; stamens 5; staminodium 1: lvs. large and striking, often beautifully marked: sts. arising from a strong rootstock.—Perhaps 35 species in Trop. Amer., various of which have been intro. into cult., but the following are the only ones appearing in the American trade. Many species are being described from trop. Asia, and there is doubt about the American nativity of the genus. Some writers consider the Old World species as of the genus Heliconiopsis, which in the absence of evidence is not maintained here. For the botany of this very much perplexed genus, see Griggs, Bull. Torrey Club 20:640–664. Baker, Ann. Bot. 7:189–200. K. Schumann in Engler's Pflanzenreich, hft. 1 (1900). H. N. Ridley, G.C. III. 44:13.



1800. Helicodiceros muscivorus. (×⅛)

A. *Bracts of the infl. ovate-acuminate, deeply boat-shaped.*

Bihâi, Linn. (*H. caribǽa*, Lam.). Balisier. Wild Plantain. Becoming 10–15 ft. tall, banana-like: lvs. oval or oblong-oval, long-petioled, transversely ribbed, the blades 3–5 ft. long: blossom-sheaths very large, scarlet and black, the fls. red or orange. W. Indies and south. B.R. 374. L.B.C. 3:252.—A most striking plant, often seen in glasshouse collections. It is naturalized in the Old World tropics, and is the parent of many horticultural forms, of which the next two are almost surely examples.

aûreo-striàta, Bull. Perhaps a form of the preceding: lvs. beautifully striped along both midrib and transverse veins with golden yellow: sts. striped with yellow and green: lf.-limb oval-acuminate not decurrent: fr. ½in. long, obconic, orange. I.H. 29:464; 42, p. 289 (where a list of the best kinds will be found). S.H. 2, p. 133. F.R. 3:493. G.Z. 26, p. 123.—Very handsome. The best-known kind. Ridley considers this distinct from *H. Bihai*, but says he knows no native country for the species.

illústris, Bull. (*H. rùbro-striàta*, Hort.), is of the general style of the last, but the rib and veins are marked with pink and the lf.-bases are somewhat decurrent. Var. **rubricaûlis**, Hort., has more red, the petiole being bright vermilion; fr. red about ¼in. long. R.H. 1896:36 (where a review is made of the species). R.B. 21, p. 69. Gn. 52, p. 359. G. 20:369; 29:431. G.W. 2, p. 115; 7, p. 389.

AA. *Bracts of infl. lanceolate-acuminate, not boat-shaped.*

Michólitzii, Ridley. A very large plant forming large tufts: sts. 2 ft. or more tall, 3 in. across, pale green, marbled with gray: lvs. pale green, blade about 3 ft. long and about 1 ft. wide: infl. about 12 in. long on a hairy peduncle: rachis yellow, dotted with green: fls. 14 or more in each bract, the latter long-acuminate, white; sepals and petals acute, brownish; stamens slender, anthers linear: fr. orange, pear-shaped. New Ireland.—May not be a true Heliconia.

angustifòlia, Hook. (*H. bícolor*, Benth.). Dwarfer, whole plant not over 4 ft. tall: lvs. long and narrow, 1½–2½ ft. long, 3–6 in. wide, green: peduncle erect, glabrous; fls. yellowish green, 6–10 in each glabrous red bract. S. Amer. B.M. 4475.

H. insígnis, Hort., intro. by F. Sander & Son in 1912, is of uncertain botanical origin. It is described as "with dark bronzy-green lvs." and may be some form of H. metallica, Planch., which is described as dark shining green and purple beneath when young. B.M. 5315.—*H. Lêhmannii variegàta*, Hort., advertised by Royal Palm Nurseries, is of doubtful botanical position. It is described as "a stocky, broad-lvd. plant, somewhat resembling a miniature banana, with lvs. striped with creamy yellow, and having yellow sts."

N. Taylor.†

HELICOPHÝLLUM (*spiral leaf;* lateral segments of the pedatisect leaves sometimes twisted). *Aràceæ.* Nine or ten arisæma-like herbs of western Asia and delta of the Nile, of which one species may appear in collections; very little planted in the coolhouse, or in the open in mild climates with some protection.

Tuberous-rooted herbs, with radical lvs. and fls. appearing together: scape shorter than lvs., bearing a single inflorescence: spathe with an oblong tube and an erect or more or less hooded limb; spadix tailed, mostly included or short, the middle part with neutral fls.; apetalous; stamens 2; ovary 1, 1-celled, 2- or 4-ovuled: fr. an ovoid or globose berry. *H. Álberti*, Regel, is a stemless plant with a dark maroon-purple spathe 7 in. long: spadix 5 in. long, the appendix protruding and blackish purple: lvs. of young plants simple, oblong-lanceolate; of mature plants oddly divided, the "blade hastate, acuminate, undulate, concave at the base, with 2 lateral spreading horn-like horizontal basal lobes, and between them 2 long linear erect ones that are nearly as long as the blade, and face it; these front lobes have each on the outer margin below the middle a curved horn-like process." E. Bokhara. B.M. 6969. G.C. III. 36, suppl. Oct. 29.—Blooms in late spring, and requires protection.

L. H. B.

HELIOCÈREUS (*sun* and *cereus*). *Cactàceæ.* Procumbent plants with weak stems clambering over rocks and bushes.

Branches strongly angled: ribs usually 3 or 4, bearing clusters of spines from all the areoles: fls. diurnal, large and showy, with a short tube; petals elongated; stamens long and numerous, declined; ovary and fr. spiny.—The four species known all come from Mex. The species of this genus readily hybridize with species of Epiphyllum (Phyllocactus) and other related genera, giving rise to many horticultural varieties.

speciòsus, Brit. & Rose (*Cèreus speciòsus*, Cav.). Sts. freely branching at base, 1 in. diam., with a few aërial roots: spines in fascicles of 5–8, needle-like: fls. appearing from the older growth of the sts., 6 in. diam., remaining open for several days, purple-red: fr. 1½–2 in. long.

amecaénsis, Brit. & Rose (*Cèreus amecaénsis*, Heese). A recent introduction similar to the above, but with perfectly white fls. It is not common in this country, but is common in Eu.

J. N. Rose.

HELIÓPHILA (Greek, *sun-loving;* grows in the open country of the Cape). *Cruciferæ.* This genus includes a blue-flowered half-hardy annual that grows mostly a few inches high and is sometimes advertised in catalogues of flower seeds.

Heliophila contains about 80 species of annual and subshrubby perennials, natives of S. Afr. The transversely twice-folded cotyledons are an important character of the genus: other important generic characters are pods sessile or pedicelled, 2-celled, 2-valved, dehiscent: seeds in a single row, often winged: racemes long and leafless, and fls. yellow, white, rosy or sky-blue: lvs. various.

pilòsa, Lam. A very variable species, with st. 6–24 in. high, erect or diffuse, simple or unbranched from the base: lower lvs. often opposite, the rest alternate: fls. normally sky-blue, with a yellow center, but the natural varieties include lilac and yellow. The typical *H. pilosa* has a st. that is rough with spreading hairs: lvs. hairy, either oblong or linear, entire or sometimes lobed near apex, cuneate at base: pods linear, erect or spreading. Var. **incìsa**, Sonder, has lvs. linear-cuneate, 3-cut at the apex, rarely 5-cut, the lobes linear or acuminate. B.M. 496 (as *H. arabioides*). Wilhelm Miller.

HELIÓPSIS (Greek, *like the sun*). *Compósitæ.* Hardy herbaceous plants, bearing numerous yellow flowers in autumn.

Stem erect, loosely branching: heads yellow, long-stalked, borne in loose terminal or axillary panicles both radiate and discoid: lvs. opposite, petioled, 3-ribbed, oblong-ovate to ovate-lanceolate, coarsely toothed. Heliopsis has no pappus, while in Helianthus the pappus has 2 awns. In Heliopsis the rays have pistils, but may be fertile or sterile. In Helianthus the rays have no pistils at all.—About 10 species, all native of N. Amer. They are all perennials except one, and that is not cult. They are not common in gardens because of the more attractive forms in Helianthus. *H. helianthoides* var. *Pitcheriana*, however, deserves wider popularity. For cult., see *Helianthus*.

helianthoìdes, Sweet (*H. lævis*, Pers.). St. 3–5 ft. high: lvs. 3–5 in. long, thinnish, smooth on both sides or roughish above, opposite or sometimes in 3's: fls. numerous, 1½–2½ in. broad, long-stemmed. July–Oct. Open places, Canada to Fla., west to Ill. and Ky. B.M. 3372. Gn. 25, p. 237. Var. **Pitcheriàna** (*H. Pitcheriàna*, Hort.). A dwarf, more branching and bushy form, 2–3 ft. high, with a spread of 3–4 ft.: fls. produced much more freely than in the preceding and a deeper yellow. One of the best hardy plants for the perennial border, being especially valuable for cutting and for planting in dry places. A.G. 16:323. F.R. 2:259.

scàbra, Dunal. Differs from *H. helianthoìdes*, chiefly in being rough throughout: upper lvs. sometimes entire: heads few, often solitary. B.R. 592 (as *H. canescens*). Var. **gratíssima**, Hort. Fl.-heads large, brilliant pale yellow. Var. **imbricàta**, Hort. "A dwarf form with fls. 3 in. diam., golden yellow." Var. **màjor**, Hort. Larger in every way than the type. J.H. III. 33:359. Var. **zinniæflòra**, Hort. "A double form, there being several series of ligulate florets." R.H. 1908, p. 419. Dry soils, Maine to N. J. and west to Mo.

S. W. Fletcher.
N. Taylor †

HELIOTROPE: *Heliotropium.*

HELIOTRÒPIUM (heliotropic; *turning to the sun*). *Boraginàceæ.* Heliotrope. Popular glasshouse plants, prized for their flowers and fragrance.

Herbs or rarely shrubs, with small fls. in terminal, forking often scorpioid clusters and alternate simple lvs.: corolla short funnelform or salver-shape, the throat mostly open (sometimes constricted); stamens 5, attached to the tube, not exserted, the filaments very short; ovary 4-loculed and splitting into 4 nutlets (or two 2-loculed nutlets) when ripe, surmounted by a simple style.—Species upward of 250, in the warmer regions of the globe, many of them annuals. There is a heliotrope (*H. curassávicum*, Linn.) native to the U. S., from Del. and S. Ill. southward on seashores and in salty soils, with white or bluish fls. and oblong or linear lvs.; another species (*H. tenéllum*, Torr.) in open dry lands from Ky. to Kans. and southward, with white scattered or somewhat umbellate fls. and very narrow revolute lvs.; several species in the southern states and southward; also a naturalized species (*H. indicum*, Linn.) with bluish scented fls. and oval or ovate-rugose lvs.

The garden heliotropes seem to be derived from 2 species. **H. peruviànum**, Linn., is perhaps the leading species. Fig. 1801. Lvs. oval or oblong-lanceolate, very veiny, not conspicuously narrowed at the base: fls. small, in a close cyme, the corolla-tube little longer than the calyx. Peru. B.M. 141. G. 8:252. Vanilla-scented. *H. regale* is a garden race of this, with very large clusters and fls. of variable color. Gt. 50, p. 163. **H. corymbòsum**, Ruiz & Pav. (*H. grandiflòrum*, Don), has longer and relatively narrower lvs., which are distinctly narrowed to the base, fl.-clusters larger and more open, fls. nearly twice larger and the corolla-tube nearly twice longer than the calyx; calyx-teeth longer and narrower. Peru. B.M. 1609. Narcissus-scented. Many of the large-trussed and large-fld. garden varieties are apparently of this species rather than of the former; or possibility the two are hybridized. Originally both species were violet-fld. but the colors are now in various shades of purple, and there are white-fld. forms. **H. Voltaireànum**, Hort., is a compact garden form, and said to be a hybrid. P.M. 16: 100. Another species, **H. europæum**, Linn., is rarely seen in old collections, and it is sparingly naturalized. It is a hoary-downy annual herb 6–30 in. high, with long-petioled oval lvs., and white fls. in scirpioid racemes. **H. incànum**, Ruiz & Pav., of W. S. Amer., is perhaps in cult. as a greenhouse shrub: 2–3 ft.: lvs. thick, ovate, crenulate, more or less silky, hoary beneath: fls. white, in forking spikes, the corolla twice exceeding the calyx. Var. **glàbrum**, G.C. II. 22:809, has lvs. rough, nearly destitute of silky covering, broader and more ovate, a denser infl., a larger and more hairy calyx and purple fls. **H. anchusæfòlium**, Poir., of Brazil to Argentina, is said sometimes to be found in gardens and it is recorded as spontaneous in parts of this country; it is odorless: perennial, with 4-angled hispid st.: lvs. lanceolate to linear-lanceolate, sessile, entire: fls. violet, about ¼in. across. B.M. 8480.
L. H. B.

1801. Heliotropium peruvianum. (×½)

Heliotrope, apart from its use as a border plant and for bedding, being a universal favorite, usually forms part of the stock in trade of florists who do a local business, ranking next to the geranium as a pot-plant for spring trade. For cut-flowers in winter it is equally popular, but its lasting qualities when cut are uncertain. Successful growers think that for best results, strong stems and good keeping qualities, it should be grown in a moderately cool, airy house. Some of the best are grown in a house suited to violets and mignonette, where the temperature seldom rises to 50° F. at night.

Stout, soft cuttings make the best plants, and root easily in a temperature of 60° F. From the time they are inserted, sufficient water must be given to prevent wilting. A propagating-bed is not required. Ordinary flats will do—the medium half-leaf soil and sand. They must be well shaded for a week or so. They are very liable to the cutting-bench fungus, and should be potted or boxed off as soon as rooted, which should be in ten or twelve days. Any light soil will do, and it need not be rich for the first shift.

LII. Heliotrope, an old-time favorite.

For winter flowers, cuttings may be taken in July and treated as above. Some of the plants among the spring batch with straight stems may be grown along for standards by taking out the side shoots until 2 feet high. These make handsome drooping specimens. By pruning about midsummer they may be kept in good condition for years.

Heliotropes may be grown in the same pots for several years, by using fairly rich top-dressing or weak liquid manure in growing season.

Stock intended for spring cuttings is better grown continuously in pots, as the plants lift badly in the autumn. A few left-over bedding-plants may be grown along in pots, purposely for stock. As a matter of fact, stock taken from these pot-plants root more readily than those taken from plants grown outdoors. A good plan is to prune them rather closely a few weeks before the time for taking cuttings comes, say in January. In this way we secure an even lot of cuttings, and all at one time.

Heliotrope is extensively used as a bedding-plant, is a favorite in window-gardens, and is much grown by florists for cut-flowers. The ease with which it may be grown either in pots or the garden, the color and fragrance of its dainty flowers, and the continuity of bloom, have all contributed to make it a general favorite.

There have been numerous garden varieties and a number of hybrids—white and the different tints of blue predominating. Floral catalogues rarely mention, however, more than six to eight varieties. Madame de Blonay has been a favorite white for years, while Queen of Violets is perhaps the finest of the blues. Chieftain is a lighter tint. Albert Delaux is a variety with golden variegated foliage, but variegated heliotropes are undersirable. Among seedlings double forms occasionally appear. They have no special merit, and are seldom perpetuated. T. D. HATFIELD.

HELÍPTERUM (Greek for *sun* and *wing;* said to refer to the light-plumed pappus). Including *Acroclínium* and *Rhodánthe. Compósitæ.* Half-hardy annual or perennial herbs cultivated as everlastings or immortelles.

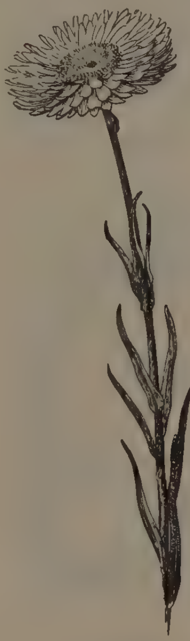
Flowers mostly perfect, with 5-toothed open corollas: achenes woolly, bearing a pappus of many plumose bristles: involucre glabrous, obovate or top-shaped, silvery or rose-colored: plants mostly glabrous.—About 60 species in Austral. and S. Afr. This and Helichrysum, from which it is distinguished by its plumose not roughened pappus-hairs, are amongst the most important of everlasting fls. The cult. kinds are annual herbs (or grown as such), of easiest cult. in any garden soil.

1802. Helipterum Manglesii. Generally known as Rhodanthe. (×⅓)

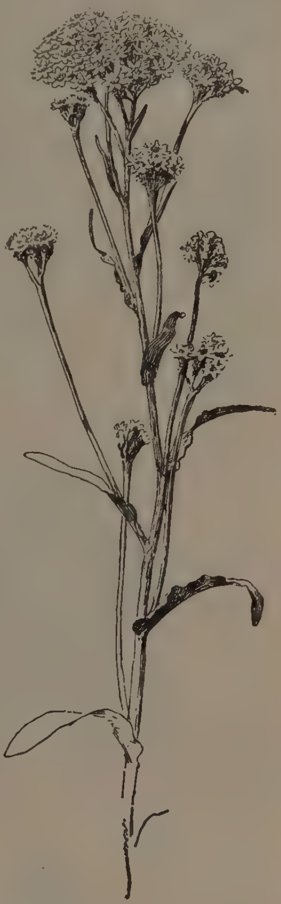
A. *Heads large, many-fld.*

B. *Lvs. broad.*

Mánglesii, Muell. (*Rhodánthe Mánglesii*, Lindl. *Roccárdia Mánglesii*, Voss). Fig. 1802. Neat glaucous annual, 12–18 in. tall, with very slender, long pedicels, bearing pretty nodding showy heads: lvs. thin, oval or elliptic, clasping: involucre silvery-chaffy, the ray-florets originally clear handsome pink, but now varying to white (*R. álba*, Hort.), and to dark red (*R. atrosanguínea*, Drumm.). R.H. 1852:141. Var. **maculàtum** (*R. maculàta*, Drumm. *Roccárdia Mánglesii* var. *maculàta*, Voss), is usually larger, with shorter lvs. and involucre flecked with red: rays pink or white. Austral. F.S. 22:2291. B. R. 1703.—A charming plant, and one of the few everlastings which retains much of its grace and beauty after being dried. There are double-fld. forms, i.e., those with all or nearly all the florets ligulate. Excellent also for pot culture. Seeds of the mixed varieties are sometimes sold under the name *Rhodanthe varius.*



1803. Helipterum roseum. (×½)



1804. Helipterum Humboldtianum. (×½)

BB. *Lvs. linear.*

ròseum, Benth. (*Acroclínium ròseum*, Hook. *Roccárdia ròsea*, Voss). Fig. 1803. Annual, 1–2 ft. high, glabrous, with many strict simple branches from the crown, each st. terminated by one large head: lvs. numerous, alternate, small and linear: rays many, pointed, bright pink (or varying to white in *H. álbum*, Hort.). Austral. B.M. 4801.—A serviceable plant.

AA. *Heads small, clustered.*

Humboldtiànum, DC. (*H. Sánfordii*, Hook. *Roccárdia Humboldtiàna*, Voss). Fig. 1804. Annual (or cult. as such), erect or with a decumbent base, the sts. somewhat branching: lvs. (and sts.) white-tomentose, at least when young, linear or lance-linear, pointed, alternate: heads small, oblong, yellow, in a dense terminal corymb. Austral. B.M. 5350. V. 3, p. 160.

corymbiflòrum, Schlecht. (*Roccárdia corymbiflòra*, Voss). Annual, lower than the last, more branchy: lvs. broader: heads 2–3 times larger, top-shaped, in small corymbs, the prominent rays white. Austral.

L. H. B.
N. TAYLOR.†

HELLÉBORUS (ancient name of *H. orientalis*, meaning unknown). *Ranunculàceæ.* HELLEBORE. Hardy herbaceous perennials, admired for their very early flowers and also their attractive leaves.

Erect, with large palmately divided lvs., the basal long-petioled, the upper sessile and sometimes reduced to bracts: fls. large, white, greenish, red, purple, or yellowish; sepals 5, broad, petal-like, mainly persistent; petals small, tubular, furnished with claws; stamens many: carpels 3–10, sessile, forming leathery, many-seeded caps., dehiscent at the apex.—About 8 species, natives of Eu. and W. Asia. Monographs by J. G. Baker in G.C. II. 7:432 (1877) and by Thos. Moore in G.C. II. 11:431 (1879).

All the kinds will thrive in ordinary garden soil, but for the best results use a soil of rich loam and coarse sand, with a top-dressing of rotten manure. A moist, well-drained, partially shaded situation is preferable. The species may be planted in shrubbery borders, and in rockeries, or if wanted for cut-flowers they should be planted in beds. An important point is not to disturb the plants when once established, as they are very sensitive to frequent changes of location. All the species bloom before spring arrives; a few mild days in December or January will bring out the buds and flowers of *H. niger* varieties, and the others are not far behind. White hellebore is not of this genus: see *Veratrum.*

1805. Christmas rose, Helleborus niger. (×1/3)

They are easily forced under glass. Strong plants should be taken up into large pots and gradually inured to a warm temperature. Blossoms may thus be brought forth at any time desired in winter. Propagation is best by division of roots in fall or spring. Gardeners prefer to divide the roots in late summer or fall, as this does not come at the flowering season. If seeds mature they will germinate well if planted immediately in boxes or in rich, open ground. Seedlings should bear flowers the third season.

A. *Lvs. dying annually, thin.*

víridis, Linn. St. scapose: rootstock creeping: 1 basal lf. 8–12 in. broad, on petiole 6–10 in. long; segms. 7–11, oblong, acute, sharply serrate: fl.-st. hardly exceeding the basal lf., bearing 3–6 fls. and large, lf.-like bracts: fls. large, yellowish green; sepals broadly oblong, obtuse, spreading: caps. about 4, as long as the sepals, transversely ribbed; style erect. Eu. Naturalized in eastern states. G.C. II. 25:553.—Not so much used as the other species here given. Var. **purpuráscens,** Waldst. & Kit. Differs chiefly in the central lf.-segms. being deeply palmately cleft, and the fls. much tinged with purple, especially on the outside. Hungary. B.M. 3170.

AA. *Lvs. evergreen, coriaceous.*

B. *Fl.-st. never more than once forked; fls. 1 or 2.*

nìger, Linn. CHRISTMAS ROSE. Fig. 1805. Stemless: rootstock short, black: only 1 lf. somewhat irregularly divided into lobes, toothed on the outer half; petiole 5–7 in. long: fl.-st. simple or once branched; fls. very large; sepals white, or flushed with purple: caps. 6–8. Rocky places, Eu. B.M. 8. Gn. 55, p. 13. J.H. III. 51:591; 61:583. G.W. 10, p. 245. Gn.M. 8:279. G. 27:534. C.L.A. 9:288. Var. **angustifòlius,** Hort. (var. *mìnor,* Hort.). Plant and lf. similar, but fls. small. Very pretty. G.C. II. 21:85, and III. 21:19. G.M. 50:933. G.W. 2, p. 230. Gn.W. 23:45. Var. **altifòlius,** Hayne (var. *màjor,* Hort. Var. *máximus,* Hort.). Petiole reaching 1 ft. long: fls. the largest in the genus, 3–5 in. across, and often several on same st. Gn. 14:178; 48:6. G.C. II. 20:693. A.G. 11:63; 21:41. G. 1:657; 8:537; 11:395; 6:367; Var. **præcox,** Hort. Fls. smaller than in type, from Sept. to Feb.

BB. *Fl.-st. forked 2 or 3 times; fls. several or many.*

C. *Without lvs. on st. below infl.*

orientàlis, Lam. Stemless; short creeping rootstock: 1 radical lf., 7–9-lobed; segms. 6 in. long, 1½–2 in. broad, acute, serrate in the outer half, pubescent, with strongly raised veins beneath; petiole 1 ft. long: fl.-st. over 1 ft. high, forked above, 2–6-fld., large, lf.-like bracts; sepals roundish, imbricated, white, purple beneath and purple edges, spreading: caps. oblong, shorter than the sepals, transversely ribbed; style erect or incurved. Asia Minor. Gn. 47, p. 136. G. 18:79.—There are numerous varieties of this beautiful species.

Purple-fld. varieties of H. orientalis.

Var. **cólchicus,** Regel. St. purple-spotted, quite glaucous: 1 lf. to each fl.-st.: fls. 3–6 on a st., deep bright purple, both inside and out. Asia Minor. B.M. 4581. J.F. 2, pl. 140 (both as *H. atrorubens*). Gt. 1860:293. Var. **cólchicus-punctàtus,** Moore. Fls. deeper plum-purple, more glaucous, exquisitely mottled inside with innumerable dark dots. Gn. 16:60, f. 8.—One of the handsomest of all the hellebores.

Var. **abchásicus,** A. Braun. Much like var. *Colchicus,* but differing in having 2 or more lvs. to a fl.-st. Caucasus region. Gt. 1866:496 (as *H. caucasicus* var. *abchasicus,* Regel).

Var. **atrórubens,** Waldst. & Kit. Only 1 lf. on a fl.-st. glabrous, thinner in texture than in the rest of the orientalis group: segms. narrow: fls. 2–4 on a st.; sepals dark purple outside, greenish purple within. Hungary. R.H. 1865:231.—A connecting link between the viridis and orientalis groups.

Var. **rùbro-purpùreus,** Hort. (*H. atropurpùrea,* Hort.). A seedling of var. *atrorubens,* with bold foliage and purple fl.-sts.: fls. spreading, deep purple. Characters well fixed and very handsome. Gn. 16:60, f. 1. R.H. 1884:564.

Purple-fld. hybrids of the varieties of *H. orientalis* are found in the trade under the following names: Var. *elegans;* var. *iridescens; F. C. Heinemann,* fls. very large, imbricated, deep purple and mottled; *Frau Irene Heinemann,* fls. rose-purple outside, greenish white, with dark lines and dots inside; *Gretchen Heinemann,* red-fld., strong grower; *Hofgarten-Inspector Hartwig,* fls. rose-purple without and greenish within; *Apotheker Bogren,* rose-purple, very large.

White-fld. varieties of H. orientalis.

Var. **olýmpicus,** Lindl. Glabrous: fls. small, but spreading, very numerous; sepals green on outer surface, white within. Bithynia. B.R. 28:58.—Hybrids closely allied to this have been given the trade names: Willy Schmidt and Prof. Dr. Schleicher.

Var. **guttàtus,** A. Braun. Glabrous, green st.: sepals green outside, white within and elegantly spotted with purple-crimson dots. Caucasus region.—Two allied hybrid forms are named: Commerz Benary and Albin Otto. Gn. 16:60, f. 4. G.M. 54:73.

Var. **antiquòrum,** A. Braun. Glabrous, green mottled st.: fls. as in var. *olympicus,* but more imbricated, maintaining the bell-shaped form. B.R. 28:34 (as *H. orientalis,* Lindl.). Gn. 16:60, f. 3.

Green-fld. variety of H. orientalis.

Var. **caucásicus,** A. Braun. Lvs. very glossy; segms. more oblong than in the type, often 3 or 4 in. broad: sepals round, pale green, much imbricated. Caucasus region. G.M. 51:873. Gn.W. 24:44.

cc. *With lvs. on st. below infl.*

fœtidus, Linn. True st. 1 ft. high, marked with lf.-scars near the base: lvs. coriaceous, with petioles 3–6 in. long: fl.-st. branched low down; sepals green or bordered with bright purple, under 1 in. long, stamens of same length. Fls. in late winter and early spring. W. Eu.

H. córsicus, Willd. (H. lividus, Auth.). Lvs. trifoliate, dirty yellowish green in color; lfts. broad-ovate, sharply toothed on margins. Blooms March to April. Corsica, Sardinia.—*H. lividus,* Ait. Under cult. a robust plant with thick, fleshy sts.: radical lvs. simple, cordate; cauline trifoliate: fls. 2½ in. across, dull purple-gray, tinged with green, nodding, in panicles of 6–8. Balearic Isls. B.M. 72;7903. G. 27:422.

K. C. Davis.

HELÒNIAS (Greek, referring to swamp). *Liliàceæ.* Swamp-Pink. Stud-Pink. A hardy perennial bulbous plant in wet places from northern New Jersey to North Carolina and is sold by dealers in native plants for bog-gardening.

Rootstock stout and tuberous: scape hollow, bracted, bearing at the top a short dense spike of rather showy purple fls.: segms. 6, persistent; stamens 6: caps. obovoid, 3-lobed, dehiscent above.—One species.

bullàta, Linn. Lvs. several or numerous, thin, dark green, clustered at the base of the scape, 6–15 in. long, ½–2 in. wide, with fine parallel nerves: scape stout, bracted below: in very early spring it bears a hollow scape 1–2 ft. high, crowned by a raceme 1–3 in. long, composed of perhaps 30 pink or purplish fls., each ½ in. across, 6-lobed, and with 6 blue anthers. B.M. 747. L.B.C. 10:961. B.B. 1:402.—Helonias, which is perfectly hardy, is so easily prop. by division that it is hardly worth while to grow from seed. Under cult., also, it seems rarely to mature perfect seed. It multiplies itself rapidly from offsets, a single plant often providing a dozen others in a season. It is found growing in dense shade and also in the full glare of the sun, always in wet sphagnum bog in the latter case, while in the shade it sometimes spreads to dry ground. Although one of the showiest of all American bog-plants, it is comparatively little known here, though better in England. It makes an elegant pot-plant.

Harlan P. Kelsey.
Wilhelm Miller.

HELONIÓPSIS (Greek, *like Helonias*). *Liliàceæ.* Herbaceous plants resembling the swamp-pink, *Helonias bullata,* in the color of flowers, but the flowers are larger and fewer, and the leaves numerous and tufted.

Scapose plants, with fls. few in a raceme or sometimes solitary: style a conspicuous feature, being long and red, tipped with a purple undivided stigma, while in Helonias the style is very short and 3-cut. Both genera are separated from numerous allied genera by the septicidal dehiscence of their caps. The fls. are bell-shaped, drooping, deep pink, 6-lobed, with 6 red filaments and purple-blue stamens.—The genus has about 4 species in Japan and Formosa.

japónica, Maxim. Rootstock short, stout, with long root-fibers: lvs. oblanceolate, persistent, green tinged brown or purple: fls. pink or rose-colored, on rather long pedicels, in few-fld. racemes: seeds small, very numerous, with a conspicuous tail at each end. Japan. B.M. 6986.—It grows in the mountains of Japan at an altitude of 2,000–7,000 ft., and is presumably hardy.

breviscàpa, Maxim. (*H. grandiflòra,* Franch. & Sav.). Rootstock præmorse, thick and short: radical lvs. spatulate, acuminate; scape-lvs. short: pedicels very short; perianth blush-white, the segms. obovate; style and stamens scarcely exserted: seeds appendaged. Japan. G.C. III. 37:178. Gn. 68:52.—Recommended in England for early spring bloom and hardy; requires a damp and shady position.—Entire plant 6–8 in. high.

H. umbellàta, Baker, from Formosa, has oblanceolate mucronate lvs., st. 3–5 in. high, and 3–10 fls. in an umbel, the segms. obtuse and scarcely 1 line wide.

L. H. B.

HELWÍNGIA (after G. A. Helwing, 1666–1748, a German clergyman, who wrote on the botany of Prussia). *Araliàceæ.* A curious deciduous shrub, remarkable for the reason that the small, inconspicuous greenish flowers are borne in clusters on the midribs of the leaves at about the center of their upper surfaces.

Flowers diœcious, short-pedicelled, with obsolete calyx, 3–5 petals and stamens and 3–4-celled ovary: fr. a berry-like, 3–4-seeded drupe.—Two species in Japan and Himalayas. Of not much decorative value and therefore rarely cult., but interesting on account of the unusual position of the fls.; hardy as far north as Boston. It seems to grow in any soil that is somewhat moist. Prop. by greenwood cuttings under glass.

japónica, Dietr. (*H. rusciflòra,* Willd.). Bushy shrub, 3–5 ft. high: lvs. petioled, ovate or elliptic-ovate, acuminate, serrate, stipulate, 1½–3 in. long: fls. in June, the staminate generally with 3, the pistillate with 4 petals. Japan. S.Z. 86. A.G. 13:8.

A. Phelps Wyman.

HELXÌNE (from the Greek to *tear,* because the seeds catch on the clothes). *Urticàceæ.* A small creeping herb with filamentous branches: lvs. alternate, small, entire, roundish: fls. monœcious, pistillate in the axils of the lower lvs., staminate in axils of upper. One species, *H. Soleiròlii,* Req., from Corsica and Sardinia. Sts. slender, reddish: lvs. bright green, cordate-reniform: fls. inconspicuous.—A good plant for the alpine garden, to be grown in moderate shade.

HEMEROCÁLLIS (Greek, *beautiful for a day;* because the blossoms fail at night). *Liliàceæ.* Yellow Day Lily. Popular yellow- and orange-flowered stout-rooted glabrous perennials with abundant radical foliage, prized for their hardiness and the showy bloom in spring and summer.

Erect with more or less branching scapes overtopping the long keeled lvs. which are both radical and 2-ranked at the base of the scape: fls. lily-like, mostly horizontal or oblique; tube short, inclosing the ovary; segms. 6, much exceeding the tube, oblong or spatulate; stamens 6, inserted in the throat, declined, the filaments slender, the style simple; ovary oblong, 3-celled, becoming a loculicidally 3-valved caps.: seeds black, spherical.—Species about a half-dozen, Eu. to Japan.

Hemerocallis includes the lemon lily (*H. flava*), one of the hardiest and best of herbaceous perennials. All the blue and white day lilies belong to the genus Hosta; all the yellow and orange day lilies belong to Hemerocallis. The yellow day lilies have narrow, grass-like foliage, and their flowers have wider funnels; the blue and white day lilies have very broad foliage, which is not at all grass-like. The plants are all remarkably free from enemies, and need no protection of any kind, even in the severest winters. The roots are bundles of fleshy tubers, and are sometimes classed with bulbs in catalogues of nurserymen. Small plants will bloom the first year from the nursery. Clumps can often be left undivided for four or five years without loss in size or number of flowers, but as a general thing all robust-growing herbaceous perennials should be divided frequently. In old clumps the roots often become firmly matted near the middle, and the wasteful competition between the too-numerous roots weakens the vitality of the plant and the flowers are likely not to be good. Next to *H. flava*, the oldest garden favorites among the yellow day lillies is *H. fulva*, sometimes called brown day lily, and erroneously in some catalogues the lemon lily. *H. fulva* is a taller plant, with later and orange-colored flowers and wavy inner segments. *H. aurantiaca* has come into prominence, and its var. *major* by some connoisseurs is considered the finest of all day lilies. As a rule, double forms are not so popular as the types, and they lack the simplicity and definite character of the single flowers. Yellow day lilies have a wholesome fragrance. The individual flowers are short-lived, but there is a good succession. The plants thrive in almost any garden soil, but are most luxuriant along the borders of ponds or moist places, and in partial shade. The flowers are excellent for cutting. Plants propagated by division. R. B. Whyte gives the succession of bloom at Ottawa, Canada, as follows: *H. Dumortierii*, June 4; *H. minor*, *H. Middendorfii* and *H. Thunbergii*, June 11; *H. rutilans*, June 18; *H. fulva*, July 2; *H. aurantiaca* var. *major*, July 9; *H. fulva* var. *Kwanso*, July 23, and *H. disticha fl.-pl.*, July 30. The common species, particularly *H. fulva*, often colonize about yards, and along roadsides, sometimes making great areas of foliage and very little bloom. There are several worthy hybrids in cultivation in the choice collections of plants (see supplementary list).

1806. Hemerocallis flava.

INDEX.

aurantiaca, 8.
citrina, 5.
crocea, 6.
Cypriani, 9.
disticha, 9.
Dumortierii, 7.
flava, 1.
flore-pleno, 7, 9.
fulva, 9.
graminea, 6.
graminifolia, 6.
hupehensis, 9.
Kwanso, 9.
longituba, 9.
luteola, 3.
maculata, 9.
major, 3, 8.
Middendorffii, 4.
Minor, 6.
pallens, 3.
rutilans, 7.
Sieboldii, 7.
Thunbergii, 2.
variegata, 9.

A. *Group of yellow-fld. species: fragrant.*

1. **flàva**, Linn. LEMON LILY. Fig. 1806. Lvs. 18–24 in. long, 6–8 lines wide: scapes longer than the lvs.; corymb 6–9-fld.; pedicels 12–24 lines long; tube 6–15 lines long. Eu., Temp. Asia. B.M. 19. A.G. 17:437; 24:363. Gn. 48, p. 400. G.W. 8, p. 277.—Blooms in June in the N. U. S.

2. **Thúnbergii**, Baker. Except for its later flowering, according to Baker, this species does not differ materially from *H. flava:* lvs. 6–7½ lines wide: corymb loose, 8–10-fld., with 1 or 2 fls. lower down; tube nearly 1 in. long; fls. lemon-yellow, opening widely, 3 in. across; segms. membranous, crisped. Japan. Intro. 1890.—Said to differ from all others in having the upper 6–10 in. of the scape thickened and flattened.

3. **lutèola**, Hort. Hybrid of *H. aurantiaca* var. *major* × *H. Thunbergii:* fls. golden-yellow, 6 in. across, on stout branching sts. 4 ft. high. Midway between parents in habit and in size of bloom. G. 25:346.—Raised at Colchester Nurseries, England. There is a var. **màjor,** Hort., large. Var. **pállens,** Hort., is a hybrid between *H. citrina* and *H. luteola:* vigorous, many-fld.: fls. large, fragrant, canary-yellow.

4. **Míddendorffii,** Traut. & Mey. Height 1–1½ ft.: lvs. 15–18 in. long, 8–12 lines wide: scapes about as long as the lvs.; corymb 2–4-fld.; pedicels almost none; tube 5–6 lines long; inner segms. 9–12 lines wide. Amur region. Gt. 522. R.H. 1897, p. 139.

5. **citrìna,** Baroni. Fls. lemon-yellow or pale sulfur-yellow: differs from *H. minor* in the lvs. being twice as broad and the fls. much larger; from *H. Dumortierii* in having a longer scape and lvs. three times as long, and fls. twice the size and longer-tubed. China.—Tall-growing, very fragrant; considered to be a fine species; excellent for cutting.

6. **mìnor,** Mill. (*H. gramínea,* Andr., not Schlecht. *H. graminifòlia,* Schlecht.) Fls. golden-yellow: lvs. 15–18 in. long, 2–3 lines wide, darker green than in the other species: scapes about as long as the lvs.; corymb 3–6-fld.; pedicels 3–24 lines long; inner segms. membranous and wavy at the margin. July, Aug. N. and E. Asia. B.M. 873. Var. **cròcea,** Hort., is saffron-yellow.

AA. *Group of orange-fld. species: the last not fragrant.*

7. **Dumortièrii,** Morren (*H. rùtilans,* Hort. *H. Sièboldii,* Hort.). Height 1½–2 ft.: lvs. 12–15 in. long, 6–8 lines wide: scapes hardly as long as the lvs.; corymb 2–3-fld.; pedicels 3–6 lines long; fls. 2–2½ in. long, while they are 3–4 in. long in the other species; inner segms. 5–6 lines wide; tube very short. Japan. B.H. 2:43. Gn. 31:280. Var. **flòre-plèno** is less cult.—This species is the earliest to blossom. This species is confused; some authors consider it to be a form of *H. minor.*

8. **aurantìaca,** Baker. Height 2½–3 ft.: lvs. more than 12 lines wide: corymb 6–8-fld.; fls. bright orange, opening less widely than any other species, fragrant. July. Japan or E. Siberia (?).—The type was intro. to cult. in 1890 and has rapidly given way to var. **màjor,** Baker, intro. 1895, which is larger in all parts. Lvs. 12–18 lines wide: tube 9 lines long; fls. when expanded 5–6 in. across. July–Sept. Japan. G.C. III. 18:71. Gn. 48:400; 50, p. 17. J.H. III. 31:157. A.G. 18:179.—Closest to *H. Dumortierii,* from which it is chiefly distinguished by its much larger, later and more reddish fls. with longer tube.

9. **fúlva,** Linn. (*H. dísticha,* Donn). Lvs. 18–24 in. long, 9–15 lines wide: corymb 6–12-fld.; fls. orange; pedicels short; inner segms. with wavy margins, with numerous veins joined by cross veins. July, Aug. Eu., Temp. Asia. B.M. 64 (central band of white). Mn. 5, p. 193. Var. **Kwánso,** Hort. (*H. Kwánso,* Hort.), the "double orange lily," blooms longer than any single-fld. form. Gt. 500. It has a sub-variety with variegated lvs. Var. **maculàta,** Baroni. Fls. with a red-purple blotch inside. China. Var. **longitùba,** Hort. Perianth-tube half as long as segms. Gt. 34:1187. Japan. Var. **flòre-plèno,** Hort., is shown in F.S. 18:1891, with a red spot on the middle of each segm. Gn. 48, p. 401. R.H. 1897, p. 139. Var. **variegàta,** has a stripe of white down the middle of each lf. Var. **hupehénsis,** Hort. Fls. very bright coppery red, with yellow throat; segms. undulate, reflexed. China. Var. **Cypriàni,** Hort. Dwarfer and more floriferous than the type: fls. coppery red with golden center and a golden line in the middle of the segms. China.

H. Baròni, Hort. (H. Thunbergii × H. citrina). Pale yellow; segms. narrow and pointed.—*H. coròna,* Hort. (H. flava × H. aurantiaca var. major). Floriferous, golden yellow.—*H. elménsis,* Hort. (H. minor and H. citrina).—*H. Flórham* is said to be a variety of American origin, with large golden yellow fragrant fls. in June and July. *H. Fórrestii,* Diels, recently intro. from W. China, is allied to H. fulva, but readily distinguished by its narrow perianth which has a remarkably short tube: fls. deep reddish orange: lvs. 8–14 in. long and ⅔ in. or less broad.—*H. fulcitrìna,* Hort. (H. fulva var. maculata and H. citrina).—*H. hippeastroìdes,* Hort. (H. minor var. crocea and H. Thunbergii.)—*H. Muèlleri,* Hort. (H. Thunbergii and H. citrina).—*H. ochroleùca,* Hort. (H. Thunbergii and H. citrina). Pale primrose-yellow.—*H. vomerénsis,* Hort. (H. Thunbergii and H. minor var. crocea).

WILHELM MILLER.
L. H. B.†

HEMIÁNDRA (*half anther* or *male,* referring to the 1-celled anthers). *Labiàtæ.* Three shrubs or subshrubs in W. Austral., with opposite, rigid and narrow entire sharp-pointed lvs., and solitary axillary white or pink fls.: corolla with a short erect broadly 2-lobed upper lip, and a longer spreading 3-lobed lower lip with the middle lobe often 2-lobed; stamens 4, didynamous; style briefly 2-lobed, *H. púngens,* R. Br., is recorded in European horticultural literature: rigid shrub, 1–2 ft. or less, glabrous or nearly so: lvs. sessile, linear or linear-lanceolate, with 1 or 2 prominent veins beneath: fls. white or pink with darker spots; corolla-tube exserted and dilated. J.F. 2:126.—Mentioned as a greenhouse subshrub.

L. H B.

HEMICỲCLIA (Greek, *semi-circular,* referring to the seed-scar or the half-circular stigma). *Euphorbiàceæ.* Shrubs or trees, one cultivated in southern California for its holly-like leaves and red fruits.

Leaves alternate, simple, entire, leathery: fls. diœcious, in axillary clusters or the pistillate singly; sepals of the staminate fls. 4–5, imbricate, sometimes somewhat petal-like, petals none; stamens numerous from a disk; stigma sessile, broad, flat; 2 ovules in the single cell: fr. a 1-seeded, indehiscent drupe.—About 9 species of E. Indies to Austral. Related to Drypetes and Putranjiva. *H. australasica* is distinguished from the other 2 Australian species by its very short filaments and glabrous ovary.

australàsica, Muell. Arg. Lvs. broadly ovate to ovate-oblong, obtuse, 1½–3 in. long, finely veined below: fr. nearly ½in. long, very smooth, red and succulent, inclosing a stone.

J. B. S. NORTON.

HEMÍGRAPHIS (*half written,* of some obscure or fanciful application). *Acanthàceæ.* Diffuse or prostrate, mostly herbs, grown for foliage and fls. The genus, comprising perhaps 30 species in Trop. Asia, China, Japan and the Philippines, is allied to Strobilanthes and more remotely to Ruellia. From the former it is distinguished by the 3–∞ ovules in each cell, linear caps. with base scarcely constricted, and in the prostrate or trailing habit. Fls. in short terminal crowded spikes, the bracts usually herbaceous and imbricated; calyx deeply 5-cut; corolla slender-tubed with 5 rounded more or less unequal lobes; stamens 4, didynamous: lvs. opposite, simple, entire or dentate. **H. coloràta,** Hallier (*Ruèllia coloràta,* Blume; once listed as *Amaglyptus*), from Java, is a name listed in S. Fla., as a good subject for baskets and for cover: lvs. of *H. colorata* are ovate, shallowly cordate at base, crenate and bullate, purplish: fls. white or whitish, about ¾in. long. There is likely to be confusion in the trade plants in this and related groups.

L. H. B.

HEMIONÌTIS (Greek, *mule;* the plants erroneously supposed to be sterile). *Polypodiàceæ.* A group of small tropical ferns, with copiously netted veins and naked lines of sporangia following the veins. Eight or 9 species occur in the tropics of both hemispheres. The plants are dwarf, and are grown in Wardian cases by a few fanciers in the Old World. For cult., see *Ferns.*

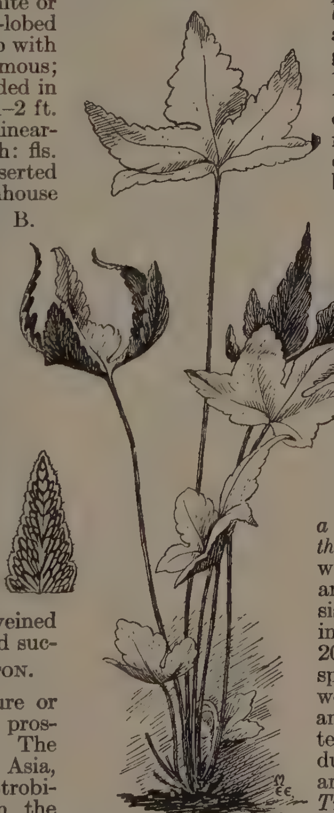
palmàta, Linn. STRAWBERRY FERN. Fig. 1807. Lf.-blades borne on tall stalks, palmate, 2–6 in. wide, with 5 nearly equal triangular divisions, those of the sterile lvs. less acute; surfaces pubescent. Reproduces by numerous buds as well as by spores. W. Indies, Mex., S. Amer.

élegans, Davenp. Lvs. 4–10 in. wide, with a broad sinus at the base and 5 long slender, lanceolate divisions: plant smooth. Mex. G.F. 4:485.

L. M. UNDERWOOD.
R. C. BENEDICT.†

HEMIPHRÁGMA (*half partition,* referring to structure of the capsule). *Scrophulariàceæ.* One trailing perennial herb, *H. heterophýllum,* Wall., sometimes grown abroad for rockwork and ground-cover, requiring protection in England. It is prostrate, with wiry branches, pilose or becoming glabrous: lvs. on main st. opposite, petiolate, orbicular and crenate; on branches small and fascicled, linear and ciliate: fls. sessile in the axils, small, pink; calyx 5-parted, with linear segms.; corolla-tube short, the limb 5-lobed and nearly equal; stamens 4: fr. a fleshy caps. or berry, shining, red. Himalaya region.

L. H. B.



1807. Hemionitis palmata. (×½)

HEMIPTÈLIA: *Zelkova.*

HEMITÈLIA (Greek, *with half a roof;* referring to sori). *Cyatheàceæ.* Tree ferns of the tropics, with round or semiglobose sori and an inferior indusium, consisting of a scale which is often indistinct and deciduous. Some 20 species occur in both hemispheres. This genus is not very well distinguished from Cyathea and Alsophila, differing only in technical characters of the indusium. For cult., see *Cyathea* and *Alsophila;* also article on *Tree ferns,* under *Ferns.*

guianénsis, Hook. Rachis slightly scaly and hispid: lvs.

bi-tripinnate, the secondary rachis distinctly winged, especially at the upper portion: sori few in each segm., usually 2–4; indusium ciliate and often lobed. Var. **Paràdæ,** Hort., is the form commonly in cult. British Guiana. I.H. 24:280.

Líndenii, Hook. Lvs. pinnate, the pinnæ distant and slightly stalked, 6–12 in. long, 1–1¼ in. broad, the base truncate or wedge-shaped: sori in 2–3 irregular lines near the margin. Venezuela. I.H. 42:46.

L. M. UNDERWOOD.
R. C. BENEDICT.†

HEMLOCK in Old World literature is what is known as poison hemlock, an umbelliferous herb, *Conium maculatum.* By hemlock, Americans mean hemlock spruce, an evergreen tree, *Tsuga canadensis.*

HEMP: common hemp is *Cannabis sativa* (which see); **Bowstring H.,** *Sansevieria;* **Manilla H.,** *Musa textilis;* **Sisal H.,** *Agave rigida* var. *Sisalana.*

HEN-AND-CHICKENS. A proliferous form of the English daisy, *Bellis perennis;* also the thick-leaved rosettes of Cotyledon, used in carpet-bedding, usually as Echeveria.

HENBANE: *Hyoscyamus niger.*

HENFRÈYA: *Asystasia.*

HEPÁTICA (*liver-like,* from the shape of the leaves). *Ranunculàceæ.* HEPATICA. LIVER-LEAF. MAYFLOWER (incorrectly). Stemless low perennials sometimes grown in the wild border for very early spring bloom.

Leaves 3-lobed and sometimes toothed, appearing after the fls. and remaining green over winter: scapes 1-fld., with an involucre of 3 small sessile lvs. simulating a calyx; sepals petal-like, white, pink or purple: achenes short-beaked, pubescent. (Fig. 1808.)—A genus of 3 species, natives of the north temperate zone, grown in open flower-beds for their attractive fls., which appear in early spring; the peculiar foliage is also much admired.

The plants prefer shade, but do fairly well in open places. They should remain undisturbed from year to year, in rich well-drained loam. Well suited to the north or east slope of a rockery. Plants kept in pots in a coldframe until midwinter will quickly bloom at any time desired if removed to a warm room or greenhouse.

Propagation of old plants is easily accomplished by division of the roots. Seeds may be sown very shallow in a moist, shaded soil. The seed is sometimes started in frames in very early spring and the plants transplanted to the garden later, but little is gained by this as the flowers will not show until the next season.

1808. Flower of Hepatica. (Natural size)

tríloba, Choix (*Hepática Hepática,* Karsten. *Anemòne Hepática,* Linn. *A. tríloba,* Hort.). Scapes 4–6 in.: lobes of lvs. obtuse: fls. ½–1 in. across; sepals oval or oblong, obtuse. Earliest spring. E. U. S., Eu., and Asia. B.M. 10. B.R. 387 (as *H. americana*). White-, blue-, and pink-fld. forms have been fixed in cult., and are known as var. **álba,** Hort.; var. **cærùlea fl.-pl.,** Hort.; var. **rùbra fl.-pl.,** Hort. Gn. 26:24. Gn. M. 15:306. G.C. 1873, p. 645 (var. *marmorata,* Moore).

acutíloba, DC. (*H. tríloba* var. *acùta,* Pursh. *Anemòne acutíloba,* Laws, *H. acùta,* Brit.). Fig. 1809. Much like *H. tríloba,* but with the lobes of the lvs. ovate and acute, occasionally the lateral lobes 2-cleft (rarely the middle one): achenes slightly stipitate. E. U. S.

angulòsa, DC. (*Anemòne angulòsa,* Lam.). Plant tufted as in the other hepaticas, hairy: lvs. 3–5-lobed, lobes often serrate: involucre near the fl. toothed; fls. large, blue, whitish or reddish. Hungary. B.M. 5518. G.C. 1865:698. Gn. M. 4:190. Gn. 26, p. 25. G. 2:551. Var. **álba,** Hort. Fls. large, pure white. var. **ròsea,** Hort. A rose-colored form. Var. **lilácina,** Hort. A free-flowering variety with lilac-colored fls.

1809. Hepatica acutiloba. The flowers of hepatica droop and close at night.

K. C. DAVIS.

HEPTAPLEÙRUM: *Schefflera.*

HERACLÈUM (dedicated to Hercules, who used it in medicine, according to Pliny). *Umbellíferæ.* COW-PARSNIP. Perennial or biennial herbs, some of which are used in bold planting effects where there is ample space.

Mostly tall and coarse herbs, with prominent and often very large lobed or pinnate or dissected lvs.: fls. in large umbels, white or purplish, with mostly obcordate petals and the outer ones often larger and cleft and forming rays: fr. obovate, oval or orbicular, dorsally flattened, the oil-tubes extending scarcely below the middle.—Probably 70 species, in the northern hemisphere, one reaching Abyssinia.

Heracleums are not suited for general gardening, but are sometimes grown in wild gardens or parks, or as single specimens on lawns, where a very bold and striking object is desired. The garden species are coarse herbs, growing 5 to 10 feet high, with broad foliage, which is their chief beauty. They are adapted to all soils, but prefer a rich moist soil, and often do well at the edge of running water. They should not be allowed to go to seed. If these plants are grown on an open, sunny lawn, they should be liberally supplied with moisture at all times. Propagated by division or seed.

A. *Plant biennial* (*or biennial-perennial*).

sibíricum, Linn. Lvs. scabrous to hirsute, pinnate or deeply pinnatifid; lfts. oblong or ovate; segms. lobed or palmately parted, serrate: fls. yellowish, without rays; petals about equal: fr. subrotund-oval, deeply notched at the apex. Eu., N. Asia.—Height 5–6 ft., blooming in summer, forming a handsome plant with the much-cut foliage.

platytæ̀nium, Boiss. (*H. éminens*, Lange). Lvs. often 2 ft. across, tomentose beneath, the lower ones trisect and the upper ones less deeply cut, segms. stalked and obtusely palmate-lobed: fls. white, in hairy umbels sometimes 1 ft. across: fr. large, hairy. W. Asia.—Said to be specially valuable for woods and wild-gardens: 4–5 ft. Sometimes perennial.

pérsicum, Desf. Lvs. large, once- or twice-pinnate, glabrous above and pubescent beneath, the segms. in 3 or 4 pairs, much cut into narrow divisions: fls. white, in large somewhat pubescent umbels. W. Asia.—Reaches 12 ft. in height. Sometimes perennial.

pubéscens, Bieb. (*H. caucásicum*, Stev.). Lvs. pinnatisect, pubescent beneath and glabrous above, the segms. 2 or 3 pairs, with elliptic lobes: fls. white, the setulose umbels many-rayed: fr. elliptic, pilose, only the margin aculeate. Asia Minor. Sometimes perennial. Var. **Wílhelmsii,** Boiss. (*H. Wilhelmsii*, Fisch. & Mey.) differs in its prominently aculeate fr.

Lehmanniànum, Bunge. St. stout: lvs. glabrous above and pubescent beneath, the lower ones pinnatisect; segms. 2–3 pairs and pinnatifid and at apex 3-parted, the lobes short-ovate and acute and coarsely toothed: fls. many, dull pink, in large umbels. Turkestan; 3–7 ft. Gn. 66, p. 259.

AA. *Plant perennial.*

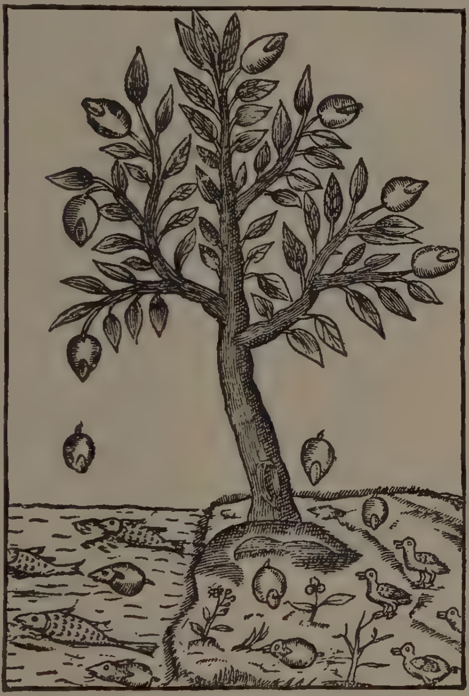
lanàtum, Michx. Lvs. trisect, tomentose beneath; segms. petiolulate, rotund, cordate, lobed and sharply serrate; lfts. of the involucel lanceolate: fr. oval-orbicular. N. Amer., W. Asia. Mn. 4, p. 164.—A striking coarse pubescent plant of low or moist grounds, 4–8 ft. high.

villòsum, Fisch. (*H. gigantèum*, Hort.). Lvs. sinuate-pinnatifid, sharply serrate, acuminate, woolly-tomentose beneath; lfts. of involucres short, bristly, deflexed: fls. white or whitish, in umbels sparingly rayed: fr. elliptic, ciliate, woolly on the back. Caucasus. G.C. III. 3:437; 20:271. J.H. III. 49:115. G. 7:537. G.W. 7, p. 357. Gn.W. 20:47. Gn.M. 14:171.—A bold species, reaching 8–12 ft. in height. Said to be sometimes biennial.

Mantegazziànum, Sommier & Levier. A recent intro. into cultivation and said to be the finest of the genus: lvs. 3 ft. long, deeply cut into many oblong-lanceolate notched lobes, making a gigantic clump: fls. clear white, large, in umbels 4 ft. across, produced in great number. Gn. 59, p. 148; 74, p. 526. G.W. 12, p. 410; 15, p. 636.—This noble species comes from the Caucasus. Seeds were sown at Geneva, Switzerland, in 1893, germinated in 1894, and the plants were 8 ft. high, in 1896. It grows 9 ft. high, and perhaps more. Said to be of easy cult., preferring deep rich soil that is cool and damp; the roots, and especially the tap-root, should remain uninjured, and it is said that it thrives better if not transplanted, although the seedlings may be handled in pots. L. H. B.†

HERBA IMPIA of the old herbalists is *Gifola germanica*.

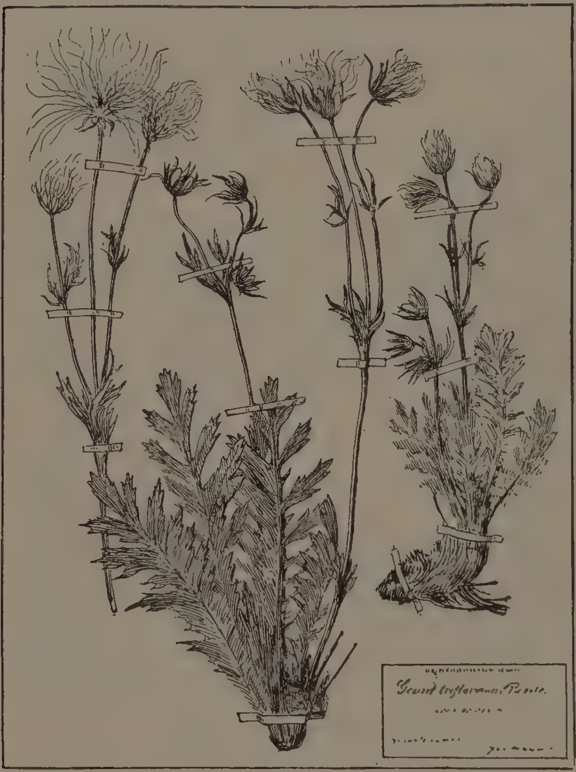
HERBALS. Books on plants, published from the fourteenth to the middle of the eighteenth century, were largely written from the medicinal point of view, and were often called herbals. The scientific point of view of plant-knowledge is conveniently dated from 1753, when Linnæus published his "Species Plantarum." Of the herbalists, John Gerarde is probably read most at the present time. His style is chatty, quaint and personal. One of the notions accepted by the early herbalists was that of the vegetable lamb, which is pictured in this work under *Cibotium* (Fig. 961). Another idea that fascinated these worthy plant-lovers was that of the barnacle goose tree. Fig. 1810 is reproduced from a book by Duret, 1605, and shows how the fruits that fall upon dry land become "flying birds," while those that fall into the water become "swimming fishes." Other conceptions of this goose tree are reproduced in the "Gardeners' Magazine," 35:749, (1892). Almost every large library possesses a few herbals, as Matthiolus, Bauhin, L'Obel and Fuchsius. The largest collection of herbals in America is the one given by the late E. Lewis Sturtevant to the Missouri Botanical Garden at St. Louis. See Agnes Arber (Mrs. E. A. Newell Arber), "Herbals: Their Origin and Evolution," a recent British work. The herbals are invaluable in tracing the growth of ideas about plants.



1810. The Goose Tree of the herbalists.

HERBARIUM. An herbarium is a collection of dried plants systematically named, and arranged in cases for ready reference and protection. In the study of systematic botany such collections have existed for many years, and they are an absolute necessity to the student, supplementing field work. Indeed, without an herbarium, scientific systematic work would be practically impossible, for the identification of species, the study of the plants of any given area and the comparison of the flora of different regions can be conducted thoroughly only where specimens of the plants under consideration are at hand and can be readily consulted. Type specimens of new species are deposited in herbaria, and reference is constantly being made to these types to settle the identity of species when meager descriptions only are available. Floras of distant regions have been written by those who have never visited the places, but have worked on the collections that have been brought back. It is only through such collections of dried plants that publications of the plants of a region are possible. It is a vital supplement to actual work in the field. Large and important herbaria exist at many centers of botanical activity in this country and abroad, while private collections are countless.

There are few collections of pressed specimens of plants embracing the wide range of horticulture, and there should be more of them. The advantage of such herbaria in identifying plants under cultivation and in comparing the many forms that are constantly being evolved, and that do not occupy a place in collections of native plants, must be obvious to everybody. Every horticulturist should have a good herbarium, for it increases very largely the value of his work besides giving much pleasure in the preparation and use of it.


Geum triflorum, Pursh.

1811. A common method of mounting herbarium specimens.

It is like a reference library and it enables a nurseryman to keep his stock true to name. One of the most difficult problems for a systematic botanist or a horticulturist to meet is that of nomenclature, and much trouble and waste time can be avoided by having at hand an authentically named collection, embracing as many forms as possible. A good working herbarium can be made by pressing the cultivated plants at hand and by securing from others specimens of additional forms.

In collecting plants for the press it must be remembered that they are to be mounted on paper 11½ by 16⅜ inches in size. These are standard dimensions. Take up small plants by the roots, and of larger plants secure a branch that will show typical leaves and flower or fruit according to what is desired. Note with each plant, on a label or on a tag slipped on the end of the stem, the important characters that are to be entered on the final label, such as trade name, color of flowers, whether it is annual, biennial or perennial, date, locality, collector, and so on. These should be kept carefully with the plant.

The specimens are then laid for pressing between sheets of unsized paper that will readily absorb the moisture. Newspaper will do, but prepared sheets can be bought at very small cost of any botanical dealer, from whom also can be obtained collecting-boxes, trowels, presses and all other details used in making an herbarium. Plants can be folded once or even twice to be adapted to the size of the sheet, unless too many leaves overlap, in which case two specimens, or even more, can be made of the same plant and pressed separately. A little skill will enable one to lay out his plants artistically, showing upper and under surfaces of the leaves, and the various sides of the flowers. Sometimes it is best to section a thick stem or root. The folder with its inclosed plant or plants and accompanying data is then put between driers, which are sheets of a heavy felt paper, very absorbent. On this is placed another folder, and so on until a pile a foot or more high is reached. This pile is then placed in a press. The best kind of press is a simple, portable one, composed of two frames, each made of strips of hard wood arranged at right angles to each other. The press is then tightened by strong straps. The driers should be changed daily for a few times, and the specimens examined, and then less frequently till they are perfectly dry. Most excellent results in quick drying can be secured by means of sheets of corrugated card board with one side flat. (See J. F. Collins, Rhodora xii. 221, 1910). By placing a sheet between the various driers each plant is isolated from its neighbors, and the circulation of air through the pores speedily dries the plants. Put the press in the sun when possible. The old-fashioned method of using plain boards and a heavy weight on top is not to be recommended.

The specimens should then be mounted on sheets of stiff, white, calendered paper, 11½ by 16⅜ inches, eighteen pounds to the ream being standard weight. This is for a perfectly appointed herbarium. The plants can be kept in the original folders and filed in that way, but, for safety and ease in handling, the specimens should be properly secured to the sheets. The regular method is by gluing them down, fish glue being used, and supplementing this with strips of gummed paper, surgeon's isinglass plaster being the best material. These strips are put over portions of the plant that are liable to separate from the sheet. In some large herbaria gummed strips are used entirely. Each mounted sheet must contain but one species, variety or form, but two or more different collections may be on a single sheet. A label accompanies each collection composed of one or more specimens. A convenient size is 3½ by 1¾ inches. On it should be written the name, locality, date, collector and any useful data such as have been mentioned above.

The mounted sheets are put loose into genus covers of stiff manila paper, 16½ by 11⅞ inches, each cover devoted to a single genus. The name of the genus is written in the lower left-hand corner, and that of the species in the lower right-hand corner. More than one species of the same genus can be put into the same cover. These covers are placed systematically in the herbarium case fitted with pigeon-holes wide and deep enough to hold the covers easily and 6 inches between shelves. The doors must close tightly to keep out insects and dust. The cases are of varying heights, according to convenience, and are generally of wood. The most approved have two rows of about thirteen pigeon-holes each, and are made of steel, thus securing absolute safety.

An herbarium was called "Hortus siccus," or dry garden, by the ancients, but, although in one sense true, it does not convey the correct idea. To the true scientific lover of plants, whether botanist, horticulturist, florist, or nurseryman, a carefully equipped collection of dried plants is not only a great and necessary aid, but a true delight. In them he sees the living plants that they represent, and to dissect a flower, however old it may be, he has but to boil it for a few seconds in a retort, and it can be as easily dissected as if fresh.

Walter Deane.

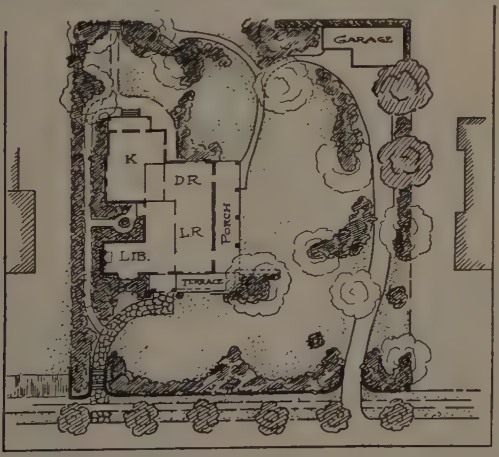
HERB, HERBS. An herb is a plant that dies to the ground each year, or at least that does not become woody. It may be annual, as bean, pigweed; biennial, as mullein, parsnip; perennial, as dictamnus, rhubarb; many of the perennials live only three or four years effectively. To the gardener, however, the word "herb" is ordinarily synonymous with herbaceous perennial; and he usually has in mind those particular perennial herbs grown for ornament, and which remain where they are planted. Goldenrod, bleeding-heart, sweet william, hollyhock, daffodil are examples. To many persons, however, the word herb is synonymous with sweet herb, and it suggests sage and tansy.

Herbs are grown in an herbary, which, as here understood, is a garden or collection of herbs, and particularly of perennial herbs, since the collection may then be more readily and certainly continued.

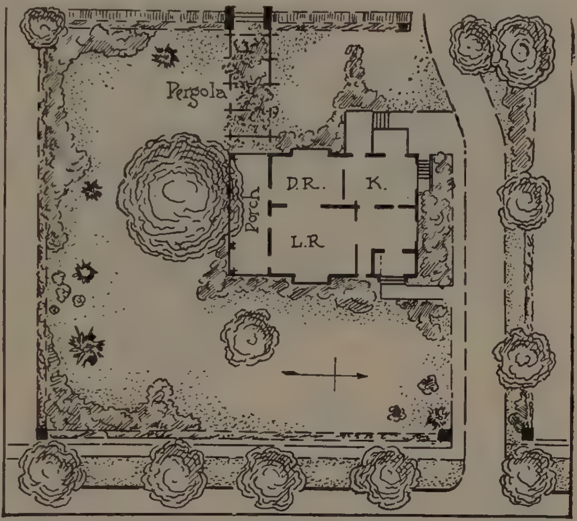
Herbs have two kinds of values,—their intrinsic merits as individual plants, and their value in the composition or the mass. It is usually possible to secure both these values at one and the same time. In fact, the individual beauty of herbs is enhanced rather than diminished by exercising proper care in placing them. Planted with other things, they have a background, and the beauties are brought out the stronger by contrast and comparison. It is quite as important, therefore, to consider the place for planting as to choose the particular kinds of plants. The appreciation of artistic effects in plants is a mark of highly developed sensibilities. Happily, this appreciation is rapidly growing; and this fact contributes to the increasing popularity of landscape gardening and ornamental gardening. Some of the best effects in herb-planting are to be seen in the wild, particularly along fences, roads and streams. The planter must remember that herbs are likely to grow larger and more bushy in cultivation than in the wild.

A strip or border along the side of a lawn, or bounding an area, is the best place for a collection of herbs—whether annual or perennial—that are grown for ornamental effect. (See Fig. 597, Vol. I.) About any place there will be special uses of herbs. (See the plans, Figs. 1812, 1813.) The home-maker should cover the bare and unseemly places about the borders of his place (Fig. 1814). He may utilize a rock or a wall as a background (Fig. 1815). He may hide the ground-line about a post (Fig. 1816) or along a fence. Some of the commonest herbs, that excite the least admiration, are handsome when well grown and well placed. (See Fig. 1817.) One should always plant where the herbs will have relation to something else,—to the general design or handling of the place. This will usually be about the boundaries. The hardy border is the unit in most planting of herbs. (See Figs. 1814, 1818.) A rockwork herb border (Fig. 1819) is often useful in the rear or at one side of the premises. It is well to fill some of the corners by the house (Fig. 1820). In remote parts of the grounds, half-wild effects may be allowed, as in Fig. 1821. A pond or pool, even if stagnant, often may be utilized to advantage (Fig. 1822). A good herb out of place may be worse than a poor herb in place. But when herbs are grown for their individual effects, give plenty of room and good care (Figs. 1823, 1824). Other discussions of herbs in relation to planting will be found under *Annuals, Biennials, Border, Landscape Gardening;* also, for special uses, *Alpine Plants, Autumn-Gardening, Kitchen-Garden and Flower-Garden, Spring-Gardening, Wild-Gardening,* and others.

L. H. B.



1812. Plan of a residence area on uneven ground. The heavy planting against banks and borders provides areas for herbs as well as for shrubs. The location is indicated of library, dining-room and kitchen.

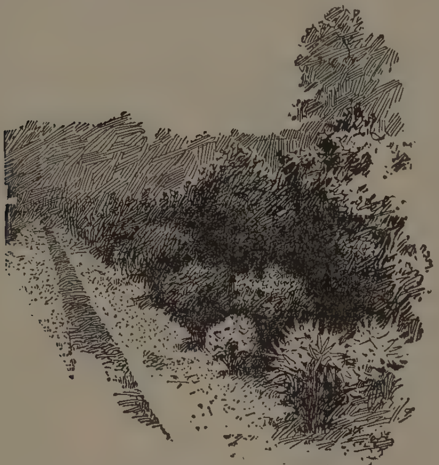


1813. Planting areas in a home ground. The general center is kept open. There are trees along the streets and two on the lawn. About the residence and on the boundaries, as well as in the parking at one side, there is opportunity for herbs and shrubs. D.R., dining-room; L.R., living-room; K., kitchen.

Herbaceous perennials in landscape planting.

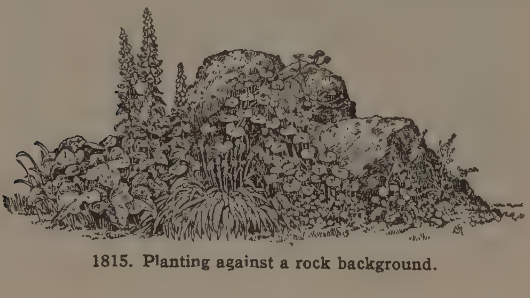
No clear definition can be drawn between herbaceous perennials, biennials and annuals, between herbs and woody plants, for there are tender herbs that in a warmer climate would become shrubs or even trees, biennials that become perennials from stolons or offsets, and annuals that become biennials from seed germinating late in the season. Strictly speaking, however, herbaceous perennials are plants having perennial roots with tops that die to the ground annually, such as the columbines, larkspurs, day lilies, peonies, and most sedges, grasses and ferns. It is customary, however, in publications relating to this class of plants as well as in actual use, to include closely allied species with evergreen foliage, such as statice, yucca, sempervivums and certain pentstemons, together with plants having more or less woody and persistent above-ground stems, such as the suffruticose artemisias and the evergreen creeping species of phlox, veronica, vinca, the iberis, the helianthemums, and many alpine plants, while most bulbous-rooted plants which are true herbaceous perennials are separately classified and grown as bulbs.

Herbaceous perennials are an exceedingly important element of landscape, for they predominate in the mat of grassy or sedgy plants, covering dry or wet open fields, and in the surface vegetation under woods and shrubby thickets, either as a grass crop, composed of a comparatively few species cultivated for economic purposes, or as a wild growth made up of many species. The most attractive of these native plants are being cultivated and improved more and more from year to year for ornamental purposes, and are planted in the flower-garden, in artificial plantations of shrubbery and in the wild-garden. It is to such natives and to exotics of the same class, which are cultivated for a similar purpose, that reference is to be made hereafter.


1814. An informal herb border.

Fifty years ago nearly every well-to-do family maintained a flower-garden, in which there were from fifty to one hundred and fifty species and varieties of herbaceous perennials, and there were few of the humbler families that did not have a dozen or more species established about their homes. Such plants were distributed by exchange among neighbors and were propagated and offered at retail by dealers, who, however, gradually allowed their stock of plants to run low or abandoned them altogether, until many kinds dropped out of cultivation or were neglected in favor of the tender "bedding out" plants that were brought suddenly into favor by the displays at the Philadelphia Centennial Exposition. Then they gradually declined in favor until the interest was newly revived at the period of the Chicago Exposition.

Since that time there has been such a constantly increasing interest in herbaceous perennials that there are now offered in catalogues of American nurserymen and collectors of native plants, nearly 3,000 species and varieties, exclusive of the many garden forms that are distinguished chiefly by the color of their flowers.


1815. Planting against a rock background.

In use, the species and varieties of herbaceous perennials may be broadly separated into three groups.

First, plants for the garden requiring the favorable conditions of a highly cultivated ground, and careful attention to attain perfection and to persist and increase from year to year. This would include many exotics, some native species and most of the horticultural varieties. Many of such species which would find a congenial place only in the garden have attractive flowers which are so fugitive that they can be enjoyed only on the plant. Other species which are suitable to cut flowers from can hardly be grown in the flower-garden in sufficient quantity liberally to meet the floral requirements of the home, and they should be grown in quantity in the kitchen-garden or in a special cut-flower garden, for their crops of flowers. Included among plants of difficult cultivation with fugitive flowers are the rock or alpine plants, many of which are offered in European catalogues. (See article on *Rock Gardens.*)

Second, plants for the shrubbery, having aggressive habits, which make them rather objectionable in the flower-garden, but fit them to withstand successfully the crowding of shrubs. This class of plants will give variety and prolong the flowering season of shrub borders about lawns, and would be made up chiefly of strong-growing natives and a few of the more persistent exotics.

Third, plants for the wild garden, including the species that require for success some one of the many special conditions prevailing in uncultivated or uncultivable land, or which are so rampant as to require the restraint that some one of these natural conditions will provide. This class of plants would be made up chiefly of natives and a few of the more persistent exotics, and they would be used to enrich groups of native plants under woods, in meadows, along streams, ponds and hedge-rows and on poor soil. There are attractive plants that will and do grow successfully under all these conditions without special cultivation, and many of them may be already on the ground. If every plant in a group of natives is watched for at least a year, it will be found that many are so attractive at one season or another that they will be retained and developed in beauty by the gradual removal of the less desirable kinds, for which others that are more desirable may be substituted.

1816. The ground line is hidden by herbs or shrubs.

In arranging plants in new plantations, or in modifying existing plantations in gardens, lawns or woods, much more effective landscape compositions and more agreeable color effects can be secured by using large quantities of a few sorts than by using a few individuals of many kinds. Groups of different species should be chosen that will give from period to period during the flowering season effective and dominating masses of foliage and color, and all other plants of the garden which appear at the same time should be made subordinate to these.

Herbaceous perennials are propagated by divisions and from offsets, cuttings and seed. Some kinds, as dictamnus and papaver, may be propagated by root cuttings. The exotic species of gardens and many of the more readily grown natives can be obtained in wholesale quantities from nurserymen. A few exotics and a very large number of attractive native species can be procured in wholesale quantities from collectors of native plants, many of whom also offer nursery-grown plants of the best natives and of a few exotics. The attractive native plants in any region can be transplanted with little difficulty if they are collected with a good sod of earth about the roots.

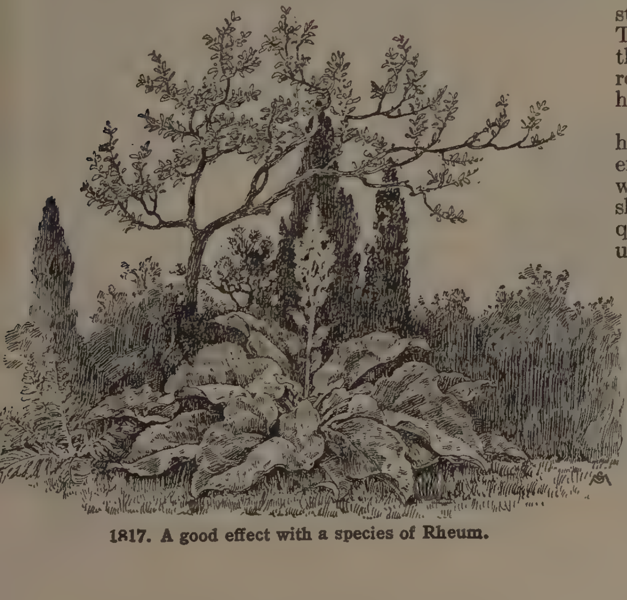
Warren H. Manning.

The culture of herbaceous perennials.

A good number of the herbaceous perennials grown in gardens are exceedingly easy of cultivation, thriving well in any moderately rich soil of suitable physical condition, and enduring winter cold and changeableness and summer heat and drought. There are, however, other species that do not grow well in the American climate, except in more moderate seasons or when placed where the climate is locally modified. Whether the plants one desires to grow be easy or difficult of culture, one should aim first of all for a luxuriant growth, for any time or labor saved by poorly preparing the soil, or any money saved by the use of weak or stunted plants will be regretted later. Unless it is intended to imitate the effect of certain barrens in nature, a garden without luxuriance is lacking in essential quality.

The preparation of ground for planting consists, in the order of importance: in making the soil by openness and fineness suitable for root-penetration to a depth of 18 inches to 2 feet; in providing underground drainage at a depth of at least 2½ feet; in making the soil sufficently fertile; and in making the surface soil not liable to "baking."

Depth and physical condition of soil are very important, and should be one's first care. If the season is short and work must be rushed, it is better to omit the manuring and to devote all one's energy to securing a deep feeding-area for the roots and a fine physical condition of the soil. In the hardy border the roots are able to penetrate far more deeply into the soil than they do usually in a wild state or in ordinary field culture. This vigor of root-growth reaching to good depth, as compared with that of equal vigor but nearer the surface, gives not only greater endurance of drought but aids the plant to endure changeableness of weather, and particularly contributes to hardiness. Many plants are hardy only if protected until the roots are thoroughly established. This is more often noticed with trees and strong-rooted plants that are able to penetrate deeply into the subsoil, but the same applies to herbaceous plants, except that it is usually necessary to loosen the subsoil to ensure penetration by their finer roots to a satisfactory extent. It is not necessary to make the subsoil equal in richness to the upper part, but it should preferably be mixed with a portion of the surface soil.



1817. A good effect with a species of Rheum.

1818. A mixed herbaceous border.

The fine roots are the feeding roots and the surfaces of the soil-particles are their feeding-ground, so that in making the soil-particles smaller the feeding-surface is vastly increased, thus allowing for more roots and closer planting. A fine physical condition can usually be obtained by turning the soil over a few times. No soil should be turned or handled when too moist to crumble, as the clay in the soil is quick to become puddled, and therefore impervious to feeding-roots.

Underground drainage is necessary, since most plants cannot grow in soil filled with stagnant water. When the natural subsoil drainage is not sufficient, artificial means should be used. Unless the drainage is good, many plants will be injured in the rainier seasons or killed in winter. Plants that are not firmly established are often easily killed by excess of moisture about the roots during their dormant season; for example, many bog-plants otherwise perfectly hardy will winterkill if planted late in the fall. A further fact showing the effect of water on dormant roots is that many plants if cut down low enough in the fall to allow water, as from melting snow, to reach the root through the hollow stems, will often be entirely rotted by spring. Thus, when it is necessary to destroy goldenrod, the dry stems may be mown in late autumn with a sharp scythe. The vulnerability of the root to water coming through the stem may be easily seen by comparing in the spring roots of corn, the stalks of which were cut at different heights the previous fall.

In the hardy border, no large amount of coarse or highly fermentable material should be used. The enrichment of the land should, if possible, be made while preparing the border, and any fertilizers used should be well mixed with the soil. Even if a liberal quantity of stable manure is available, it is well to use some potash or phosphoric acid in connection with it. A light top-dressing of manure given in the fall will keep up the fertility, correct the soil in various ways, and afford a slight winter protection, which is appreciated by even the hardiest plants. Over-richness as well as poverty of soil tend to make plants in general less hardy, but usually a great abundance of plant-food should be given, especially for the hardier species with vigorous constitutions and long season of growth. Many plants having a season of rest in late summer do best in land not overly rich, especially if the position is moist.

A loose and open surface soil prevents baking after rains and waterings; saves some of the labor necessary to keep the soil open and friable; allows the growth of many smaller, finer-rooted or creeping plants that cannot grow well in a stiff soil; permits the sowing of many annuals in the border. Many low-growing plants are injured on clayey soil by having the under surfaces of the leaves coated with earth by spattering of rain. A clay soil may be made more loose by the addition of manures, sawdust, coal-ashes, sand or almost any such material. A light, fine mulch should be kept on the surface of a clay soil.

The points to be borne in mind in planting should be healthy plants, careful planting and sufficient thickness of planting. Plants should be obtained which have not been stunted, as a weakened plant will seldom make as good a specimen as if rightly treated from the start. When plants are received from the nursery they may be heeled-in if necessary, but every day plants are left where they have no root-hold on the soil is an injury to them, in proportion to the suitableness of the weather for root-growth. If plants must remain any considerable length of time before being placed in their permanent position it is best to plant them in reserve ground, and to remove them when desired with balls of earth.

Symmetry of top-growth is to some extent, at least, dependent on symmetry of root-growth, so that by careful planting the roots not only become more quickly and strongly active, but give us hope for a more symmetrical plant than can be secured by careless planting. The proper way to place a plant in the ground is to distribute the roots equally about the plant, leaving the tips pointed downward, and then to firm the soil sufficiently about the roots.

A perennial border should be planted rather thick, so that when in foliage it shall appear as one mass. Any showing of soil between plants is not only unnatural but destroys the beauty of the border as a whole. Of course, if plants are wanted for their individual or separate merits, they should be given full room.

Winter protection of herbaceous perennials.

The protection of species not reliably hardy may be accomplished with any material suitable for keeping out frost which is not naturally too moist or close. The material should preferably be heaped over the crown of the plant to shed part of the rain as well as to prevent quick changes of temperature, or wholly to exclude frost, as the plant may need.

The material to be used will be determined for the plants to be protected, by what is on hand or easily obtainable, and by the presence or not of mice or other vermin, which often work under such material as straw. Protected plants should be examined frequently in the winter, and if mice are present they may be killed or driven away by placing a few drops of carbon bisulfide in each hole found. (This is also a good way to rid coldframes of these pests. Plenty of ventilation should be given at the time, as the gas evaporated is destructive to vegetation. As the gas is heavier than air it sinks for the most part down the holes.) If, however, mice are not troublesome, there is no better material for keeping out cold and shedding water than straw. Nature's plant-protection is to use the foliage and stems of the plant themselves, the whole ground surface being covered as the weather grows colder with successive coatings of snow, which protection again grows lighter as spring approaches. This is still the ideal winter protection for plants, but snows are likely to disappear in midwinter and mice are well adapted to live under heavy litter. Where mice are troublesome, a light material may be made by composting leaves, manure rakings from lawns, greenhouse waste, weeds not in fruit as pulled during the season, and the like. The material should be earthy enough to keep mice out, and loose enough to permit of easy removal in spring. It should also be loose enough not to hold too much water in winter. Sawdust and charcoal are examples of such material.

1820. A rear corner, embellished with weeds.

Most of the plants that are largely cultivated need no protection, but all herbaceous perennials, unless they are evergreen or easily smothered, are benefited by a slight covering to protect the soil from alternate freezing and thawing. If the plants are evergreen, a covering to supply shade is often desirable. Other plants, such as *Helianthus decapetalus fl. pl.*, really need protection, not to exclude frost but to lessen considerably the severity of the winter. Still others, as many of the lilies, are best covered to the exclusion of frost. In general, the plants that need complete protection have crowns below the surface, and so may be covered with any amount or kind of material. When it is desired thoroughly to protect crowns on the soil surface, flats may be first placed over the crowns before adding the protection. In most cases, late fall plantings should be protected to some extent, since plants are less hardy when poorly established in the soil. See *Winter Protection*, Vol. VI.

Propagation of herbaceous perennials.

The methods of propagation most used are by seed, by division of the plant, and by cuttings.

Propagation by seed is commonly not of use for the perpetuation of horticultural varieties, although to a varied extent with different species any variety tends to reproduce its characteristics more perfectly the longer it becomes established as a variety. However, some of the garden plants have been separated into their present number of varieties or forms mainly by continual propagation by seed- and plant-selection, and such may be satisfactorily increased by seed. An example might be taken in the hollyhock, although, if a group be left to resow itself, or no seed-selection be maintained, it will soon become mainly composed of single-flowered plants

1819. An herb-covered rockwork.

1821. A tame-wild corner, asparagus and boneset.

by reason of their greater seed-production. In general, propagation by seeds is satisfactory for all established species and for such varieties and forms as have been thoroughly established by selection.

Seed-sowing is not, however, always an easy way to increase many of our garden plants, as there are often a few small items necessary to know concerning a species before success can be assured. Seeds of some perennials remain dormant for a long period after sowing, and, in general, they are very much slower in starting than annuals. Some require more heat than others to germinate, while others require a very cool soil. Many plants brought into cultivation from foreign countries or milder parts of our own land do not produce seed that will remain sound over winter in the earth, nor do seedlings of all hardy perennials withstand the colder season: for example, *Papaver orientale,* a hardy plant itself, produces a great quantity of seed which germinates readily as it falls, but the seedlings will not survive the winter in the northern United States unprotected.

A general rule for seed-sowing would read: Sow the seed when ripe, and then maintain such conditions of temperature and moisture as the seed would receive in the native habitat of the plant. Native American plants not from decidedly milder parts, and many foreign species, may be easily increased by sowing of seed when ripe in the open ground. Among such might be included rudbeckia, aquilegia, coreopsis, monarda, asters (perennial), delphiniums, digitalis, *Dianthus barbatus,* and phlox, all of which will bloom the following season.

Plants usually have one or rarely two particular seasons for blooming, and unless of sufficient size and suitable condition when that season approaches, they will wait for its recurrence before showing flowers, so that by sowing seed early in the spring and giving good cultural attention to the plants, we may expect to flower the first year many plants naturally blooming late in the year, or such as are somewhat floriferous at nearly all seasons: for example, *Lobelia cardinalis* and other lobelias, many of the native asters, *Gaillardia aristata* var. *grandiflora, Bellis perennis,* hollyhocks, platycodon, delphiniums, hardy chrysanthemums, salvias, rudbeckia, dahlias. See *Seeds,* Vol. VI.

Propagation by division is simply the separation of a larger clump of roots and crowns into smaller plants. In the case of plants producing buds on the roots, this division may be carried further, and small pieces of the root used to grow other plants.

The separation of plants as practised in the garden is not usually so much for the purpose of increase as to avoid overcrowding of roots and crowns, with loss of vigor to the plant; for example, a plant of iris, having been undisturbed for a number of years, becomes a tangled circular mat of rootstocks, which in the center cannot find room to grow, and so the plant appears as a large mass of rootstocks, throwing up foliage only on the outer ring. The period in which a plant may remain in any one place without needing separation will vary with the vigor of growth of the plant in each position; a group of plantain lily in a favorable situation will need separation every two years, while in a poorer place it might remain four. However, the average length of time for a few typical species may be given thus: *Bellis perennis,* pompon chrysanthemums, and other strong-spreading, shallow-rooted and easily established plants do best with yearly separation; *Phlox maculata* and monarda every two years; helianthus, asters and many of the compositæ and *Phlox decussata* about every three years; *Convallaria majalis* and many spring-flowering bulbs every four years; such plants as peonies may be left for a longer period.

In general, better flowers are secured from a plant with but one crown than when two or more are left, but unless the new growths are crowding out the central parts or are themselves too numerous to make a vigorous growth possible, division is not necessary. In fact, many plants require a better establishment in the soil than can be given by transplanting or than they can

1822. Pool made attractive by planting of herbs.

quickly secure, and such are best undisturbed until quite overcrowded. The question is whether by dividing a plant better flowers and foliage may be obtained than by allowing it to become more thoroughly established.

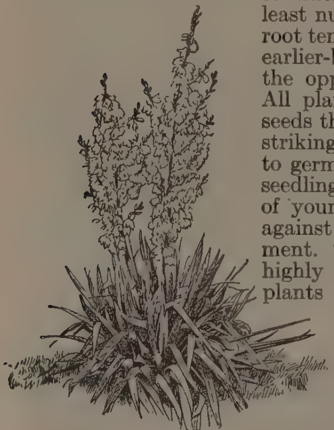
1823. A good subject—Eupatorium.

The time of year for separation will vary as to the blooming season of the plant; that is, for early-blooming plants late summer or early fall, and for late-blooming plants either late fall or spring, preferably the latter, as many otherwise hardy plants are either weakened or killed if disturbed in fall. See *Separation*, Vol. VI.

Propagation by cuttings is rarely useful for the amateur, in the case of herbaceous perennials, but it is an important commercial method. Plants may be obtained from almost any plant having foliage-stems by taking a short piece of the growing wood with a bud, either lateral or terminal, and placing the lower end in moist sand or other material suitable for root-growth. It is usually necessary to have the lower end of the cutting a node or joint of the stem, and to make the temperature of the material in which it is placed higher than that of the atmosphere (which is the relation of the soil and air in sunshine), and to diminish the evaporation from the exposed parts of the cutting by maintenance of a moist atmosphere and by removal in part of the foliage on the cutting. Some experience will be necessary to know the best temperatures for sand and atmosphere and the most desirable degree of ripeness in the wood to be taken, as they will vary somewhat with species. In general, any cutting of growing wood will form roots in moist sand at a temperature suitable for vigorous root-growth of the plant. See *Cuttings*. Vol. II.

The increase of plants by cuttings has the advantages of being rapid and of allowing the perpetuation of any variation noticed on a portion of any plant.

Whichever method of propagation is used, selection of stock for increase should be practised. If by seed, then the best seed from the best plant should be taken. It is considered that seeds borne the least number of nodes from the root tend to produce dwarfer and earlier-blooming plants, while the opposite is equally certain. All plants vary, and often the seeds that will produce the most striking variations are the slower to germinate and are weaker as seedlings, but any mistreatment of young plants is likely to be against any desirable improvement. The double-flowered and highly colored forms of garden plants are generally the results not only of intercrossing of species or selection, or both, but of intense and perfect culture. A poor, starved plant may not retrograde itself, but it is likely to produce seed which will vary.



1824. A good subject—Yucca filamentosa.

Variations in plants are the result of climatic, soil, cultural, and other conditions, and such plant forms are unstable when the conditions which caused them are radically changed. Any new variety naturally reproduces itself best in the region in which it originated, and may easily revert or otherwise change when grown under different conditions. This is especially true in the reproduction by seed of plant variations. See *Breeding*, Vol. I.

In propagating by division, the aim should be not only to secure vigorous plants but to select for increase such plants as appear to be the best. Cuttings also should be taken from selected plants—and the more so since the method is rapid. F. W. BARCLAY.

Herbs for the northeastern states.

Selections for special purposes.—The following lists are to be taken as merely suggestive, and are far from being complete. Nearly all are to be found in the American trade.

1. FOR MOIST AND WET PLACES. Those marked with an asterisk (*) will also thrive under drier conditions.

A. *Near the water's edge.* Actual flooding will not injure any of these.

Acorus japonicus.
Actæa.
Anemone apennina.
Anemone rivularis.
Anemone virginiana.
Caltha palustris.
Carex riparia.
Cyperus alternifolius.
*Cyperus Papyrus.
*Filipendula palmata.
*Filipendula rubra var. venusta.
*Iris Kaempferi.
Iris Pseudacorus.
*Iris sibirica.
*Monarda didyma.
Myosotis palustris.
Peltandra virginica.
Polygonum amphibium.
Polygonum sachalinense.
Pontederia cordata.
Primula pulverulenta.
Ranunculus aquatilis.
Ranunculus fluitans.
Ranunculus graminifolius.
Ranunculus hederaceus.
Ranunculus Lingua var. grandiflorus.
Rheum palmatum.
Rodgersia æsculifolia.
Rumex.
*Thalictrum aquilegifolium.
Typha latifolia.
Zizania aquatica.

AA. *Moist ground preferred.*

*Achillea Ptarmica, The Pearl.
*Aconitum.
Anemone alpina.
Anemone palmata.
*Arenaria balearica.
Arenaria purpurascens.
*Artemisia lactiflora.
Arundo Donax.
Asarum europæum.
Asperula odorata.
*Astilbe Arendsii var. hybrida.
*Astilbe Davidii.
*Astilbe grandis.
*Astilbe rivularis.
*Astilbe Thunbergii.
Astrantia carniolica.
Butomus umbellatus.
Caltha palustris.
Caltha polypetala.
Carex Fraseri.
Carex Gaudichaudiana.
*Chelone.
*Chrysobactron Hookeri.
*Cimicifuga racemosa.
Claytonia virginica.
*Cypripedium acaule.
Cypripedium spectabile.
*Dodecatheon Meadia.
*Doronicum.
Eomecon chionantha.
Epilobium angustifolium.
Epimedium macranthum.
Eryngium aquaticum.
Eupatorium purpureum.
Filipendula camtschatica (Spiræa gigantea).
Filipendula hexapetala.
Gunnera chilensis.
*Heleniums.
Hibiscus Moscheutos.
*Hosta cærulea (Funkia ovata).
*Hosta Sieboldiana.
Houstonia cærulea.
Iris cristata.
Iris Delavayi.
Iris Monnieri.
Iris setosa.
Ligularia.
*Lobelia cardinalis.
*Lobelia syphilitica.
*Lysimachia clethroides.
Lysimachia punctata.
Lysimachia thyrsiflora.
Lythrum.
*Mertensia virginica.
Mimulus cardinalis.
Miscanthus saccharifer.
Nierembergia rivularis.
*Œnothera fruticoa var. major
*Œnothera speciosa.
Ourisia coccinea.
Pennisetum latifolium.
*Phlox divaricata.
Podophyllum peltatum.
Polygonatum multiflorum.
Polygonum amphibium.
Polygonum sachalinense.
Polygonum Weyrichii.
Primula japonica.
Primula rosea.
Primula sikkimensis.
Rheum palmatum var. atro sanguineum.
Rhexia virginica.
Rumex Hydrolapathum.
Sarracenia Drummondii.
Sarracenia purpurea.
*Saxifraga peltata.
*Saxifraga virginiensis.
Senecio clivorum.
Senecio Veitchianus.
Senecio Wilsonianus.
Soldanella alpina.
Spartina cynosuroides var. aureo-marginata.
*Stenanthium robustum.
*Thalictrum adiantifolium.
*Thalictrum dipterocarpum.
*Thalictrum flavum.
Trillium.
*Trollius asiaticus.
Trollius europæus.
*Trollius excelsior.
Trollius giganteus.

2. For Dry Places. The following plants will grow in dry localities, withstanding considerable neglect and drought. Some are for this reason well adapted for naturalization.

**=Flower in spring. †=Flower in summer. §=Flower in autumn.*

*Alyssum saxatile var. compactum.
*Anemone caroliniana.
*Anemone Pulsatilla.
*Antennaria dioica.
†Anthericum Liliago.
*Aquilegia canadensis.
†Asclepias tuberosa.
†§Asters, many kinds.
†§Callirhoë involucrata.
*†Campanula, many kinds.
†Centaurea dealbata.
†Centaurea montana.
†Cerastium tomentosum.
*†Cheiranthus Allionii.
*Cheiranthus alpinus.
*†Cheiranthus, Harpur Crewe.
†Coronilla cappadocica.
§Coronilla varia.
†§Daphne Cneorum.
†Dianthus arenarius.
†Dianthus deltoides.
†Dianthus neglectus.
†Dianthus sylvestris.
†Dictamnus albus.
†Dictamnus albus var. caucasicus.
†Draba azoides.
†Draba pyrenaica.
†Echinops Ritro.
†Echinops sphærocephalus.
*†Erinus alpinus.
†§Erodium.
*Erysimum pulchellum.
†Euphorbia corollata.
†Euphorbia epithymoides.
†Genista sagittalis.
*†Geranium.
†Geum montanum.
†Gypsophila acutifolia.
†§Gypsophila paniculata.
†Helianthemum.
†§Heliopsis lævis var. Pitcheriana.
†§Hemerocallis.
*Hepatica.
†§Hieracium.
*Hutchinsia alpina.
*Iberis sempervirens.
†§Inula.
†Iris germanica.
†Iris pumila.
*Iris unguicularis.
†§Kniphofia.
*Lathyrus (Orobus) vernus.
†Leontopodium alpinum.
†Linarias.
†§Linum perenne.
Muehlenbeckia complexa.
†Œnothera Lamarckiana.
*Ononis rotundifolia.
†§Onopordon bracteatum.
†§Onopordon polycephalum.
*†§Papaver nudicaule.
*Phlox amœna.
*Phlox pilosa.
*Phlox subulata.
†Plantago maxima.
†Platycodon.
†Reseda glauca.
†Rudbeckia laciniata.
†Rudbeckia Newmanii.
†§Saponaria caucasica.
†Saponaria ocymoides.
*Saxifraga.
†§Sedum.
*Sempervivum.
*†Silene.
§Solidago.
§Statice latifolia.
†§Thymus.
†§Tunica Saxifraga.
†Verbascum.
*Vicia (Orobus) oroboides.
†Yucca filamentosa.
†Yucca flaccida.
†Yucca gloriosa.

3. For Shady Places.

A. The following plants require quite heavy shade; many others succeed almost equally well in sunshine and shade.

Anemone alpina.
Anemone canadensis.
Anemone nemorosa.
Anemone rivularis.
Anemone sylvestris.
Cortusa Matthioli.
Cypripedium.
Hepatica.
Horminum pyrenaicum.
Ourisia coccinea.

AA. Doing better in partial shade; a number of them will stand a moderate amount of sunshine.

Actæa spicata.
Adonis amurensis.
Adonis pyrenaica.
Adonis vernalis.
Anemone apennina.
Anemone ranunculoides.
Arnebia echioides.
Arum italicum.
Arum maculatum.
Asarum europæum.
Asperula odorata.
Astilbe.
Astrantia carniolica.
Claytonia virginica.
Convallaria majalis.
Cypripedium.
Digitalis purpurea.
Dodecatheon.
Doronicum.
Goodyera.
Habenaria.
Helleborus niger.
Helleborus niger var. altifolius.
Liparis.
Myosotis alpestris.
Myosotis palustris.
Omphalodes cappadocica.
Omphalodes verna.
Orchis spectabilis.
Polygonatum multiflorum.
Primula.
Ramondia Nathaliæ.
Ramondia pyrenaica.
Ranunculus aconitifolius.
Sanguinaria canadensis.
Saxifraga Camposii.
Saxifraga muscoides.
Saxifraga Rhei.
Spigelia marilandica.
Spiræa.
Tiarella.
Trillium.
Vancouveria hexandra.
Viola canina.
Viola pedata.

4. Suitable for Carpets or Edgings. The following are of compact habit and mostly low; some are also almost continuous bloomers.

Acæna, species.
Achillea Clavenæ.
Achillea tomentosa.
Achillea umbellata.
Æthionema iberidium.
Ajuga reptans.
Alyssum argenteum.
Alyssum saxatile var. compactum.
Arabis albida.
Arabis aubrietioides.
Arenaria balearica.

4. Suitable for Carpets and Edgings, continued.

Arenaria cæspitosa.
Armeria latifolia var. rosea.
Armeria plantaginea var. leucantha.
Armeria vulgaris.
Armeria vulgaris var. Laucheana.
Artemisia lanata.
Asarum europæum.
Aubrietia deltoidea.
Bellis perennis flore-pleno.
Campanula carpatica.
Cerastium tomentosum.
Daphne Cneorum (treated as an herb).
Dianthus cæsius.
Dianthus chinensis.
Dianthus deltoides.
Dianthus sylvestris.
Erodium Manescavi.
Erysimum pulchellum.
Helianthemum mutabile.
Heuchera sanguinea.
Iberis sempervirens.
Lavandula nana var. compacta.
Linaria hepaticæfolia.
Myosotis.
Nepeta Mussinii
Phlox amœna.
Phlox divaricata.
Phlox frondosa.
Phlox ovata.
Phlox reptans.
Phlox subulata.
Polemonium reptans.
Scabiosa graminifolia.
Silene acaulis.
Silene alpestris.
Silene maritima.
Silene Saxifraga.
Silene Schafta.
Tellima grandiflora.
Thymus citriodorus.
Veronica cæspitosa.
Veronica repens.
Veronica rupestris.
Viola cornuta var. alba.
Viola cornuta var. purpurea.

5. For Cut-flowers. The following varieties are well adapted for cutting.

**=Spring-flowering. †=Summer-flowering. §=Autumn-flowering.*

†Achillea Ptarmica, The Pearl.
†Achillea Ptarmica, Perry White.
†§Aconitum.
†Alstrœmeria.
§Anemone japonica.
*Anemone sylvestris.
†Anthericum.
†Anthurium.
†Aquilegia.
†Armeria vulgaris var. Laucheana.
§Artemisia lactiflora.
*†§Aster.
†§Astilbe.
*Baptisia australis.
†§Belamcanda chinensis (Pardanthus).
†§Boltonia.
†Campanula latifolia var. macrantha.
†Campanula Medium.
†Campanula persicifolia.
†§Campanula pyramidalis.
†Centaurea montana.
†Centaurea ruthenica.
†§Ceratostigma plumbaginoides.
†Chelone Lyonii.
†§Chrysanthemum maximum, in variety.
†§Chrysanthemum, Autumn Glory.
†Cimicifuga racemosa.
†Clematis Davidiana.
†Clematis recta.
†Clematis recta flore-pleno.
†Convallaria majalis.
†Coreopsis grandiflora.
†§Delphinium.
*†Dianthus.
*†Dicentra spectabilis.
†Dictamnus albus.
†Digitalis purpurea.
*Doronicum.
†Epilobium angustifolium.
†§Erigeron.
§Eupatorium.
†Euphorbia corollata.
†§Gaillardia aristata.
†Gaillardia grandiflora.
†§Geum coccineum, Mrs. Bradshaw.
†Gypsophila acutifolia.
†Gypsophila paniculata.
†Helleborus niger.
§Helenium autumnale var. superbum.
§Helenium autumnale var. pumilum.
†Helenium Hoopesii.
†§Helianthus.
†§Heliopsis lævis var. Pitcheriana.
†§Hemerocallis.
†§Hesperis matronalis.
†Heuchera sanguinea.
§Hosta plantaginea var. grandiflora.
†§Hypericum Moserianum.
*Iberis sempervirens.
†Incarvillea Delavayi.
†Iris germanica.
†Iris Kaempferi.
†Iris sibirica.
†§Kniphofia (Tritoma).
Lathyrus latifolius.
†§Liatris pycnostachya.
§Lobelia cardinalis.
†§Lobelia syphilitica.
†Lupinus polyphyllus.
†Lychnis.
†§Lysimachia clethroides.
†§Lythrum Salicaria var. roseum superbum.
*†Myosotis.
†Œnothera speciosa.
†Pæonia.
*†Papaver.
†§Pentstemon.
†Phlox Arendsii.
*Phlox divaricata.
†§Phlox paniculata.
†Phlox suffruticosa.
†§Physostegia virginiana.
†Platycodon grandiflorum.
†§Plumbago Larpentæ.
*†Polemonium.
†Potentilla.
*Primula.
†Pyrethrum hybridum.
§Pyrethrum uliginosum.
†Rehmannia angulata.
†§Rudbeckia.
†Salvia azurea.
†Salvia pratensis.
†Saxifraga pyramidalis.
†§Scabiosa caucasica.
§Sedum spectabile.
†Sidalcea candida.
†Sidalcea malvæflora var. Listeri.
§Solidago.
†Spiræa.
†§Statice latifolia.
†§Stokesia cyanea.
†§Thalictrum adiantifolium.
§Thalictrum dipterocarpum.
†Thermopsis caroliniana.
*†Trollius.
†Valeriana officinalis.
Veronica longifolia var. subsessilis.
Veronica spicata.
†Yucca filamentosa.

In addition to the foregoing list, there are a number of other plants usually accepted and often listed as herbaceous plants, such as montbretias, eremurus, lilium, which are suitable for cutting. These will be found under *Bulbs*.

6. **For Bold Effects.** The following plants are striking in their habit and for this reason are very serviceable in groups or as single specimens. Some are foliage plants with comparatively inconspicuous flowers.

**=Tall varieties, growing 5 feet or more in height.*
†=Medium varieties, growing from 2 to 4 feet.
§=Varieties with striking foliage.

*Acanthus mollis var. latifolius.
†Anemone japonica.
†Artemisia lactiflora.
†§Aruncus sylvester.
*Arundo Donax.
*Astilbe Arendsii.
*Astilbe Davidii.
*Astilbe grandis.
§Bambusa.
†Baptisia australis.
†Clematis recta.
*Crambe cordifolia.
*Delphinium hybridum.
†Dictamnus albus.
†Echinacea purpurea (Rudbeckia).
§Elymus glaucus.
§Eryngium amethystinum.
†Filipendula rubra var. venusta.
§Gunnera chilensis.
*Helenium autumnale var. superbum.
†Helenium, Riverton Beauty.
*Helianthus mollis.
†Helianthus decapetalus, Soleil d'Or.
*Helianthus orgyalis.
†Hemerocallis aurantiaca var. major.
†Hemerocallis flava.
†Hemerocallis Thunbergii.
§Heracleum villosum.
†§Hosta plantaginea var. grandiflora.
†Hypericum Moserianum.
†Kniphofia Uvaria var. nobilis.
†Kniphofia Pfitzeri.
†Pæonia.
†Papaver orientale.
†Phlox paniculata.
*†Polygonum sachalinense.
*§Polygonum Sieboldii.
§Rheum palmatum var. atrosanguineum.
*§Rodgersia æsculifolia.
*§Rodgersia pinnata.
*Rudbeckia, Golden Glow.
*Rudbeckia maxima.
*Thalictrum dipterocarpum.
†Veronica longifolia var. subsessilis.
*§Yucca filamentosa.

7. **For Forcing and Greenhouse Decoration.** The following species are suitable for forcing. As a general rule, they succeed best in a temperature not exceeding 50° at night. Many of these can be potted, but some of the more robust sorts are better grown in boxes or benches. The astilbes and spireas will thrive in a higher temperature than other varieties named.

Alyssum saxatile var. compactum.
Aquilegia cærulea.
Aquilegia chrysantha.
Arabis alpina.
Aster alpinus.
Aster subcæruleus.
Astilbe Arendsii.
Astilbe Davidii.
Astilbe grandis.
Aubrietia, all varieties.
Campanula carpatica.
Campanula Medium.
Campanula pyramidalis.
Cheiranthus Allionii.
Cheiranthus alpinus.
Coreopsis grandiflora.
Cypripedium acaule.
Cypripedium pubescens.
Cypripedium spectabile.
Delphinium grandiflorum.
Delphinium hybridum.
Dianthus cæsius.
Dianthus deltoides.
Dianthus, Napoleon III.
Dianthus neglectus.
Dicentra spectabilis.
Digitalis purpurea.
Digitalis purpurea var. gloxiniæflora.
Dodecatheon Meadia.
Francoa ramosus.
Gerbera Jamesonii.
Geum coccineum, Mrs. Bradshaw.
Helleborus niger var. major.
Hepatica angulosa.
Hepatica triloba.
Hesperis matronalis.
Heuchera sanguinea.
Hosta lancifolia var. albomarginata.
Iberis sempervirens.
Incarvillea Delavayi.
Iris cristata.
Iris pumila.
Myosotis, all kinds.
Pæonia, all varieties.
Papaver nudicaule.
Phlox amœna.
Phlox Arendsii.
Phlox divaricata.
Phlox subulata.
Phlox suffruticosa, Miss Lingard.
Polygonatum multiflorum.
Primula, all species.
Pyrethrum hybridum.
Saxifraga, all species.
Sisyrinchium angustifolium.
Spiræa, many species.
Trillium, all species.
Trollius, all species.
Vicia oroboides (Orobus).
Viola, all kinds.

8. **New and Very Desirable Species.** The following list comprises some of the best introductions of recent years, up to and including 1914.

Achillea Ptarmica, Perry White.
Aconitum Fischeri var. Wilsonii.
Aconitum Hemsleyanum.
Anchusa italica, Dropmore.
Anchusa italica, Opal.
Anchusa italica, Perry variety.
Anchusa myosotidiflora.
Anemone vitifolia.
Arabis aubrietioides.
Artemisia lactiflora.
Aster Amellus, Beauty of Rowdorf.
Aster, Beauty of Colwell.
Aster, Feltham Blue.
Aster novæ-angliæ, L. Fardel.
Aster novi-belgii, St. Egwin.
Aster, Peter White.
Astilbe Arendsii, Ceres.
Astilbe Arendsii, Pink Pearl.
Astilbe Arendsii, Queen Alexandra.
Astilbe Arendsii, Salmon Queen.
Astilbe Arendsii, Vesta.
Campanula carpatica, Kilnfield White.
Campanula, Warley.

8. **New and Very Desirable Varieties**, continued.

Chrysanthemum, Autumn Glory.
Chrysanthemum maximum, Etoile de Nouvelles.
Chrysanthemum maximum, King Edward VII.
Chrysanthemum maximum, Mrs. Tersteeg.
Chrysanthemum, Rosy Gem.
Clematis recta flore-pleno.
Delphinium Belladonna semi-plena.
Delphinium, J. S. Brunton.
Delphinium, Rev. E. Larcelles.
Delphinium Moerheimei.
Delphinium, Persimmon.
Geum coccineum, Mrs. Bradshaw.
Gypsophila paniculata flore-pleno.
Helenium autumnale, Riverton Beauty.
Helenium autumnale, Riverton Gem.
Heuchera gracillima, Perry var.
Heuchera, Nancy Perry.
Heuchera, Scarlet Spray.
Heuchera, Shirley.
Kniphofia, John Benary.
Kniphofia, Twilight.
Kniphofia, Unique.
Iris germanica, Kashmir White.
Iris germanica, King of Iris.
Iris germanica, Lady Foster.
Iris germanica, Lohengrin.
Iris germanica, Miss Willmott.
Iris interregna, varieties.
Lupinus polyphyllus var. Mœrheimei.
Phlox Arendsii, all varieties.
Phlox paniculata, Frau A. Buchner.
Phlox paniculata, Eliz. Campbell.
Phlox paniculata, Rheinlander.
Phlox paniculata, Rynstrom.
Phlox paniculata, G. A. Strohlein.
Primula Beesiana.
Primula Bulleyana.
Primula Forrestii.
Primula pulverulenta.
Primula sikkimensis.
Primula Veitchii.
Salvia virgata var. nemorosa.
Sedum spectabile, Brilliant.
Senecio clivorum.
Senecio tanguticus.
Thalictrum dipterocarpum.
Viola cornuta var. purpurea.

W. N. Craig.

Herbs in Canada.

Many species and varieties of herbs succeed admirably in Canada, the covering of snow which they have in winter, in most places, affording them excellent protection from extreme cold and sudden changes of temperature. The conditions are thus, in many places, more favorable than farther south, where they are exposed, for long periods, to cold and changeable weather.

Following are lists of best herbaceous perennials.

One hundred best hardy herbaceous perennials for the Dominion of Canada, except prairie provinces.

**=Best twenty-four.*

Achillea Ptarmica fl.-pl., The Pearl.
Aconitum Fischeri.
Aconitum Napellus var. bicolor.
Adonis vernalis.
Æthionema grandiflorum.
Althæa rosea (Hollyhock).
*Anemone japonica varieties.
Anemone patens var. Nuttalliana.
Anemone sylvestris.
Aquilegia chrysantha.
*Aquilegia cærulea and hybrids.
Aquilegia flabellata var. nana alba.
Aquilegia glandulosa.
Aquilegia oxysepala.
*Arabis albida var. flore-pleno.
Aruncus sylvester var. Kneiffi.
Aster alpinus var. superbus.
Aster Amellus var. amelloides.
Aster Amellus var. bessarabicus
Aster novæ-angliæ, Mrs. J. F. Rayner.
Campanula carpatica and varieties.
Campanula lactiflora.
Campanula latifolia var. macrantha.
*Campanula persicifolia and varieties.
Campanula pyramidalis.
*Chrysanthemum maximum, varieties.
Cimicifuga americana.
*Clematis recta.
Convallaria majalis.
*Coreopsis grandiflora.
Delphinium Belladonna (a name for garden forms).
Delphinium cashmerianum.
*Delphinium grandiflorum (D. chinense).
*Delphinium hybridum and varieties.
*Dianthus plumarius, Mrs. Sinkins.
*Dicentra spectabilis.
Dictamnus albus.
Doronicum plantagineum var. excelsum.
Echinacea purpurea.
*Epimedium alpinum var. rubrum.
Erigeron speciosus var. superbus.
Filipendula hexapetala var. flore-pleno.
Filipendula rubra.
Gaillardia aristata.
Gypsophila paniculata.
Helenium autumnale var. pumilum magnificum.
Helenium autumnale var. striatum.
Helenium Hoopesii.
Helianthus multiflorus, Meteor, or Soleil d'Or.
Helianthus multiflorus, Mrs. Moon.
Helianthus rigidus, Miss Mellish.
*Hemerocallis aurantiaca var. major.
*Hemerocallis flava.
Hemerocallis Thunbergii.
Heuchera brizoides var. gracillima.
Heuchera sanguinea var. splendens.
Hibiscus Moscheutos and varieties.
Hosta plantaginea.
Iberis sempervirens var. Garrexiana.
Iberis sempervirens var. superba, Snowflake.

Hardy herbaceous perennials for the Dominion of Canada, continued.

Incarvillea Delavayi.
Iris aurea.
*Iris germanica, in great variety.
*Iris lævigata (Kaempferi), in great variety.
Lilium auratum.
Lilium croceum, or L. dauricum (davuricum).
Lilium longiflorum.
Lilium speciosum and varieties.
*Lilium superbum.
*Lilium tenuifolium.
Lilium testaceum.
Lilium tigrinum.
Lupinus polyphyllus.
Mertensia virginica.
Monarda didyma.
Myosotis alpestris.
Œnothera fruticosa var. Youngii.
*Pæonia albiflora and P. officinalis, in great variety.
Pæonia tenuifolia var. flore-pleno.
*Papaver nudicaule.
Papaver orientale and varieties.
Phlox amœna.
Phlox divaricata.
Phlox glaberrima var. suffruticosa, Miss Lingard.
*Phlox paniculata (P. decussata), in great variety.
*Platycodon grandiflorum.
Platycodon grandiflorum var. album.
Polemonium humile.
Primula elatior.
*Rudbeckia laciniata fl.-pl., Golden Glow.
Rudbeckia maxima.
Rudbeckia speciosa (R. Newmanii).
Salvia azurea var. grandiflora.
Statice latifolia.
Trillium grandiflorum.
Trollius asiaticus var. plenus.
*Trollius europæus, Orange Globe.
Veronica subsessilis.
Yucca filamentosa.

Best hardy herbaceous perennials for the prairie provinces of Canada.

Achillea Ptarmica fl.-pl., The Pearl.
Aconitum, in variety.
Anemone patens var. Nuttalliana.
Aster novæ-angliæ.
Coreopsis lanceolata.
Delphinium, in variety.
Dianthus, in variety.
Dicentra spectabilis.
Dictamnus albus var. purpureus.
Doronicum caucasicum.
Filipendula Ulmaria.
Gaillardia aristata.
Hemerocallis flava.
Iris germanica, in variety.
Lilium tigrinum.
Pæonia, in variety.
Papaver nudicaule.
Papaver orientale.
Phlox paniculata, in great variety.
Platycodon grandiflorum.
Pyrethrum uliginosum.

W. T. Macoun.

Western perennials for western gardens.

A leading principle in the prairie style of landscape gardening is restoration of the native flora. The history of every country shows three stages in the development of taste. First, the native flora tends toward extermination by agriculture, drainage, fires, and the growth of cities. Second, cosmopolitanism spreads everywhere, until the gaudiness of temporary plants, like cannas and coleus and the artificiality of complicated geometric beds tends to make all parts of the world look alike. Third, people recognize that the greatest variety and highest beauty come from restoring and intensifying the "local color" originally impressed upon each distinct region by eons of experiment on the part of nature. This "return to nature," which has taken many centuries in Europe has begun in Illinois within a single century, owing largely to the high percentage (89 per cent) of its arable land. The process of banishing native vegetation went so fast and far that, a few years ago, the secretary of the Illinois Horticultural Society declared, "It is probable that no equal area of the earth's surface has been degraded to such utter ugliness and monotony as Illinois." But, in 1906 to 1909, nearly $4,000,000 was spent on the West Side parks of Chicago under the direction of Jens Jensen, with restoration as the leading idea. The largest and most impressive restorations in the Middle West are, "the Prairie River" in Humboldt Park, and "Chicago during the carboniferous era" in the greenhouses at Garfield Park. In all western restorations, perennials are often more important than trees or shrubs, because the former are the characteristic vegetation of prairies, or treeless areas, and because there are more species of western herbs than of western woody plants.

Perennials that do not cross the Alleghanies.—Of the 179 plants that do not cross the Alleghanies, according to Brendel ("Flora Peoriana," pp. 76–78), thirty-four are perennials cultivated for ornament. Of western origin, he thinks, are the following: *Anemone caroliniana, Chrysopsis villosa, Clematis Simsii* (*C. Pitcheri*), *Echinacea angustifolia, Helianthus lætiflorus* and *H. scaberrimus* (*H. rigidus*), *Lithospermum linearifolium* (*L. angustifolium*), *Lythrum alatum, Petalostemon candidus* and *P. violaceus, Camassia esculenta*, (*Quamasia hyacinthina*), and *Solidago glaberrima* (*S. missouriensis*, Hort. not Nutt.). The above came originally from the Great Plains. Of southern origin are: *Amsonia Tabernæmontana* (*A. Amsonia*), *Baptisia leucantha, Boltonia asteroides, Coreopsis lanceolata, Liatris* (or *Lacinaria*) *cylindracea* and *L. pycnostachya, Lepachys* (or *Ratibida*) *pinnata, Rudbeckia subtomentosa* and *R. triloba* (biennial), *Silphium laciniatum, S. perfoliatum*, and *S. terebinthaceum*. The origin of the eleven following species is not stated: *Cypripedium candidum, Echinacea purpurea, Eupatorium altissimum, Filipendula rubra* (*Ulmaria rubra, Spiræa lobata*), *Helianthus doronicoides, Heuchera hispida, Hibiscus militaris, Jeffersonia diphylla, Phlox glaberrima* and *P. maculata*, and *Solidago ohioensis*.

State flowers.—Before a legislature chooses a state flower, lists like the above should be carefully studied by impartial observers, to make sure that the flowers recommended are really characteristic, easy of cultivation, and lend themselves to the decorative arts. When sentiment alone is allowed to decide these matters, plants are often chosen which it is impracticable to grow. Yet, it is a great advantage to choose a flower that can be grown in every garden. One prairie state chose the "prairie violet." Doubtless the showy *Viola sororia* was meant, yet this is a native of the woods, and it is as common East as West. The bird's-foot violet (*V. pedata*) is showy on the dunes, and, even when conventionalized by the decorative arts, would be distinct, but it is not confined to the West. Its western representative (*V. pedatifida*) is a genuine prairie plant, but infrequent and presumably impracticable for cultivation. Unfortunately, *V. sororia* makes its response to good soil by producing leaves instead of flowers.

City flowers.—The western cities have now definitely begun the practice of choosing city flowers to be grown in every yard and woven into their civic art. Perhaps the most appropriate way to symbolize the history or ideals of each locality is to choose a flower characteristic of its peculiar scenery or soil type. The soil type can be determined by correspondence with the Bureau of Soils, United States Department of Agriculture. The prairie states belong chiefly to the Upper Austral zone, but there are a few cities and counties that can choose their public planting motives from the Lower Austral and some from the Transition zones. "Life Zones and Crop Zones," by C. H. Merriam (Bulletin No. 10, Division of Biological Survey), gives the trees characteristic of each zone, and these may be helpful in suggesting the most characteristic plant-associations of each locality. The nearest local botanist will usually give invaluable help.

The best garden perennials.

The following are all sun-loving plants, succeeding in ordinary garden soil without special care. They are arranged according to the month in which they ordinarily begin to bloom, although, of course, considerable variation in season may be expected.

White.—April: *Sanguinaria canadensis*. May: *Phlox divaricata* var. *alba grandiflora*. June: *Anemone canadensis, Pentstemon Cobæa* var. *albus*. July: *Euphorbia corollata, Phlox paniculata* vars. Miss Lingard, Snow Queen, White Queen, Albion, Diadem, Hermione, Helena Vacaresco, and Von Lassburg, *Physostegia virginiana, Thalictrum polygamum*. August: *Boltonia asteroides, Hibiscus Moscheutos* var. *albus, Salvia azurea* var. *alba, Aster ptarmicoides*. September

Eupatorium urticæfolium. October: *Aster commutatus. A. ericoides* var. Sensation, *A. Tradescantii.*

Blue.—April: *Iris cristata* and *I. verna, Phlox Stellaria.* May: *Amsonia Tabernæmontana, Baptisia australis, Phlox divaricata, Polemonium reptans, Camassia esculenta.* June: *Tradescantia virginiana, Clitoria mariana.* July: *Delphinium carolinianum* (bluish white). August: *Eupatorium cœlestinum.* October: *Aster lævis* and *A. amethystinus.*

Pink.—June: *Tradescantia virginica* var. *delicata.* July: *Phlox paniculata* vars. Grévin, Lady Molly, Sonnenkind, and Le Soleil, *Echinacea purpurea* var. *rosea* (*Rudbeckia elegans rosea*), *Physostegia virginiana* var. *speciosa.* August: *Hisbiscus Moscheutos* and *H. militaris.* September: *Boltonia asteroides, Aster longifolius, A. ericoides* var. Sensation, *A. novæ-angliæ* var. Ryecroft Pink, *A. paniculatus* var. Triumph.

Rose and rosy purple.—July: *Physostegia virginiana.* August: *Liatris* (*Lacinaria*) *pycnostachya, L. scariosa,* and *L. squarrosa.* September and October: *Aster novæ-angliæ* var. *roseus, Lythrum alatum.*

Purple and violet.—May: *Clematis Simsii* (*C. Pitcheri*), *Sedum pulchellum.* July: *Phlox paniculata* var. Ryecroft Purple, *Echinacea purpurea.* August: *Aster Shortii.* September: *Aster patens.*

Crimson.—June: *Callirhoë involucrata.* July: *Phlox paniculata* var. Lord Kelvin. September: *Aster novæ-angliæ* var. *coccineus.*

Magenta.—May: *Phlox pilosa, P. stolonifera* (*P. reptans*). June: *Phlox glaberrima, P. maculata.* July: *Phlox paniculata* vars. Champs Elysées. Eclaireur and Obergärtner Wittig.

Scarlet.—May: *Aquilegia canadensis.* June: *Lilium canadense* var. *rubrum, L. umbellatum,* Pursh. not Hort. July: *Pentstemon barbatus* var. *Torreyi* (from the Great Plains), *Phlox paniculata* var. Stendahl, *Lilium canadense* var. *rubrum.* August: *Gaillardia aristata* var. Glory.

Yellow.—May: *Caltha palustris* var. *flore-pleno, Aquilegia canadensis* var. *flavescens, Ranunculus repens* var. *flore-pleno, Viola Nuttallii.* June: *Œnothera missouriensis, Lepachys pinnata, Baptisia tinctoria, Coreopsis lanceolata* and *C. grandiflora.* July: *Coreopsis verticillata, Helianthus mollis, H. lætiflorus* and *H. strumosus* (*H. macrophyllus*), *Silphium perfoliatum, Chrysopsis villosa, Asclepias tuberosa, Rudbeckia speciosa* and *R. Newmanii, Heliopsis helianthoides, H. lævis* and var. *Pitcheriana, H. scabra* var. *zinniæflora.* August: *Rudbeckia fulgida* and *R. subtomentosa, Coreopsis tripteris, Helenium autumnale* and var. *pumilum magnificum, Helianthus decapetalus* vars. *multiflorus, maximus,* and Soleil d' Or, *Helianthus scaberrimus* (*H. rigidus*) var. Miss Mellish. September: *Helianthus orgyalis.* October: *Helianthus Maximilianii.*

Orange.—May: *Lithospermum canescens.* July: *Asclepias tuberosa.*

Perennials classified by height.—It is easy to get flowers of medium height any month from the color lists given above. The prairie has also produced many tall perennials suitable for gardens, especially in the genera Helenium and Helianthus, which furnish many species that grow taller than a man. Many asters and the boltonias will attain 5 feet under favorable conditions, and so will *Lilium canadense* and *L. superbum,* if they have shade and unfailing moisture. The prairie has produced no edging plants equal to the pinks, alyssums, or rock cresses. Perhaps the best western garden plants growing 12 inches high or less are: April: *Iris cristata* and *I. verna, Sanguinaria canadensis.* May: *Fragaria virginiana* var. *illinoiensis, Lithospermum canescens, Ranunculus repens* var. *flore-pleno.* June: *Sedum pulchellum* and *S. ternatum, Œnothera missouriensis, Callirhoë involucrata,* and the plant known to the trade as *Erigeron glabellus,* which blooms in October, and is presumably different from the spring-blooming *Erigeron asper,* to which *E. glabellus* has been referred (although some retain *E. asper* as a synonym of *E. glabellus*).

Perennials for special uses and soils.

Perennials for cut-flowers.—The ideal subject for cutting lasts a long time, has long stems, is fragrant, and has large or numerous flowers. About the only perennial that comes up to this standard is the garden phlox, but long stems and large flowers are produced by many species of Gaillardia, Helianthus, Heliopsis, and Rudbeckia. Smaller flowers in abundance are produced by Aster, Boltonia, and Coreopsis. Long and effective spikes are produced by Liatris, and Physostegia. For lightening bouquets, *Galium boreale* is an excellent substitute for *Gypsophila paniculata.*

Perennials for fragrance.—The phloxes are fragrant at dusk, but otherwise the prairie seems to have produced no fragrant flowers of the first importance for cultivation.

Perennials for the collector.—The groups that appeal most to collectors are those having the greatest variety in form, color, and size. Perennial phlox (*P. paniculata*) has produced more varieties in cultivation than any other American flower, one Scotch catalogue offering 346 kinds. The color range is from purple through crimson-pink to white, and the chief forms are the large-flowered, large-trussed, and halo. *Gaillardia aristata* has produced 102 varieties, ranging from yellow to red, the chief forms being toothed, laciniate, quilled, and reflexed, with some double varieties (e.g. *G. splendidissima plena*) and a maximum size of 5½ inches (James Kelway). The perennial sunflowers make a very impressive collection, but require much space unless only a few of each kind are grown. They are all yellow-flowered, and offer no great variety of form but they vary in season from July to October, and in height from 3 to 12 feet, with single or double flowers and yellow or brown disks. The best twelve species of sunflower are native to the prairie. The coneflowers (comprising Rudbeckia and Lepachys) make a more elegant and varied collection with a wider range of color, the prominent disks being green, yellow, brown, or purple, while the rays range from yellow to reddish brown and purple. Thirty-nine species and seventy-one varieties of perennial asters or Michælmas daisies are offered by a single English dealer. There are thirty-nine species native to the prairie, and in cultivation. The New Jersey aster (*A. novi-belgii*), which is not native to the prairie, has produced the greatest number of varieties, viz., forty-five. Asters are more satisfactory in borders by themselves than in the garden.

Perennials for light soils.—All the artists of the prairie school have been deeply influenced by the sand-dunes near Chicago, to which the Prairie Club has conducted several hundred excursions. The flowers of the dunes have been introduced into the gardens of Chicago, a large part of which is built on dunes. In perhaps a third of the city, the conventional material of the nurseries fails to give satisfaction, but the plants of the dunes succeed admirably. The greatest color shows at the dunes are produced by *Lupinus perennis* and *Viola pedata,* which bloom by the thousands in sand, but commonly fail in rich soil. Other showy perennials of these and other inland dunes are, *Asclepias tuberosa, Euphorbia corollata, Liatris scariosa, Lathyrus maritimus, Lithospermum canescens,* the fleshy-leaved *Solidago Virgaurea, Tephrosia virginica,* and *Physostegia virginiana,* which assumes fleshy leaves and dwarf habit in sand. One of the best grasses is *Calamovilfa longifolia,* and one of the best gray-leaved plants is *Artemisia canadensis.*

Perennials for the roadside.—The greatest opportunity for the public use of perennials in the prairie states is connected with the roadsides, which can be turned into a public park without the cost of buying the land.

LIII. Good use of spring flowers.—Mertensia virginica.

The roadside is the chief sanctuary of the native flora, and if the movement to preserve and restore the prairie flowers has progressed farther in the prairie states than others it may be because the prairie states must, to a great extent, create their own scenery. The following list contains very characteristic and beautiful flowers that can be bought or collected cheaply, and are easy of cultivation, but not weedy. Many of them are excellent for cut-flowers, but few of them would be likely to encourage vandalism. To this list should be added three important bulbous plants which can be used to edge the shrubbery, viz., dodecatheon, mertensia, and camassia. The following plants are all sun-loving species, and most are well adapted to stand drought: May: *Phlox divaricata.* June: *Callirhoë involucrata, Tradescantia virginica, Phlox glaberrima* and *P. maculata, Eryngium aquaticum.* July: *Phlox paniculata, Echinacea purpurea, Helianthus mollis, H. lætiflorus, H. helianthoides, Asclepias tuberosa, Rudbeckia speciosa, Heliopsis scabra.* August: *Gaillardia aristata, Boltonia asteroides, Liatris pycnostachya, Aster novæ-angliæ, Rudbeckia subtomentosa, Helenium autumnale, Helianthus decapetalus.* September: *Aster ericoides, A. paniculatus,* and *A. patens, Helianthus orgyalis.* October: *Aster amethystinus, A. lævis,* and *A. commutatus, A. Tradescantii, Helianthus Maximilianii.*

Perennials for shade.—A great problem in the prairie states is restoration of wild flowers to woodlots that have been pastured. The chief wooded areas are along streams and whenever they exist elsewhere they furnish the only scenic foil to, or relief from, the prairie. The western woods are scarcely differentiated from the eastern woods in spring unless by greater abundance of American bluebells (*Mertensia virginica*), and wild blue phlox (*P. divaricata*). The snow or early wake-robin (*Trillium nivale*) is often the first flower, preceding the hepaticas. Perhaps the most characteristic spring wild flower of the woods is *Erythronium albidum,* which replaces the yellow adder's-tongue of the East. In summer, the most characteristic species, probably, are *Helianthus decapetalus* and *H. divaricatus. Lilium canadense* and *L. superbum* grow taller and produce more flowers in moist woods than open places. At the edge of the woods, *Anemone virginiana* and *A. canadensis* bloom freely. Phloxes appear to much better advantage in woods where their magenta color is toned down by the shade, especially when they are seen amid grass. The best planting policy ordinarily is to spend money chiefly near the trails, a favorite foliage plant beside trails being the maidenhair fern (*Adiantum pedatum*). Perhaps the best large masses of color are produced by colonies of *Cimicifuga racemosa* and *Aralia racemosa,* the berries of which change from green through purple to scarlet during the summer.

In autumn, many species of aster and goldenrod fill the woods, notably *Aster cordifolius* and *A. divaricatus,* and *Solidago cæsia.*

Perennials for rock-gardens.—Natural rocks are so rare in the West that rock-gardens hardly seem appropriate. Among the best flowers native to western rocks are *Aquilegia canadensis, Campanula rotundifolia, Eupatorium cælestinum, Fragaria virginiana* var. *illinoiensis, Heuchera americana, Oxalis violacea, Sedum pulchellum* and *S. ternatum,* and *Silene virginica.*

Perennials for bog-gardens.—Sphagnum bogs in convenient locations are getting rare in the West, but western people are beginning to buy them because they contain some of the most beautiful flowers, especially orchids, pitcher-plants, and members of the heath family. Many of these plants and the fringed gentian require sphagnum moss or peat. They present a higher type of beauty than the plants that grow in ordinary muck or wet soil, which are named in the next list.

Water-loving perennials.—The following are suitable for the margins of ponds, lakes, brooks, rivers, and water-gardens. They require more water than it is convenient to give them in ordinary flower-gardens, and even if they thrive they are likely to look out of place: April: *Caltha palustris.* May: *Chamælirium luteum, Senecio aureus, Menyanthes trifoliata.* June: *Iris versicolor, Parnassia caroliniania, Angelica atropurpurea.* July: *Angelica hirsuta, Aster puniceus, Caltha palustris, Lilium canadense* and *L. superbum, Thalictrum polygamum* (*T. Cornuti*). August: *Lobelia cardinalis, Aster paniculatus, Eupatorium purpureum, Hibiscus Moscheutos.* September: *Gentiana Andrewsii, Helenium autumnale, Pontederia cordata.* October: *Helianthus orgyalis* and *H. Maximilianii.* Colored water-lilies are not used in the prairie style of landscape gardening as they spoil the purity of the composition, since the white water-lily is the only one native to prairie rivers. Perhaps the finest aquatic plant yet to be naturalized in western water-gardens is the yellow lotus (*Nelumbo lutea*).

Bird-pools.—Few, if any, perennials are worth planting around bird-pools to furnish food, but water-loving perennials are important for finishing such compositions. Where the gardenesque style uses German or Japanese iris, variegated calamus, eulalia, and eastern cattail, the prairie style uses *Iris versicolor,* green calamus, bluejoint (*Calamagrostis canadensis*), and western cattail (*Typha angustifolia*). Several wild flowers of the lily family suggest the flight of birds by their habit, e.g., *Polygonatum giganteum.* In the prairie school, the motive is often to reproduce something like the characteristic local spring. Among the original plants native to springs which Brendel records are, *Archangelica atropurpurea, Aster corymbosus* and *A. umbellatus, Caltha palustris, Parnassia caroliniana, Cypripedium spectabile* and *C. candidum,* the last of which is distinctly western.

Bibliography.—H. C. Cowles, "The Plant Societies of Chicago and Vicinity" (1901); Frederick Brendel, "Flora Peoriana (1887); Brendel in Fred Gerhard, "Illinois as It Is" (1857), pp. 271–8; H. A. Gleason, "A Botanical Survey of the Illinois River Valley Sand Region" in Bot. Gaz. 7:149–194 (1907); and "The Vegetation of the Inland Sand Deposits of Illinois," Bull. Ill. State. Lab. Nat. Hist. 9:23–171 (1910).

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Perennial herbs for the South.

1. *Piedmont Zone* extends from the Mountain Zone to the "Fall Line," which follows approximately the following cities: Weldon and Raleigh, North Carolina; Camden and Columbia, South Carolina; Augusta, Milledgeville, Macon and Columbus, Georgia; Montgomery, Alabama; Columbus and Holly Springs, Mississippi.

Sun-loving plants for Piedmont Zone.

Acanthus mollis.
Achillea Millefolium.
Adonis vernalis.
Agave.
Alyssum saxatile.
Amaryllis.
Anchusa italica.
Anemone japonica.
Anthemis tinctoria.
Antigonon leptopus.
Aquilegia.
Arabis alpina.
Arenaria grandiflora.
Armeria vulgaris.
Artemisia.
Arundo Donax.
Asclepias.
Asters, grandiflorus, etc.
Astilbe chinensis.
Astilbe japonica.
*Astragalus tennesseensis.
Bamboo.
Baptisia australis.
Belamcanda chinensis.
Bocconia cordata.
Boltonia.
Caladium esculentum.
Callirhoë involucrata.
Campanula.
Canna.
Centaurea.
Chrysanthemums.
Clematis.
Clerodendron macrosiphon.
Coreopsis lanceolata.
Coronilla.
Crinum.
Dahlia.
Dianthus barbatus.
Dianthus deltoides.
Dianthus latifolius.
Dianthus plumarius.
Dictamnus albus.

**Astragalus tennesseensis,* Gray, from Tenn. and Ala. Hirsute: fls. in a short spike or head, cream-color, often tinged with purple: fr. pointed, strongly wrinkled. April, May.

Sun-loving plants, continued.

Digitalis.
Dioscorea. Climber.
Dolichos. Climber.
Doronicum plantagineum var. excelsum.
Echinacea purpurea.
Erianthus.
Eryngium amethystinum.
Erythrina herbacea.
Eulalia (Miscanthus).
Eupatorium.
Euphorbia corollata.
Festuca glauca.
Gaillardia.
Geranium maculatum.
Gilia coronopifolia.
Gynerium (Cortaderia).
Gypsophila.
Helenium.
Helianthus.
Heliopsis lævis.
Hemerocallis.
Heuchera sanguinea.
Hibiscus.
Hosta (Funkia).
Hydrangea.
Iberis.
Incarvillea Delavayi.
Indigofera decora.
Ipomœa.
Iris germanica.
Iris verna.
Lathyrus latifolius.
Lavandula vera.
Lespedeza japonica.
Lespedeza Sieboldii.
Liatris.
Lilium.
Linum perenne.
Liriope spicata.
Lupinus polyphyllus.
Lychnis.
Lysimachia clethroides.
Malvaviscus Drummondii.
Marshallia.
Monarda didyma.
Montbretia.
Nierembergia rivularis.
Œnothera.
Oxalis. [Ground cover.
Pachysandra terminalis.
Pæonia.
Papaver orientale.
Pennisetum longistylum.
Pentstemon.
Phalaris.
Phlox amœna.
Phlox decussata.
Phlox divaricata.
Phlox paniculata.
Phlox subulata.
Physalis.
Physostegia virginiana.
Platycodon.
Plumbago Larpentæ.
Polygonum Sieboldii.
Pyrethrum uliginosum.
Rudbeckia.
Salvia azurea.
Salvia Greggii.
Salvia Pitcheri.
Santolina.
Saxifraga crassifolia.
Scabiosa.
Sedum acre.
Sempervivum.
Silene Schafta.
Silene virginica.
Solidago.
Spiræa chinensis.
Stachys lanata.
Stokesia.
Thalictrum aquilegifolium.
Thermopsis fabacea.
Thymus carnosus.
Tradescantia.
Tritoma (Kniphofia).
Trollius caucasicus.
Tunica Saxifraga.
Veronica incana.
Veronica longifolia.
Vinca.
Viola.
Yucca.

Shade-loving plants for Piedmont.

Aconitum.
Ægopodium.
Agapanthus umbellatus.
Allium.
Amaryllis.
Amsonia angustifolia.
*Amsonia ciliata.
Apios tuberosa. Climber.
Aquilegia.
Arundo Donax.
Asarum.
Asperula.
Aster corymbosus.
Aster macrophyllus. Hardy native.
Bambusa.
Boltonia asteroides.
Carex (weedy).
Clematis crispa. Climber.
Coreopsis.
Crinum.
Cypripedium.
Delphinium.
Dicentra.
Digitalis purpurea.
Dodecatheon.
Erythronium.
Eulalia (Miscanthus).
Eupatorium.
Gentiana.
Geranium maculatum.
Hepatica.
Heuchera.
Hosta (Funkia).
Iberis sempervirens.
Iris.
Lilium tigrinum.
Linaria Cymbalaria.
Liriope spicata.
Lobelia cardinalis.
Lysimachia nummularia. Ground-cover.
Mentha spicata.
Mitchella repens.
Myosotis.
Oxalis.
Pachysandra.
Pæonia.
Phlox maculata.
Phlox reptans.
Podophyllum peltatum.
Polemonium.
Polygonatum.
Rhexia virginica.
Sanguinaria.
Saxifraga crassifolia.
Spigelia marilandica.
Tradescantia.
Trillium.
Vinca.
Viola.
Waldsteinia lobata.

Amsonia ciliata, Walt., from N. C. and Ark. to Fla. and Texas. Sts. and branches pubescent: lvs. numerous: calyx-lobes acute; corolla glabrous.

Bog- and moisture-loving plants for Piedmont.

Acorus Calamus.
Agapanthus umbellatus.
Amaryllis.
Apios tuberosa. Climber.
Arundo Donax.
Asarum.
Asclepias incarnata.
Aster puniceus.
Aster surculosus.
Bambusa.
Boltonia asteroides.
Calopogon pulchellus.
Carex.
Chelone glabra.
Cyperus.
Eriophorum polystachyon.
Eriophorum virginicum.
Eulalia (Miscanthus).
Eupatorium purpureum.
Gynerium (Cortaderia).
Habenaria blephariglottis.
Habenaria ciliaris.
Helonias bullata.
Hibiscus incanus.
Hibiscus Moscheutos.
Houstonia

Bog- and moisture-loving plants, continued.

Iris hexagona.
Iris lævigata.
Iris versicolor.
Lilium tigrinum.
Lobelia cardinalis.
Lobelia syphilitica.
Lythrum.
Mertensia.
Myosotis.
Pancratium.
Pogonia ophioglossoides.
Rhexia virginica.
Sagittaria.
Saururus cernuus.
Solidago patula.
Stenanthium robustum.
Thalictrum.
Typha latifolia.

2. *Coastal Zone* extends from the "Fall Line" as outlined under the Piedmont Zone (p. 1471) to the Atlantic Ocean and Gulf of Mexico, but exclusive of Florida south of a line drawn across the state from St. Augustine to Cedar Keys.

Sun-loving plants for Coastal Zone.

Achillea.
Agave.
Alocasia macrorhiza.
Aloe arborescens.
Althæa rosea.
Alyssum saxatile.
Amaryllis.
Amsonia angustifolia.
Anchusa italica.
Antigonon leptopus. Climber.
Armeria vulgaris.
Artemisia.
Arundo Donax.
Asclepias.
Aster.
Asystasia bella.
Bamboo.
Baptisia australis.
Belamcanda chinensis.
Bellis perennis.
Bocconia cordata.
Boltonia.
Caladium esculentum.
Callirhoë involucrata.
Canna.
Capsicum baccatum.
Centaurea.
Chrysanthemum.
Clerodendron fœtidum.
Clerodendron fragrans.
Clerodendron macrosiphon.
Clerodendron Siphonanthus.
Clerodendron trichotomum.
Colocasia.
Coreopsis lanceolata.
Crinum.
Dahlia.
Delphinium.
Desmodium pendulifolium.
Dianthus barbatus.
Dianthus deltoides.
Dianthus latifolius.
Dianthus plumarius.
Digitalis.
Dioscorea. Climber.
Dolichos. Climber.
Echinacea purpurea.
Erianthus.
Eryngium amethystinum.
Erythrina Crista-galli.
Eulalia (Miscanthus).
Eupatorium.
Euphorbia corollata.
Euphorbia splendens.
Furcræa.
Gaillardia.
Gilia coronopifolia.
Gynerium.
Hedychium coronarium.
Helenium.
Helianthus.
Hemerocallis.
Hibiscus.
Hosta (Funkia).
Hydrangea.
Hymenocallis caribæa.
Ipomœa. Climber.
Iris germanica.
Kaempferia Gilbertii.
Lantana.
Lathyrus latifolius.
Leonotis Leonurus.
Lespedeza japonica.
Liatris.
Lippia citriodora.
Liriope spicata.
Lupinus villosus.
Lynchis.
Malvaviscus arboreus.
Malvaviscus Drummondii.
Mirabilis Jalapa.
Montbretia.
Moræa iridoides.
Œnothera.
Oxalis.
Pancratium.
Papaver orientale.
Pennisetum longistylum.
Phalaris.
Phlox amœna.
Phlox decussata.
Physostegia virginiana.
Platycodon.
Plumbago capensis.
Plumbago Larpentæ.
Polygonella ericoides.
Polygonum cuspidatum.
Reineckia carnea.
Richardia africana.
Rudbeckia.
Salvia azurea.
Salvia Greggii.
Salvia Pitcheri.
Santolina.
Scabiosa.
Silene Schafta.
Solidago.
Statice latifolia.
Stokesia.
Thymus carnosus.
Tradescantia.
Tritoma (Kniphofia).
Verbena.
Vinca.
Viola.
Xanthosoma bataviensis.
Xanthosoma violaceum.
Yucca.

Shade-loving plants for Coastal Zone.

Aconitum.
Agave.
Amaryllis.
Anemone.
Anthemis.
Aquilegia.
Asclepias incarnata.
Astilbe.
Caladium.
Caltha.
Canna.
Chrysanthemum maximum.
Coreopsis.
Crinum.
Euphorbia.
Gaillardia.
Hedychium coronarium.
Hemerocallis.
Hibiscus, Mallows.
Hosta (Funkia).
Hymenocallis.
Iris verna.
Lantana.
Liatris gracilis.
Lilium.
Lobelia cardinalis.
Œnothera.
Papaver orientale.
Phlox decussata.
Physalis.
Plumbago.
Pyrethrum.
Rudbeckia.
Sagittaria.
Sanguinaria.
Sedum.
Solidago.

Shade-loving plants, continued.

Stokesia cyanea.
Tradescantia.
Trillium.
Tritoma (Kniphofia).
Vinca.
Viola.
Xanthosoma.

Plants for the seaside.

Armeria.
Aster carolinianus.
Eryngium amethystinum.
Eryngium planum.
Hibiscus coccineus.
Hibiscus grandiflorus.
Hibiscus militaris (H. carolinensis, Muhl.).
Ipomœa dissecta.
Ipomœa Jalapa.
Ipomœa Pes-capræ.
Kosteletzkya virginica.
Rosmarinus.
Solidago sempervirens.
Statice latifolia.
Tradescantia virginica.

Bog- and moisture-loving plants for Coastal Zone.

Asclepias lanceolata.
Aster carolinianus.
Brunella grandiflora.
Calopogon.
Castilleja.
Coreopsis integrifolia*.
Eichhornia.
Gerardia.
Habenaria ciliaris.
Hedychium.
Hibiscus.
Hydrophyllum.
Hymenocallis lacera.
Iris versicolor.
Liatris graminifolia.
Liatris spicata.
Limodorum multiflorum.
Lobelia cardinalis.
Lobelia syphilitica.
Nelumbo.
Nymphæa.
Pogonia.
Pontederia.
Rhexia.
Sabbatia.
Sagittaria.
Sarracenia.
Zephyranthes Atamasco.
Zingiber.

**Coreópsis integrifòlia*, Poir. Perennial, 2–3 ft.: lvs. opposite, entire; heads 1–1½ in. broad including rays, the ray-fls. about 8. Ga. and Fla.

3. *Mountain*, or *Upper Zone* includes all the territory above Salem, Morgantown, and Rutherfordton, North Carolina; Spartanburg and Pendelton, South Carolina; Gainesville and Cartersville, Georgia; Huntsville, Alabama; and Murfreesboro, Tennessee; thence north to the Kentucky line.

Shade-loving plants for Mountain Zone.

Aconitum species.
Actæa alba.
Adonis species.
Ajuga species.
Alstrœmeria aurantiaca.
Anemone species.
Aquilegia species.
Aralia nudicaulis.
Arisæma Dracontium.
Arisæma triphyllum.
Aruncus.
Asarum species.
Asclepias.
Asperula odorata.
Asphodelus.
Aster species.
Astilbe biternata.
Aubrietia species.
Boykinia aconitifolia.
Buphthalmum salicifolium.
Calopogon pulchellus.
Campanula species.
Carex species.
Cerastium species.
Chimaphila maculata.
Cimicifuga species.
Clintonia species.
Convallaria majalis.
Coreopsis pubescens.
Cypripedium.
Delphinium species.
Dicentra species.
Dictamnus albus.
Digitalis species.
Diphylleia cymosa.
Dodecatheon Meadia.
Doronicum species.
Epigæa repens.
Epilobium angustifolium.
Epimedium species.
Erythronium species.
Eupatorium species.
Ferns.
Galax aphylla.
Galeorchis (Orchis) spectabilis.
Gaultheria procumbens.
Gentiana species.
Geum species.
Gillenia stipulata.
Gillenia trifoliata.
Glechoma.
Goodyera pubescens.
Gynerium (Cortaderia).
Habenaria ciliaris.
Helleborus.
Hemerocallis species.
Hepatica species.
Hesperis matronalis.
Heuchera species.
Hosta (Funkia) species.
Houstonia serpyllifolia.
Incarvillea Delavayi.
Iris species.
Jasione perennis.
Jeffersonia diphylla.
Liatris species.
Lilium species.
Linaria Cymbalaria.
Linum perenne.
Liriope spicata.
Lobelia species.
Lychnis species.
Lysimachia species.
Mentha species.
Mertensia virginica.
Mitchella repens.
Monarda didyma.
Montbretia.
Myosotis palustris.
Nierembergia rivularis.
Œnothera species.
Opuntia.
Ornithogalum umbellatum.
Platycodon species.
Podophyllum peltatum.
Polygonatum commutatum (P. giganteum).
Polygonum amplexicaule.
Primula officinalis.
Sanguinaria canadensis.
Santolina Chamæcyparissus.
Saponaria species.
Saxifraga species.
Scutellaria montana.
Sedum species.
Shortia galacifolia.
Silene virginica.
Smilacina racemosa.
Solidago species.
Spigelia marilandica.
Spiræa species.
Streptopus roseus.
Thalictrum species.
Thermopsis caroliniana.
Thermopsis fraxinifolia.
Tiarella cordifolia.

Shade-loving plants, continued

Tradescantia species.
Trautvetteria carolinensis.
Tricyrtis species.
Trillium species.
Trollius species.
Uvularia species.
Veratrum viride.
Vinca.
Viola species.
Xanthorrhiza.

Sun-loving plants for Mountain Zone.

Acanthus.
Achillea species.
Actæa alba.
Adonis species.
Ægopodium Podograria var. variegatum.
Ajuga species.
Aletris farinosa.
Althæa rosea.
Alyssum species.
Amsonia species.
Anaphalis margaritacea.
Anchusa italica.
Angelica hirsuta.
Anthemis species.
Anthericum species.
Aquilegia species.
Arabis alpina.
Arenaria species.
Armeria species.
Artemisia species.
Arundo Donax.
Asclepias species.
Aster species
Baptisia species.
Belamcanda chinensis.
Bellis perennis (the English Daisy).
Bocconia cordata.
Boltonia species.
Calimeris incisa.
Callirhoë involucrata.
Campanula species.
Caryopteris incana.
Cassia marylandica.
Centaurea species.
Centranthus species.
Cephalaria species.
Cerastium species.
Ceratostigma plumbaginoides.
Chamælirium luteum.
Chrysanthemum, Hardy.
Chrysopsis mariana.
Clematis species.
Coreopsis.
Coronilla varia.
Delphinium species.
Dianthus species.
Dicentra species.
Digitalis species.
Doronicum species.
Echinacea purpurea.
Echinops Ritro.
Eremurus robustus.
Erianthus Ravennæ.
Erigeron species.
Eryngium species.
Eupatorium urticæfolium.
Euphorbia corollata.
Festuca glauca.
Gaillardia grandiflora.
Gentiana.
Geum species.
Gillenia species.
Gypsophila species.
Habenaria ciliaris.
Helenium species.
Helianthemum species.
Helianthus species.
Heliopsis species.
Helleborus.
Hemerocallis.
Heuchera sanguinea.
Hibiscus species.
Hieracium aurantiacum.
Hosta (Funkia) species.
Houstonia serpyllifolia.
Hypericum species.
Hyssopus.
Iberis sempervirens.
Iris species.
Lathyrus (Orobus) vernus
Lathyrus species.
Lavandula vera.
Lepachys pinnata.
Liatris species.
Lilium species.
Linum species.
Lobelia species.
Lupinus polyphyllus.
Lychnis.
Lysimachia species.
Lythrum species.
Marshallia grandiflora.
Mentha species.
Mertensia virginica.
Miscanthus species.
Molinia (Aira) cærulea.
Monarda didyma.
Œnothera species.
Ophiopogon.
Opuntia.
Origanum vulgare.
Pachysandra.
Pæonia.
Papaver.
Pardanthus.
Pentstemon species.
Phlox.
Physalis.
Physostegia species.
Platycodon species.
Plumbago Larpentæ.
Pogonia species.
Polygonatum giganteum.
Polygonum species.
Potentilla tridentata.
Pulmonaria.
Pyrethrum.
Ranunculus species.
Rhexia virginica.
Rudbeckia species.
Salvia species.
Saxifraga species.
Scabiosa species.
Sedum species.
Sempervivum.
Silene species.
Silphium species.
Sisyrinchium grandiflorum.
Solidago species.
Spigelia marilandica.
Spiræa species.
Stachys species.
Stenanthium robustum.
Stipa pennata.
Stokesia cyanea.
Symphytum asperrimum var. aureo-variegatum.
Tanacetum species.
Thalictrum species.
Thermopsis caroliniana.
Thermopsis fraxinifolia.
Thymus species.
Tradescantia species.
Tritoma (Kniphofia) species.
Tunica Saxifraga.
Valeriana species.
Verbascum olympicum.
Vernonia species.
Veronica species.
Vinca.
Viola species.
Xerophyllum setifolium.
Yucca filamentosa.
Yucca flaccida.

Bog- and moisture-loving plants for Mountain Zone.

Acorus Calamus.
Apios tuberosa.
Asclepias.
Aster puniceus.
Aster surculosus.
Calla palustris.
Calopogon pulchellus.
Caltha palustris.
Chelone species.
Cypripedium spectabile.
Decodon (Nesæa) verticillatus.
Eupatorium purpureum.
Habenaria ciliaris.
Helonias bullata.
Heuchera species.
Hibiscus species.
Houstonia serpyllifolia.
Impatiens pallida.
Iris species.

Bog- and moisture-loving plants, continued.

Liatris species.
Lilium species.
Lobelia species.
Mimulus ringens.
Monarda didyma.
Orontium aquaticum.
Parnassia asarifolia.
Pogonia species.
Rhexia virginica.
Rodgersia podophylla.
Sarracenia species.
Saxifraga species.
Senecio aureus.
Senecio clivorum.
Solidago patula.
Stenanthium robustum.
Symplocarpus fœtidus.
Thalictrum species.
Typha latifolia.
Veratrum viride.
Viola palmata var. cucullata.
Xerophyllum setifolium.

L. A. Berckmans.

Herbs for California (mostly perennial).

Border or low edging plants.

The following plants produce the appearance of neatness and finish by more clearly defining edges of beds, walks or drives, and by serving as connecting elements between taller plants and the greensward. In so doing they may also screen the lower, more or less bare leafless stems of other plants.

Achillea santolinoides.
Agrostis nebulosa.
Allium neapolitanum.
Alyssum maritimum.
Alyssum saxatile.
Arabis alpina.
Armeria vulgaris (A. maritima).
Asperula odorata.
Aubrietia deltoidea var. græca.
Aubrietia deltoidea var. Leichtlinii.
Baeria chrysostoma var. gracilis. Thrives in sunshine.
Begonia Erfordii.
Bellis perennis, English Daisy
Bulbs of various kinds.
Calendula officinalis, Pot Marigold.
Cerastium tomentosum.
Chænostoma hispidum.
Chrysanthemum Tchihatchewii, Turfing Daisy.
Convolvulus mauritanicus.
Dianthus, Pinks.
D. barbatus, Sweet William.
Echinopsis Eyriesii.
Erigeron mucronatus, Mexican Daisy.
Festuca glauca.
Freesia.
Gazania splendens.
Geranium, Ivy.
Geranium, Madam Salleroi.
Godetia, dwarf.
Gypsophila muralis.
Gypsophila paniculata, Baby's Breath.
Helianthemum vulgare var. mutabile, Sun Rose.
Heuchera sanguinea, Coral Bells.
Iberis sempervirens, Evergreen Candytuft.
Impatiens Sultani.
Iresine Lindenii (Achyranthes acuminata).
Iris, small blue.
Kalanchoë flammea.
Lantana, dwarf.
Lobelia Erinus.
Lotus Bertholetii (L. peliorhyncus), Coral Gem.
Mahernia verticillata (M. odorata), Honey Bells.
Marigold, African (Tagetes erecta).
Marigold, French (Tagetes patula).
Mesembryanthemum cordifolium, Dew Plant.
Mignonette (Reseda odorata).
Moræa iridioides, Natal Lily.
Myosotis, Forget-me-not.
Nasturtium, dwarf.
Œnothera ovata, Sun-Cups.
Œnothera rosea, Mexican Primrose.
Omphalodes linifolia.
Ophiopogon japonicus.
Oxalis.
Oxalis cernua.
Oxalis oregana.
Oxalis purpurea.
Oxalis tetraphylla.
Pansy.
Pennisetum villosum (P. longistylum).
Phlox, dwarf.
Portulaca grandiflora, Rose Moss.
Primula.
Primula malacoides, pink.
Santolina Chamæcyparissus, Lavender Cotton.
Sanvitalia procumbens var. flore-pleno.
Saxifraga crassifolia.
Scilla.
Scirpus cernuus. For shade.
Sempervivum globiferum, Hen-and-Chickens.
Specularia Speculum (Campanula Speculum), Venus' Looking-Glass.
Specularia Speculum var. procumbens.
Spergula.
Stachys alpina.
Stachys lanata.
Sweet Pea, Cupid.
Vinca minor.
Viola cornuta.
Viola odorata.
Viola odorata, Marie Louise.
Viola odorata, Princess of Wales.
Zaluzianskya selaginoides (Nycterinia selaginoides).
Zinnia, dwarf.

For dry places.

The following are fairly drought-resistant and may be grown in dry situations, where they will bloom freely with little attention.

Abronia umbellata.
Achillea santolinoides.
Antirrhinum Coulterianum.*
Argemone platyceras.
Artichoke (Cynara Scolymus).

**Antirrhinum Coulterianum*, Benth., of S. Calif., 2–4 ft., has spicate infl and rather large corolla with protuberant yellowish palate; violet-purple or white: the slender branches and the linear or oval lvs. act as support for the plant.

For dry places, continued.

Bidens ferulæfolia*.
Calla lily (Zantedeschia æthiopica).
Cheiranthus Cheiri, Wallflower.
Cistus, Rock-Rose.
Coreopsis lanceolata.
Coreopsis tinctoria.
Cornflower (Centaurea Cyanus).
Cotyledon.
Crassula.
Encelia californica.
Eriogonum fasciculatum.
Eriogonum latifolium.
Eriogonum umbellatum.
Eschscholtzia californica, California Poppy.
Gazania splendens.
Gilia californica.
Gilia chamissonis.
Godetia grandiflora.
Goldenrod (Solidago californica).
Helianthus annuus, Sunflower.
Helichrysum petiolatum.
Heliopsis lævis var. Pitcheriana.
Kniphofia Uvaria, Red-hot-poker Plant.
Layia elegans, Tidy-Tips.
Layia glandulosa, White Daisy.
Lippia repens.
Lupinus arboreus, Yellow Tree Lupin.
Marigold, French and African.
Mentzelia Lindleyi.
Mesembryanthemum.
Mimulus brevipes, Yellow Monkey-Flower.
Mimulus glutinosus, Sticky Monkey-Flower.
Nasturtium (Tropæolum).
Nigella damascena, Love-in-a-Mist.
Ophiopogon japonicus.
Pelargonium.
Pentstemon antirrhinoides.
Pentstemon gloxinioides.
Pentstemon heterophyllus.
Pentstemon spectabilis.
Petunia hybrida.
Phacelia grandiflora.
Phacelia Whitlavia.
Romneya Coulteri, Matilija Poppy.
Romneya trichocalyx.
Salvia carduacea, Thistle Sage.
Sansevieria zeylanica, Bowstring Hemp.
Scabiosa atropurpurea, Mourning Bride.
Sedum acre.
Sedum album.
Sedum Anacampseros.
Sedum nicæense.
Sedum pulchellum.
Sedum spectabile.
Shirley poppies (Papaver Rhœas).
Trichostema lanatum.
Turfing Daisy (Chrysanthemum Tchihatchewii).
Verbenas.
Wild flowers of many kinds.
Zauschneria californica, California Fuchsia.

**Bidens ferulæfolia*, DC., from Mex., although perennial, blooms the first year from seed. It has bright orange-yellow rather small heads, and very finely cut pinnatisect or pinnate lvs., the ultimate segms. small and linear or linear-oblong: plant diffuse, the sts. 16–30 in. long. B.M. 2059.

Cut-flowers and greenery.

The following plants are well adapted for use in a garden when quantities of flowers and greenery are wanted for interior decoration and other purposes.

Adiantum Croweanum.
Adiantum cuneatum.
Adiantum gracillimum.
Adiantum grandiceps.
Allium neapolitanum.
Amaryllis.
Anemone japonica.
Anthemis tinctoria.
Antirrhinum majus, Snapdragon.
Asparagus plumosus.
Asparagus scandens var. deflexus.
Asparagus Sprengeri.
Asperula hexaphylla.
Aster, China.
Bellflower (Campanula).
Bermuda lily (Lilium).
Bidens ferulæfolia.
Bleeding-heart (Dicentra).
Boltonia latisquama.
Brake, common (Pteris aquilina).
Briza maxima.
Bromus brizæformis.
Browallia demissa.
Calceolaria.
Calla lily.
California wild flowers.
Campanula Medium.
Campanula Medium var. calycanthema.
Campanula persicifolia.
Candytuft.
Canna.
Carnation.
Centaurea imperialis, Sweet Sultan.
Chrysanthemum, pompons.
Clarkia.
Coreopsis tinctoria.
Cornflower (Centaurea Cyanus).
Cosmos.
Cyclamen.
Daffodil.
Dahlia.
Delphinium cardinale.
Doronicum caucasicum.
Erythronium.
Eschscholtzia californica, California Poppy.
Euphorbia corollata.
Everlasting flowers.
Felicia amelloides.
Ferns, Maidenhair and Sword-Fern.
Feverfew, double white.
Gaillardia aristata.
Gaillardia aristata var. grandiflora, var. maxima.
Gaillardia picta, Lorenziana, amblyodon.
Galax.
Geranium, scarlet.
Gerbera Jamesonii, Transvaal Daisy.
Geum coccineum.
Gilia liniflora.
Gladiolus.
Godetia.
Goldenrod (Solidago).
Gypsophila paniculata.
Helenium autumnale var. pumilum.
Heliopsis lævis var. Pitcheriana.
Heliotrope (Heliotropium).
Hesperis matronalis.
Heuchera rubescens.
Hollyhock.
Honesty (Lunaria annua).
Hunnemannia fumariæfolia, Mexican Poppy.
Hydrangea hortensis.
Iberis sempervirens.
Indian pink.
Iris.
Iris lævigata (Kaempferi), Japanese Iris.
Ixia.
Kniphofia Uvaria, Red-hot-poker Plant.
Larkspur (Delphinium).

Cut-flowers and greenery, continued.

Lilium Humboldtii.
Lily, Bermuda.
Lily-of-the-Valley (Convallaria majalis).
Maidenhair fern (Adiantum).
Marguerite (Chrysanthemum frutescens).
Marigold, African (Tagetes erecta).
Marigold, French (Tagetes patula).
Mexican ivy (Vancouveria hexandra).
Mignonette (Reseda).
Mimulus.
Myosotis, Forget-me-not.
Narcissus.
Nasturtium (Tropæolum).
Nigella.
Orchids (Cattleya and others).
Panicum atrosanguineum.
Panicum plicatum.
Pansy.
Pentstemon.
Petunia, double and single.
Phlox Drummondii.
Phlox grandiflora.
Pink (Dianthus).
Polygala apopetala.
Poppy.
Russelia juncea var. Lemoinei.
Russelia sarmentosa (R. multiflora).
Salvia azurea var. grandiflora.
Salvia, scarlet.
Scabiosa, Mourning-Bride.
Schizanthus.
Scilla.
Shasta daisy.
Smilax.
Snapdragon (Antirrhinum).
Snowflake (Leucojum).
Statice fruticans (S. arborea).
Statice Suworowi.
Stock.
Sunflower (Helianthus).
Sweet alyssum.
Sweet pea.
Sweet sultan (Centaurea).
Tritonia crocosmæflora.
Tuberose.
Tulip.
Verbena.
Vinca, white with red eyes, pure white.
Violet.
Volutarella muricata (Amberboa muricata).
Water-lily.
Woodwardia.
Zinnia grandiflora.

Herbaceous hedge plants (some of them shrubby).

The following plants range from 1½ to 3 to 4 feet high and may be used to give a profusion of color and brightness to a home place; to make low boundary lines between property lines; partially to hide some disagreeable object; to give a touch of privacy about some garden feature; to plant around a vegetable-garden to make it more attractive; they are very effective treated as temporary plant material.

Achillea santolinoides.
Artichoke (Cynara Scolymus).
Atriplex Breweri.
Calceolaria integrifolia.
Calla lily (Zantedeschia).
Eriogonum fasciculatum.
Feverfew (Chrysanthemum Parthenium).
Fuchsia arborescens.
Fuchsia corymbifolia.
Geranium.
Helichrysum petiolatum (Gnaphalium lanatum).
Heliotrope, Queen Marguerite.
Lantana, Dwarf.
Lantana Sellowiana.
Lavandula vera, Lavender.
Leonotis Leonurus, Lion's-Tail.
Mahernia verticillata, Honey-Bells.
Malvaviscus mollis.
Marguerite (Chrysanthemum frutescens).
Pelargonium.
Rock rose (Cistus).
Rosemary (Rosmarinus officinalis).
Salvia splendens.
Santolina Chamæcyparissus.
Streptosolen Jamesonii.
Teucrium fruticans.
Valerian, red (Centranthus ruber).
White valerian (Centranthus ruber var. albus).

For naturalizing.

Plants that will grow year after year without much attention, and therefore good to naturalize and leave alone.

Aquilegia truncata.
Aquilegia vulgaris var. nivea.
Brodiæa.
Calochortus.
Camassia Cusickii.
Camassia esculenta.
Camassia Leichtlinii.
Ceratostigma plumbaginoides.
Cow parsnip (Heracleum lanatum).
Cynoglossum grande.
Daffodil.
Delphinium nudicaule.
Dicentra spectabilis.
Dwarf bamboo.
Eriogonum.
Erythronium californicum.
Ferns.
Freesia refracta var. alba.
Iris.
Micromeria Chamissonis, Yerba Buena.
Mimulus glutinosus.
Narcissus.
Nierembergia rivularis.
Œnothera ovata.
Pentstemon barbatus var. Torreyi.
Pentstemon, California Blue-Bedder.
Saxifraga crassifolia.

Moist soil, bogs, or edges of water.

For wet grounds, bogs or near edges of water the following have been found to be successful.

Achillea Ptarmica, The Pearl.
Anemopsis californica, Yerba Mansa.
Aquilegia eximia (probably a form of *A. formosa*).
Boykinia occidentalis.*

Moist soils, bogs, or edges of water, continued.

Calla lily (Zantedeschia).
Calochortus nitidus.
Camassia Cusickii.
Camassia esculenta.
Camassia Leichtlinii.
Cat-tail (Typha latifolia).
Cyperus alternifolius, Umbrella Plant.
Cyperus alternifolius var. gracilis.
Cyperus Papyrus, Papyrus.
Cypripedium californicum, Lady's Slipper. A rare bog-plant.
Dodecatheon Jeffreyi, Shooting Star.
Elephant's Ear (Colocasia antiquorum var. esculenta; Caladium esculentum).
Epipactis Royleana. Banks or in moist soil.
Gunnera chilensis (G. scabra).
Hemerocallis aurantiaca.
Hemerocallis aurantiaca var major.
Hemerocallis Thunbergii.
Iris lævigata (I. Kaempferi).
Iris orientalis (I. ochroleuca).
Miscanthus sinensis (Eulalia japonica).
Miscanthus sinensis var. gracillimus.
Miscanthus sinensis var. variegatus.
Miscanthus sinensis var. zebrinus.
Nierembergia rivularis.
Pampas-grass (Cortaderia argentea).
Rudbeckia nitida.
Sagittaria sagittæfolia.
Tolmiea Menziesii.
Tule (Scirpus lacustris var. occidentalis).
Water-cress (Nasturtium officinale).

Almost continuous bloomers in some parts of California.

The following plants are almost continuous bloomers; i.e., flowers usually can be had most of the year in most parts of California.

Alyssum maritimum, Sweet Alyssum.
Anchusa capensis.
Begonia Erfordii.
Begonia gracilis.
Begonia semperflorens var. Vernon.
Begonia luminosa (a garden form).
Bidens ferulæfolia.
Canna.
Carnation, Corbett.
Chænostoma hispidum.
Convolvulus floridus or Rhodorhiza florida.
Convolvulus mauritanicus.
Cuphea hyssopifolia.
Cuphea ignea.
Cuphea Llavea.
Cuphea micropetala.
Dwarf lantana.
Erigeron mucronatus.
Erigeron speciosus.
Eschscholtzia californica.
Felicia amelloides.
Feverfew (Chrysanthemum Parthenium).
Geraniums, Ivy-leaved, Chas. Turner, Etincelant, Carlos Uhden, Gringoire, Leopard.
Geranium sanguineum.
Gerbera Jamesonii.
Geum, Mrs. Bradshaw.
Heliotrope, La Duse.
Heliotrope, Queen Marguerite.
Hemerocallis aurantiaca.
Hollyhock (Althæa rosea).
Marguerite (Chrysanthemum frutescens).
Pelargonium odoratissimum, Nutmeg Geranium.
Pennisetum Ruppellii.
Pentstemon antirrhinoides.
Pentstemon gloxinioides.
Petunia hybrida.
Primula obconica.
Primula sinensis.
Saxifraga crassifolia.
Shasta daisy.
Snapdragon.
Statice macrophylla.
Stokesia cyanea.
Vinca rosea.

Rock-gardens in shade.

A selection from the following will enable one to bring into the garden some of the dainty beauty of wildwood plants:

Aquilegia.
Asarum caudatum.
Boykinia occidentalis.
Epimedium.
Fuchsia procumbens.
Heuchera micrantha.
Heuchera pilosissima.
Heuchera rubescens.
Heuchera sanguinea.
Linaria Cymbalaria, Kenilworth Ivy.
Micromeria Chamissonis, Yerba Buena.
Myosotis, Forget-me-Not.
Nierembergia rivularis.
Oxalis oregana.
Phlox subulata.
Primula kewensis.
Primula malacoides.
Primula obconica.
Primula sinensis.
Sagina subulata.
Saxifraga crassifolia.
Saxifraga integrifolia.
Saxifraga Mertensiana.
Saxifraga sarmentosa.
Saxifraga umbrosa.
Tellima grandiflora.
Tiarella unifoliata.
Tolmiea Menziesii.
Vancouveria hexandra.
Vancouveria parviflora.

For shady places.

Many plants that grow freely in the direct rays of the sun in middle California, require shade in southern California and must be protected from the fierce summer heat of the Sacramento and San Joaquin valleys. Therefore, plant them under lath-houses or in the shade of trees or on the north side of a house.

Acanthus Caroli-Alexandræ.
Acanthus mollis.
Acanthus mollis var. latifolius.
Acanthus spinosus.
Aconitum, Monkshood.
Agapanthus umbellatus.
Allium neapolitanum.
Alsophila australis.
Alyssum saxatile.
Amomum Cardamon.
Anemone japonica.

**Boykinia occidentalis*, Torr. & Gray. Calif. to Wash. Erect or declined 1–2 ft.: lvs. round-cordate, 3–9-lobed: fls. many, the petals white.

For shady places, continued.

Anemone japonica var. alba.
Anemone coronaria.
Anemone fulgens.
Aquilegia, Columbine.
Asarum caudatum.
Asparagus crispus (A. decumbens).
Asparagus asparagoides, Smilax of florists.
Asparagus plumosus.
Asparagus plumosus var. comorensis.
Asparagus plumosus var. nanus.
Asparagus plumosus var. robustus (A. Hatcheri).
Asparagus plumosus var. tenuissimus.
Asparagus retrofractus.
Asparagus scandens var. deflexus.
Asparagus Sprengeri.
Asperula odorata, Woodruff.
Aspidistra lurida.
Asystasia bella (Mackaya bella).
Balm, Moldavian (Dracocephalum Moldavica).
Begonia argenteo-guttata.
Begonia coccinea (B. rubra).
Begonia Erfordii.
Begonia floribunda (a garden form).
Begonia fuchsioides.
Begonia luminosa.
Begonia Margaritæ.
Begonia nitida var. odorata alba.
Begonia Rex.
Begonia rosea.
Begonia rubella.
Begonia Sandersonii (B. Digswelliana).
Begonia semperflorens.
Begonia Templinii.
Begonia weltoniensis.
Bellis perennis, English daisy.
Calla lily (Zantedeschia).
Cibotium Barometz, Scythian Lamb.
Cinerarias.
Clivia miniata. It will not stand frost.
Convolvulus mauritanicus.
Crinum Moorei.
Cyclamen.
Cyperus alternifolius.
Cyrtomium falcatum.
Dædalacanthus nervosus.
Daffodil.
Dicentra spectabilis, Bleeding Heart.
Digitalis purpurea, Foxglove.
Dog's-tooth violet (Erythronium californicum).
Doronicum magnificum.
Eremurus Elwesii.
Eremurus himalaicus.
Eremurus robustus.
Erigeron mucronatus.
Felicia amelloides.
Ferns.
Foxglove (Digitalis purpurea).
Haworthia atrovirens.
Haworthia cymbiformis.
Haworthia margaritifera.
Haworthia rugosa.
Helleborus niger, Christmas Rose.
Heuchera micrantha.
Heuchera pilosissima.
Hyacinth.
Linaria Cymbalaria, Kenilworth Ivy.
Kniphofia Uvaria, Red-hot-poker Plant.
Larkspur (Delphinium nudicaule).
Lily (Lilium).
Lily-of-the-Valley (Convallaria majalis).
Mentha piperita.
Mimulus glutinosus.
Myosotis, Forget-me-not.
Nephrolepis exaltata var. bostoniensis.
New Zealand Flax (Phormium tenax).
Œnothera cæspitosa.
Onychium japonicum.
Oxalis oregana.
Pansy (Viola).
Papaver heterophylla.
Pentstemon cordifolius.
Pæonia.
Petasites palmata.
Pilea microphylla, Artillery Plant.
Primula (P. obconica).
Pteris cretica albo-lineata.
Pteris quadriaurita argyræa.
Pteris tremula.
Salvia patens.
Saxifraga crassifolia.
Saxifraga umbrosa.
Senecio Kaempferi aureo-maculatus.
Star Flower (Trientalis europæa var. latifolia).
Star of Bethlehem (Tellima affinis).
Solomon's Seal, False (Smilacina amplexicaulis; also S. sessilifolia).
Thalictrum Delavayi.
Tiarella unifoliata.
Tradescantia fluminensis.
Trillium.
Tulip. Shade one-third to one-half day.
Vancouveria hexandra.
Vancouveria parviflora. For partial shade.
Violet (Viola odorata). For half shade.
Wallflower (Cheiranthus Cheiri). For partial shade.

Rock-gardens in the sun.

For rock-gardens in the sun, many interesting plants may be grown, instead of the more gaudy succulents and curious desert plants.

Alyssum saxatile.
Aubrietia deltoidea var. Leichtlinii.
Calandrinia umbellata.
Cerastium tomentosum.
Chænostoma hispidum.
Convolvulus mauritanicus.
Cotyledon.
Crassula.
Echeveria.
Edelweiss (Leontopodium alpinum).
Eriogonum.
Flax (Linum).
Gazania splendens.
Geranium sanguineum.
Geum chiloense.
Geum coccineum.
Helichrysum petiolatum (Gnaphalium lanatum).
Lewisia Cotyledon.
Lewisia Howellii.
Lewisia Leana.
Lewisia oppositifolia (Calandrinia).
Lewisia rediviva.
Lewisia Tweedyi.
Lychnis Haageana.
Mahernia verticillata.
Nierembergia gracilis.
Œnothera, America.
Œnothera ovata, Sun-Cups.
Othonna capensis.
Pentstemon cæruleus.
Pentstemon Menziesii.
Santolina Chamæcyparissus, Lavender Cotton.
Sanvitalia procumbens.
Sedum.
Statice.
Synthyris rotundifolia.

John Wm. Gregg.
R. T. Stevens.
Katherine D. Jones.

HERBÉRTIA (Wm. Herbert, 1778–1847, Dean of Manchester, distinguished botanist, author of "Amaryllidaceæ," and ardent lover of bulbs). *Iridàceæ.* Bulbous plants, native from Texas to Chile and southern Brazil, with fugitive blue or lilac flowers borne in summer; allied to Tigridia.

Stems simple or forking, from a tunicated corm: lvs. mostly basal, few, long and narrow, somewhat folded or plicate: fls. several from a single terminal spathe, pedicelled; perianth showy, without tube and segms. 6 in 2 very unlike series, the inner being much smaller; stamens 3, united by their filaments into a tube; ovary long, 3-celled; styles partially united, the 3 branches forked: fr. an oblong loculicidally 3-valved exserted caps., with many small angled seeds.—About a half-dozen species, of secondary value horticulturally. There is some confusion in the generic name; but the situation is: Herbertia, Sweet, 1827; Alophia, Herbert, 1838; Trifurcia, Herbert, 1840. The herbertias thrive in usual garden soils; sometimes started in coldframes; prop. by seeds and offsets.

pulchélla, Sweet. Bulb or corm globose, ½in. or more thick; tunics brown: lvs. about 4, linear, plaited, 3–6 in. long: spathes 1½ in. long: fls. lilac; outer segms. obovate, with a white claw spotted lilac. Chile, Argentina, Brazil. B.M. 3862.

platénsis, Hort. Franceschi. Bulb or corm very large: lvs. sword-shaped, glaucescent, ribbed, 2 ft. and more long: scapes to 4 ft.; fls. large, light porcelain-blue, produced in 8 months of summer. La Plata.

H. amatòrum, C. H. Wright. Bulb or corm globose, with brown scales: lvs. lanceolate, acuminate, plicate, 8 in. long: scape 18 in., very slender, branched: spathes herbaceous, the inner twice longer than outer: fls. violet; perianth 2 in. across; outer segms. with white midrib inside, 3 times longer than inner, the latter brown-spotted at base. Uruguay.—*H. cærùlea,* Herb.=H. Drummondiana.—*H. Drummondiàna,* Herb. Corm small and ovoid, with brown tunics: st. 1 ft. or less high, simple or forked; fls. blue, 2 in. across; outer segms. obovate, with white claw; inner segms. oblanceolate, acute. Prairies, Texas. B.M. 3862.—*H. Wátsonii,* Baker. Lower: fls. purple; outer segms. oblanceolate, 1 in.; inner segms. obovate, ¼in. long. Damp prairies, Texas.

L. H. B.

HERBS, Pot: *Greens.* **Salad:** *Greens and Salad Plants.*

HERCULES' CLUB: *Aralia spinosa;* also *Zanthoxylum Clava-Herculis.*

HERÍNCQUIA: *Gesneria.* The plant once known in horticultural literature as *H. floribunda* is probably *Gesneria libanensis.*

HERITIÈRA (Charles Louis L'Heritier de Brutelle, 1746–1800, French botanist). *Sterculiàceæ.* About 4 species of trees on the tropical seacoasts of the Old World, little known horticulturally: lvs. thick, simple, entire, silvery or shining beneath: fls. small, unisexual, in axillary panicles; calyx 4–6-toothed or -cleft; petals none; stamens united into a column, bearing 5 anthers at top; ovaries mostly 5, nearly free, bearing short style and 5 stigmas: carpels woody and indehiscent when ripe, cornered, keeled or winged. Called "looking-glass tree," from the shining under-surface of the lvs. *H. littoràlis,* Dry. Moderate-sized tree: lvs. oblong, acute, 3–8 in. long: staminate fls. small, in axillary branched clusters, with an urn-shaped downy calyx; pistillate fls. larger with bell-shaped calyx: carpels or follicles 1–4 in. long, smooth or tubercled. Afr., Asia, Pacific islands.

L. H. B.

HERMÁNNIA (Paul Hermann, 1646–1695, botanical traveler, professor of medicine at Leyden). *Sterculiàceæ.* Shrubs, mostly small, growing chiefly in Afr., but a few in Amer. from Texas south, some 150 species in all. They are little known horticulturally. Lvs. alternate, entire, toothed or pinnatifid, sometimes laciniate: fls. many, yellow, orange, cream-color or reddish, on axillary peduncles or panicled; calyx campanulate, 5-cleft, often inflated, without involucre; petals 5, clawed; stamens 5, standing opposite the petals, the filaments joined at the base: fr. a coriaceous 5-celled and 5-valved many-seeded caps. *H. texàna,* Gray, occurs in dry or rocky places in Texas and adjacent Mex.: 2–4 ft.: lvs. tomentose, suborbicular to oval, serrate or dentate: fls. dull scarlet or crimson. *H. cándicans*, Ait., is a variable species of S. Afr.: erect or diffuse, tomentose: lvs. long-petioled, elliptic or ovate-oblong, obtuse, nearly entire: fls. more or less tomentose, bright yellow, the petals twice as long as calyx. Gn. 71, p. 15, where the name "cowslip bush" is proposed, its fls. closely resembling those of a small cowslip; blooms spring to fall. Other species of Hermannia are likely to be mentioned in horticultural literature.

L. H. B.

HERMINIÈRA (name refers to the stout thorns and stamens). *Leguminòsæ.* One species, in Trop. Afr.: by some included in Æschynomene. Fls. papilionaceous; calyx 2-lipped; standard orbicular, short-clawed; wings about equaling the standard, obliquely obovate; keel broad, obtuse or somewhat beaked: pod linear and nearly flat, curved spirally, separating at the square articulations. *H. Elaphróxylon*, Guill. & Perr. (*Æschynómene Elaphróxylon*, Taub.), the ambash or pith-tree of the upper Nile and beyond, may possibly be planted somewhere in our region: erect thorny shrub, to 20 ft.: lvs. bristly; lfts. 10–20 pairs, ½in. or less long, linear-oblong: fls. bright orange, subcorymbose, the peduncles bristly; standard 1½ in. broad. G.W. 14, p. 605.—It grows in wet places, sometimes choking streams.

L. H. B.

HERMODÁCTYLUS (Greek, *Mercury's* or *Hermes' fingers;* from the arrangement of the tubers). *Iridàceæ.* SNAKE'S-HEAD IRIS. A hardy tuberous plant closely allied to Iris, the fls. purplish black and green, of a quaint and peculiarly attractive beauty. The plant is procurable from European growers. The genus differs from Iris in the 1-celled ovary with 3 parietal placentæ; Iris has a 3-celled ovary: rootstocks digitate.—One species, S. France to Greece. Cult. of the tuberous irises. Flowers April, May.

tuberòsus, Salisb. (*Íris tuberòsa*, Linn.). Tubers 2–4, about 1 in. long: st. 1-fld., 1 ft. or more high: lvs. 2–3, glaucous, 4-angled, 1–2 ft. long: spathe usually with only 1 large lanceolate valve: outer perianth-segms. 2 in. long, black-purple; inner ones green. April. B.M. 531. F.S. 11:1083. G.C. II. 23:672.—*H. longifòlius*, Sweet, is a form, according to Baker, with lvs. 3–4 ft. long; and *H. bispathàceus*, Sweet, a form with 2 valves in the spathe. *H. tuberosus* is sometimes called the "widow iris" or "mourning iris," from its fls. of apple-green and velvet-black.

J. N. GERARD.
L. H. B.†

HERNÁNDIA (Francisco Hernandez, physician to Philip II of Spain, traveled in West Indies and Mexico, 1593–1600, and wrote on natural history of Mexico). *Hernandiàceæ*, formerly included in *Lauràceæ.* JACK-IN-A-BOX. Ornamental trees, grown chiefly for their large handsome foliage.

Evergreen: lvs. alternate, long-petioled, often peltate, entire, 3–7-nerved, without stipules: fls. monœcious, small, in loose terminal corymbs or panicles; the extreme branches terminated by 3-fld. cymes with a 4–5-leaved involucre at the base; their central fls. pistillate and sessile, the lateral staminate and stalked; pistillate fls. with a lobed cupula; sepals 8–10; ovary inferior, 1-ovuled; style short, with a large lobed stigma; staminate fls. with 3–4 stamens shorter than the 6–8 sepals: fr. globose, ribbed, indehiscent, inclosed in an inflated often colored involucre.—Eight species in the tropics.

These are handsome trees with large glossy foliage and with small yellowish or greenish white flowers in terminal corymbs followed by yellowish or whitish subglobose or ovoid fruits. *H. sonora* is much used in Europe for subtropical bedding, and produces a juice that removes hairs from the face without pain. *H. ovigera* is cultivated in southern California by Franceschi, who says it has light green, glossy leaves with a red spot in the center, and large, whitish, egg-snaped fruits. Propagation by cuttings of half-ripened wood under glass, which root easily with bottom heat.

sonòra, Linn. Tree, to 60 ft.: lvs. chartaceous, ovate to oblong-ovate, usually peltate, or cordate at the base, acuminate, entire, glabrous, penninerved, 7–12 in. long: corymbs grayish tomentulose; fls. yellowish, ⅛in. across; stamens 3–4; filaments with 1 gland at the base: fr. ovoid, yellow, about 1 in. long. W. Indies.—The similar *H. Moorenhoutiana*, Guill., from the Pacific islands, has smaller, more coriaceous, palmately 3–5-nerved lvs. and larger fls. ¾in. across. B.M. 5839.

ovígera, Linn. Tree, to 40 ft.: lvs. coriaceous, broadly ovate to ovate-oblong, not peltate, acuminate, subcordate at the base, palmately 7-nerved, glabrous, 4–7 in. long: corymbs grayish tomentulose; filaments with 2 glands at the base: fr. whitish, subglobose, about 1 in. long. Trop. Asia and Afr.

ALFRED REHDER.

HERNIÀRIA (Greek; supposed to cure hernia or rupture). *Caryophyllàceæ.* HERNIARY. RUPTURE-WORT. Trailing or sprawling little small-leaved herbs, one of which is grown as a carpeter.

Herniaria has about 15 species, scattered from the Canaries to W. Asia, but all grow in sandy places, chiefly near the sea. It has no near allies of much garden value, but 2 species of Paronychia are cult. for the same purpose and are easily distinguished by general appearance. Herniaria and Paronychia are alike in their 5-parted perianth and 2 stigmas, but in Herniaria the segms. are blunt, while in Paronychia they are hooded near the apex and have a horn or small sharp point on the back near the apex. Herniaria is composed of annuals or perennials with roots of short duration, and they are all much branched, trailing plants, either glabrous or hirsute: lvs. opposite, alternate or clustered, small, entire: fls. minute, crowded in the axils; sepals, petals and stamens 5: seed solitary.

glàbra, Linn. Lvs. obovate, rarely orbicular, glabrous except a few hairs at edges, which are usually recurved: fls. small and green, in a leafy spike or the lower ones at considerable intervals. July, Aug. Eu., Asia.—A hardy herbaceous perennial which grows about 2 in. high and produces inconspicuous greenish fls. in summer. It makes a dense mat of moss-like foliage, which turns a deep bronzy red in winter. It is much used in carpet-bedding and to a less extent in rockeries and for edgings of hardy borders. Recommended for covering graves. It thrives in the poorest soils, makes a solid covering, and is by some regarded as one of the most valuable of hardy trailers. Prop. by division or seed. Grows wild in England, and is kept in many large collections of hardy plants. **H. hirsùta,** Linn., Eu., has narrow hirsute lvs.: sometimes planted.

WILHELM MILLER.

HERPÉSTIS (name refers to the creeping habit of some species). *Scrophulariàceæ.* About 60 herbs, mostly of warm and tropical parts of the world, 1 or 2 of which may be transferred to cult. grounds now and then. The name Herpestis is now given up by systematic botanists, the "nomina conservanda" of the Vienna code using Aublet's Bacopa for the genus and others adopting P. Browne's Monniera or Lamarck's Bramia. Allied to Mimulus, but differs in short corolla and in unequally toothed calyx: low herbs, blooming in summer, sometimes rather succulent: lvs. opposite: fls. small, peduncled, mostly solitary in the axils, blue, purple or white, corolla 2-lipped or nearly regular; stamens 4, didynamous, not protruding; style slender; stigma 2-lobed or capitate. *H. Monnièria*, HBK., or *Bacòpa Monnièria*, Wettst., grows near the sea and along river-banks, Md. to Texas and south: glabrous, creeping, perennial, somewhat fleshy: lvs. spatulate to cuneate, entire or sparingly toothed, sessile: fls. pale blue, about ½in. long or less, the corolla only obscurely 2-lipped. Other native species with 2-lipped corolla are *H. amplexicaùlis*, Pursh, blue; *H. rotundifòlia*, Pursh, white or pale blue; *H. nigréscens*, Benth., whitish or purplish. L. H. B.

HERPETOSPÉRMUM (name refers to some character of the seeds). *Cucurbitàceæ.* Two annual tendril-climbers, one from the Himalaya region and one from China, allied to Abobra, but differing in the usually racemose sterile fls. and the long-tubular calyx. Lvs. long-petioled, ovate, nearly entire or angled: tendrils bifid: fls. rather large, yellow; corolla broadly campanulate, very deeply parted, the segms. elliptical and entire; stamens 3, included, inserted on calyx-tube, the filaments short and free: fr. medium-size, broadly oblong and 3-angled, costate, more or less 3-valved. *H. grandiflòrum*, Cogn., from China, has been cult. abroad: lvs. broadly ovate-cordate, more or less angular, 4–5 in. long: staminate fls. 3–6 at the apex of a 3–5-in. peduncle, with large golden-yellow petals; pistillate fls. solitary or in pairs, short-stalked, slightly smaller than the staminate: fr. about 2½ in. long, densely hairy and greenish, 7–8-ribbed. *H. caudìgerum*, Wall., the other species, has very lightly crenulate ovate lvs. to 6 in. long: staminate fls. usually on twin peduncles, one single-fld. and one 5–10-fld.; pistillate fls. on stout peduncles less than 1 in. long: fr. sparsely hairy, about 3 in. long. L. H. B.

HESPERÁLOE (Latin, *western Aloe*). *Liliàceæ*, tribe *Yúcceæ.* Acaulescent plants with filiferous leaves like many yuccas, but ephemeral diurnal greenish or red flowers, recalling those of the true aloes. Cultivated somewhat in the open in warm dry regions, but elsewhere under glass. Treatment much as for agaves.

Leaves outcurved, soft-pointed, with coarse marginal threads: infl. usually few-branched; fls. oblong; filaments slender, attached to base of perianth; pistil with ovoid ovary, slender style and small stigma: caps. 3-celled, 6-valved, rugose, beaked; seeds thin, flat and smooth.—Two species from Texas to Mex.

parviflòra, Coult. (*H. yuccæfòlia*, Engelm. *Alòe yuccæfòlia*, Gray. *Yúcca parviflòra*, Torr. *Y. parvifòlia*, Hemsl.). Cespitose: lvs. concave, striate on back, 1 in. x 3–4 ft., green: infl. 3–4 ft. high, glabrous and somewhat glaucous; fls. nodding, rosy, 1¼ in. long; style exserted: caps. round, 1 in. long. S. W. Texas. Rep. Mo. Bot. Gard. 13:1, 85.—With more bell-shaped fls. 1 in. long, and scarcely protruding style it is var. **Éngelmannii,** Trel. (*H. Éngelmannii*, Krauskopf). G.C. II. 18:199. B.M. 7723. Rep. Mo. Bot. Gard. 13:1.

funífera, Trel. (*H. Dàvyi*, Baker. *Yúcca funífera*, Koch. *Agàve funífera*, Lem.). Larger: infl. 6–8 ft. high; fls. purplish green, 1 in. long; style scarcely protruding: caps. 1–2 in. long. N. Mex.—The source of Zamandoque fiber, one of the kinds of "Tampico hemp." William Trelease.

HESPERÁNTHA (Greek, *evening flower*). *Iridàceæ.* Bulbs, sometimes grown indoors.

These plants belong to the Ixia tribe and are much inferior to ixias for general cult., but have fragrant fls., opening at evening; the style is short with long subulate branches, and the spathe-valves are green rather than brown. The genus is still more closely allied to Geissorhiza, and differs in having shorter style and longer style-branches and spathe-valves always green instead of sometimes brownish above. The corms are ½in. thick or less: lvs. 2–5, narrow and distichous: fls. 2–10 in a lax, distichous spike; perianth rotate and a cylindrical tube; inner segms. white; outer ones red outside; stamens inserted on the throat.—Species about 40, in Trop. Afr. and the Cape, mostly the latter. For cult. see *Ixia* and *Bulbs.*

A. *Foliage hairy.*

pilòsa, Ker. Corm globose: lvs. 2, linear, erect, strongly ribbed, 3–6 in. long: st. slender, erect, 6–12 in.: outer segms. claret-red or green. B.M. 1475 (outer segms. speckled with color).

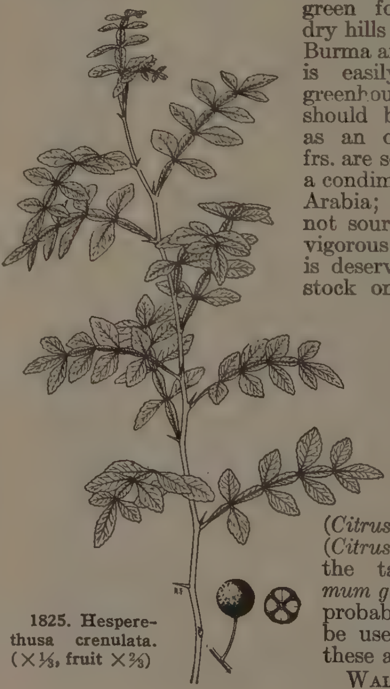
AA. *Foliage not hairy.*

falcàta, Ker. Corm conic: lvs. 2–4, lanceolate, spreading, 2–3 in. long: st. slender, 1 ft. or less, simple or forked: outer segms. claret-red. B.M. 566 (as *Ixia falcata*).

graminifòlia, Sweet. Corm globose: lvs. 3–5, linear, erect, 4–6 in. long: st. slender, 1 ft. or less, simple or rarely forked: outer segms. reddish brown or reddish green outside. B.M. 1255 (as *Geissorhiza setacea*). L. H. B.

HESPERETHÙSA (from Latin *Hesperethusa*, one of the Hesperides). *Rutàceæ*, tribe *Cìtreæ.* A slender, spiny tree or shrub: lvs. persistent, pinnate: fls. 4-merous; stamens 8, free: frs. small, 4-celled, a single seed in each cell but with no pulp-vesicles; seeds hard and rounded, cotyledons epigeous in germination: the first foliage-lvs. simple, opposite.—Only 1 species is now recognized.

crenulàta, Roem. (*Limònia crenulàta*, Roxbg. *L. acidíssima*, Auct., not Linn.) Naibel. Fig. 1825. Lvs. 5–9-foliate, the lfts., winged petiole and broadly winged segms. of the rachis crenate-margined: fls. small, white, fragrant, 4-merous; ovary 4-celled, 1 ovule in each cell: frs. small (⅓–½in. diam.), globose, dark-colored when ripe, containing 1–4 hard smooth seeds imbedded in a scanty very bitter pulp which is not composed of pulp-vesicles: cotyledons epigeous in germination, remaining small, caducous: first foliage-lvs. simple, opposite, ovate, crenate-margined. Ill. Roxbg. Pl. Corom. 1:60, pl. 86. Talbot, For. fl. Bombay, p. 198, fig. 121.—This plant is usually but erroneously called *Limonia acidissima*, Linn., which name was originally applied to the wood-apple, *Feronia Limonia*, Swingle, which see. The genus Limonia is invalid and hence the oldest valid name for this plant is the one used here. A handsome spiny shrub or small tree with beautiful light green foliage, native to dry hills in Ceylon, India, Burma and Indochina. It is easily grown under greenhouse conditions and should be better known as an ornamental. The frs. are sometimes used as a condiment in India and Arabia; they are bitter, not sour. The tree has a vigorous root-system and is deserving of trial as a stock on which to graft citrous fruit trees. In the greenhouses of the Dept. of Agric. at Washington, D. C., it has been found to grow readily when grafted on grapefruit (*Citrus grandis*), lemon (*Citrus Limonia*) and on the tabog (*Chætospermum glutinosa*) and it is probable that it could be used as a stock for these and other species. Walter T. Swingle.



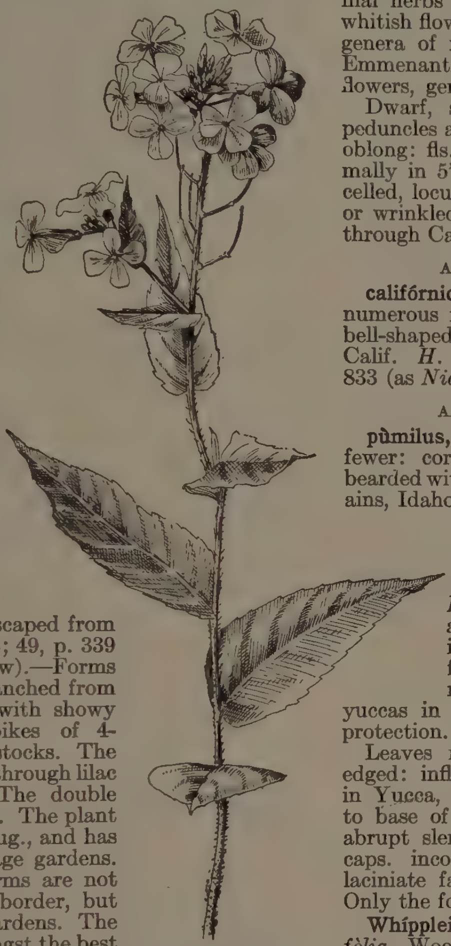
1825. Hesperethusa crenulata. (×⅓, fruit ×⅔)

HÉSPERIS (Greek, *evening*, same root as vesper; flowers more fragrant at evening). *Cruciferæ*. This includes the dame's rocket, a vigorous old-fashioned hardy herbaceous perennial.

Herbs, biennial or with a st. that is perennial at the base, pilose, the hairs simple, forked or glandular: st.-lvs. usually sparse, ovate or oblong, entire, dentate or lyrate: fls. white or purple, in loose racemes, often fragrant; petals 4, long-clawed; stigma lobed and erect: pods long, linear, cylindrical or nearly so; seeds in 1 row in each cell, usually wingless. The genus is allied to the stocks, but has a somewhat different habit and the cotyledons incumbent not accumbent.—Species about 2 dozen in the Medit. region to Cent. Asia.

matronàlis, Linn. ROCKET. SWEET ROCKET. DAME'S VIOLET. DAMASK VIOLET. Fig. 1826. Lvs. ovate-lanceolate, 2–3 in. long, toothed: pods 2–4 in. long, straight, much contracted between the seeds. Eu., N. Asia. Escaped from gardens. Gn. 53, p. 293; 49, p. 339 (a lovely garden view).—Forms clumps 2–3 ft. high, branched from the base, and covered with showy terminal pyramidal spikes of 4-petaled fls. resembling stocks. The colors range from white through lilac and pink to purple. The double forms are most popular. The plant blooms from June to Aug., and has long been cult. in cottage gardens. The ordinary single forms are not worth growing in the border, but may be used in wild gardens. The double rockets are amongst the best hardy plants, very productive of bloom and useful for cutting. The double-fld. white, var. **álba-plèna**, Hort., very fragrant, is much prized. G. 25:283; 28:701. Gn. W. 22. suppl. Apr. 29. Var. **purpùrea**, Hort., is a purple-fld. garden form. Var. **pùmila**, Hort., is a dwarf form. Var. **nàna candidíssima**, Hort., is a pure white garden form.

WILHELM MILLER.
L. H. B.†



1826. Dame's Rocket or sweet rocket—Hesperis matronalis. (×½)

HESPEROCÁLLIS (Greek, *evening beauty*). *Liliaceæ*. Leafy stemmed bulbous plant of the Colorado desert, and the desert sections of southern California, sometimes planted in California and elsewhere.

Of the tribe Hemerocallideæ, and characterized by Watson as having a large white perianth cleft to below the middle, the segms. several-nerved: anthers linear: caps. ovate-oblong, deeply lobed: fls. few in a raceme, the stout pedicels jointed at the top; seeds many, horizontal, flattened, black.—One species.

undulàta, Gray. Bulb large, corm-like: st. stout, 1–2 ft. high, 5–8-fld.: lvs. linear, fleshy, keeled, 3–6 lines wide, wavy margined: fls. 1½–2 in. long; style exserted: caps. ⅓in. long.—The fls. very fragrant, waxy-white or greenish; bulb should be deeply planted. L. H. B.

HESPEROCHÌRON (Greek, *hesperos*, originally evening, but here western, i.e., in the direction of the setting sun, and *Chiron*, a centaur distinguished for his knowledge of plants; hence "Western Centaury," these plants being at first placed in the Gentian family). *Hydrophyllàceæ*. Northwest American tufted perennial herbs with scapes bearing solitary, rather large whitish flowers, ¾ inch or less long. The nearest allied genera of recognized garden value are Phacelia and Emmenanthe, which are very distinct in color of flowers, general appearance and cymose inflorescence.

Dwarf, stemless perennials or possibly biennials: peduncles all radical and 1-fld.: lvs. entire, spatulate or oblong: fls. purplish or nearly white, with parts normally in 5's rarely in 6's to 7's; style 2-cut: caps. 1-celled, loculicidal, 15–20-seeded; seeds minutely netted or wrinkled.—Two species that have been procurable through Californian specialists and collectors.

A. *Corolla-lobes shorter than the tube.*

califórnicus, Wats. (*Capnòrea nàna*, Raf.). Lvs. numerous in a radical tuft: corolla somewhat oblong bell-shaped. Hills and meadows, Utah to Wash. and Calif. *H. latifòlius*, Kellogg, is a large form. B.R. 833 (as *Nicotiana nana*).

AA. *Corolla-lobes longer than the tube.*

pùmilus, Porter (*Capnòrea pùmila*, Greene). Lvs. fewer: corolla nearly wheel-shaped; tube densely bearded within. Springy and marshy grounds in mountains, Idaho and E. Wash. to Calif.

WILHELM MILLER.

HESPEROSCÓRDUM: *Brodiæa.*

HESPEROYÚCCA (Latin, *western yucca*). *Liliàceæ*, tribe *Yúcceæ*. Yucca-like nearly acaulescent plants, forming a very characteristic feature of the coast-range flora of California when in bloom. Hardy only in mild regions: frequently planted out-of-doors like yuccas in California, but elsewhere requiring house protection. Cultivated much like agaves.

Leaves narrow, rigid, pungently pointed, rough-edged: infl. panicled; fls. vespertine, cup-shaped as in Yucca, usually white; filaments clavate, attached to base of perianth; pistil with short oblong ovary, abrupt slender style, and fimbriate capitate stigma: caps. incompletely 6-celled, 3-valved through the laciniate false septa; seeds thin, flat and smooth.—Only the following species:

Whípplei, Baker (*Yúcca Whípplei*, Torr. *Y. graminifòlia*, Wood. *Y. Ortgiesiàna*, Roezl. *Y. califórnica*, Groenl.). Simple or cespitose: lvs. more or less 3-sided, finely striate, rough-edged, ½in. x 1–3 ft., glaucous: infl. 6–15 ft. high, oblong, long-peduncled, glabrous; fls. nodding, fragrant: caps. broad, 2 in. long. S. Calif. G.C. II. 6:197. Gn. 35, p. 561. R.H. 1886, p. 63. B.M. 7662 Rep. Mo. Bot. Gard. 3:11, 12, 54; 4:17, 23; 13:4, 5, 85.—With extremely glaucous lvs. it is var. **glaùca**, Hort. With decidedly violet-shaded fls. it is var. **violàcea** (*Y. Whípplei violàcea*, André). R.H. 1884:324. G.C. III. 39:154; 51:106 and suppl. With flatter, broader and smoother-edged lvs. it is var. **nítida** (*Y. nítida*, Wright). G.C. III. 39:153. G. 30:33. Gn. 69, p. 161.

WILLIAM TRELEASE.

HETERANTHÈRA (name refers to the unlike or different anthers). *Pontederiàceæ*. A few American bog herbs, one of which now and then occurs in horticultural literature. Sts. creeping, ascending or floating: lvs. long-stalked, grass-like or the blades ovate, oval or reniform: fls. white, blue or yellow, small, arising from the sheathing base of the petiole; perianth with slender tube, the segms. narrow and nearly or quite equal; stamens 3, unequal or equal: fr. a 1-celled or 3-celled caps. inclosed in the withered perianth-tube. *H. limòsa*, Willd., has blue fls.: spathe 1-fld.: lvs. oblong to lance-oblong, obtuse. *H. renifórmis,* R. & P., has smaller white or pale blue fls.: spathe 3–5-fld.: lvs. orbicular-reniform to cordate, acute. Both these species have unequal anthers. *H. dùbia,* MacM., has equal anthers and small pale yellow fls. All these are natives in E. U. S. and southward, and are useful for transferring to wet grounds and shallow pools. L. H. B.

HETEROCÉNTRON (*unlike spurs,* referring to structure of anthers). *Melastomàceæ.* Includes *Heeria* of Schlechtendal, not of Meissner. About 6 Mexican and Central American species, sometimes grown under glass.

Herbs or shrubs, erect or prostrate, with opposite membranaceous pinnately nerved (rarely 3-nerved) entire lvs., and white, rose or purple irregular fls. in panicles or rarely solitary: stamens 8, very unequal, the 4 larger ones with long appendages or connections; ovary loculed; petals 4.—Not to be confounded with Centradenia, which has winged sts. unequal-sided lvs., and calyx-teeth small and much shorter than the calyx-tube.—Warmhouse plants, requiring the cult. of centradenia, but grown chiefly for the fls., whereas centradenias are grown also for foliage.

ròseum, A. Br. (*H. mexicànum,* Naudin. *Heèria ròsea,* Triana) is the only species in general cult.: 1 ft. or more high, with 4-angled (but not winged) st.: lvs. elliptic, obtuse or acute, pinnate-nerved: fls. bright rose, in a large, terminal panicle, showy, in autumn and early winter. B.M. 5166. I.H. 3:97. Var. **álba,** Hook., is a white-fld. form.

subtriplinérvium, A. Br. (*Heèria subtriplinérvia,* Triana). Little branched, the branches sharply 4-angled, the young foliage and calyx sparsely pilose: lvs. oblong-lanceolate, acute at apex, narrowed into long petiole, the margin entire, blade 9–13-nerved: fls. white, the petals broadly obovate with retuse apex. Mex.

H. élegans, O. Kuntze (Heeria elegans, Schlecht. H. procumbens, Naudin), will be found under Schizocentron. L. H. B.

HETERÓMELES: *Photinia.*

HETEROPÁPPUS (Greek, *two kinds of pappus*). *Compósitæ.* A hardy herbaceous perennial that bears azure-blue aster-like flowers in summer.

Herbs, erect, branched above: lvs. alternate, entire or coarsely toothed: heads in loose irregular panicles or solitary at the tips of branches, rays white or sky-blue. The genus is closely related to Aster, having the habit of the asters of the section Calimeris. The plant in the trade is known as *Calimeris tatarica.* Heteropappus is closely related to Boltonia and is not far from Callistephus, which contains the China asters. The chief botanical distinction resides in the pappus, which in the large group containing Callistephus and Aster is composed of numerous bristles arranged in one or more series, while Boltonia and Heteropappus belong to a group in which the pappus is anomalous. In Boltonia it is composed of very short, somewhat chaffy bristles, with the addition usually of 2–4 awns not longer than the achene. In Heteropappus the pappus of the rays is composed of very short, somewhat chaffy bristles, while in the disk-fls. it consists of numerous slender bristles arranged in 1 or 2 series.—A genus of 2–4 species from Japan and China.

híspidus, Less. (*Calímeris tatárica,* Lindl. *Áster híspidus,* Thunb.). St. roughish: lvs. linear, acute, pubescent and ciliated on the margins: branches spreading, usually unbranched and bearing 1 head: involucral scales acuminate, hirsute, herbaceous, not white-margined, rays blue. Japan, Mongolia. L. H. B.

HETEROPHRÁGMA (Greek, *different* and *septum;* alluding to the peculiar 4-angled septum of the typical species). *Bignoniàceæ.* Three species of E. Indian trees, with large opposite pinnate lvs. and large yellow or pink fls. in terminal panicles or from the old wood: calyx campanulate, irregularly 3–5-lobed; corolla campanulate-funnelform; ovules in several series in each cell of the broadly linear ovary: caps. cylindric or compressed, falcate or twisted, loculicidally 2-valved; septum flat or 4-angled. The 2 African species referred by some writers to this genus belong to Fernandia. Only the following species has been offered in this country. **H. adenophýllum,** Seem. (*Bignònia adenophýlla,* Wall.). Tree, 30–50 ft.: young growth tomentose: lfts. 5–7, broadly elliptic, acute or obtuse, entire, tomentose, 7–9 in. long: fls. in terminal panicles; calyx irregularly 5-lobed; corolla brownish yellow, densely woolly outside, with spreading 5-lobed limb, 2 in. wide: caps. twisted, resembling a cork-screw, 1–3 ft. long; septum flat. Wight, Ill. 160 (as *Spathodea adenophylla*).—Little known in cult. and adapted for subtropical or tropical countries only. Prop. probably like Radermachia by cuttings and air-layering.

ALFRED REHDER.

HETERÓPTERIS (*various winged,* referring to the fr.). *Malpighiàceæ.* Shrubs, erect or rarely climbing, of Trop. Amer. and 1 in W. Afr. Fls. small, yellow or purple, in panicles or racemes: lvs. opposite, nearly or quite entire. The calyx is 5-parted, some or all the lobes with a pair of sessile glands; petals clawed; stamens 10, all perfect but unequal; ovary 3-celled, with 3 subulate styles, the stigma on an angle of the style: fr. 1–3 samaras, with a somewhat semi-circular wing.—Species 90 or more. The climbing species may be found in choice collections. *H. purpùrea,* Kunth, is a low climber among shrubs, according to Grisebach, in the farther W. Indies and Venezuela: lvs. oval, glabrous, somewhat glaucous beneath, the petiole with 2 glands at the middle: fls. purple, corymbose or racemose, on slender pedicels that are jointed below the middle: fr. 1 in. long, with semi-obovate oblique wings. *H. chrysophýlla,* HBK. Twining: lvs. oval or oval-oblong, entire, glabrous above and golden pubescent beneath: fls. orange, becoming reddish. Brazil. B.M. 3237. An interesting plant for the warmhouse, long-climbing. L. H. B.

HETEROSMÌLAX (Greek, *another kind of Smilax*). *Liliàceæ.* This includes an ornamental climber with the habit of smilax, but the perianth is undivided (instead of 6-parted, as in smilax) and the mouth is minutely 2–5-dentate. It resembles smilax in having diœcious fls. borne in umbels, and tendril-bearing petioles. The genus contains 5 species of woody climbers from India, Malaya, China and Japan: lvs. 3–5-nerved: fls. small or very small. Little known culturally outside the far East.

japónica, Kunth. Lvs. with stalks about ½in. long, blades about 4–5 in. long. Japan, where it is cult. for the roots, which are used in medicine: Hemsley writes that it is said to have been intro. into Japan from China but that no Chinese specimens are known to exist (1903). L. H. B.

HETEROSPÀTHE (Greek, a *different kind of spathe*). Also written *Heterospatha.* *Palmàceæ,* tribe *Arèceæ.* A rare and highly ornamental palm, with graceful, spreading habit and pinnatisect leaves, the segments being long, slender and tapering.

Its nearest allies of garden value are Verschaffeltia and Dypsis, in which the stigmas are basal in fr., while Heterospatha belongs to a group in which the stigmas are eccentric or lateral in fr. Other important generic characters are the 6 stamens with versatile anthers and the 1-celled ovary.—Only 1 species, native of the small island of Amboyna, the Dutch headquarters in the E. Indies. Intro. from the Java botanic garden in 1879 to England. The plant is procurable from importers and from S. Fla., but is cult. in Amer. only in botanic gardens.

LIV. Herbs and shrubs employed about a pond.

elàta, Scheff. (*Metróxylon elàtum,* Hort.). Tall, unarmed: lvs. terminal, long-petioled, equally pinnatisect; segms. numerous, lanceolate, narrowed at both ends, acuminate, 1-nerved, margins thickened and recurved at the base; rachis round on the back, flat on the face; sheath short, fibrous, swelled at the base: spathes 2, the lower 2-crested, the upper much longer.—A very worthy palm, valuable chiefly for its graceful habit while still quite young. Must be grown in a moist hot house. N. Taylor.†

HETERÓTOMA (name refers to the unequally cut corolla). *Campanulàceæ.* About 10 species of Mexican annuals and perennials, one of which has come somewhat into cult. Lvs. alternate: fls. blue, yellow or orange, in terminal racemes; calyx tubular with an unequally 5-parted limb, the 2 anterior lobes usually adnate to the spur of the corolla; corolla-tube split to the base on the back, in front produced into a horizontal or deflexed spur, the limb short and incurved and with either nearly equal or unequal lobes; stamen-tube free from corolla; ovary inferior, 2-celled, many-ovuled: caps. 2-valved. **H. lobelioìdes,** Zucc. Erect, branching, the st. pubescent: lvs. alternate, ovate-lanceolate, distantly toothed, acuminate: fls. about 2 in. long, single on slender axillary peduncles, odd; corolla-spur blood-red, the limb golden yellow and 3-lobed; lower lip of calyx adnate to the corolla-tube and the 2 subulate green lobes projecting beyond it; staminal column erect, as long as the corolla-limb, and prominent. Mountains in Mex. and Cent. Amer. B.M. 7849. R.H. 1905, p. 9.—An interesting showy perennial, sometimes called "bird flower," to be grown in a cool greenhouse in winter and in the open in summer. L. H. B.

HETERÓTRICHUM (name refers to the *variable hairs* on the lvs.). *Melastomàceæ.* Ten or a dozen hispid, or glandular shrubs in Trop. Amer., with white or pink fls. in terminal or lateral panicles; calyx campanulate or globular, with 4–8 teeth; corolla of 6–8 petals; stamens 8–12 or more: lvs. large, ovate or oblong, cordate at base, entire or toothed. *H. mácrodon,* Planch., is sometimes mentioned in horticultural literature. A very handsome shrub, 7–9 ft., flowering when small: lvs. opposite, large, the 2 in the pair unequal, cordate-ovate, abruptly acuminate, serrate, 7-nerved: fls. 10–12 in a terminal cyme, white with red at base of petals, 1¾ in. across, the 8 petals obovate and flat-spreading; calyx and young parts hispid or villous. Venezuela. B.M. 4421. G.W. 14, p. 652.—Requires hothouse treatment. L. H. B.

HEÙCHERA (Johann Heinrich von Heucher, 1677–1747, professor of botany at Wittenberg). *Saxifragàceæ.* Herbs resembling the dainty wild flower, the bishop's cap (Mitella) in their habit, as they have a tuft of heart-shaped, five- to nine-lobed, crenate leaves, from which spring a dozen or so slender scapes a foot or more high with small flowers borne in panicles, giving a delicate and airy effect. This includes *H. sanguinea* which probably ranks among the best low perennials with small, red flowers. It is very desirable for the hardy border, where it blooms from spring to late fall. It is also useful to florists for cut-flowers and autumn forcing.

Heuchera belongs to a group of genera including Mitella and Tiarella, in which the ovary is 1-celled. There is a well-developed hypanthium often bell-shaped, sometimes urceolate, cylindrical, turbinate, or saucer-shaped, often more or less oblique, and adnate to the lower part of the pistil. Most of the distinguishing characters of this difficult genus are found in the shape of the hypanthium. In Heuchera the petals are 5 or none, and entire; in Mitella 5, 3-fid or pinnatifid; in Tiarella 5 and entire. Heuchera has 5 stamens; Mitella 5 or 10; Tiarella 10. The caps. of Heuchera is inferior, 2-beaked; in Mitella superior, not beaked; in Tiarella superior, compressed.—Heuchera has 72 species, all N. American and ranging from Mex. to the arctic regions. A full botanical treatment is by P. A. Rydberg, in N. Amer. Flora. 22:97–117 (1905), which has been followed in the account below. Many of the species are distinguished only by rather technical botanical characters, but only a few of them are known horticulturally.

The attractive and petal-like part of *H. sanguinea* is the calyx, the petals being small in all heucheras (often shorter than the calyx). The other species are attractive by reason of their general habit, and particularly the graceful, open panicle. *H. sanguinea* came into prominence about 1884 and is now deservedly one of the most popular of hardy perennials. The others are procurable from the largest dealers in native plants and from western collectors. They range from 3 inches to 3 feet high, averaging about 1½ feet, and bloom in summer, having greenish white or purplish flowers. Almost any good garden soil suits them, and they are not particular as regards exposure to sunlight (though an open situation is preferable); and they look well in borders, rockeries, separate beds and elsewhere. Propagate by division or seed.

INDEX.

alba, 10.
americana, 3.
bracteata, 7.
brizoides, 10.
cylindrica, 9.
erubescens, 2.
gracillima, 10.
grandiflora, 10.
hispida, 6.
hybrida, 10.
maxima, 10.
micrantha, 2.
parvifolia, 8.
pubescens, 5.
ribifolia, 5.
robusta, 10.
rosea, 10.
rubescens, 4.
rubifolia, 5.
sanguinea, 10.
splendens, 10.
villosa, 1.

KEY TO THE SPECIES.

A. *Stamens equaling or exceeding the sepals.*

B. *Panicle open, not spike-like.*

C. *Hypanthium not strongly oblique.*

D. *Breadth af hypanthium about as the length.*

E. *Lobes of the lf.-blade broadly triangular, acute* .... 1. **villosa**

EE. *Lobes of the basal lf.-blades, at least, rounded.*

F. *The hypanthium, with the sepals 1–1½ lines long* ... 2. **micrantha**

FF. *The hypanthium, with the sepals 1½–4 lines long* .. 3. **americana**

DD. *Breadth of hypanthium about twice the length* .... 4. **rubescens**

CC. *Hypanthium strongly oblique; stamens equaling or slightly exceeding the sepals.*

D. *Flowering branches more or less leafy* .... 5. **pubescens**

DD. *Flowering branches leafless or practically so* .... 6. **hispida**

BB. *Panicle dense, contracted, almost spike-like* .... 7. **bracteata**

AA. *Stamens much shorter than the sepals.*

B. *Hypanthium and sepals 1½–2½ lines long* .... 8. **parvifolia**

BB. *Hypanthium and sepals 2½–5 lines long.*

C. *Infl. contracted and spike-like* ..... 9. **cylindrica**

CC. *Infl. open, not spike-like* ....10. **sanguinea**

1. **villòsa,** Michx. Height 1–3 ft.: lf.-blades nearly round, deeply 5–7-lobed, the lobes triangular acute: scape mostly leafless; calyx and hypanthium about 1 line long; petals pinkish, twice as long as the sepals. Rocky places, Va. to Ga. and Tenn. B.B. 2:179.—A good border plant.

2. **micrántha,** Douglas. Height 1–2 ft., the flowering branches 1–4-lvd. or almost scape-like.: lvs. slightly hairy, the blades round-cordate, about as long as broad, long-stalked: infl. glandular-hairy; petals oblanceolate whitish, not very showy. Calif. to Brit. Col. B. R

1302. R.H. 1898, p. 431.—The *H. erubescens* of the gardeners seems certainly to belong here.

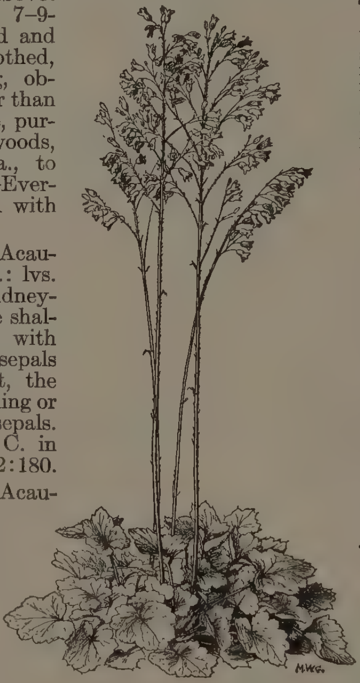
3. **americàna,** Linn. Alum Root. Height 2–3 ft.: scape leafless or with a few small lvs.: basal lvs. round-cordate, hirsute on the veins beneath, often glabrous above, at least when mature: infl. glandular hairy; the petals about equaling the sepals, greenish white; stamens at least 3 times the length of the sepals. Dry or rocky woods, Ont. to La. and Minn. B.B. 2:179. R.H. 1898, p. 431.—Has mottled foliage when young, but becomes plain green in age.

4. **rubéscens,** Torr. Acaulescent: height 8–15 in.: scape usually leafless: lvs. kidney-shaped or round-cordate, perfectly glabrous or sometimes slightly glandular, thick and often shining: sepals pinkish, green-tipped; petals almost twice as long as the sepals, linear-oblanceolate. Mountains of Utah and New Mex. to Ore and E. Calif.—Useful for the alpine-garden.

5. **pubéscens,** Pursh (*H. ribifòlia,* Fisch. & Avé-Lall. *H. rubifòlia,* Hort., also seems to belong here). Acaulescent: height 9–12 or 15 in.: scapes densely glandular pubescent, at least above: lvs. round-cordate, 7–9-lobed, the lobes broad and rounded, sharp-toothed, ciliate; sepals oblong, obtuse, somewhat shorter than the broadly spatulate, purplish petals. Rich woods, in mountains of Pa., to N. C. B. B. 2:179.—Evergreen foliage marbled with bronzy red.

6. **híspida,** Pursh. Acaulescent: height 2–4 ft.: lvs. round-cordate or kidney-shaped, 5–9-lobed, the shallow, rounded lobes with broad teeth, ciliate: sepals spatulate, very blunt, the petals spatulate, equaling or shorter than the sepals. Woods, Va. and N. C. in the mountains. B.B. 2:180.

7. **bracteàta,** Ser. Acaulescent and densely cespitose: flowering branches usually about 4–6 in. tall, usually with a few minute lvs.: basal lvs. round-kidney-shaped, more or less round-lobed and with cuspidate teeth: sepals oblong, obtuse, the petals oblanceolate or spatulate, slightly exceeding the sepals. Alpine regions of Colo. and S. Wyo.—Useful only in alpine collections.



1827. Heuchera sanguinea.

8. **parvifòlia,** Nutt. Acaulescent and cespitose: flowering branches scape-like and quite naked: lvs. kidney-shaped, usually with an open sinus, and with 7–9 shallow, rounded lobes: infl. ultimately elongated; sepals broadly ovate, somewhat shorter than the spatulate, yellowish petals. Alberta to N. Mex. and Ariz.

9. **cylíndrica,** Douglas. Acaulescent: height 10–24 in.: the infl. spike-like and naked or with a few minute bracts: lvs. round-cordate, with a few shallow lobes and ovate, cuspidate teeth; sepals oblong, the yellowish green petals minute or sometimes lacking. Brit. Col. to Ore. and Idaho.—Grown chiefly for its foliage.

10. **sanguínea,** Engelm. Coral Bells. Crimson Bells. Fig. 1827. Height 1–1½ ft.: scapes pilose below, glandular pubescent above: fls. typically bright red, but in horticultural varieties ranging from white through pink and rose to dark crimson. New Mex., Ariz. and N. Mex. Very good pictures are B.M. 6929. Gn. 26:360; also those in Gt. 45, p. 577. I.H. 43, p. 334. Mn. 8 p. 75. A.G. 17:201. R.H. 1898, p. 431. R.B. 22, p. 246. S.H. 2:120. G.C. III. 4:125. P.G. 4:35. Var. **álba** (*H. álba,* Hort.) has pure white fls., and was intro. about 1896 by Haage & Schmidt. Var. **spléndens,** intro. 1898 by the same firm, has dark crimson fls. Var. **robústa,** or **grandiflòra,** Hort., according to J. B. Keller, is an improvement on the type, the bells being larger and the color brighter. Var. **hýbrida** ("Rosy Morn"), Hort., according to D. M. Andrews, is "more robust than the type, foliage deeper cut and the divisions more pointed: fls. rosy pink." Andrews adds that var. **álba** comes true from seed. Var. **rôsea,** and var. **máxima** with dark crimson fls. are advertised. —Under the name *H. brizoides,* Hort., there is a widely cult. plant with red sts. and pale pink fls. It is chiefly interesting because it is a bigeneric hybrid, it apparently being a cross between *Heuchera sanguinea* and *Tiarella macrophylla.* It is a garden hybrid first noticed in 1897. Var. **gracíllima,** Hort., seems merely a more slender form.

The following names are seen in trade catalogues or in Rydberg's monograph: *H. convallària,* Hort. About 2½ ft., with long-stalked panicles of fls. somewhat like the lily-of-the-valley. There is a pink-fld. form, *H. cárnea.*=(?)—*H. cristàta* has been listed in Calif. as "a wonderfully pretty crested variety, originated by Luther Burbank."—*H. macrophýlla,* Hort., not Lodd., may be Tiarella macrophylla.—*H. pilosíssima,* F. Muell. 1–2 ft. high: fls. in close clusters; calyx globular. Calif.—*H. purpuráscens* was advertised 1898.—*H. Wheèleri,* Hort., was found in the S. some years ago, and resembles a form of H. canadensis with variegated lvs.—*H. Zabelliàna,* Hort., has pale pink fls. on long fl.-stalks.

N. Taylor.†

HEÚRNIA: *Huernia.*

HÈVEA (from the Brazilian name). *Euphorbiàceæ.* Tropical trees; some yield rubber and are cultivated for that reason.

Juice milky: lvs. alternate, long-petioled, the 3 lfts. entire: fls. small, monœcious, in loose panicles; calyx valvate, 5-lobed or 5-toothed; petals none; stamens 5–10, filaments united into a column; ovary 3-celled, 1 ovule in each cell: fr. a large caps.; seeds about 1 in. long.—About 17 species chiefly in the Amazon region.

The milky juice of some species is rich in caoutchouc, and they are among the most important sources of rubber; otherwise rarely cultivated except in economic and botanical collections. *H. braziliensis,* especially var. *janeirensis,* Pax, is the chief source of the South American or Para rubber. The various species are closely related and difficult to separate. The rubber plant commonly cultivated as a house-plant is *Ficus elastica.*

Damp, hot climates, such as the tropical rain forest region, without a dry season, are best suited for the culture of hevea, though it will stand some drought. It is best grown from seeds, but can be propagated by cuttings. The seed should be planted as soon as ripe, as they live but a short time. The trees grow rapidly, and attain their full height of 60 feet in about eight years, but live for many years longer. A six-year-old tree will yield as much as a pound of rubber a year and more when older. For further directions on culture, see "Cyclopedia of American Agriculture," Vol. II, p. 555. See M. T. Cook, "Diseases of Tropical Plants," p. 191, for rubber plant diseases.

brasiliénsis, Muell. Arg. South American Rubber Tree. Para Rubber Tree. Caoutchouc Tree. Brazil Rubber. Seringueira. Tree, to 60 ft. high: petioles slender, 3–10 in. long; lfts. elliptical-lanceolate, 6 in. long, straight-veined: branches of the panicle and fls. finely and closely pubescent: staminate buds acute; stamens 10 in 2 whorls. Amazon region of Brazil. Quite variable. H.I. 2573, 2575. Gn. 18, p. 564.

pauciflòra, Muell. Arg. (*H. confùsa,* Hemsl.). Tree, to 60 ft. high: lfts. obovate, cuneate, obtuse acuminate, 4–6 in. long: staminate buds obtuse; stamens 10 in 2 whorls. British Guiana. H.I. 2574, 2575.—Sometimes used for rubber.

guianénsis, Aubl. (*Siphònia Cahùchu,* Willd. *S. elástica,* Pers.). SERINGA. Tree, to 60 ft. high: lfts. obovate, base acute, apex obtuse, 3–5 in. long: panicle tomentose: staminate buds obtuse; stamens 5 in 1 whorl. French Guiana to the Amazon. H.I. 2573.—Intro. but rarely cult. for rubber. J. B. S. NORTON.

HEXACÉNTRIS: *Thunbergia.*

HEXADÉSMIA (name alludes to the 6 pollen-masses). *Orchidàceæ.* About a half-dozen Trop. American epiphytic orchids, rarely grown in hothouses. They are like Scaphyglottis, but differ in having 6 pollinia in 2 series rather than 4. The fls. are small, in fascicles or racemes: lvs. fleshy. Apparently none of the species is in the trade.

HEXASTÝLIS: *Asarum.*

HEXÌSEA (Greek, *six equal things;* because the attractive and bright-colored parts of the fls. are 6, and of equal size.) Should have been written *Hexisia. Orchidàceæ.* This includes a small epiphytic plant which was once advertised as "bearing profuse panicles of bright vermilion fls. twice a year." The genus belongs to a subtribe closely related to Epidendrum but with different pollinia. Sts. terete or angled, with usually 2 lvs. at the apex of each annual growth. New growths arise in the axils of the lvs., the entire st. being thus made up of long, fusiform, apparently superimposed pseudobulbs, with 2 lvs. at each node: lvs. few, narrow: racemes terminal, the short-peduncled furnished with overlapping, leathery scales; fls. orange or purple; anthers semi-globose; pollinia 4, in 1 series.—Four species, ranging from Mex. to Guiana.

bidentàta, Lindl. Height 6–8 in.: st. branched, forming spindle-shaped, many-grooved internodes: lvs. in pairs, 2–4 in. long, 3 lines wide, channelled, notched. Panama. B.M. 7031. G.M. 37:19.

HEINRICH HASSELBRING.

HEYDÈRIA: *Libocedrus.*

HIBBÉRTIA (George Hibbert, English patron of botany, died 1838). *Dilleniàceæ.* Shrubs or subshrubs with yellow or white showy flowers, suitable for the greenhouse or for growing in the open in the warm parts; apparently none is in the American trade.

Erect, procumbent or climbing, sometimes almost herbaceous, some species reaching 5 or 6 ft.: lvs. mostly small, entire or dentate, often heath-like, strongly 1-nerved with obscure or rarely prominent reticulations, some of them usually crowded beneath the blossoms: fls. solitary, terminal, sometimes approximating into clusters; sepals 5, sometimes united at base; petals 5, spreading and usually making an open fl.; stamens usually 12 or more, sometimes with staminodia: carpels usually 2–5, dehiscent at the top when ripe.—Species about 100, nearly all Australian, a few from Madagascar. Any of these species is likely to appear in lists, but only 2 or 3 are regularly known as horticultural subjects.

dentàta, R. Br. Woody only at base, trailing or twining, with rather large dark yellow pedunculate fls. (to 2 in. diam.): lvs. stalked, oblong, to 2 in., distantly toothed or sinuate, coppery: petals obovate, entire or nearly so; stamens slender and very numerous; staminodia present. New S. Wales and Victoria. B.M. 2338. B.R. 282. G. 32:127. L.B.C. 4:347.

perfoliàta, Hueg. Sts. trailing, procumbent, ascending or becoming erect: lvs. ovate, usually somewhat toothed, perfoliate: petals obovate, entire, pale yellow, the fls. peduncled; stamens numerous, with a few staminodia. W. Austral. B.R. 29:64. J.H. III. 43:147.

volùbilis, Andr. Sts. woody, trailing, or climbing 2–4 ft.: lvs. obovate to lanceolate, to 3 in., clasping: fls. large, yellow, somewhat fetid, sessile or nearly so; petals obovate, entire; stamens very numerous, no staminodia. Queensland and New S. Wales. B.M 449.—This and *H. dentata* are offered in England.

L. H. B.

HIBISCADÉLPHUS (brother of *Hibiscus*). *Malvàceæ.* Under this name, J. F. Rock founds three species of Hawaiian small trees; of two of the species only one individual tree is in existence, while of the third several may still be found on the slopes of Mt. Hualalai, in the forest of Waihau, in North Kona, Hawaii. From Hibiscus the genus differs in the deciduous calyx and other floral characters: fls. 2½ in. or less long, yellowish, magenta, or green: lvs. cordate, unevenly 3–5-pointed or rounded and entire. *H. Giffardiànus,* Rock, is a medium-sized tree with peculiarly shaped deep magenta fls. and cordate-orbicular lvs.; a single tree known in 1913 and in danger of extinction. *H. Wilderiànus,* Rock, is a tree 15–18 ft. high with yellowish fls. and 3-lobed wavy lvs. of orbicular outline; one tree known in 1912 and in a dying condition, one on which the collector was able to find 1 open fl. and a few more or less developed buds. *H. hualalaiénsis,* Rock, has green fls. somewhat reddish inside, and somewhat reniform lvs.; a few trees are still in existence. These rare trees are not in the trade, but they are likely to appear in collections in the tropics if they can be rescued before destruction. See Rock, "Indigenous Trees of the Hawaiian Islands." L. H. B.

HIBÍSCUS (old Latin name). Including *Abelmóschus* and *Paritium. Malvàceæ.* ROSE-MALLOW. Showy-flowered garden and greenhouse herbs and shrubs; in the tropics some of them are trees.

Hibiscus is a polymorphous genus, allied to Gossypium, Abutilon, Althæa and Malva, the species widely distributed in temperate and tropical countries: herbs or shrubs, or even trees, with lvs. palmately veined or parted: parts of the fl. in 5's; calyx gamosepalous, 5-toothed or 5-cleft, subtended by an involucel of narrow bracteoles; corolla usually campanulate, showy, of 5 distinct petals; stamens united into a 5-toothed column; ovary 5-loculed, bearing 5 styles: fr. a dry, more or less dehiscent caps (Fig. 1828).—Between 150 and 200 species, of which perhaps 20 occur in the U. S. Horticulturally, there are 4 general groups of Hibiscus—the annuals, the perennial border herbs, the hardy shrubs, and the glasshouse shrubs, to which might be added the tree-like species of tropical countries that are often planted along roadsides and about dwellings. The perennial herbaceous species are among the boldest subjects for planting in remote borders or in roomy places, particularly in soil that is damp. These plants, of the *H. Moscheutos* type, are commonly known as marsh-mallows, but this name properly belongs to *Althæa officinalis.*

1828. Capsule of Hibiscus syriacus.

In recent years, improved and valuable hardy forms of the native herbaceous rose-mallows have been introduced. They bloom throughout a long season. (Fig. 1829.) The Meehan Mallow Marvels were introduced in 1905, the first successful cross having been made in 1898. They are stated to be hybrids of *H. coccineus, H. militaris,* and *H. Moscheutos.* They are in pink, shades of red, and white; the flowers often have an eye of different color. The Giant-flowering marsh-mallows of Bobbink & Atkins, now catalogued as *H. Moscheutos* hybrids, were first offered in 1909 at retail and in

1911 to the trade. They are stated to be hybrids of *H. coccineus* and *H. Moscheutos*, the first cross being made in 1905, first plant flowered in 1906. The colors range from white to crimson, sometimes with an eye.

The culture of such a various group as hibiscus cannot be described in detail. In general, the species present no special difficulties. They are strong and profuse growers, and mostly thrive under a variety of conditions.—The herbaceous perennial species are late summer and fall bloomers, with hollyhock-like flowers. They send up new strong shoots or canes each year. Many of them are perfectly hardy in the North, but even these profit by a mulch covering. Others are tender in the North, and the roots should be taken up after frost and stored in a dry, warm cellar. Keep them just moist enough to maintain life in them. Many times the roots of these herbaceous species are set in large pots in the spring, and they then make excellent specimens. All the species require a deep rich soil and a good unfailing supply of moisture.—The only popular glasshouse species in this country is *H. Rosa-sinensis*, a showy and floriferous summer bloomer, of many varieties. The culture of this species is indicated under No. 28.

1829. A garden rose-mallow. White. (×⅙)

INDEX.

Abelmoschus, 4.
aculeatus, 8.
africanus, 1.
amplissimus, 29.
anemonæflorus, 29.
Arnottianus, 25.
atrorubens, 29.
bicolor, 29.
brilliantissimus, 28.
californicus, 12.
Calleri, 28.
calycinus, 22.
camelliæflorus, 29.
cannabinus, 3.
carminatus, 28.
chrysanthus, 22, 28.
cisplatinus, 17.
coccineus, 10.
cœlestis, 29.
Cooperi, 28.
Denisonii, 26.
dissectus, 6.
diversifolius, 7.
elatus, 20.
elegantissimus, 29.
esculentus, 5.
Fauriei, 25.
flore-purpureo, 16.
fulgens, 28.
fulgidus, 28.
Genevii, 24.
grandiflorus, 11.
Hamabo, 19.
heterophyllus, 18.
incanus, 15.
kermesinus, 28.
lasiocarpos, 12.
Leopoldii, 29.
liliiflorus, 24.
Lindlei, 16.
luteolus, 28.
luteus, 28.
major, 1.
Manihot, 6.
Meehanii, 29.
militaris, 9.
miniatus, 28.
Moscheutos, 13.
mutabilis, 27.
occidentalis, 12.
oculiroseus, 14.
pæoniflorus, 29.
palustris, 13.
purpureus, 29.
radiatus, 16.
ranunculæflorus, 29.
Rosa-sinensis, 28.
rosella, 2.
roseus, 13.
ruber, 29.
Sabdariffa, 2.
Schizopetalus, 23.
sinensis, 28.
speciosus, 10, 29.
splendens, 28, and suppl.
sub-violaceus, 28.
syriacus, 29.
tiliaceus, 21.
totus albus, 29.
Trionum, 1.
Van Houttei, 28.
vesicarius, 1.
violaceus, 29.
zebrinus, 28.

KEY TO THE SPECIES.

A. *Plant annual or biennial (sometimes perennial in the case of Nos 3 and 6).*
  B. *Habit low and diffuse* .... 1. **Trionum**
  BB. *Habit erect, the plants mostly tall, strict and stout.*
    C. *Calyx 5-cleft, not ventricose or spathe-like.*
      D. *St. not prickly* .... 2. **Sabdariffa**
      DD. *St. prickly* .... 3. **cannabinus**
    CC. *Calyx long and spathe-like, splitting on one side, deciduous.*
      D. *Bracteoles linear.*
        E. *Caps. short (3 in. or less)* ..... 4. **Abelmoschus**
        EE. *Caps. long and large (5 in. or more)* .... 5. **esculentus**
      DD. *Bracteoles broad and leafy* ...... 6. **Manihot**
AA. *Plant obviously perennial, herbaceous (or sometimes woody below).*
  B. *Branches and petioles prickly* .... 7. **diversifolius**
  BB. *Branches and petioles not prickly.*
    C. *Bracteoles lobed or forked* .... 8. **aculeatus**
    CC. *Bracteoles entire, not enlarged at apex.*
      D. *Foliage glabrous or essentially so.*
        E. *Lvs. toothed or lobed* .... 9. **militaris**
        EE. *Lvs. deeply divided* ....10. **coccineus**
      DD. *Foliage pubescent or tomentose.*
        E. *Calyx-lobes ovate or ovate-lanceolate.*
          F. *Lvs. hastately 3-lobed* ......11. **grandiflorus**
          FF. *Lvs. only obscurely angle-lobed* ....12. **lasiocarpus**
        EE. *Calyx-lobes with triangular outline.*
          F. *Fls. rose-color* ....13. **Moscheutos**
          FF. *Fls. white with reddish center* ....14. **oculiroseus**
        EEE. *Calyx-lobes ovate to triangular-lanceolate; fls. often yellow*.15. **incanus**
AAA. *Plant distinctly woody, being a shrub or a tree.*
  B. *Branches and petioles prickly. (No. 18 may sometimes lack prickles.)*
    C. *Fls. yellow* ....16. **radiatus**
    CC. *Fls. pink* ....17. **cisplatinus**
    CCC. *Fls. white* ....18. **heterophyllus**
  BB *Branches and other parts usually not prickly or spiny.*
    C. *Color of fls. on the order of yellow.*
      D. *Involucre an 8–10-toothed cup.*
        E. *Species Japanese: a shrub*...19. **Hamabo**
        EE. *Species tropical; usually small trees.*
          F. *The involucre deciduous with the calyx*..........20. **elatus**
          FF. *The involucre persistent with the calyx*..........21. **tiliaceus**
      DD. *Involucre of 5 separate bracteoles*.....................22. **calycinus**
    CC. *Color of fls. pink, scarlet, white.*
      D. *Petals deeply cut*.............23. **schizopetalus**
      DD. *Petals entire or essentially so.*
        E. *Lf.-margins practically entire (sometimes toothed at apex), or only obscurely crenulate.*
          F. *Fls. red*.................24. **liliiflorus**
          FF. *Fls. white, axillary*.......25. **Arnottianus**
          FFF. *Fls. white, terminal*. .....26. **Denisonii**
        EE. *Lf. margins lobed or toothed.*
          G. *Lvs. downy*............27. **mutabilis**
          GG. *Lvs. essentially glabrous.*
            H. *Stamens prominently exserted*...........28. **Rosa-sinensis**
            HH. *Stamens not exserted*...29. **syriacus**

1. **Triònum**, Linn. (*H. vesicàrius*, Cav. *H. africànus*, Hort.). FLOWER-OF-AN-HOUR. BLADDER KETMIA. TRAILING HOLLYHOCK. Fig. 1830. Annual, 1–2 ft. high, bushy-spreading, the main branches becoming prostrate, usually hispid-hairy: lvs. 3–5-parted, the upper ones 3-parted, with the middle lobe much the largest, the lobes linear-oblong or sometimes widening

upward, coarsely notched, the root-lvs. undivided: fls. solitary in the upper axils, opening wide in the sunshine but closing in shadow, 1–3 in. across, sulfur-yellow or white, usually with a brown eye; pedicel elongating in fr., and the calyx becoming much inflated. Cent. Afr. B.M. 209.—An interesting annual, blooming freely throughout the hot weather of summer, and thriving in any open, warm place. Seeds are usually sown where the plants are to stand. Excellent for rock-work. It is sometimes a weed in cult. grounds. *H. Trionum* as sometimes defined, has much wider and more spatulate and relatively shorter lf.-lobes, which are round-toothed or lyrately lobed: fls. smaller: and in this case the above description would apply to *H. vesicarius;* but there seems to be insufficient reason for keeping the two distinct. Var. **màjor,** Hort., is offered: 2 ft.: fls. primrose-yellow with deep violet center.

1830. Hibiscus Trionum. (×⅓)

2. **Sabdaríffa,** Linn. (*H. rosélla,* Hort.). Jamaica Sorrel. Roselle. Strong annual, 5–7 ft. high, nearly glabrous, the sts. terete and reddish: root-lvs. ovate and undivided, the upper ones digitately 3-parted, the side lobes sometimes again lobed; lobes lanceolate-oblong and crenate-dentate: fls. solitary and almost sessile in the axils, much shorter than the long lf.-stalks; calyx and bracts red and thick, less than half the length of the yellow corolla. Old World tropics. Gn. 66, p. 428.—Widely cult. in the tropics, and now grown somewhat in S. Fla. and S. Calif. for the fleshy calyxes, which, when cooked, make an excellent sauce or jelly with the flavor of cranberry. The green seed-pod is not edible. The juice from the calyxes makes a cooling acid drink. It thrives in hot, dry climates.

3. **cannabìnus,** Linn. Annual, or sometimes perennial, the st. glabrous and prickly: lower lvs. cordate and not lobed, the upper deeply palmately lobed into narrow serrate parts: peduncle short: bracteoles 7–10, narrow: fls. large, yellow with crimson center, on very short axillary peduncles; sepals lanceolate, bristly, with gland on back of each; corolla spreading: caps. nearly globose, bristly. Old World, and widely grown for a coarse fiber which is known as "Bimlipitam jute."

4. **Abelmóschus,** Linn. (*Abelmóschus moschàtus,* Moench). Annual or biennial, 2–6 ft., hispid: lvs. various, usually palmately 5–7-lobed, the lobes spreading and oblong-lanceolate and coarsely toothed: bracteoles 6–12, linear, ¾in. or less long: fls. 4 in. diam., yellow with crimson center; calyx 15-toothed: caps. 3 in. or less long, oblong-lanceolate in outline, setose. India.—Grown in tropical countries for the musk-scented seeds, which are also sometimes used medicinally; also for the fls. Varies greatly, some of the forms having no lobed lvs.

5. **esculéntus,** Linn. (*Abelmóschus esculéntus,* Moench). Okra. Gumbo. Annual: mostly strict, 2–6 ft. or more, the sts. terete and more or less hispid: lvs. cordate in outline, 3–5-lobed or divided, the lobes ovate-pointed and coarsely toothed or notched: bracteoles very narrow, about 1 in. long: fls. solitary and axillary, on inch-long peduncles, yellow, with a red center: fr. a long ribbed pod (5–12 in. long), used in cookery. Trop. Asia.—For cult., see *Okra.* A large-fld. form (var. *speciosus,* cf. *H. Manihot*) in Gt. 43, p. 623.

6. **Mánihot,** Linn. Fig. 1831. Tall and stout (3–9 ft.), glabrous or somewhat hairy: lvs. large, palmately or pedately 5–9-parted into long and narrow oblong-lanceolate dentate lobes: bracteoles oblong-lanceolate, falling after a time (as does the calyx): fls. large (4–9 in. across), pale yellow (sometimes white), with a purple eye, very showy: caps. oblong and hispid. China and Japan; widely spread in the tropics, and naturalized in the southern states. B.M. 1702; 3152; 7752. S.H. 2:263.—This is apparently the Sunset hibiscus of the trade; also the Queen of the Summer hibiscus. In botanical works, *H. Manihot* is said to be an annual, but as known to horticulturists it is perennial in mild climates, although not persisting long and making its best bloom on young plants. For a discussion of this point as related to the limitations of the species, see G. C. III. 22:249; Gn. 53, p. 127 (and plate 1157). Botanically, the species is allied to *H. esculentus.* Not hardy in the open in the N., but the roots may be taken up in the fall and carried over winter in a warm dry cellar. In the Middle States and S., it may be expected to survive if well mulched. Grows readily from seeds, blooming late the first year if the seeds are started under glass. Var. **disséctus,** Hort., has the lvs. cut almost to the petiole into narrow lobes.

7. **diversifòlius,** Jacq. Tall and rigid, herbaceous or subshrubby, stiffly pubescent, the branches and petioles bearing stout and short conical prickles: lvs. variable, mostly broad-cordate or nearly orbicular, angular or somewhat 5-lobed, toothed: fls. in axillary or terminal racemes, primrose-yellow with dark red center; sepals linear-lanceolate, bristly; corolla much

1831. Hibiscus Manihot. (×⅙)

larger than calyx: caps. ovoid, pointed and hispid; seeds glabrous. Trop. Afr., Pacific islands, and Austral., and cult. in E. India. B.R. 381.—Offered in S. Calif.

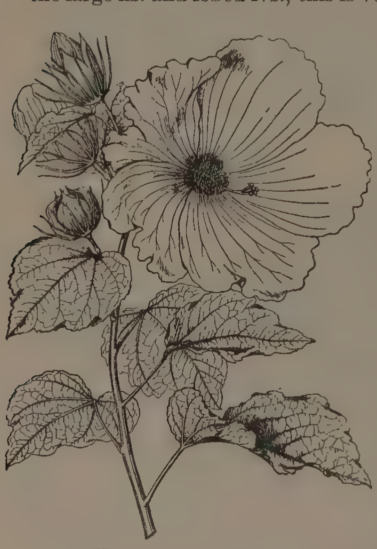
8. **aculeàtus,** Walt. Herbaceous perennial, not very stout, 2–6 ft. tall, hispid all over but not tomentose nor whitish: lvs. roundish or roundish-ovate in outline, 3–5-lobed or -parted into linear or oblanceolate cut or toothed blunt segms., the sinuses often rounded and enlarging: bracteoles 10–12, linear, forking and bristly, not so long as the calyx: fls. 3–4 in. across, yellow or cream-colored with purple in the base, the petals about 3 in. long and the calyx-lobes lanceolate and bristly. S. C. south in sand, frequently near swamps.—Not hardy N.

9. **militàris,** Cav. Herbaceous perennial, 4–6 ft., strong-growing, glabrous or very nearly so: lvs. rather small, usually hastate (2 short lobes at base), the middle lobe ovate-lanceolate or triangular-lanceolate, long-acuminate, equally crenate-toothed; upper lvs. halberd-form: bracteoles linear or awl-like, nearly or quite half as long as the calyx: fls. 3–5 in. across, white, blush or pale rose, purple-eyed: fr. inclosed in inflated calyx; seeds hairy. Wet places, Pa. to Minn. and south to the Gulf. B.M. 2385.—A hardy and fine species. Forms occur with lvs. not lobed.

10. **coccíneus,** Walt. (*H. speciòsus,* Ait.). Perennial herb, green and glabrous throughout, glaucous, 3–10 ft.: lvs. palmately lobed, or the lowest and sometimes all of them palmately compound, the divisions long-linear-lanceolate and remotely toothed: bracteoles about 1½ in. long, curved: fls. very large (5–6 in. across), rose-red, the petals obovate and conspicuously narrowed at the base; column of stamens very long. Ga. south in swamps. B.M. 360. R.H. 1858, p. 575; 1866:230.—This fine species is apparently not hardy in the northern states, although there are reports that plants have lived in the open in the neighborhood of Philadelphia. The roots should be stored in a cellar in winter. Plants have been carried over winter under glass when used in hybridizing.

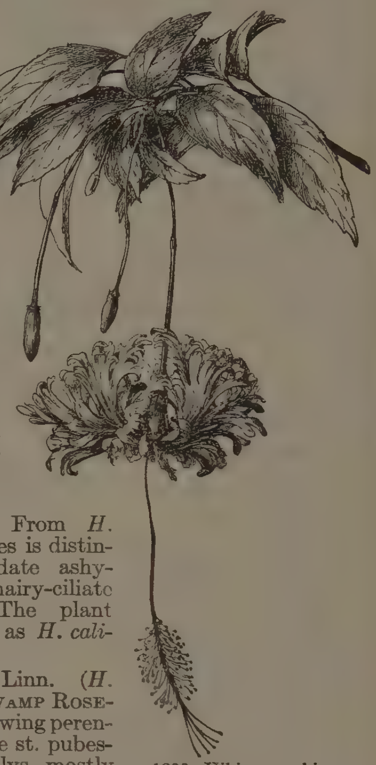
11. **grandiflòrus,** Michx. Perennial herb, tall and stout (3–8 ft.), the terete reddish st. becoming glabrous: lvs. large, 3-lobed, the lobes ovate-acuminate or ovate-oblong-acuminate, the side ones widely spreading, blunt-toothed or even again lobed: bracteoles linear, 1 in.: fls. very large (6–8 in. across), white or rose, with deeper eye. Ga., Fla. west, in swamps.—Aside from the large fls. and lobed lvs., this is very like *H. Moscheutos.* It is doubtful whether the true *H. grandiflorus* is in the trade.

12. **lasiocárpos,** Cav. Fig. 1832. Perennial herb, to 6 ft.: st.: and lvs. pubescent: lvs. ovate, more or less cordate, acuminate, toothed, often angular or slightly 3-lobed, the upper ones narrower: bracteoles linear-subulate and bristly: fls. white or pale rose with darker center, the petals 3–4 in. long: caps. very hairy. Swamps, Ky., west and south. G. F. 1:426 (reduced in Fig. 1832).



1832. Hibiscus lasiocarpos. (×⅓)

Var. **califórnicus** (*H. califórnicus,* Kell. *H. lasiocárpos* var. *occidentàlis,* Gray). Lvs. more uniformly cordate: caps. less hairy; seeds papillate: marshy places along San Joaquin and Sacramento Rivers. It is strong-growing, to 7 ft., the st. terete or slightly grooved above, more or less pubescent: lvs. distinctly cordate, ovate, acute, shallow-toothed and not lobed, dull ashy gray beneath: involucre-bracts hairy: corolla white or rose, with a purple eye, 3–5 in. across: caps. pubescent. Although the name *H. californicus* is common in the trade, it is a question how much of the stock, if any, is this species. Certainly some of it is *H. Moscheutos.* From *H. Moscheutos* this species is distinguished by its cordate ashy-tomentose lvs. and hairy-ciliate involucre-bracts. The plant known to the trade as *H. californicus* is hardy.



1833. Hibiscus schizopetalus. (×½)

13. **Moscheùtos,** Linn. (*H. palústris,* Linn.). Swamp Rose-Mallow. Strong-growing perennial 3–8 ft., the terete st. pubescent or tomentose: lvs. mostly ovate, entire in general outline or sometimes shallowly 3-lobed at the top, crenate-toothed, very soft-tomentose beneath but becoming nearly or quite glabrous above, the long petiole often joined to the peduncle: bracteoles linear, nearly or quite as long as the tomentose calyx: calyx-lobes triangular-ovate; fls. very large (4–7–8 in. broad), light rose-color: caps. globose-ovoid, glabrous. Marshes along the coast from Mass. to Fla. and west to Lake Michigan. B.M. 882. B.R. 1463; 33:7. Mn. 2:161. Gng. 2:227. F.S. 12:1233. R.H. 1907, p. 203 (as var. *palustris*). G.W. 6, p. 63. *H. ròseus,* Thore, of Europe, is considered to be a naturalized form of this American species. R.H. 1879:10.—One of the best of the rose-mallows, thriving in any good garden soil. Of easiest cult. and perfectly hardy. Blooms in Aug. and Sept. The foliage is strong and effective. The most generally cult. of the hardy herbaceous kinds.

14. **oculiròseus,** Brit. Crimson-Eye Rose-Mallow. Resembles *H. Moscheutos:* differs in fls. being white with dark crimson center, calyx-lobes triangular-lanceolate and nearly twice as long as broad, caps. ovoid-conic and long-pointed. Marshes near the coast, N. J. southward.

15. **incànus,** Wendl. Much like *H. Moscheutos,* and probably sometimes passing for it in the trade: lvs. smaller and narrower, ovate-lanceolate, rarely lobed, serrate-toothed: fls. sulfur-yellow, pink or white with a crimson eye: caps. ovoid and beaked, stellate-tomentose and loosely hairy. Md. and south in swamps.—Seems to be hardy in the N. with a mulch protection.

16. **radiàtus,** Willd. (not Cav.). Woody shrub, 3–4 ft., armed on branches and petioles with small prickles: lvs. rather narrow, deeply palmately divided, 3–5-lobed, or uppermost simple, the lobes broad-lanceo-

late and serrate; stipules linear: bracteoles 8–10, linear, forked: fls. axillary and solitary, yellow with crimson center; calyx not glandular. India, Java. Widely cult. in tropics. Var. **flòre-purpùreo,** Hook., has rose-purple fls. B. M. 5098. Var. **Líndlei** (*H. Líndlei*, Wall.) has deep purple fls. B.R. 1395.

1834. Hibiscus Rosa-sinensis. (×½)

17. **cisplátinus,** St. Hil. Bushy, 3–5 ft.: sts. glabrous but prickly: lvs. deltoid-lanceolate or deltoid-ovate, 3-lobed, coarsely toothed, sparsely hairy on the veins: fls. solitary, 4–5 in. across, light pink, with darker color in the eye and sometimes darker on the margins. Brazil (this side the Platte River, whence apparently the specific name). R.H. 1898:480. Gng. 7:50.—Little known in this country. It is a handsome late fall bloomer, and may be planted out in summer. It seeds freely, and these, sown as soon as ripe, will give blooming plants for the following fall.

18. **heterophýllus,** Vent. Tall shrub, glabrous except on infl. and very young shoots, the branches often prickly: lvs. varying from linear to lanceolate and elliptic-oblong and from entire to 3-lobed, 5–6 in. long, usually serrulate and sometimes white beneath: fls. large (3–4 in. long), white with a deep crimson eye, the calyx tomentose: caps. hairy; seeds glabrous. Austral.; intro. in S. Calif., where it is a free and showy bloomer.

19. **Hamàbo,** Sieb. & Zucc. Shrub, 6–10 ft. high, closely pubescent: lvs. roundish, with an abrupt short point, irregularly shallowly toothed, or wavy, white tomentose beneath and green or grayish hairy above: involucre of scales united at the base: fls. solitary in the upper axils, large, yellow, with a darker base, about 3 in. across.—A Japanese species offered by importers but not yet tested in this country, and probably not hardy south of the southern-middle states. Said to be cult. in Japan.

20. **elàtus,** Swartz (*Parítium elàtum*, Don). Mountain Mahoe. Spreading small tree: lvs. round-cordate, short-cuspidate, entire, hoary beneath: involucre deciduous with the calyx, 8–10-toothed: fls. 4 in. long, opening primrose-color in the morning, then changing, as the day advances, to orange and deep red: seeds hairy. W. Indies.—This species, the next, and probably others, yield the Cuba bast, used for tying cigars and for other purposes. Lvs. and shoots medicinal: wood durable.

21. **tiliàceus,** Linn. (*Parítium tiliàceum*, Juss.). Round-headed tree, 20–30 ft. high, sometimes a tall shrub: lvs. round-cordate and short-acuminate, entire or obscurely crenate, hoary beneath: involucre persistent with the calyx, 10-toothed or -cut: fls. 2–3 in. long, yellow: seeds glabrous or very nearly so. Fla. keys and W. Indies, but widespread in tropics and probably of Old World origin. Sprouts from the base if frozen.

22. **calycìnus,** Willd. (*H. chrysánthus*, Hort.). Small slender shrub: pubescent: lvs. long-stalked, round-cordate, somewhat 3–5-angled and 5–7-nerved, crenate, hairy or velvety: stipules subulate: fls. on axillary peduncles which are shorter than the petioles, large, yellow, with a dark center: involucre bracts 5, bristle-pointed: caps. tomentose. S. Afr.—To be grown indoors, but may be planted out in the summer with good results. Probably valuable for permanent planting in the extreme S.

23. **schizopétalus,** Hook. f. Fig. 1833. Tall glabrous shrub with slender drooping branches: lvs. ovate-elliptic, toothed: bracteoles minute: fls. pendulous, on long jointed peduncles, red or orange-red, the recurved petals beautifully and deeply cut; calyx tubular; stamens long-exserted: fr. long, bearing smooth seeds. E. Trop. Afr. B.M. 6524. F.S. 23:2397, 2398. G.Z. 25, p. 241.—A beautiful species, for the warmhouse; grown in the American tropics.

24. **liliiflòrus,** Cav. (*H. Genèvii*, Bojer). Shrub, glabrous: lvs. petioled, ovate, 2–4 in. long, entire or crenate, often few-toothed at apex, obtuse or acute, rounded at base, the young ones sometimes deeply parted: bracteoles 5, linear, connate at base: fls. solitary in upper axils, long-peduncled, bright red; sepals 1½ in. or less long, lanceolate, connate above the middle; corolla funnel-shaped; stamens equaling corolla or somewhat exserted. Mauritius and Seychelles Islands. B.M. 3144. — An excellent glasshouse species, of several varieties.

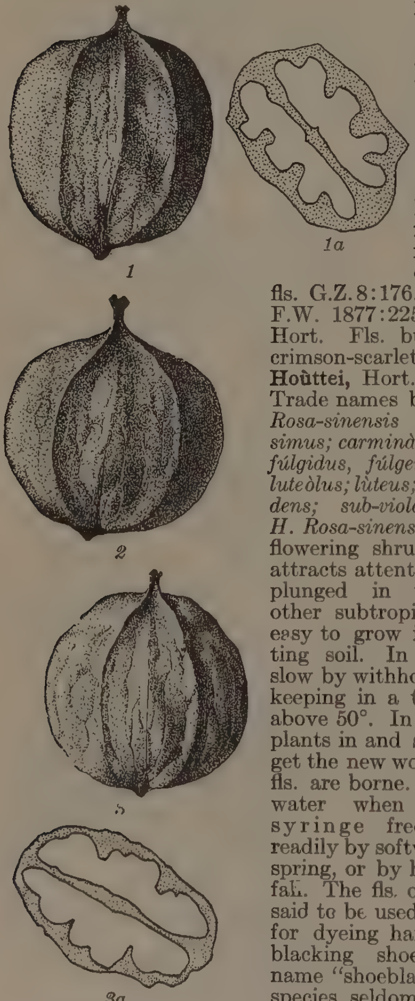
1835. Hibiscus syriacus. (×½)

25. **Arnottiànus,** Gray (*H. Faùriei*, Leveil.) Tree, 20–30 ft.: lvs. large, ovate, short-acuminate, entire, 3-nerved, stiffish, shining: bracteoles 5–7, triangular to lanceolate: fls. axillary and solitary, very large, white, sometimes with pinkish veins; calyx tubular, 5-toothed; stamens long-exserted, white or red. Hawaii; cult. there, and intro. in S. Calif.

26. **Dénisonii,** Burb. Small glasshouse shrub, flowering when very small, glabrous: lvs. thick and rather stiff, slender-stalked, elliptic-ovate, entire or obscurely crenulate, acuminate, dull green: fls. terminal, large, white, 4–5 in. across. Nativity unknown, but intro. from Austral. F.M. 1876: 232. G.Z. 22: 217.—A good greenhouse plant, requiring warm temperature; apparently little grown.

27. **mutábilis,** Linn. Tree-like: lvs. cordate, 5-angled and toothed, downy: bracteoles shorter than calyx: fls. axillary, opening white or pink but changing to deep red by night, 3–4 in. across; sepals ovate-lanceolate, joined below the middle: caps. globose, hairy; seeds hispid. China. H.F. II. 11:80.—Cult. in tropical and subtropical regions. Intro. in S. Fla. under the name of "cotton rose" and "confederate rose."

28. **Ròsa-sinénsis,** Linn. (*H. sinénsis,* Hort.). CHINESE HIBISCUS. Fig. 1834. In glasshouses a shrub 3–8 ft. high, but reaching 30 ft. in subtropical regions and becoming tree-like: glabrous: lvs. rather large, thin and shining green, broad-ovate to lance-ovate, somewhat tapering to the base, acuminate, coarsely and unequally toothed: bracteoles linear, free, as long as the calyx: fls. solitary in the upper axils of the new growth, on peduncles which exceed the petioles, bright rose-red, 4–5 in. across, with a projecting red column of stamens and pistil; sepals lanceolate, joined below the middle: caps. ovoid, glabrous, the valves terminating in a short beak. Asia, probably China: now distributed in warm countries, and one of the best known old-fashioned conservatory pot-plants, and one of the characteristic plants in tropical countries. B.M. 158. I.H. 29:441. G.C. III. 2:529. Gn. 53, p. 127.—It is now immensely variable. Forms are double-fld., and others are orange, yellow, bright red, magenta, and parti-colored. Var. **Coòperi,** Hort. (*H. Coòperi,* Hort.), has narrow white-marked lvs. and distorted scarlet fls. G.Z. 8:176. H.F. II. 6:210. F.W. 1877:225. Var. **Cálleri,** Hort. Fls. buff-yellow with crimson-scarlet base. Var. **Van Hoùttei,** Hort., deep crimson. Trade names belonging to *H. Rosa-sinensis* are *brilliantíssimus; carminàtus, chrysánthus; fúlgidus, fúlgens; kermesìnus; luteòlus; lùteus; miniàtus; spléndens; sub-violàceus; zebrìnus. H. Rosa-sinensis* is a summer-flowering shrub which always attracts attention. It is often plunged in the open with other subtropical stuff. It is easy to grow in ordinary potting soil. In winter keep it slow by withholding water and keeping in a temperature not above 50°. In spring head the plants in and start them up to get the new wood on which the fls. are borne. Give plenty of water when growing, and syringe frequently. Prop. readily by softwood cuttings in spring, or by hard cuttings in fall. The fls. of this plant are said to be used in some places for dyeing hair and also for blacking shoes, whence the name "shoeblack plant." The species seldom seeds in cultivation, although it is reported as seeding freely in some tropical regions.



1836. Forms of Carya ovata. 1, 1*a*, Meriden; 2, Jackson; 3, 3*a*, Milford.

29. **syrìacus,** Linn. (*Althæa frùtex,* Hort.). SHRUBBY ALTHEA. ROSE OF SHARON. Figs. 1828, 1835. Shrub, 6–12 ft. high, sometimes almost tree-like, much branched, nearly or quite glabrous: lvs. rather small, short-petioled, strongly 3-ribbed, triangular- or rhombic-ovate, lower ones mostly 3-lobed and with many rounded teeth or notches: bracteoles linear, 6 or 7: fls. solitary in the axils on the young wood (late in the season), short-peduncled, somewhat bell-shaped, 2–3 in. long, rose or purple, usually darker at the base; sepals ovate-lanceolate, exceeding the bracteoles: pod short, splitting into 5 valves. Asia. B.M. 83. R.H. 1845:133 (var. *speciosus,* with double fls.). Gn. 75, p. 604. J.H. III. 55:473. G.W. 13, p. 65. G.Z. 24:97. J.F. 4: pl. 370. G. 7:149; 11:167. F.E. 25:459; 32:127.—One of the commonest of ornamental shrubs, and hardy in Ontario; commonly known as althea. It is immensely variable in character of fls., the colors ranging from blue-purple to violet-red, flesh-color and white; also full double forms. There are forms with variegated lvs. Colored plates of some of the double-fld. forms will be found in Gn. 52:504. The species thrives in any good soil. Prop. by seeds, by cuttings of ripened wood taken in the fall, and named varieties by grafting on the common seedling stock. Nativity uncertain, but probably not Syrian, as Linnæus supposed: probably native in China. To this species belongs the trade name *H. Lèopoldii.* There are many horticultural forms of this interesting late summer-flowering shrub. Var. *Meèhanii,* Hort., is a variegated-lvd. form of somewhat dwarf habit, and single fls. 3–4 in. across, lavender, and purple-blotched. Other trade names that belong with *H. syriacus* are: *amplíssimus,* double, purple-pink with carmine center; *anemonæflòrus; atrórubens; bícolor,* semi-double, white with dark center; *camelliæflòrus; cœléstis; elegantíssimus; Lèopoldii; pæoniflòrus; purpùreus; ranunculæflòrus; rùber; speciòsus; tòtus álbus; violàceus.*

H. aponeùrus, Sprague & Hutch. Shrub, to 4 ft.: lvs. small, ovate or elliptic, sometimes slightly 3-lobed: fls. solitary, axillary, 1 in. across, brilliant scarlet. Trop. E. Afr. B.M. 8231.—*H. Árcheri,* Hort., is a hybrid of H. Rosa-sinensis and H. schizopetalus, raised by A. S. Archer, Antigua, W. Indies. Much like H. Rosa-sinensis. Fls. red. Gn. 55:310.—*H. Cámeronii,* Knowles & West. Tall shrub, with heart-shaped 3-lobed lvs. and large, solitary, cream-colored, red-veined fls. Madagascar. B.M. 3936. H.U. 3, p. 42. The plant figured under this name in Gn. 53:280 is probably a form of H. Rosa-sinensis.—*H. cùpreus,* Pampan. Allied to H. Rosa-sinensis: branches coppery purple in color: lvs. lanceolate, undulate and usually entire: bracteoles 6–8, linear: fls. nearly 2 in. long, purple with carmine eye. Ceylon.—*H. Kòkio,* Hildeb. Tree: lvs. ovate or elliptic-oblong, crenate, glabrous: fls. axillary and solitary, red, the petals to 2½ in. long; staminal column red, not long-exserted. Hawaii.—*H. Pátersonii,* R. Br.=Lagunaria.—*H. puníceus,* Hort., apparently has no botanical standing: still offered abroad. G.Z. 19:1.—*H. Scóttii,* Balf. Large bush or small tree from Isl. of Socotra: lvs. ovate, entire, 3-lobed, or toothed: fls. 3½ in. across, bright golden yellow with carmine eye. B.M. 7816.—*H. spléndens,* Fras. Shrub. 12–20 ft., soft-tomentose, prickly: lvs. cordate-ovate, palmately 3–5–7-lobed: fls. very large, rose-red. Austral. B.M. 3025. B.R. 1629. Handsome.—*H. suratténsis,* Linn. Trailing, with palmately 3–5-parted lvs.: fls. yellow: involucre-bracts with odd nail-like spines. India, but widely distributed. G.C. III. 9:529.—*H. venùstus,* Blume. Very like H. mutabilis, but involucre-bracts broad. Java. B.M. 7183.—*H. villòsus,* undetermined trade name.—*H. Waìmeæ,* Heller. Tree, 20–30 ft.: lvs. suborbicular, crenate, pubescent on both sides: fls. axillary near ends of branches, large, white or tinged with pink; staminal column red, long-exserted. Hawaii. G. C. III. 57:8.

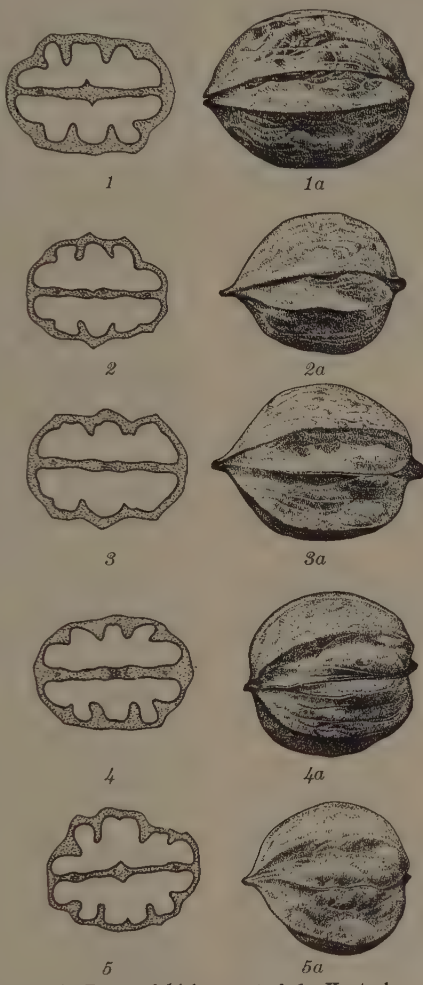
L. H. B.

HICKORY-NUT. Notwithstanding the high esteem in which the nuts of several species of hickory have been held since the settlement of America by the white men, but little progress has been made in their domestication and improvement. Out of the nine or ten species recognized by botanists, not more than three or four have been found sufficiently promising from an economic standpoint to justify conspicuous effort at amelioration. Of these the pecan (*Carya Pecan*) stands easily first, followed in order of apparent value by the shagbark (little shellbark), *C. ovata;* the shellbark (big shellbark), *C. laciniosa,* and the pignut, *C. glabra.* The pecan differs in its requirements of soil and climate from the other species, and is described separately under *Pecan*. For the botany of the hickories, see *Carya.*

In flavor and quality of kernel, the shagbark is esteemed by most Americans as the choicest of native nuts, though in these respects the shellbark is but little inferior to it. The thinner shell and larger proportion of kernel have given the former precedence over the latter in most cultural efforts; though the thrifty growth, symmetrical form and luxuriant foliage of the latter render it one of the most handsome and useful of native trees for roadside or lawn planting. The shagbark has the broader area of natural distribution, being found in localities throughout most of the United States to the eastward of the Great Plains, except on the lowlands of the South Atlantic coast and Gulf states. The shellbark is mainly confined to the valley of the Mississippi and its larger tributaries, extending eastward, however, into eastern Pennsylvania and western New York.

The pignut, which is similar to the shagbark in area of distribution, is much inferior to the others in quality, but shows wider variation than either in this respect, and has disclosed at least one variety of distinct cultural merit.

As the hickories, other than the pecan, are slow-growing species at best, they should not be planted on other than fertile soil. The shellbark is native to river bottoms, and requires richer land than the others, which endure a rather wide range of soil characteristics, provided there is sufficient depth and good drainage. Deep, well-drained fertile loams, either of sandy or clayey nature, are acceptable to all the species.



1837. Forms of hickory-nut. 1, 1a, Kentucky; 2, 2a, Kirtland; 3, 3a, Rieke; 4, 4a, Swain; 5, 5a, Weiker.

Propagation.

All the species are propagated by seed. Planting is frequently done in autumn, but, to lessen the destruction by rodents, is more safely done in early spring. In such case the freshly gathered nuts, after removal from the hulls, should be stored in slightly dampened sand during the winter or stratified, as other tree seeds. Uniformity of growth is promoted by planting nuts where trees are to stand, as the transplanting process in ordinary seasons is accompanied by a considerable loss. If trees must be transplanted, it is probably best to transplant annually in nursery rows, in rich soil, to promote growth of fibrous roots and lessen the shock of final transplanting to the permanent location.

The propagation of the hickories (except the pecan) by budding and grafting, is exceedingly difficult, even the most experienced propagators securing but a partial stand in the nursery, under favorable conditions. This fact coupled with the comparatively high mortality in transplanting such trees from the nursery has greatly retarded the dissemination of the many choice varieties that have been located in the form of seedling trees, during the past quarter-century.

One of the simplest methods of multiplying the stock of a choice tree, to a limited extent, and thus to insure the preservation of the variety, is that suggested by Fuller in his "Nut Culturist," which was apparently one of the first methods successfully employed in shagbark propagation. This consists in the "turning up or exposing at the surface of the ground of side roots, severed from the parent tree." The severed side roots are straightened up and tied to stakes to hold them in position with their cut ends about level with the surface of the ground to stimulate the formation of shoots from adventitious buds, one of which is eventually made the trunk of the new tree. The lower end of the root is not severed until the top has formed, when the new tree should be transplanted to its permanent location in rich and mellow soil and kept well mulched until thoroughly established. The method is slow and sharply limited in extent of application but is perhaps the surest in the hands of the amateur grower.

The late Jackson Dawson, the very skilful propagator of woody plants at Arnold Arboretum, achieved a considerable degree of success in propagating the shagbark by side-grafting on specially grown bitternut (*C. minima*) seedlings. He grew the seedlings in boxes 4 inches deep, for one or two years until of sufficient size for grafting. The seedlings were then transferred to pots in autumn and taken into the greenhouse about January 1. They were side-grafted, close to the collar. As soon as the roots began to start, the potted trees were plunged in sphagnum to the top bud of the cion and left until March to callus.

As improvement in method and technique in pecan-propagation has been accomplished by southern nurserymen during the past ten years, considerable attention has been given to the hickory by some of them, with the result that a certain degree of success has been attained with the annular and patch-bud methods, both in nursery propagation and top-working. Unfortunately, in many cases, the shagbark has been budded upon southern pecan seedlings, the ability of which to endure the minimum temperatures of the northern regions where the principal interest in shagbark planting exists is at least very doubtful.

The cleft-grafting of thoroughly established stocks at the crown, in early spring, has thus far proved the most practical method for the average propagator. This is accomplished by removing the earth to a depth of 3 to 4 inches from the base of the tree. The stock is cut off with a fine saw about 2 inches below the ground-line or at the top of the root-swelling. Cions having terminal buds should be inserted by either center or side-graft methods. The entire stump should then be carefully mounded over to the top buds of the cion with fine earth of a texture that will retain moisture without baking. The cions should be cut when entirely dormant and held in sphagnum or sawdust in an ice-house or elsewhere to keep the buds from swelling until the stocks are starting. The young growth needs to be carefully staked until the wood has hardened, as it is soft and easily broken. See *Grafting*.

Planting.

The hickories are transplanted with such difficulty that the utmost care in preparing the soil for them is required. This should be rich, deep and thoroughly drained. Planting may be done either in autumn or early spring. Pruning should be restricted to the removal of bruised or injured roots. Heavy mulch should be applied and maintained until trees are thoroughly established. After that little attention is required.

Production and use.

The fairly abundant supply of shagbarks and shellbarks in our markets is derived entirely from seedling trees. By far the larger part of this is from second-growth trees in fence-rows or the open fields where the conditions are more favorable to nut-production than in the forests. In southern New England, New York, New Jersey, Pennsylvania, Ohio and Indiana, the shagbark product is a highly prized supplemental crop on many farms. In some sections, as in southeastern Pennsylvania, the nuts are cracked by the women and children, the shelled meats being marketed in considerable quantities at satisfactory prices, many consumers preferring them to any other nut.

Varieties.

As the attention of amateurs has been concentrated on the subject in recent years, many wild trees yielding choice nuts have been located and preserved. A considerable number of these have received varietal names, but only a few have actually been propagated in such way that trees are obtainable at nurseries even in small numbers.

The qualities that should be considered in shagbarks and shellbarks from the commercial viewpoint are: (1) cracking quality, including easy release of the kernel; (2) thinness of shell; (3) size of nut; (4) plumpness and flavor of kernel; (5) productiveness.

The following sorts are worthy of consideration by those who are interested in testing representative sorts. Not all of them are yet to be had from nurseries.

Shagbarks.

Curtis.—Connecticut. A smooth nut of medium size, slightly compressed; kernel plump, light in color and of good quality; shell thin; cracking quality good.

Dover.—Pennsylvania. A medium-sized angular nut, rather broad at the base, but having a long and sharp basal point; shell moderately thin; cracking quality good; quality good.

Eliot.—Connecticut. Of medium size, compressed, angular, ovate, with prominent tip; kernel plump; flavor mild and pleasant; shell thin; cracking quality good.

Hales (*Hales Papershell*).—New Jersey. Large, quadrangular, slightly compressed, with a peculiar wavy surface; kernel rather deeply corrugated, but plump and of good quality, retaining its sweetness for two years or more; shell thin and of fair cracking quality. The Hales nut is the first-named variety of hickory, having been described and illustrated by A. S. Fuller in "The Rural New Yorker" in 1870. It is probably the only sort now obtainable at the nurseries. The original tree bears a fair crop annually, and numerous younger trees grafted from it are now in bearing.

Jackson.—Ohio. A compressed oval nut of large size; kernel large, plump, and of excellent quality; shell thin; cracking quality medium. Fig. 1836.

Kentucky.—Northern Kentucky. A nut of medium size, with quite angular and somewhat lumpy surface, short, sharp apex and flattened base, having a very short tip: shell moderately thin, kernel very plump, rich and sweet. Fig. 1837.

Kirtland.—Quadrangular, above medium size, slightly ridged and having a rather lumpy surface; shell thin, with excellent cracking quality; kernel plump, rich and of good flavor. Fig. 1837.

Leaming.—Missouri. A large nut of fine flavor and excellent cracking quality; the kernel coming out in unbroken halves.

Meriden.—Connecticut. Large, oblong, compressed; kernel large and of good quality; shell rather thick but cracks well. Fig. 1836.

Milford.—Massachusetts. A compressed ovate nut, medium to large in size, with large, plump kernel of excellent quality; cracks well; one of the best nuts yet brought to notice. Fig. 1836.

Rice.—Ohio. Angular, ovate, medium to large in size; kernel plump, bright and of fine quality; shell thin and of good cracking quality; tree regularly productive.

Swain.—Indiana. A rather long nut of medium size, with sharp apex and irregularly pointed base; surface rough; shell thin; cracking quality fair; kernel plump and sweet. Fig. 1837.

Vest.—Virginia. Of medium size, distinctly quadrangular with very lumpy surface; shell very thin and papery; kernel deeply corrugated but plump and of good quality.

Woodbourne.—Pennsylvania. Long, compressed ovate, large and smooth; kernel tender and of very high quality; shell rather thick but cracks well.

Shellbarks.

Lefevre.—Pennsylvania. Large, quadrangular, slightly ridged; shell thin, cracking fairly well; kernel very large, plump, rich and sweet.

Rieke.—Illinois. Above medium size, elongated, with a long, sharp apex and flattened base; shell moderately thick, cracking quality very good; kernel fairly plump and sweet. Fig. 1837.

Weiker.—Pennsylvania. Large, elongated, with moderately thick shell, cracking easily; kernel plump, rich and of good flavor. Fig. 1837.

Pignut.

Of the somewhat numerous sweet-flavored forms found in this species, the following one at least has been deemed worthy of perpetuation because of its delicate flavor, thin shell, and excellent cracking quality.

Brackett.—Iowa. Roundish compressed, smooth and of grayish color, medium to large in size; kernel plump, sweet and of delicate flavor; shell very thin, and easily freed from the kernel.

WM. A. TAYLOR.

HICÒRIA: *Carya.*

HIDÁLGOA ("after the Mexican Hidalgo"). Syn., *Chìldsia. Compósitæ.* A tender herbaceous vine, allied to Dahlia, with scarlet flowers about 2½ inches across, introduced in 1899 by John Lewis Childs, under the name of *Childsia Wercklei*, or "treasure vine."

Hidalgoa is closely allied to Dahlia and Coreopsis, but differs from both in the large, fertile achene of the rays and in the sterile disk-fls., the styles of which are entire or very shortly 2-lobed.—Only 2 species were hitherto recognized, both from Cent. Amer. From these *H. Wercklei* differs in its more compound lvs. and much larger heads. Suitable for cool, shady verandas but cannot be grown north of Washington out-of-doors; quite hardy in S. Calif.

Wércklei, Hook. (*Chìldsia Wércklei*, J. L. Childs). CLIMBING DAHLIA. Tall, woody at base, much branched, climbing by petioles: lvs. opposite, pinnately ternatisect, 1½–2½ in. long, 2 in. wide, the teeth tipped reddish brown; petiole 1½–2 in. long, coiled at base: peduncle axillary, as long as the lvs., 1-fld.; rays about 10, "dazzling orange-scarlet." Costa Rica. B.M. 7684. J. L. Childs' Cat. Rare Flowers, etc., 1899, p. 1, with colored plate. A.G. 20:570.

WILHELM MILLER.
N. TAYLOR.†

HIERÀCIUM (Greek, *a hawk;* it is said the ancients thought that hawks sharpened their eyesight by using the sap of these plants). *Compósitæ* (*Cichoriàceæ*). HAWK-WEEDS. Hardy herbaceous perennials, some of which are bad weeds in the eastern states.

Leaves often toothed, but never deeply lobed: heads usually small, loosely paniculate or cymose, rarely solitary; receptacle flat, usually quite naked; rays truncate, 5-toothed at the apex; anthers sagittate at the base; style-branches slender: seeds angular.—Over 400 species mostly native to Eu. and S. Amer. The genus passes into Crepis, from which it is distinguished by having stiff, usually brownish, rarely white pappus, and oblong or columnar seeds.

The cultivated species bear in summer and autumn a succession of small yellow or orange-colored flowers. There is one white-flowered species, *H. nivale.* They are often worth growing in rockeries and waste places, but care should be taken to prevent them from crowding out more desirable plants. In some parts of the East *H. aurantiacum* has become one of the worst weeds ever introduced into America. It is magnificently colored, and makes very attractive patches. *H. villosum* is the most desirable species. Hawkweeds will grow in almost any soil or aspect. They are propagated chiefly by dividing the stolons, or by seeds, and if left to themselves will soon form a dense mat of herbage over the poorest of soils. The Old World species are much confused.

A. *Flowering st. leafless or with 1–5 lvs.: lvs. mostly in a rosette at base of st.*

B. *Scapes unbranched above, bearing but a single head.*

Pilosélla, Linn. MOUSE-EAR HAWKWEED. St. slender, 4–12 in. high, stoloniferous, densely hairy throughout: lvs. entire, oblong or spatulate, narrowed into a petiole: fls. 1 in. broad, pale yellow, sometimes striped or tinged with red or purple.—Commonly flowers the whole season. Intro. from Eu. and common in dooryards and fields; often as a troublesome weed. Ont. to Pa. and Mich.

BB. *Scapes branched above, bearing several to many heads.*

C. *Basal lvs. coarsely toothed.*

vulgàtum, Fries (*H. umbròsum,* Jord.). St. 1–3 ft. high, slightly glaucous: basal lvs. 2–5 in. long, oblong to lanceolate, acute at both ends, petioled; petioles usually pubescent: fl.-stalks straight, sticky. July–Sept. Intro. from Eu. and Asia. Lab. to N. J.

CC. *Basal lvs. entire or very finely toothed.*

D. *Lvs. mostly obovate to ovate, purple-veined.*

venòsum, Linn. RATTLESNAKE WEED. St. 1–3 ft. high, slender, smooth or nearly so: lvs. 1–4 in. long, obovate to spatulate, subsessile: fls. ½–¾in. wide, bright yellow. Aug., Sept. Dry woods, Maine to Ga. and west to Manitoba and Neb.—A common plant in woods and, as an escape, a very troublesome weed. Advertised by one dealer in native plants.

DD. *Lvs. mostly spatulate to oblong, green-veined.*

aurantìacum, Linn. ORANGE HAWKWEED. DEVIL'S-BIT. St. 6 in. to 2 ft. high, slender, somewhat hairy: heads ½–1 in. across, short-stalked, orange to orange-red. June–Oct. Naturalized from Eu. by roadsides and in fields, Ont. to Pa.—A bad weed if allowed to spread. It is worthy of being established in high and dry parts of a rockery, where few other plants can grow.

præáltum, Vill. (*H. stolonìferum,* Bess.). Plants usually spreading very rapidly by stolons: st. 2–3 ft. high, slender, glaucous, hairy at base: basal lvs. entire: heads ½in. across, in an open cyme, bright yellow. June–Sept.—Naturalized from Eu. along roadsides in N. Y.; sometimes troublesome in cult. land.

AA. *Flowering st. leafy, at least below.*

B. *St. branching from the base.*

ramòsum, Waldst. & Kit. Lvs. ovate to lanceolate, narrowed at the base, toothed, hairy on margin and beneath; lower lvs. petioled, upper ones subsessile. July–Sept. Eu.

nivàle, Froel. WHITE HAWKWEED. Differs from *H. ramosum* chiefly in having white fls. and glaucous, somewhat leathery lvs., which are not hairy on the margin. A white hawkweed is advertised and, according to some, this is the only white-fld. species in the genus. Tyrolese Alps.

BB. *St. unbranched below.*

C. *Whole plant silky-villose.*

villòsum, Jacq. SHAGGY HAWKWEED. St. 1–2 ft. high, often 4 ft. under cult.: basal lvs. oblong-lanceolate to lanceolate, narrowed at the base, finely toothed; st.-lvs. sessile, the upper half clasping: fls. 1½–2 in. across, bright golden. June–Aug. Eu. Gn. 46:542. G.M. 44:596.—The silvery foliage and showy fls. of this species make it more desirable for the garden than any other hieracium now in cult. It is easily kept from spreading.

CC. *Plant smooth or slightly pubescent.*

canadénse, Michx. St. 1–5 ft. high, slender: lvs. ovate-oblong to lanceolate, acute, serrate or deeply incised, sessile, the upper with clasping base: fls. 1 in. across, the outer involucral bracts spreading. June–Aug. Dry woods, Nova Scotia to Pa., west to Brit. Col. and Ore.

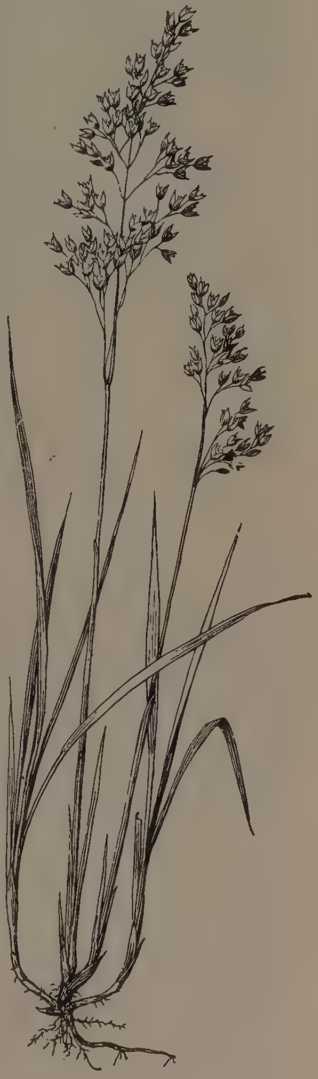
Gronòvii, Linn. St. 1–3 ft. high, stiff: lvs. hairy, the upper oval or oblong, broadly sessile, the lower obovate to spatulate, narrowed into a short petiole: fls. ½–¾in. wide. Sandy soils. Canada to Fla., west to Mo. and La.

H. alpìnum, Linn. Lvs. oblong or lanceolate, slightly toothed: fl.-sts. about 6 in. high, bearing 1–3 small, narrow lvs. and a single rather large head of bright yellow fls. Mountains of N. Eu. and Asia and the higher ranges of Cent. and S. Eu.—*H. Bórnmuelleri,* Freyn. Resembling H. villosum but lvs. thicker and more woolly, and fl.-heads larger and brighter yellow. Asia Minor.—*H. marginàtum,* Froel. A glaucous erect perennial, the leafy branches widely spreading: lvs. linear-lanceolate, st.-clasping at the base, the margins toothed and the under side reticulated: peduncles quite naked. Habitat(?). Little known in U. S.

S W. FLETCHER.
N. TAYLOR.†

HIERÓCHLOË (Greek, *hieros,* holy, and *chloe,* grass). *Gramíneæ.* Fragrant perennial grasses with flat blades and terminal panicles; only rarely planted. Spikelets with 1 terminal perfect and 2 lateral staminate florets, usually shining brown.—Species about 13, temperate and arctic regions of both hemispheres. This genus contains the fragrant vanilla-grass, the sterile shoots of which are woven by the North American Indians into small mats, baskets and boxes. These retain their fragrance for years. The seed seems to be nowhere obtainable, and only one American dealer advertises plants of it. The odor is like that of the common perennial sweet vernal grass, *Anthoxanthum odoratum,* but is more powerful. Hierochloë is closely allied to Anthoxanthum, but is distinguished by the staminate lateral florets and rather loose panicles, Anthoxanthum having sterile lateral florets and contracted panicles.

odoràta, Wahl. (*H. boreàlis,* Roem. & Schult. *Savastàna odoràta,* Scribn.). VANILLA-GRASS. HOLY-GRASS. SENECA-GRASS. SWEET-SCENTED GRASS. Fig. 1838. Rather slender, smooth, 1–2 ft. high: lvs. short: panicle brownish, spreading, 2–4 in. long. June, July. Eu., N. Amer. B. B. 1:132. Dept. Agric., Div. Agrost. 20:56. A. S. HITCHCOCK.



1838. Hierochloe odorata.

HIGGÍNSIA: *Hoffmannia.*

HILLEBRÁNDIA, (Wm. Hillebrand, author of a flora of Hawaii). *Begoniàceæ.* One of the 4 genera of the family, represented by a single Hawaiian species, *H. sandwicénsis,* Oliver. It is a begonia-like succulent herb with alternate long-petioled obliquely cordate 5- to 9-lobed lvs. and bright pink or rose-colored showy fls. in a peduncled corymb: from Begonia it differs in having the ovary free in its upper third, and bearing petaloid organs in the female fls.: petals 5 in both male and female fls.; stamens many; styles 5, fleshy: caps. globose, opening at apex, not winged. The plant grows 2–5 ft. high, from a tuberous rhizome, sparsely hairy or glabrate. It inhabits deep ravines or near waterfalls in different islands of the Hawaiian group. B.M. 6953. G.C. III. 44: suppl. Dec. 12.—Requires the treatment of shrubby or branching begonias, as in all regards but its technical botanical characters it is a begonia.

L. H. B.

HÍLLIA (Sir John Hill, 1716–1775, British botanist). *Rubiàceæ.* Shrubs of Trop. Amer., sometimes epiphytic, 2 of which are rarely grown as greenhouse or warmhouse evergreen subjects. Smooth, branches often rooting: lvs. opposite, simple, more or less fleshy: fls. large and rather showy, terminal and solitary, white and fragrant; corolla salverform, the tube long; stamens 4–7, inserted at the throat of the corolla: fr. a follicle.—Species about 10, W. Indies to S. Amer. **H. tetrándra,** Swartz. Plant 3–4 ft., the root bearing tubers: lvs. obovate to lanceolate, cuneate at base and rounded at top: lobes of corolla 4, roundish-obovate, not more than one-third length of tube. Mountains of Jamaica, Cuba; June in cult. B.M. 7355. *H. longiflòra,* Swartz, has elliptical pointed lvs., and 6–7 lanceolate bluntish reflexed corolla-lobes. W. Indies; apparently not now in the trade.

L. H. B.

HIMALAYA BERRY. The Himalaya berry is one of the evergreen blackberries of Asiatic origin. It is reported to have been introduced by Luther Burbank in the early nineties, the seed being received by him from an English traveler who secured it from the Himalaya Mountains. The vine is heavily thorned and a vigorous grower, making from 20 to 40 or 50 feet in a season and continues to grow until cold weather. It is of a trailing habit of growth, like the dewberry. The fruit begins to ripen in midsummer and gradually matures during a long period. As fruited in the Middle West, the berries are medium or below medium in size, decidedly tart unless dead ripe and with a more tender core than is usually found in the blackberry. The quality of the fruit is fair though not delicate in flavor. The fruit is of firm texture and on the Pacific coast it is reported as being a good shipper.

The Himalaya berry, like all of the evergreen blackberries, does not properly ripen its wood for winter and is not sufficiently hardy to be adapted for planting in the Upper Mississippi Valley and the other sections in which the winters are severe. Where covered with a heavy blanket of snow, the vines come through the winter in fair condition but in open winters they are completely killed back.

The Himalaya berry has been widely planted in the last three or four years, but it has not as yet established itself as a commercial berry in competition with several of the best standard varieties of blackberries with which it would be compared. See *Rubus.*

A. T. Erwin.

HIMANTOGLÓSSUM: *Orchis.*

HIMANTOPHÝLLUM: *Imantophyllum=Clivia.*

HIPPEÁSTRUM (*knight* or *horse* and *star,* from some fancied resemblance in *H. equestre,* perhaps of the equitant leaves and the star-shaped corolla-opening). *Amaryllidàceæ.* Includes *Habránthus.* Showy bulbous plants, blooming in late winter to early summer; handled under glass in frosty climates. Some of them are frequently grown as spring- or summer-blooming house-plants.

Bulb tunicate: scape hollow: lvs. linear or strap-shaped: fls. large and showy, usually two to several being borne on a stout, leafless scape; perianth-tube evident, often long, dilated in the throat; segms. erect-spreading, nearly or quite equal; filaments (6) distinct, often with small scales between; throat of perianth often closed or provided with scales or a corona: fr. a loculicidally 3-valved caps.; seeds black, usually flattened or compressed.—From 60 to 70 Trop. American bulbous plants, much cult. and now much hybridized. Closely allied genera are Amaryllis (African), Crinum, Sprekelia, Brunsvigia, Zephyranthes, Lycoris, Sternbergia, Vallota. The genus divides itself into the narrow-lvd. (lvs. linear) and broad-lvd. sections. All the common garden sorts belong to the latter section. The species chiefly known in cult., or which have been parents of hybrid races, are contrasted in this account, although the kinds commonly seen are hybrids or derivatives. In some species the fls. precede the lvs.

The hippeastrums are usually known in gardens under the general name of amaryllis; and their culture is given in full under that name. Many of them are noble garden plants, but the high price of the bulbs prevents them from becoming popular. Most of the species were first described in the genus Amaryllis, but that genus differs in its solid scape and absence of scales between the filaments. Gardeners sometimes secure blooming plants in two years from seeds, by keeping the plants growing nearly continuously. The seeds are sown in flats and pricked off into small pots at the two-leaf stage. By the close of summer, they are shifted into 4- or 5-inch pots and grown through the winter. They go into about 6-inch pots when one year old, where they grow till the second winter, when they are then partially rested; in late winter, they begin active growth again, and can be brought into flower in spring.

Very many of the names in trade catalogues are of horticultural forms; and many of them cannot be referred positively to any of the original species. For the Belladonna lily, see *Amaryllis;* for Atamasco lily, see *Zephyranthes;* for Josephine lily, see *Brunsvigia.* For *Amaryllis aurea,* see *Lycoris;* for *A. candida,* see *Zephyranthes;* for *A. formossissima,* see *Sprekelia;* for *A. gigantea,* see *Brunsvigia;* for *A. longifolia,* see *Crinum;* for *A. lutea,* see *Sternbergia;* for *A. Nerine,* see *Nerine;* for *A. orientalis,* see *Brunsvigia* (*B. gigantea*); for *A. ornata,* see *Crinum;* for *A. speciosa* or *purpurea,* see *Vallota.* Following are Latin-form trade names, probably of hybrids: *atrosanguineum, cardinalis, crocea, delicata, formosa, Lindenii, macrantha, refulgens, rubis* (hybrid), *rubra striata, Williamsii.* Other trade names may be expected in the lists of dealers.

INDEX.

Ackermanni, 5.
acuminatum, 13.
Alberti, 10.
aulicum, 4.
citrinum, 13.
crocatum, 13.
equestre, 7.
Forgetii, 3.
fulgidum, 7, 13.
Gravinæ, 10.
ignescens, 7.
Johnsonii, 15.
Leopoldii, 11.
major, 7.
maranensis, 9.
miniatum, 13.
nudum, 9.
pardinum, 2.
platypetalum, 4.
procerum, 12.
psittacinum, 6.
pulcherrimum, 5
pulverulentum, 13.
pyrrochroum, 7.
Rayneri, 12.
Reginæ, 10.
reticulatum, 8.
Roezlii, 7.
rutilum, 13.
solandriflorum, 1.
spathaceum, 7.
Spectabile, 10.
splendens, 7.
striatifolium, 8.
stylosum, 9.
vittatum, 14.
Walteri, 7.

A. *Perianth-tube 4–5 in. long, very slender.*

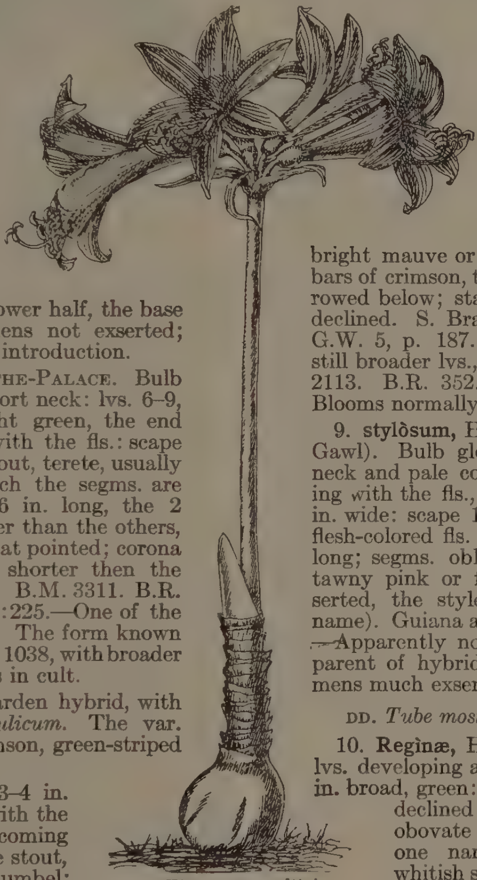
1. **solandriflòrum,** Herb. Bulb ovoid, 3–4 in. diam., with a short neck: lvs. appearing with the fls., 1–2 ft. long, 1–2 in. wide, blunt: scape somewhat flattened, 2–3 ft. tall, bearing 2–4 declined greenish white fls.; perianth-tube cylindrical, nearly as long as the obovate sometimes purple-ribbed segms.; stamens not exserted. S. Amer. B.M. 2573; 3771. L.B.C. 12:1200. I.H. 35:58. —Little known in gardens, but the parent of hybrids.

AA. *Perianth-tube short (usually not more than 1 in. long).*

B. *Throat constricted or closed by a neck or collar.*

C. *Stigma capitate.*

2. **pardìnum,** Dombr. Bulb globular, 2–3 in. diam., with a short neck: lvs. 5–7, appearing with the fls. but not fully developed until after the fls. are gone, becoming 2 ft. long and 2 in. broad, narrowed to the base: scape nearly terete, 1½ ft. tall, glaucous, usually bearing 2 spotted fls.; perianth-segms. 4–5 in. long, oblong but much narrowed at the base, acute, greenish yellow and much spotted with red, not striped, the lowest inner segm. narrowest; stamens declined, shorter than the perianth. Peru. B.M. 5645. G.W. 12, p. 654.—A handsome species, with fls. 6–7 in. across, offered in the trade, and also a parent in the modern spotted hybrids.



1839. Hippeastrum vittatum. (×⅙)

CC. *Stigma 3-parted.*

3. **Fórgetii,** Worsley. Differs from *H. pardinum* in the fls. being only partially striped, unspotted, and with narrower segms.: pedicels somewhat longer (about 3 in.); perianth dull crimson (color of *H. rutilum*), the segms. keeled in the lower half, the base green, about 6 in. across; stamens not exserted; stigma 3-lobed. Peru; a recent introduction.

4. **aùlicum,** Herb. Lily-of-the-Palace. Bulb ovoid, 3–4 in. diam., with a short neck: lvs. 6–9, 1–2 ft. long, 2 in. broad, bright green, the end blunt or nearly so, appearing with the fls.: scape scarcely longer than the lvs., stout, terete, usually bearing 2 large red fls., of which the segms. are green at the base; segms. 5–6 in. long, the 2 upper inner ones much broader than the others, all of them obovate and somewhat pointed; corona in the throat green; stamens shorter then the perianth; filaments red. Brazil. B.M. 3311. B.R. 444. Gt. 45, p. 417. Gn.M. 2:225.—One of the best, and common in the trade. The form known as var. **platypétalum,** Lindl., B.R. 1038, with broader petals and more robust habit, is in cult.

5. **Áckermanni,** Hort., is a garden hybrid, with large crimson fls., near *H. aulicum.* The var. **pulchérrimum,** Hort., with crimson, green-striped fls., is best known.

6. **psittacìnum,** Herb. Bulb 3–4 in. diam., with a long neck: lvs. with the fls., 6–8, lightly glaucous, becoming nearly or quite 2 ft. long: scape stout, 2–3 ft. tall, bearing a 2–4-fld. umbel; perianth-segms. 4–5 in. long, oblong and acute, undulate, the edge crimson, the main part green but crimson-striped; stamens much shorter than the perianth. S. Brazil. B.R. 199. L.B.C. 13:1204.—Apparently little known in cult., but it has been a parent in hybridizations.

BB. *Throat not constricted.*

C. *Stigma capitate or only obscurely lobed.*

D. *Tube of perianth ½–1 in. long.*

7. **equéstre,** Herb. (*Amarýllis equéstris,* Ait.). Barbados Lily. Bulb globular, 2 in. diam., producing offsets freely, with brown scales and a short neck: lvs. 6–8, developing fully after the fls., 12–20 in. long and becoming about 2 in. wide, narrowed to the point: scape 1–2 ft., terete, glaucous; fls. 2–4, 4–5 in. across, the green tube 1 in. long, the segms. obovate-pointed, bright red with green at the base, the 3 inner ones narrower than the outer; stamens shorter than the perianth. Mex. to Chile and Brazil. B.M. 305. G.W. 9, p. 368.—An old garden species, one of the best for winter and spring blooming. There are several garden forms and hybrids, with larger and better fls. Var. **spléndens,** Truff., R. H. 1895:578 (var. *Wálteri,* Wittm., Gt. 44, 1418), is larger in all its parts, fls. red, and the pedicels are longer. Var. **fúlgidum,** Hort. (not *H. fúlgidum,* Herb.), has brilliant orange segms. margined with white. Var. **ignéscens,** Hort., is deep clear scarlet, with white throat and white bars on the segms. Var. **màjor,** Hort., has very large, bright orange fls., with a green central star. B.R. 234. *H. Roézlii,* Regel, *H. pyrróchroum,* Lem., I.H. 11:420, and *H. spathàceum,* Sims, B.M. 2315, are regarded by Baker as forms of this species. There are double-fld. forms.

8. **reticulàtum,** Herb. Bulb nearly globular, with a short neck: lvs. appearing with the fls., rather short and broad for the genus, being oblanceolate, 1 ft. long and 2 in. broad, thin, and bright green: scape about 1 ft. tall, nearly terete, bearing 3–6 tesselated or checkered fls. 4–5 in. across; fls. bright mauve or purple-red, with cross lines and bars of crimson, the segms. obovate and much narrowed below; stamens shorter than the perianth, declined. S. Brazil. B.M. 657. R.H. 1912:448. G.W. 5, p. 187. Var. **striatifòlium,** Baker, has still broader lvs., with a white keel or stripe. B.M. 2113. B.R. 352. G.C. III. 4:477.—Handsome. Blooms normally in late summer.

9. **stylòsum,** Herb. (*Amarýllis maranénsis,* Ker-Gawl). Bulb globular, 3 in. diam., with a short neck and pale coverings: lvs. 4–6, mostly appearing with the fls., bright green, becoming nearly 2 in. wide: scape 1–2 ft., bearing 3–8 light red or flesh-colored fls. 4 in. across; perianth-tube ½in. long; segms. oblong-acute, less than 1 in. wide, tawny pink or flesh-red; stamens somewhat exserted, the style much so (whence the specific name). Guiana and Brazil. B.M. 2278. B.R. 719. —Apparently not much cult., but it has been a parent of hybrids. Var. **nùdum,** Worsley. Stamens much exserted and spreading.

DD. *Tube mostly very short (or scarcely any).*

10. **Regìnæ,** Herb. Bulb globular, 3 in. diam.: lvs. developing after the fls., 2 ft. long and 1½–2 in. broad, green: scape 10–20 in., bearing 2–4 red declined fls.; perianth-segms. 4–5 in. long, obovate and acute, the lowest innermost one narrower, all bright red, a large whitish star in the throat; tube sometimes nearly or quite 1 in. long; stamens shorter than the perianth. Mex. to Peru and Brazil. B.M. 453.—An old garden plant, still much cult. There are double-fld. forms: *Amaryllis Alberti,* Lem., I.H. 13:498, Baker considers to be one of these. *H. Gravìnæ,* Melaz., is a hybrid resembling this species (*Amaryllis Graveana?*). G.W 5, p. 187. *H. Spectábile,* Hort., is a hybrid near *H. Reginae.* L.B.C. 159.

11. **Lèopoldii,** Dombr. Bulb globular, 2–3 in. diam., with short neck: lvs. with the fls. or nearly so, often 2 ft. long: scape stout, 1½–2 ft., nearly terete, bearing about 2 large, very regular and parti-colored fls., measuring 6–7 in. across; perianth-tube without any corona or constriction at the throat; segms. obovate, 2 in. broad, the lower half dull crimson, the tips greenish white, the intermediate part bright red, with a forked white mark at the base of each, and a green-white throat: stamens declined, mostly exceeding the perianth, the filaments white; style exserted. Peru. G.C. 1870:733. G.Z. 14:160.

12. **pròcerum,** Lem. (*Amarýllis Ràyneri,* Hook. f.). Bulb ovoid, with a neck 10–12 in. long, on the apex of which—as on a trunk—the drooping, curling, buff-edged lvs. are borne (the lvs. 16–20 in. long): scape 12–18 in. high, 2-edged, green, bearing 2–3 horizontal pale lilac fls. 4–5 in. across; segms. oblanceolate, acute, not 1 in. broad; throat without a star; stamens much shorter than the perianth; stigma capitate. Brazil. I.H. 11:408. F.S. 20:2077, 2078. B.M. 5883. Gn. 45:350; 76, p. 93. G.C. III. 52: suppl. July 27. A.G. 22:713.—One of the most distinct of the genus. In the American trade. Sometimes called "blue amaryllis" and "empress of Brazil." Plant out for late summer or autumn bloom, in a warm, sunny place. Keep bulb dry until late spring.

cc. *Stigma markedly 3-parted.*

13. **rùtilum,** Herb. Bulb nearly globular, 2–3 in. diam., stoloniferous, with short neck: lvs. 6–8, elongating after flowering, bright green, 1 ft. long and an inch or more wide: scape as long as the lvs., somewhat compressed, glaucous, bearing 2–4 red fls.; perianth-tube ¾in. long, green, with a minute crown in the throat; segms. oblong, acute, crimson and green, keeled; stamens shorter than the perianth, the filaments red. Brazil. B.R. 23. L.B.C. 15:1449.—In cult. chiefly known in the var. **fúlgidum,** Baker (*H. fúlgidum,* Herb.), which is in all parts larger, deep crimson, the fl.-segms. 3–5 in. long. B.R. 226. B.M. 1943 (as *Amaryllis miniata*); 2475 (as *H. subbarbatum*). Var. **crocàtum,** Baker (*Amarýllis crocàta*) is as large as var. *fulgidum,* except in its fls., which are smaller, with undulate segms., saffron-colored. B.R. 38. Var. **citrìnum,** Baker, has bright yellow fls. Var. **acuminàtum,** Roem. (*A.* and *H. pulveruléntum*). Fls. pink and segms. acute. B.R. 534; 1188. L.B.C. 5:484. B.M. 2273.

14. **vittàtum,** Herb. Figs. 1839, 1840. Bulb globular, 3 in. diam.: lvs. 6–8, usually appearing after the fls., bright green, 2 ft. long: scape often 3 ft. high, bearing 3–6 horizontal or declined striped white-edged fls. 4–5-in. across; tube about 1 in. long, with an obscure crown or crest at the throat; segms. obovate-oblong and acute, 1½ in. or less broad, the under-color whitish but overlaid with red stripes, the keel white; stamens shorter than the limb. Peru; but once thought to be S. African. B.M. 129. G.C. III. 24:119.—The commonest species-type in American gardens, now cult. in many forms. It seems to have entered freely into hybrids, and some of the forms now passing as *H. vittatum* are perhaps mongrels. The double red feathery stripes on each side of the more or less irregular-edged segms. distinguish this species from its congeners.

1840. A flower of Hippeastrum vittatum. (×⅙)

15. **Jôhnsonii,** Bury. Fig. 1841. Fls. deep dull red, each segm. with a white stripe down the keel. A very profuse bloomer, and withstands much abuse. It is the most popular single amaryllid in this country, and is particularly prized for window-gardens. It is the oldest hybrid, having been raised by one Johnson, an English watchmaker, who, in 1799, crossed *H. Reginæ* with *H. vittatum.* Distinct and one of the best. Apparently not in American trade, but it has been used in hybridizing. G.W. 12, p. 653.

H. ádvenum, Herb. Belongs to the narrow-lvd. section of the genus: lvs. linear, glaucous: fls. 2–6, about 2 in. long, yellow or red, on slender pedicels, the segms. oblong-linear and acute; stigma 3-parted. Chile. B.M. 1125. B.R. 849.—A form with pale yellow fls. is var. *pállidus,* Herb. L.B.C. 18:1760.—*H. aulíctre,* Worsley. Garden hybrid of H. aulicum and H. equestre.——*H. iguapènse,* Wagn. Bulb small, ovate: lvs. lanceolate, 6–9 in. long and 2½ in. broad: scape about 6 in. high; fls. several, nodding, white with red or lilac stripes on upper segms. S. Brazil.—*H. Mándevillei,* Worsley. Hybrid, quaint and beautifully marked.—*H. praténse,* Baker. Also linear-lvd.: fls. 2–4, bright scarlet, the very short tube with small scales in the throat, the segms. 2½ in. long; stigma capitate. Chile. B.R. 28:35.—*H. ròseum,* Baker. Lvs. narrow-linear, glaucous, 1 ft. long, with the fls.: scape 6 in. high, bearing 1 or 2 small bright red fls.; stigma 3-parted. Chile. —*H. teretifòlium,* C. H. Wright. Distinguished by nearly terete lvs.: fls. rosy pink, 2 in. long, campanulate, few in an umbel. Montevideo.

1841. Hippeastrum Johnsonii. (×¼)

L. H. B.

HIPPOCRÈPIS, (from the Greek for *horse* and *shoe,* in reference to the shape of the pod). *Leguminòsæ.* Herbs, subshrubs or rarely shrubs, suitable for culture in the alpine garden.

Leaves impari-pinnate; lfts. entire, exstipellate; petioles rarely spinescent, persistent: fls. yellow, nodding, in racemes or axillary pedunculate spikes; ovary sessile, 1–2-ovuled; style filiform: pod flattened, indehiscent valves nearly horse-shoe-shaped.—Twelve species in Medit. region, Canary Isls., and 1 as far north as S. Scotland. Of easy cult. in ordinary garden soil. Prop. by division of the root or by seeds.

comòsa, Linn. Perennial, 8–24 in. high: st. herbaceous, prostrate: lfts. 7–11, obovate, obtuse: fls. yellow, in 4–8-fld. umbels. May–July. Cent. and S. Eu.—Grows on sunny slopes and prefers lime.

L. H. B.

HIPPÓMANE (Greek, *horse-mania,* transferred from an ancient tree name). *Euphorbiàceæ.* A poisonous tropical tree, rarely cult. in European gardens. Juice milky: lvs. simple, alternate: fls. monœcious; staminate calyx 2–3-lobed, imbricate; ovules 1 in each of the 6–9 cells: fr. a drupe.—One species. Related to Sapium and Stillingia. The juice is poisonous internally and externally, though some persons seem to be immune. It was formerly supposed that even the shade of the tree was poisonous. It was used by the natives for arrow poison, and the like. Prop. by cuttings in sand with heat. The tree needs a sandy loam soil.

Mancinélla, Linn. Manchineel. Manzanillo. A much-branched tree, 20–40 ft., with thick naked twigs, terminated by the thick, smooth, broad-ovate, short-acuminate, minutely sharp-serrate, pear-like lvs. and thick spikes: fr. berry-like, about 1 in. thick. Coasts of Cent. Amer., W. Indies and adjoining S. Amer. and S. Fla. Gt. 15:510.

J. B. S. Norton.

HIPPÓPHAË (*Hippophaës,* ancient Greek name of a spiny plant, possibly derived from *hippos,* horse, and *pheos,* a spiny plant, probably *Poterium spinosum*). Also spelled *Hippophaës.* *Elæagnàceæ.* Sea Buckthorn. Ornamental woody plants grown for their silvery gray foliage and the brightly colored berries.

Deciduous shrubs or trees with spiny branches; the young growth covered with silvery scales or stellate hairs: lvs. alternate, narrow: fls. diœcious, from the axils of last year's branches in short racemes, the axis of which mostly develops into a branchlet or thorn in the pistillate plant, but is mostly deciduous in the staminate one; staminate fls. sessile, with 2 valvate sepals and usually 4 stamens with short filaments; pistillate fls. short-stalked; the 1-ovuled ovary inclosed by a receptacle bearing 2 minute sepals at its apex, style filiform with a cylindric stigma: fr. drupe-like, with a bony ovate stone.—Two species in Eu. and W. and C. Asia.

1842. Hippuris vulgaris. (×½)

The sea buckthorns are suckering shrubs or small trees with spreading usually spiny branches clothed with silvery gray narrow and rather small foliage, with insignificant yellow flowers appearing in spring before the leaves and followed in the pistillate plant by small but numerous bright orange-yellow berries persisting through the winter. The common sea buckthorn is perfectly hardy North, while the Himalayan species is tenderer and but rarely planted. The former inhabits the sandy banks of rivers and the seashore and also the steppes of central Asia. It grows well in almost any kind of soil including limestone and saline soil; in poor sandy soil it remains shrubby and spreads freely by suckers and has therefore been used successfully for the fixation of shifting-sand dunes; in better soil it grows into a small tree. It also is used sometimes for hedges in Europe. The pistillate plant is strikingly handsome in autumn when covered with its orange berries, which often are so numerous as to weigh down the branches. To insure a good setting of berries it is necessary to plant one or a few staminate plants with each group of pistillate ones; the staminate and pistillate plants may be distinguished even without flowers or fruits fairly well by their habit, the former being of more upright growth, while the pistillate ones are more spreading and twiggy. The berries are somewhat poisonous and but rarely eaten by birds. Propagation is by seeds sown at once or stratified, by cuttings of mature wood in spring, and also by root-cuttings, suckers and layers.

rhamnoìdes, Linn. Shrub or tree, occasionally to 30 ft.: branches gray, usually spiny: winter-buds golden brown: lvs. linear-lanceolate, short-petioled, obtusish, covered on both sides with silvery scales, at maturity above often glabrescent, ¾–2½ in. long: fls. appearing before the lvs., very small, yellowish: fr. subglobose or ovoid, orange-yellow, ¼–⅓in. long, ripening in Sept. Eu. through W. and Cent. Asia to the Altai, W. China and N. W. Himalayas. B.M. 8016. Gn. 49:62. G.M. 37:791. Gn.W. 21:110. J.H. III. 51:161. G.W. 15, p. 345. Var. **angustifòlia**, Loud., a form with pendulous branches and narrow lvs. Var. **procèra**, Rehd. Tree, to 50 ft.: young growth villous: lvs. oblong-lanceolate to lanceolate, with stellate hairs above, finally glabrous above. W. China.

H. salicifòlia, D. Don. Tree, to 40 ft.: lvs. lanceolate, acute, green above, white villous-tomentose beneath, 1½–4 in. long: fr. orange, ½in. long. Temp. Himalayas. Alfred Rehder.

HIPPÙRIS (*horse-tail* from the looks of the plant). *Haloragidàceæ*. Perennial aquatic herbs, one sometimes used in bog-gardening. Sts. simple: lvs. small, simple and entire, verticillate: fls. small and inconspicuous, perfect or polygamous, sessile in the axils; petals none; calyx entire; stamen 1; nearly or quite sessile, with the thread-shaped style lying between the 2 anther-lobes: fr. nut-like, 1-seeded.—Three species, very widely dispersed in temperate and frigid regions. **H. vulgàris**, Linn. (Fig. 1842), may be transferred to wet grounds and pools: to 2 ft. (or more in deep water): lvs. 6–12 in a whorl, acute, usually withered at the apex. In ponds and streams, Greenland, and Alaska to N. Y., New Mex., Calif.; also in Eu., Asia and in Patagonia.—It produces an attractive effect with the simple shoots standing above the water in ponds. L. H. B.

HOBBLEBUSH: *Viburnum lantanoides.*

HODGSÒNIA (B. H. Hodgson, British scientist). *Cucurbitàceæ*. One species, a showy tendril-climbing shrub, in its native places in India sometimes extending 100 ft.; *H. macrocárpa*, Cogn. (*H. heteróclita*, Hook. f. & Thom.), hardly to be expected in cult. Lvs. coriaceous, 6–8 in. long, deeply 3–5-lobed, the lobes entire or slightly dentate: fls. diœcious, white, tinged yellow within, the limb of the deeply 5-parted corolla bearing curling fringes 4 in. long; male fls. in long racemes, females solitary; calyx very long-tubular and slender; stamens 3, exserted; stigmas 3 and 2-fid, exserted: fr. berry-like, spherical, 4–10 in. across, red-brown and tomentose; seeds 2–3 in. long. F.S. 12:1262.—This odd and showy plant is said to require the conditions provided by a temperate greenhouse, although some report it as requiring hothouse treatment. L. H. B.

HOFFMÁNNIA (Georg Franz Hoffmann, 1760 or 1761–1826, professor of botany at Goettingen). Including *Campylóbotrys* and *Higginsia*. *Rubiàceæ*. Tropical American herbs or shrubs, with opposite or verticillate leaves and small white, yellow or red flowers, cultivated for the very showy foliage.

Branches either terete or 4-angled: lvs. simple: corolla tubular, with 4 (rarely 5) oblong or linear-obtuse lobes; stamens mostly 4; disk ring-like about the 2–3-loculed ovary or cushion-like; style filiform, the stigma 2-lobed: fr. an oblong or narrow many-seeded berry.—Species above 30, Cent. and S. Amer. The hoffmannias require warm temperature, although they may be plunged in the open in the summer. Well-grown specimens are also adapted to the decoration of window-gardens and living-rooms. Prop. by cuttings. Hoffmannias are very showy foliage plants.

1843. Hoffmannia discolor. A loose-growing sprig. (×⅓)

A. *Fl.-clusters on long stalks.*

díscolor, Hemsl. (*Campylóbotrys díscolor,* Hook.). Fig. 1843. About 6 in. high, but lopping over the side of the pot or pan and making a mat, slightly hairy, the branches purplish: lvs. short-petioled, oblong-obovate, entire, satiny green above and rich light purple to green beneath: fls. small, red, in recurving racemes, on red peduncles. Mex. B.M. 4530.—Excellent little plant.

refúlgens, Hemsl. Much like the former, but twice or more as large, the lvs. sessile and almost succulent, narrow-obovate, with many parallel veins running from the midrib to the margin, the under-surface pale red or wine-color and the upper surface dull green, with iridescent shades of purple and brown: fls. 1 in. across, pale red. Mex. B.M. 5346 (as *Higginsia refulgens*). H.F. II. 5:78.—A most beautiful plant.

AA. *Fl.-clusters crowded in the axils.*

Ghièsbreghtii, Hemsl. (*Campylóbotrys Ghièsbreghtii,* Lem.). Half-shrubby, 2–4 ft. tall, nearly glabrous: st. acutely 4-angled: lvs. usually 1 ft. or less long, oblong-lanceolate-acuminate, entire, the short winged petiole somewhat decurrent, very strongly veined, purple-red beneath and dark velvety green above: fls. yellow, with a red spot in the center. Mex. B.M. 5383 (as *Higginsia Ghiesbrechtii*). I.H. 8:279 (as Campylobotrys). G.W. 15, p. 330.—A form with handsomely mottled lvs. is var. **variegàta,** Hort. (I.H. 30:498).

regàlis, Hemsl. (*Campylóbotrys regàlis,* Lind.). Shrubby, strong-growing, glabrous, the branches obtusely 4-angled and somewhat fleshy: lvs. large, round-ovate and abruptly acuminate, entire, plicate with arched nerves, glabrous, purple-red beneath and dark rich green above: fls. yellow, sessile. Mex. B.M. 5280 (as Higginsia).

H. phœnicópoda, K. Schum. Lvs. ovate to oblong, violet-red beneath: fls. inconspicuous. Cent. Amer.

L. H. B.

HOFFMANSÉGGIA (Joh. Centurius, Count von Hoffmansegg, born 1766; wrote on plants of Portugal). *Leguminòsæ.* Thirty and more dwarf mostly glandular herbs and subshrubs from Kans. and Calif. to Patagonia, and in S. Afr., perhaps not cult.: lvs. bipinnate, with or without black glands: fls. yellow in naked racemes opposite the lvs. or terminal; petals 10 and nearly equal; stamens 10 and distinct: pod flat, oblong, sometimes falcate. The genus is allied to Cassia, from which it differs in its bipinnate rather than pinnate lvs., and to Cæsalpinia, which is distinguished by its prickles, woody stature, and other characteristics.

HOHENBÉRGIA (personal name). *Bromeliàceæ.* Interesting hothouse subjects grown in pots, closely allied to Æchmea.

Leaves forming a dense rosette, spiny-margined, often terminated with a stout spine: panicle on a tall scape, bi- or tripinnate, of short, dense, sessile or stipitate spikes; fls. sessile in the axils of large bracts, white or blue.—A Trop. American genus of about 20 species.

augústa, Mez (*Æchmèa augústa,* Baker. *Hoplophỳtum augústum,* Beer). Lvs. up to 3 ft. long and 3 in. broad, spiny, with pale scales on both sides: panicle pyramidal, much exceeding the lvs., floccose; fls. a little less than ½in. long, the petals blue. Brazil.

stellàta, Schult. (*Æchmèa glomeràta,* Hook.). Lvs. up to 3 ft. long, and 3 in. wide, marginal spines long: panicle interrupted, equaling or little exceeding the lvs.; fls. about 1 in. long, the petals blue. Trinidad and Brazil. B.M. 5668.

Legrelliàna, Baker (*Æchmèa Legrelliàna,* Mez. *Guzmània Legrelliàna,* Hort.). A strong billbergia-like plant, with 7–12 strong, entire, brown-scaly lvs. and a simple dense spike of red fls. standing 4–7 ft. high: floral bracts serrate. Uruguay.

George V. Nash.

HOHÈRIA (from the New Zeal. vernacular name *hoheri*). *Malvàceæ.* Small trees or shrubs native to New Zeal.: lvs. variable, alternate, serrate, petiolate: fls. numerous, white, in axillary fascicles; peduncles jointed at the middle; bracteoles wanting; calyx hemispherical, 5-toothed; petals oblique, notched near the apex; staminal column split at the top into numerous filaments, usually arranged in 5 bundles: fruiting carpels 5, indehiscent, furnished with a broad membranous wing at the back.—Three or 4 species; by some regarded as one variable species. *H. popúlnea,* A. Cunn. A small, handsome tree, 10–30 ft., glabrous except the young shoots, peduncles and calyxes, which are more or less pubescent: lvs. very variable, especially in young plants: fls. snow-white, produced in great profusion: carpels produced outward and upward into a membranous wing, longer than broad. G.C. III. 30:384; 52:355. Gn. 62, p. 309; 76, p. 580. Scarcely cult.

HOIBRÉNKIA: *Staphylea.*

HOLBOÈLLIA (Frederick Louis Holboell, once Superintendent of Botanical Garden, Copenhagen). *Lardizabalàceæ.* Ornamental vines grown chiefly for their handsome evergreen digitate foliage.

Twining shrubs: lvs. coriaceous, long-petioled, digitate, with 3–9 stalked entire lfts.: fls. monœcious, in few-fld. racemes; sepals 6, petal-like, obtusish, fleshy; between the sepals and the 6 free stamens 6 small nectaries sometimes called petals; the staminate fls. with rudimentary ovaries; the pistillate with small stamens and 3 distinct carpels developing into 1–3 large oblong pods with numerous black seeds.—Five species in China and Himalayas.

The holboellias are quick-growing evergreen vines very similar in foliage to *Akebia quinata* but the flowers are quite different; they are either white or the pistillate are purplish and the staminate which are borne in separate racemes whitish or greenish white; they appear with the young leaves in spring and are not showy, but the large purple pods are conspicuous. None of the species is hardy North, but the plants should be tried outdoors in the South where an evergreen quick-growing climber is desired, as they make annual shoots 10 to 12 feet long, and the foliage is distinct and beautiful. For the cool greenhouse they are too rampant and produce too few flowers. Propagation is by seeds which germinate readily; also by layers and by softwood cuttings. For further cultural notes, see *Stauntonia.*

coriàcea, Diels. Lfts. always 3, coriaceous, ovate to oblong-lanceolate or narrow-oblong, acute, rounded or broadly cuneate at the base, light green below with the veinlets not visible, 2–3½ in. long: fls. ⅓–½in. long; the staminate whitish, on pedicels about 1 in. long, the pistillate purplish on pedicels to 2 in. long. Cent. China.

latifòlia, Wall. Lfts. 3–7, ovate-oblong to elliptic-oblong, acuminate, pale green below and reticulate, 2½–3½ in. long: fls. about ½in. long, in short-peduncled racemes, on pedicels ¼–½in. long; the pistillate purple, the staminate greenish white, fragrant: fr. consisting usually of 2 oblong carpels, each about 4 in. long and 2 in. thick, rosy purple, edible. Himalayas. B.R. 32:49. J.F. 2:144. R.H. 1890:348. Gn. 8, p. 548; 14, p. 369.

H. cuneàta, Oliver=Sargentodoxa cuneata.—*H. Fárgesii,* Réaubourg. Lfts. 5–9, usually oblong-lanceolate, glaucescent below: fls. ¾in. long, purplish and greenish white. Cent. China.—*H. grandiflòra,* Réaubourg. Lfts. 5–7, usually lanceolate, reticulate and grayish green below: fls. nearly 1 in. long, waxy white. W. China.

Alfred Rehder.

HÓLCUS (Latin name for a kind of grass, from *holkós,* attractive). *Gramíneæ.* This genus, named Holcus by Linnæus, was called Sorgum by Adanson (*Sorghum,* Moench). The name Holcus was accepted by some botanists while by others the genus was united with

LV. Hollyhock.

Andropogon. It seems best, however, to restore the Linnæan name. They are important fodder grasses.

The genus differs from Andropogon in having spikelets in 3's in an open or contracted panicle. The various cult. varieties known as sorghum or sorgo, broom-corn, Jerusalem corn, milo maize or milo, durra, and so on, are considered by some botanists to have been derived from the wild species, *H. halepénsis*, Linn. (*Andropògon halepénsis*, Brot. *Sórghum halépense*, Pers.). Others maintain these cult. forms as varieties of a distinct species, *H. Sórghum*, Linn. (*Andropògon Sórghum*, Brot. *Sórghum vulgàre*, Pers.). The cult. forms are annuals, with tall jointed sts. bearing large terminal panicles. Depending upon their uses, they fall naturally into 3 groups: (1) Broom-corn, in which the branches of the panicle are elongated and are thus adapted to the manufacture of brooms; (2) the sugar or saccharine sorghums, having loose panicles, with drooping branches and red-brown spikelets, cult. for the sweet juice and for forage. Amber and Orange are leading forms of sugar sorghum. (3) The remaining varieties are grouped together as non-saccharine sorghums. They are grown for forage and for the seed. Gn. 4, p. 83 (as *S. bicolor*). The common forms grown in this country and offered in the trade are: Kafir corn, with sts. 4–5 ft. high, stocky growth, and dense, upright panicles; milo or milo maize, or African millet, similar but about twice as tall; durra (variously spelled doura, dhoura, and so on), including Egyptian rice corn, and Guinea corn, with compact panicles on an often recurved stalk. The wild species, *H. halepensis*, Linn., JOHNSON-GRASS, has a large open panicle of smaller spikelets. Gn. 13, p. 305. Dept. Agric., Div. Agrost. 14:12.—It is a perennial, spreading by stout rhizomes and very difficult to eradicate from cult. ground. For history of sorghums see Dept. Agric. Bur. Pl. Ind. Bull. No. 175 (1910) and Bur. Pl. Ind. Circ. No. 50 (1910). Sudan-grass and Tunis-grass are varieties of sorghum that resemble Johnson-grass in aspect but are annuals devoid of rootstocks. They have recently been intro. in the U. S. and give promise of value as forage plants in the southern states. See "Some New Grasses for the South," Yearbook U. S. Dept. Agric., 1912.

H. lanàtus=Notholcus lanatus.

A. S. HITCHCOCK.

HOLLY: *Ilex.*

HOLLYHOCK (*Althæa rosea*, which see). Figs. 1844, 1845. The hollyhock is one of the very oldest of cultivated flowers and is today an inhabitant of most gardens, and is known by its common name not only to all cultivators of plants but even to school-children. Its showy blossoms in July after the larger number of plants have ceased flowering has much helped to make it known to all, while its history, its place in poetry and folk-lore, and its associations in the past drama of the world have been forgotten or vaguely remembered. Its beauty causes its cultivation today.

The hollyhock is a native of China, botanically described as a biennial and evidently a cultivated plant in China when first brought to the attention of European cultivators, since it is said to have been "of many colors and forms." Very probably its colors in a wild state, as now often seen in mixed retrograde seedlings, were rose-pink tending to red and white. The real reds and the present deep maroon shades would naturally be obtained rather easily by selection. The yellow color is, in the opinion of some, a much later acquired one, and the least liable to come true from seed.

The doubleness of the flower has undoubtedly been an acquired character under cultivation. The hollyhock has been propagated almost entirely from selected seed for so many years that both in color and doubleness it comes true from seed which has not been cross-fertilized with other colors or forms.

The bees delight in the plentiful pollen of the hollyhock so that in a mixed group of plants the seed will be indiscriminately crossed, and naturally a few poor single-flowered plants may affect the seed from a whole group. The color of the flower is, however, much influenced by the seed-bearing parent. The pollen on the hollyhock is so plentiful that the bee soon gets a load and goes home, in many cases not having visited more than one plant. For this reason a short distance between groups, especially if separated by some barrier, very much prevents cross-fertilization. Purchased seed comes about 75 per cent true to color and possibly 40 per cent fairly double.

The hollyhock, while called in botanical history a biennial, is at least a short-lived perennial. Its heavy type of root with very short stolons or rather side crown-buds at the head of the root-system would naturally lead to its description as a biennial. It belongs, because of its root-system, to a horticultural class of plants, which, while truly perennial under proper conditions become biennial or even annual under other circumstances. Other plants having very similar root-formations are the dandelion, digitalis, aquilegia, platycodon and delphinium. These are more or less short-lived perennials since their permanency depends on the preservation of an easily destroyed crown-bud or rather the head of the root-system. Heaving of the plant by frost exposes the main root-stem below the side buds and causes the plant to die after flowering. In like manner the removal of soil from about the plants, as by rains, shortens the life by exposing the root below its natural level with the soil. The seed of the hollyhock, as well as the other genera mentioned with this root-system, germinate very quickly —five to ten days.

1844. The hollyhock.

Hollyhock seeds sown in the greenhouse or frame during March or earlier and given plenty of root-room will flower the first year from seed although somewhat later than established plants. Plants grown as above in pots are likely to show less perennial character of the root and are more liable to disease. The seed should be sown outdoors during June or July in soil with sufficient clay and surface soil-water to cause the seedlings to form a system of strong side tap-roots, rather than one or two main roots as will occur in too sandy or dry soil, or on the other hand too many fibrous surface-roots as when grown in pots or in a too-wet soil.

Plants from outdoor spring- or early summer-sown seed should be moved to their permanent positions early the following spring, care being taken to dig the plant with all the main roots, and in planting to place these roots in a natural position, i.e., pointing downward. The crown of the plant should be a little below the surface of the ground (this is important). Fall planting, with the heaving by frost, especially of tap-rooted plants, means replanting in the spring to the proper depth or the usual loss of the plant after one year's bloom.

Hollyhocks may be propagated in the spring by placing a plant in sand so as to cover the crown of the root which will cause a number of suckers to be sent up about the crown, which may be removed and rooted.

The hollyhock rust (*Puccinia malvacearum*) bothers very little in deeply dug and drained beds with plants grown outdoors and planted with the tap-roots properly placed and the crowns in the proper place in reference to the soil-surface. An appreciation of the deep-rooting, drainage-liking habit and qualifications of the plant will do more to combat this disease than any amount of bordeaux mixture. In the United States Experiment Station Record, Vol. XXXI, No. 3, note is made from an article in a French publication (Compt. Rend. Acad. Sci. 158, No. 6) which declares the hollyhock rust to have been successfully combated during a three-year trial by supplying as water to the roots a 3 per cent solution of copper sulfate.

1845. Semi-double hollyhock. (×½)

In landscape work, the hollyhock best belongs to the herbaceous perennial groupings, but it can be well used alone in groups adjoining shrubbery, or in many places in place of shrubbery. It can seldom be used to advantage in mixture with woody plants, since the hollyhock needs light on its lower basal leaves. Further, the foliage of the hollyhock neither resembles nor contrasts well with that of the larger number of shrubs, although there are exceptions, for example, hydrangeas of the arborescens type and hollyhocks form a pleasing mixture.

F. W. Barclay.

HOLLY, SEA: *Eryngium.*

HOLMSKIÒLDIA (Theodor Holmskiold, 1732–1794, Danish nobleman and scientist). *Verbenàceæ.* Shrubs, one of which is offered, suitable for growing under glass.

Leaves opposite, entire or dentate: fls. racemose or cymose; calyx membranaceous and colored; corolla cylindric and curved, the oblique limb with 5 short lobes; stamens 4, didynamous, the anthers exserted: fr. an obovoid drupe, 4-lobed, included in the enlarged calyx. Probably 3 species, African and Asian. **H. sanguínea,** Retz., is a straggling shrub 10–30 ft. high, in the subtropical Himalayan region: lvs. 3 in. long, ovate, acuminate, entire or toothed: corolla 1 in. long, brick-red to orange: drupe ⅓in. or less long, the calyx 1 in. diam. Offered abroad; an evergreen shrub.

L. H. B.

HOLODÍSCUS (Greek *holos,* entire, and *discos;* the disk is entire). Syn., *Schizonòtus, Sericothèca. Rosàceæ.* Ornamental shrubs, cultivated for the showy panicles of creamy white flowers.

Deciduous, more or less pubescent: lvs. alternate, petioled, without stipules, incisely serrate or pinnately lobed: fls. in terminal panicles, perfect; calyx cup-shaped, 5-lobed; petals 5; stamens about 20; ovaries 5, surrounded by an entire disk, developing into 5 distinct, pubescent, 1-seeded achenes. Formerly usually referred to Spiræa, but more nearly related to Exochorda.—About 14 closely related species ranging from Brit. Col. through Mex. to Colombia, and east to Idaho, Colo. and New Mex., have been distinguished; by some botanists they are reduced to 5 or even to only 2 species.

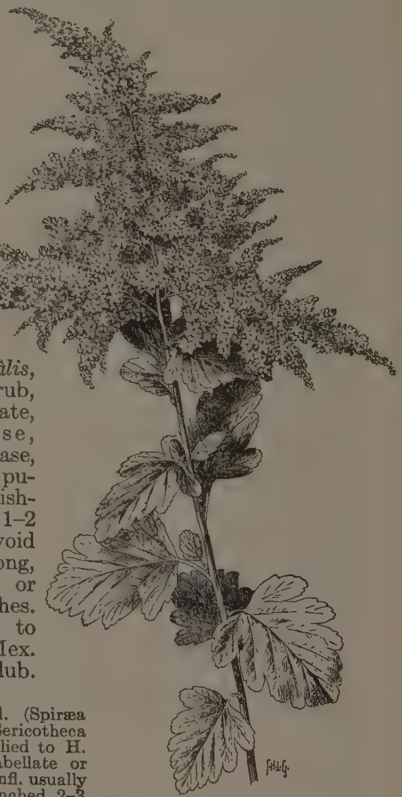
These are ornamental free-flowering shrubs with rather small dull green foliage and small, whitish flowers in ample showy panicles: fruit insignificant. *H. discolor* is a very graceful plant, with its drooping feathery panicles of creamy white flowers, and well adapted for borders of shrubberies or for single specimens on the lawn; it is hardy in favorable localities as far north as Massachusetts. They grow in almost any well-drained soil, and do best in a sunny position. Propagation is by seeds usually sown in boxes in fall and only slightly covered with soil, or by layers; sometimes also increased by greenwood cuttings under glass taken with a heel, but usually only a small percentage of them take root.

díscolor, Maxim. (*Spiræa díscolor,* Pursh. *Sericothèca díscolor,* Rydb.). Fig. 1846. Shrub, to 20 ft., with slender, arching branches: lvs. ovate or oblong, truncate or narrowed at the base, pinnately lobed, lobes dentate or nearly entire, usually glabrous above, pubescent or tomentose beneath, ½–3 in. long: fls. creamy white, small, in ample drooping panicles 3–9 in. long. July. Brit. Col. to Calif., east to Idaho and Mont. Gn. 45, p. 56; 47, p. 188; 49, p. 104; 50, p. 278; 63, p. 195; 74, p. 41; 76, p. 556. G.C. III. 25:21; 32: suppl. Oct. 11. G.W. 8, p. 302. G.F. 4:617. G. 25: 363. B.R. 1365. R.H. 1906, p. 440.—The typical form has the lvs. whitish tomentose below; var. **ariæfòlius,** Aschers. & Graebn. (*Spiræa ariæfòlia,* Sm.), which is the commonly cult. form, has the lvs. grayish green and pubescent below.

dumòsus, Heller (*H. díscolor* var. *dumòsus,* Dipp. *Spiræa dumòsa,* Nutt. *H. austràlis,* Heller). Erect shrub, 8 ft. high: lvs. obovate, acute or obtuse, cuneate at the base, coarsely toothed, pubescent above, whitish-tomentose beneath, 1–2 in. long: panicle ovoid or conic, 2–7 in. long, with ascending or spreading branches. Wyo. and Utah to New Mex. and Mex. Bull. Torrey Bot. Club. 25:338.

H. Boursièri, Rehd. (Spiræa Boursieri, Carr. Sericotheca Boursieri, Rydb.). Allied to H. dumosus, but lvs. flabellate or roundish, smaller and infl. usually simple or sparingly branched, 2–3 in. long. Calif. R.H. 1859, p. 519.

Alfred Rehder.



1846. Holodiscus discolor. (×⅓)

HÒLOTHRIX (from the Greek for *whole* and *hair;* in reference to the st. being covered with hairs). *Orchidàceæ.* A group of 50–60 species of terrestrial orchids from S. Afr. and Madagascar. Lvs. 1 or 2, sessile, ovate or orbicular-reniform, radical: scapes slender, usually hairy and without sheaths; fls. small, in slender, usually secund spikes; sepals connivent, sometimes hairy; petals smaller and longer, entire or variously divided at the apex; lip erect or spreading, adnate to the base of the column; column very short, usually auricled at the sides of the stigma: caps. ovoid or oblong. These plants require the temperature of a warm greenhouse and thrive in a mixture of peat, sphagnum and charcoal. *H. villòsa,* Lindl. Lvs. round, fleshy, hairy, borne close to the surface of the soil: infl. about 9 in. high; fls. about 30, small, yellowish green, slightly fragrant. S. Afr.

HOMALÁNTHUS (Greek *homalos,* like, and *anthos,* flower). *Euphorbiàceæ.* Tropical trees, sometimes cultivated in warmer regions or in greenhouses for the foliage.

Juice milky: lvs. simple, alternate, petioled, entire, glabrous, usually triangular-ovate: fls. apetalous, inconspicuous, in terminal racemes, the pistillate at the base; staminate calyx of 1–2 sepals, stamens 5–50: ovules 1 in each of the 2–3 cells.—Nineteen species distributed from S. E. Asia and Pacific islands to Austral. Related to Sapium and Stillingia. Some species closely resemble species of Sapium in foliage and habit. Sometimes spelled Omalanthus. The cult. and propagation are about the same as for the tree-like euphorbias.

populifòlius, Graham (*Carúmbium populifòlium,* Benth.) Queensland Poplar. Lvs. 2–4 or more in. long and as wide, slender petioled, glaucous, copper-colored when young, rarely subpeltate: racemes slender, 3–4 in. long; sepals of staminate fls. 2; stamens 5–6; stigmas without glands. Austral. B.M. 2780.

H. popúlneus, Pax=H. Leschenaultianus, Juss., of Malay region, sometimes confused with H. populifolius but separated by Pax on the glandular stigmas, may be in cult.; as also the following: *H. fatuòsus,* Vill. Lvs. peltate. Gt. 15:504.—*H. gigantèus,* Zoll. Monosepalous, stamens 10–20.—*H. polyándrus,* Cheesem. Monosepalous, stamens 40–50.

J. B. S. Norton.

HOMALOMÈNA (Greek, variously explained). Also written *Homalonema. Aràceæ.* Tender foliage plants, variegated after the fashion of the well-known dieffenbachias, and the rarer aglaonema and schismatoglottis.

Robust herbs, with a thick rhizome: st. short or none: lvs. ovate- or triangular-cordate, or lanceolate, nerves reaching the margin; petiole mostly long and sheathing: stamens distinct: fr. included within the persistent spathe; ovules anatropous, adnate to the septa.—About 80 species, natives of Trop. Asia and Amer. It is probable that the plants seldom produce fls. or fr. in cult. They are known to the trade as Curmeria, which is now regarded as a section of Homalomena, in which the spathe has a distinct tube and the lvs. are either glabrous or pilose, while in the section Euhomalomena the spathe has an indistinct tube, and the lvs. are always glabrous. For cult., see *Dieffenbachia.* Latest Monograph by Engler in Das Pflanzenreich, hft. 55. 1912. The species described below belong to the subgenus Curmeria, with 4 other species, American; the other species are Asian and of Pacific islands.

A. *Lvs. irregularly blotched.*

Wállisii, Regel (*Curmèria Wállisii,* Mast.). Fig. 1847. Lvs. glabrous throughout, the base obtuse or acute, not notched; petiole 1½ in. long; blade 5 in. long, 2–2½ in. wide. Colombia. G.C. II. 7:108. B.M. 6571 (midrib outlined in light color). I.H. 25:303. R.H. 1878, p. 193.—The blotches are pale yellowish green, becoming greenish gray. None of these pictures shows a white-bordered lf. with golden blotches, as one dealer advertises.

AA. *Lvs. with midrib bordered with white.*

picturàta, Regel (*Curmèria picturàta,* Lind. & André). Lvs. with petiole and midrib pilose; petiole 4 in. long; blade 10–12 in. long, 8 in. wide. Colombia. I.H. 20:121.—Blotched only near the midrib.

Wilhelm Miller.

HOMÈRIA (said to be from *homereo,* alluding to the *meeting* or *joining* of the filaments). *Iridàceæ.* Half-hardy bulbs that can be set out in spring, and bear orange-colored or red flowers in summer.

1847. Homalomena Wallisii.

It is an endemic Cape genus of about 6 species: st. erect from a tunicated corm, producing 1 or more peduncles above: developed lf. usually 1, linear, surpassing the st.: fls. in one or few clusters, successive and fugaceous; perianth funnelform, very deeply cut, the segms. narrow and nearly equal or sometimes the 3 inner ones narrower; stamens united by their filaments into a column: fr. a clavate caps.—Homeria is allied to Sparaxis, requires the same cult., and the bulbs are dormant from Aug. to Nov. It belongs to the Moræa tribe, in which the fls. are stalked and more than 1 to a spathe, and the style-branches placed opposite the stamens. It differs from Iris and Moræa in having style-branches furnished with terminal stigmas not overtopping the anthers. Nearer allies of garden value are Tigridia, Herbertia and Ferraria, from all of which it differs in the 2 petaloid stigmatose crests at the ends of the style-branches.

collìna, Vent. (*Moræa collìna,* Thunb.). Corm globose, ¾–1 in. diam.: lf. linear, rigid, 1½–2 ft. long, overtopping the fls.: st. bearing 1–4 clusters of fls.; perianth-limb 1¼–1½ in. long, typically bright red, as in B.M. 1033; G.C. III. 4:163; 50:476. Var. **aurantìaca,** Baker, has a slenderer habit and yellow-clawed, bright red segms. which are narrower and more acute than the type. B.M. 1612. Var. **ochroleùca,** Baker, has the habit of the type and pale yellow fls. B.M. 1103.

The other species of Homeria are as follows: *H. élegans,* Sweet. Outer segms. tawny, the others or sometimes all 6 yellow, the 3 outer with large green or yellow-brown blotch in middle.—*H. lineàta,* Sweet. Fls. copper-red, with small yellow-dotted blotch at base inside.—*H. maculàta,* Klatt. Fls. yellow, the segms. with a greenish claw and greenish blotch above the base.—*H. mineàta,* Sweet. Fls. tawny or fulvous-red throughout.—*H. pállida,* Baker. Fls. pale yellow.

L. H. B.

HOMOCÉLTIS: *Aphananthe.*

HOMÓGYNE (from *homos,* similar, and *gyne,* female, because of similarity of male and female fls.). *Compósitæ.* A small and little-known group of hardy perennials grown for their attractive white or purple heads of showy flowers.

Leaves more or less white-woolly, radical broad, cordate or sometimes sinuate-dentate, usually smaller than those in Tussilago and Petasites, to which the genus is related: scapes 1–2-headed, usually all of disk-fls.: achenes linear, 5–10-ribbed.—There are only 3 known species, all from the mountains of Cent. Eu., and they prefer moist garden borders in cult. Prop. by division in spring. Perhaps not in cult. in Amer.

alpìna, Cass. (*Tussilàgo alpìna*, Linn.). About 6 in., the st. simple: the lower lvs. cordate-reniform, those of the st. ovate-lanceolate, the radical ones withering before flowering time: fls. in solitary heads, terminating the st., all discoid, light purple. B.M. 84 (as *Tussilago alpina*).—Perhaps better treated as a partial alpine. N. Taylor.

HONCKÉNYA (named after G. A. Honckeny, 1724–1805, author of a flora of Germany). *Tiliàceæ.* Trees or shrubs covered with stellate pubescence: lvs. entire or lobed: fls. large, blue-violet, showy, in terminal racemes; calyx of 4–5 sepals; petals 4–5, glandless at the base: caps. oblong, loculicidally 4–8-valved; seeds numerous, horizontal, compressed.—Two or 3 species in Trop. W. Afr. *H. ficifòlia*, Willd., is offered abroad. Shrub, with purplish branches: lvs. cordate, roundish or oblong, more or less deeply 3–7-lobed: fls. numerous, in terminal racemose cymes; sepals 3–5, oblong; petals roundish, stalked; ovary 4–8-celled, with numerous ovules in each cell: caps. 1–2 in. long; valves covered with numerous, spreading ciliated bristles, each terminated by a small, white deciduous point. Guinea. B.M 7836.—A handsome-fld. shrub. Prop. by cuttings of young wood inserted in sand under glass with bottom heat. Thrives in a mixture of loam and peat. L. H. B.

HONESTY: *Lunaria annua.*

HONEY LOCUST: *Gleditsia triacanthos.* **Honeysuckle:** *Lonicera.* **Honeywort:** *Cerinthe.*

HOÒDIA (from a personal name). *Asclepiadàceæ.* Stout low perennial succulents of Trop. and S. Afr., sometimes seen in choice amateur collections; species about 10 or 12: allied to Huernia and Stapelia: plant usually branched, with spine-tipped tubercles, cactus-like: fls. large and showy, solitary or in small clusters, springing from the grooves toward the top of the st., yellowish, purplish or tawny; limb of corolla entire or slightly 5-lobed, the lobes subulate-pointed; corona double, arising from the staminal column, each part of 5 lobes. Require greenhouse treatment, probably similar to related genera. L. H. B.

HOÒKERA: *Brodiæa.*

HOP: *Humulus.* **Hop Hornbeam:** *Ostrya.* **Hop, Wild:** *Bryonia dioica.*

HOPLOPHỲTUM. Several bromeliads have been described under this name, but the species are now referred to *Æchmea. Halophytum* of one trade catalogue is apparently an error for *Hoplophytum.*

HÓRDEUM (an ancient Latin name for barley). *Gramíneæ.* Annual or perennial grasses with terminal bristly spikes.

Spikelets 1-fld., 3 together at each joint of the rachis, the middle one sessile and perfect, the lateral usually pedicelled, often reduced to awns: the rachis breaking up at maturity into single joints with the cluster of spikelets attached.—Species about 16, temperate regions of both hemispheres. Elymus, some species of which resemble Hordeum, differs in having 2 developed, several-fld. spikelets at each node. Hordeum includes the cult. barley (*H. vulgare*, Linn.) and several troublesome weeds. Among the latter may be mentioned, *H. murinum*, Linn., called Wild Barley, Barley-Grass and Foxtail on the Pacific slope; *H. nodosum*, Linn., common throughout the U. S., and *H. jubatum*, Linn. Squirrel-tail Grass, called Fox-tail in Wyo. and Tickle-Grass in Nev. The first two are annual. The last, a perennial, is also cult. for ornament.

jubàtum, Linn. Squirrel-tail Grass. Wild Barley. Erect, simple, usually smooth and glabrous, 10 in. to 2 ft. high: lvs. 1–5 in. long: only the central spikelet in each cluster perfect; awns of empty glumes 1–2½ in. long, spreading. In dry soil, N. U. S. and Canada. B.B. 1:229. Dept. Agric., Div. Agrost. 17:307.—Sometimes cult. for ornament on account of the feathery heads. A. S. Hitchcock.

HOREHOUND: *Marrubium.*

HORMÌNUM (old Greek name for sage). *Labiàtæ.* One herbaceous perennial, **H. pyrenàicum,** Linn., adapted to borders and rock-gardens: sts. simple and nearly leafless: lvs. mostly radical, ovate, toothed or crenate, the floral lvs. reduced to bracts: fls. medium size, purple-violet, nodding, in secund verticils or whorls; calyx campanulate, 2-lipped, about 13-nerved; corolla-tube exserted, the limb somewhat 2-lipped, the upper lip truncate-emarginate, the lower or anterior 3-parted; stamens 4, didynamous; style 2-lobed: nutlets ovoid. The plant grows 8–12 in. high; Pyrenees to the Tyrol; it makes a tuft of foliage; blooms in midsummer; hardy in England. Vars. *álbum* and *grandiflòrum purpùreum* are offered. Other plants sometimes referred to Horminum are properly salvias. L. H. B.

HORNBEAM: *Carpinus.*

HORNED POPPY: *Glaucium.*

HORSE, in combination with other names of plants, usually signifies something large and coarse, not necessarily eaten by horses.

HORSE BALM: *Collinsonia.* **Horse Bean:** *Vicia Faba.* **Horse-Chestnut:** *Æsculus.* **Horse Mint:** *Monarda.* **Horse-radish Tree:** *Moringa pterygosperma.* **Horse Sugar:** *Symplocos tinctoria.* **Horse-tail:** *Equisetum.* **Horseweed:** *Collinsonia.*

HORSE-RADISH (Fig. 1848), the well-known condiment used so much with roast beef and oysters, is a member of the natural family Cruciferæ, to which belong cabbage, turnip, wallflower, stock, charlock, mustard, and many other vegetables, flowers and weeds. It comes to us from Great Britain, where it is thought to have been naturalized from some more eastern European country. It is often found growing wild in moist locations, such as the margins of streams, in cool woods and damp meadows, and, in some places, notably in the state of New York, is troublesome as a weed.

1848. Good root of horse-radish.

The root is perennial, fleshy, whitish externally, pure white within, conical at the top, cylindrical, and, unlike the tap-roots of parsnips, is abruptly branched below. When bruised, it emits a volatile oil of strong, pungent odor and hot, biting taste. If eaten before this oil evaporates, it "is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally, it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion; but it is also occasionally employed in medicine." (U. S. Dispensatory.) As a table relish, the consumption of horse-radish is increasing, and greater attention is being paid to its cultivation than formerly. Under the old methods, profitable returns were often secured, but under the new, profits are generally highly satisfactory where enemies are not very troublesome. The season of fresh-grated horse-radish runs almost parallel to that of oysters, with which the root is most frequently eaten in this country. Ungrated roots are, however, kept in cold storage for summer use, since roots dug at that season have an unpleasant taste.

Horse-radish will do well upon almost any soil except the lightest sand and the heaviest clay, but a deep loam of medium texture and moderate richness, well supplied with humus and moisture, will produce roots of the best quality and the largest size. In dry soils the roots will be small, woody and deficient in pungency; in wet soils, small, succulent, strong-tasting. Drainage is essential, and so is a fairly open subsoil. Hard subsoil induces excessive branching of the root. Applications of nitrogenous manures should be rather light, commercial fertilizers rich in potash being given the preference. Rolfs recommends a mixture containing 10 per cent potash, 7 per cent phosphoric acid, 4 per cent nitrogen, 600 pounds drilled in to the acre. A heavier application broadcast and deeply plowed under, it is thought, would give better results, since the shaft of the root is less likely to become unduly branched when the food is below instead of above and around it, especially when the sets are placed horizontally. A weeder should be used after the harrow periodically until the plants are an inch or so tall. Thorough preparation of the soil is essential.

Since horse-radish rarely produces seeds, cuttings are made from the roots not less than ¼ inch thick and 4 to 5 inches long (Fig. 1849). To facilitate planting the large end up, the upper end is cut off square and the lower oblique. If set small end up, no growth may result. In horizontal planting this special cutting is unnecessary. Root-crowns are sometimes used, but since these develop a large number of roots too small for profitable grating, they are employed only for increasing stock.

1849. Root-cuttings of horse-radish. (×⅓)

The land having been prepared, shallow furrows are laid off 30 inches apart and 2 to 5 inches deep, according to the method of planting. Sets are planted horizontally, vertically, and at all intervening angles, the large ends being made to point in one direction to facilitate cultivation and digging. The angle is a matter of choice, good returns being secured in each. The usual distance between sets is about 12 inches. Cultivation is given after every rain, or once in ten days, until the leaves shade the ground.

Double-cropping is common in horse-radish growing, early cabbage, turnip beets and other quick-maturing plants being used. The sets are dibbled in two to four weeks after the first crop, vertically, 18 inches asunder, between the rows of cabbage, which are not less than 2 feet apart. One management answers for both crops until the first is removed, when, after one cultivation, the horse-radish usually takes full possession. Deep burying of the sets at the time the first crop is planted is also practised, the object, as in the first case, being to prevent the appearance of the former until the latter is almost mature.

Horse-radish makes its best growth in the cool autumn, steadily improves after September, and, not being injured by frost if undug, is usually left until late before harvesting with plow or spade. Storage in pits is best, since the roots lose less of their crispness, pungency and good appearance than if stored in cellars. In trimming for storage, the lateral roots are saved and buried for next season's planting. Exposure to air, sun and frost robs the roots of their good qualities and injures their vitality.

The insect enemies of this plant are those that attack other members of the cabbage family, the harlequin bug being the most dreaded. Remedies are the same as for other pests of this group of plants. Only two diseases have been reported, and these are seldom troublesome.

In the neighborhood of cities, especially where oysters are cheap, this crop is generally profitable, the usual retail price being 10 cents a pint, freshly grated, but without vinegar. This quantity weighs a scant half-pound. The cost of growing an acre is about as follows:

Cuttings, 10,000, at $2	$20 00
Fertilizer, 1,000 pounds	17 50
Cultivation, six times	6 00
Rent of land	5 00
Plowing, wear of tools, and so on	3 50
Setting roots, at 30 cents a 1,000	3 00
Total	$55 00

A marketable crop varies from 3,000 to 6,000 pounds, which may sometimes be sold as high as 5 cents a pound for first-class roots, and 2½ cents for second grade. Usually, however, prices seldom rise above 4 cents and 2 cents for the two grades. Under good cultivation, the proportion of No. 1 to No. 2 root is about 1 to 1 by weight. Lower prices may rule in well-supplied markets, and higher in poorly furnished, and when sold in small lots to retail graters, even 7 cents may be obtained. See *Radicula*.

M. G. KAINS.

HORTÉNSIA: *Hydrangea.*

HORTICULTURE (*hortus* a garden, originally an inclosure; *colere*, to care for or to cultivate). Horticulture is the growing of flowers, fruits and vegetables, and of plants for ornament and fancy. Incident to the growing of the plants are all the questions of plant-breeding, variation of plants under domestication, the bearings and applications of many biological and physical sciences, and the manufacture of many products. Primarily, horticulture is an art, but it is intimately connected with science at every point. From agriculture it has no definite boundary. It is, in fact, a department of agriculture, as forestry is; for agriculture, in its largest meaning, is the business of raising products from the land. It is customary, however, to limit the word agriculture to the growing of grains, forage, bread-stuffs, textiles, and the like, and to the raising of animals. In this restricted application it is practically coördinate, in a classificatory sense, with forestry and horticulture. The nursery business, as understood in North America, is considered to lie within the field of horticulture.

Etymologically, agriculture is the tending or cultivation of the fields (*ager*, field). Horticulture apparently was concerned with the area within the inclosure. Equivalent to horticulture in etymology is *gardening* (Anglo-Saxon *gyrdan*, to inclose, to which the verb *to gird* is allied). By custom, however, *garden* and *gardening* denote more restricted areas and operations than are implied in the term horticulture. The word *paradise* is connected with the idea of an inclosure and a garden or park. Early gardening books of the cyclopedia type are sometimes known as *paradisæ*. Parkinson's famous "Paradisus," or account of "a garden of all sorts of pleasant flowers," was published in England in 1629.

The only demarcation between horticulture and agriculture is the line of custom. Sweet potatoes are usually considered to be a horticultural crop in North

America, particularly in the northern states, but round or Irish potatoes are usually classed as an agricultural crop. Nor is there a definite division between horticulture and botany. The science of plants is botany; yet some of the most significant problems relating to plants—their response to the needs of man—have been resigned by the botanist to the horticulturist. Horticulture is a composite of botanical and agricultural subjects.

But horticulture is more than all this. It is a means of expressing the art-sense. Plant-forms and plant-colors are as expressive as the canvas work of the painter. In some respects they are more expressive, since they are things themselves, with individuality and life, not the suggestions of things. The painter's work excels in its power to suggest, and in its condensed portrayal of expression. But the essentials of a good landscape painting often can be presented in an artificially-made landscape. This effort to plant what the artist paints is modern. It is strictly not horticulture, although horticulture is contributory to the results, as paint-making is contributory to painting. Landscape-making is fundamentally a fine art. In this work it is treated under *Landscape Gardening*.

Horticulture divides itself into four somewhat coördinate branches, each branch comprising not only the raising of the crops but also such home or plantation manufacture as goes with the handling and the marketing of the materials (Annals Hort. 1891, 125–130):

Pomology, or fruit-growing;
Olericulture, or vegetable-gardening;
Floriculture, or the raising of ornamental plants for their individual uses or for their products;
Landscape horticulture, or the growing of plants for their use in the landscape (or in landscape gardening).

In the world at large, floriculture is the most important as measured by the number of persons interested, and by the number of species of plants that are grown (see *Floriculture*). In North America, pomology is the most important in commercial supremacy. North America is one of the great fruit-growing countries of the world (see *Fruit-Growing*). The growing of vegetables has been the last of these divisions to organize itself in the New World and to reach a commanding position (see *Vegetable-Gardening*). Landscape horticulture and landscape-gardening appeal to a constantly enlarging constituency with the growth of culture and of leisure and the deepening of the home life (see *Landscape Gardening*).

The occupation.

Strictly speaking, there are few horticulturists. The details are too many to allow any one person to cover the entire range. It is only those who look for principles who survey the whole field. Practitioners must confine themselves to rather close bounds. Consider that no less than 25,000 species of plants are in cultivation, each having its own requirements. Consider the great number of species which are actually on sale as registered in this Cyclopedia. The most important species vary immensely, the named and recorded forms often running into the thousands; and each of these forms has particular merits and often particular requirements. Consider that the requirements are likely to be different in any two places, and that the plants are profoundly modified by changes in conditions or in treatment. Consider the insect pests and fungous diseases and the many other kinds of hindrance that confront the cultivator. Consider, also, the vagaries of markets, which are ruled by questions of fancy more than by questions of necessity. There is probably no art in which the separate details are so many as in horticulture.

There is considerable diversity in the definition of the word "gardener." As understood by the gardening fraternity, it is described as follows by Patrick O'Mara: "In this country [North America] the man who grows vegetables for a livelihood is called a gardener, a market-gardener, and, in some sections, a trucker and a truck-farmer. We also have the florist, which embraces the man and woman who keep a flower-store, as well as those to whom the title properly belongs, viz., the persons who are cultivators of flowers. We have also the nurseryman, a calling separate and distinct from these, and yet the three must be combined in one individual to make a qualified gardener, or what is generally known as the 'private' gardener. Occasionally the so-called 'private' gardener is known as a 'manager' or 'superintendent,' but it may well be questioned if he gains honor thereby. When he leaves the place where the title was assumed or thrust upon him, it very frequently is left behind, but he still remains a gardener. It also tends to create an artificial distinction between many who are equals, and many in and out of the ranks believe it should be discouraged. Gardeners who have charge of public parks, cemeteries and botanic gardens, it has always been admitted, may with perfect propriety assume the name of superintendent, but the fact remains that no man who loves his craft need be ashamed to be known professionally by the 'grand old name of gardener.' . . .

"However, as there may be some danger of a man's true position in gardening not being defined in that word, I would suggest that the word professional be used to qualify it. In the eyes of some outside the ranks, it might have weight, and it would certainly be a proper distinction from the amateur gardener, the trucker, the nurseryman and the commercial florist. It would be well also to have all gardeners' societies known as an association of professional gardeners. It might operate to classify properly those who are entitled by education, experience and natural ability to bear the title from those who, lacking all these, are yet bold enough to call themselves gardeners and to become candidates for positions which they are unable to fill with credit to themselves, with justice to their prospective employers or with a proper regard for the responsibilities they are so willing to assume. That class would be bolder than I imagine them to be if they would, under such circumstances, assume the title of professional gardener, and the well-merited ridicule which would inevitably follow the discovery of their false pretenses would be a salutary check upon others. To have a claim upon the title, a man should be able to grow flowers, fruits and vegetables both outdoors and under glass, care for trees and shrubs, lawns and roads, in short attend to every detail connected with his calling. If in addition he knows how to attend to the details of gentlemen's farming, his services should be all the more valuable. He could then assume entire charge of a place where both farming and gardening are done, and we would, if more men were capable of this, be spared the pain of seeing one or both suffer either from incompetence or want of coöperation between the gardener and farmer."

Proceeding to a discussion of the gardener's work, O'Mara continues, in his address "The Professional Gardener's Mission in Horticulture" before the Lenox (Massachusetts) Horticultural Society in 1897, as follows: "It is to that class, then, that we must look for developments of an upward tendency and they will be held responsible for any retrogression in ornamental horticulture, for they are before all others the recognized exponents of the art. It is their mission to improve, and the general opinion is that there is room for improvement, more especially in indoor horticulture. The overwhelming tendency during the past ten to fifteen years has been to make the so-called 'private place' nothing more nor less than a cut-flower establishment and a hospital for the decorative plants which are used in the dwelling-house and for outside decoration in summer; so pronounced has this become that the only difference between the commercial establishment of today and the average private greenhouse is one of size and architecture. The latter instead of being maintained, as it should be, purely to gratify esthetic tastes, is devoted to an utilitarian purpose mainly. The product is counted and reckoned at so many dollars and cents. The most the average owner sees of them is the daily or semi-weekly cut which is sent to the house. This is not as it should be, and while it is not the gardener's fault, and may not be within his power to control, yet by well-timed suggestion and persistence, he should be able to effect a gradual and much-to-be-desired change.

1850. Early picture of an American plant. Monardes (1571).

"The greenhouses should be a place of recreation for the owners, who should be induced to visit them daily, to look forward with pleasure to that visit, and the best way to accomplish this is to induce them to get a good collection of plants. A house of roses, carnations, violets or chrysanthemums has not the attraction of a varied collection, a collection, too, that embraces in their season gloxinias, tuberous begonias, cinerarias, cyclamens, caladiums, ixias, sparaxis, primulas, and other seasonable pot-plants, both flowering and ornamental foliage. It is freely admitted that variety is the soul of gardening and not less so in small than in large places. The individual preferences of the proprietor or gardener should therefore in some measure be rendered subservient to the amount of pleasure which visitors are sure to obtain from a variety of plants. I am well aware that in many places the proprietor's residence is of short duration and very often during the summer months only, so that it is difficult, nay, well nigh impossible, for the gardener to influence him in the right direction; but if all earnestly try, some are sure to succeed, and the example once set, it will soon become general."

Of horticulture there are two general types,—that associated immediately with the home life, and that undertaken primarily for the gaining of a livelihood. The former is amateur horticulture. Those things are grown that appeal to the personal tastes: they are grown for oneself. The latter is commercial horticulture. Those things are grown that the market demands: they are grown for others. In all countries, commercial horticulture is a relatively late development. General agriculture is usually the primary means of earning a living from the soil. For the most part, horticulture comes only with the demand for the luxuries and refinements of life; it does not deal with what we call the staple food-stuffs.

It is not the purpose of this sketch to trace the general history of horticulture. If one desires such outlines, he should consult the Bohn edition of Pliny's "Natural History;" Loudon's "Encyclopædia of Gardening;" G. W. Johnson's "History of English Gardening;" Amherst's "History of Gardening in England;" Sieveking's "Gardens, Ancient and Modern;" Jäger's "Gartenkunst und Gärten, sonst und jetzt;" Hüttig's "Geschichte des Gartenbaues;" the historical chapters of André's "L'Art des Jardins." Mangin's "Histoire des Jardins Anciens et Modernes." For the histories of cultivated plants, see DeCandolle's "Origin of Cultivated Plants;" Hehn & Stallybrass' "Wanderings of Plants and Animals from their first Home;" Pickering's "Chronological History of Plants."

Early American history.

In North America there was little commercial horticulture before the opening of the nineteenth century. There were excellent home gardens more than a century ago, in which many exotic plants were growing; yet, in proportion to the whole population, these gardens were isolated. The status of any modern time is accurately reflected in its writings. It may be well, therefore, to bring in review the leading early horticultural writings of this country. Few studies have been made of our horticultural history. The best is the introductory sketch, by Robert Manning, in the "History of the Massachusetts Horticultural Society," 1880. For its field, Slade's "Evolution of Horticulture in New England," 1895, is interesting. In a still narrower field, Boardman's "Agricultural Bibliography of Maine" is critical and invaluable. The chapter on "American Horticulture," by Alfred Henderson, in Depew's "One Hundred Years of American Commerce," 1895, presents the commercial side of the subject. Another fragment of the history is presented in the writer's "Sketch of the Evolution of our Native Fruits," 1898. Histories from several points of view are presented in the "Florists' Exchange" for March 30, 1895; and the writer has incorporated parts of his own contribution to that history in the sketch that follows. One may find valuable historical material in the reports of societies devoted to horticulture and agriculture; and the files of the early journals must not be overlooked. Local histories are important. All these sources have not yet been carefully explored.

The history of the subject needs to be written from the economic side, as one part in the industrial history of North America, but this has not yet been attempted. The best that may be done here is to trace some of the events from the side of the literature.

The earliest writings on American plants were by physicians and naturalists who desired to exploit the wonders of the newly discovered hemisphere. The earliest separate writing is probably that of Nicolo Monardes on the products of the New World, which was published in Seville in parts, from 1565 to 1571. The completed treatise was translated into Italian, Latin, English and French. An English edition of 1577 was entitled, "Joyfull Newes out of the newe founde worlde, wherein is declared the rare and singular vertues of diverse and sundrie Hearbes, Trees, Oyles, Plantes, and Stones. . . . Also the portrature of the saied hearbes. . . . Englished by J. Frampton." Monardes is now remembered to us in the genus Monarda, one of the mint tribes. He wrote of the medicinal and poisonous plants of the West Indies, and gave pictures, some of them fantastical. His picture of tobacco is not greatly inaccurate, however; and it has the distinction of being probably the first picture extant of the plant, if not of any American plant. This picture is here reproduced (Fig. 1850) exact size, to show the style of illustration of three and one-third centuries ago. Jacques Cornutus is generally supposed to have been the first writer on American plants. His work, "Canadensium Plantarum . . . Historia," appeared in 1635, and it also had pictures.

One of the earliest writers on the general products and conditions of the northern country was John Josselyn, who, in 1672, published a book entitled "New England's Rarities discovered in Birds, Beasts, Fishes, Serpents, and Plants of that Country," and in 1674 a second volume, "An Account of Two Voyages to New England, made during the years 1638, 1663." The "Rarities" gives specific accounts of many plants, together with pictures of a few of them, as for example, the pitcher plant. He mentions the plants which had become naturalized from Europe. There is also a list "Of such Garden Herbs (amongst us) as do thrive there, and of such as do not." This list, perhaps the earliest record of the kind, is here transcribed:

Cabbidge growes there exceeding well.
Lettice.
Sorrel.
Parsley.
Marygold.
French Mallowes.
Chervel.
Burnet.
Winter Savory.
Summer Savory.
Time.
Sage.
Carrats.
Parsnips of a prodigious size.
Red Beetes.
Radishes.
Turnips.
Purslain.
Wheat.
Rye.
Barley, which commonly degenerates into Oats.
Oats.
Pease of all sorts, and the best in the World; I never heard of, nor did see in eight Years time, one Worm eaten Pea.
Garden Beans.
Naked Oats, there called Silpee, an excellent grain used insteed of Oat Meal, they dry it in an Oven, or in a Pan upon the fire, then beat it small in a Morter.
Spear Mint.
Rew, will hardly grow.
Fetherfew prospereth exceedingly.
Southern Wood, is no Plant for this Country. Nor
Rosemary. Nor
Bayes.
White Satten groweth pretty well, so doth
Lavender Cotton. But
Lavender is not for the climate.
Penny Royal.
Smalledge.
Ground Ivy, or Ale Hoof.
Gilly Flowers will continue two Years.
Fennel must be taken up, and kept in a warm Cellar all Winter.
Houseleek prospereth notably.
Holly hocks.
Enula Campana, in two Years time the Roots rot.
Comferie, with white Flowers.
Coriander, and
Dill, and
Annis thrive exceedingly, but Annis Seed, as also the Seed of Fennel, seldom comes to maturity; the Seed of Annis is commonly eaten with a fry.
Clary never lasts but one Summer, the Roots rot with the Frost.
Sparagus thrives exceedingly, so does
Garden Sorrel, and
Sweet Bryer, or Eglantine.
Bloodwort but sorrily, but
Patience, and
English Roses, very pleasantly.
Celandine, by the West Country men called Kenning Wort, grows but slowly.
Muschata, as well as in England.
Dittander, or Pepper Wort, flourisheth notably, and so doth
Tansie.
Musk Mellons are better than our English, and
Cucumbers.
Pompions, there be of several kinds, some proper to the Country, they are dryer then our English Pompions, and better tasted; you may eat them green.

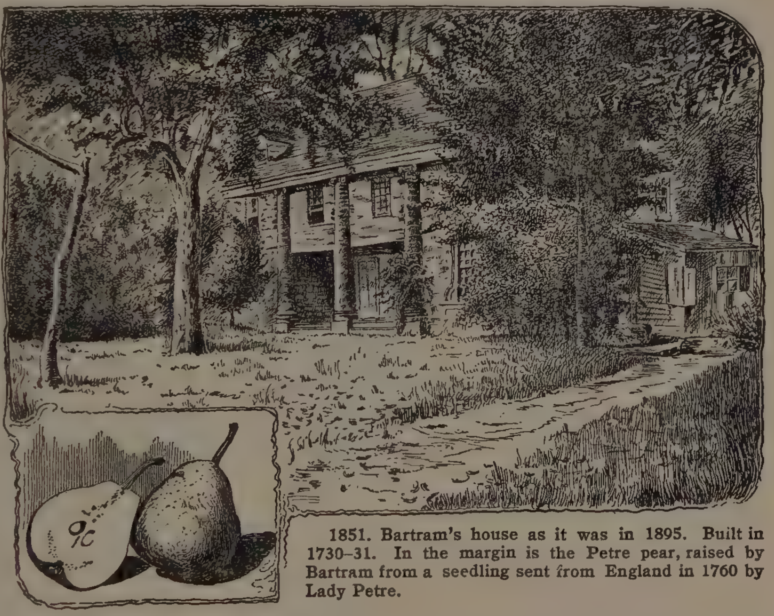
Tuckerman, who edited an edition of Josselyn in 1865, comments as follows on the foregoing lists: "The earliest, almost the only account that we have of the gardens of our fathers, after they had settled themselves in their *New* England, and had tamed its rugged coasts to obedience to English husbandry. What with their garden beans, and Indian beans, and pease ('as good as ever I eat in England,' says Higginson in 1629); their beets, parsnips, turnips, and carrots ('our turnips, parsnips, and carrots are both bigger and sweeter than is ordinary to be found in England,' says the same reverend writer); their cabbages and asparagus,—both thriving, we are told, exceedingly; their radishes and lettuce; their sorrel, parsley, chervil, and marigold, for pot-herbs; and their sage, thyme, savory of both kinds, clary, anise, fennel, coriander, spearmint, and pennyroyal, for sweet herbs,—not to mention the Indian pompions and melons and squanter-squashes, 'and other odde fruits of the country,'—the first-named of which had got to be so well approved among the settlers when Josselyn wrote in 1672, that, what he calls 'the ancient New England standing dish' (we may call it so now!) was made of them; and, finally, their pleasant, familiar flowers, lavender-cotton and hollyhocks and satin ('we call this herbe, in Norfolke, sattin,' says Gerard; 'and, among our women, it is called honestie') and gillyflowers, which meant pinks as well, and dear English roses, and eglantine,—yes, possibly, hedges of eglantine,—surely the gardens of New England fifty years after the settlement of the country, were as well stocked as they were a hundred and fifty years after. Nor were the first planters long behindhand in fruit. Even at his first visit, in 1639, our author was treated with 'half a score of very fair pippins,' from the Governor's Island in Boston Harbor; though there was then, he says, 'not one apple tree nor pear planted yet in no part of the country but upon that island.' But he has a much better account to give in 1671: 'The quinces, cherries, damsons, set the dames a work. Marmalad and preserved damsons is to be met with in every house. Our fruit trees prosper abundantly,—apple trees, pear trees, quince trees, cherry trees, plum trees, barberry trees. I have observed, with admiration, that the kernels sown, or the succors planted, produce as fair and good fruit, without grafting, as the tree from whence they were taken. The countrey is replenished with fair and large orchards. It was affirmed by one Mr. Woolcut (a magistrate in Connecticut Colony), at the Captain's messe (of which I was), aboard the ship I came home in, that he made five hundred hogsheads of syder out of his own orchard in one year.'—*Voyages*, pp. 189, 190. Our barberry-bushes, now so familiar inhabitants of the hedge-rows of eastern New England, should seem from this to have come, with the eglantines, from the gardens of the first settlers. Barberries 'are planted in most of our English gardens,' says Gerard."

The foregoing lists and comments show that the colonists early brought their familiar home plants to the new country; and there are many collateral evidences of the same character. There was long and arduous experimenting with plants and methods. Several things which were tried on a large scale failed so completely, either from uncongenial conditions or for economic reasons, that they are now unknown to us as commercial crops; amongst these are indigo, silk and the wine grape. The histories of these things can be traced only as a refrain in contemporary writing. Indian corn, tobacco and cotton early became the great staple crops.

The Indians cultivated corn, beans, pumpkins and other plants when America was discovered. They soon adopted some of the fruits which were introduced by the colonists. William Penn and others found peaches among the Indians. Orchards of peaches and apples were found in western New York by Sullivan's raid against the Six Nations in revolutionary times. Josselyn, Roger Williams, Wood and others speak of the corn and squashes of the Indians. The word squash is adopted from the Indian name, *squontersquash*, *askutasquash*, or *isqoutersquash*. C. C. Jones, in his "History of Georgia," in describing the explorations of De Soto, says that before reaching the Indian town of Canasagua (whose location was in Gordon County, Georgia), DeSoto "was met by twenty men from the village, each bearing a basket of mulberries. This fruit was here abundant and well flavored. Plum and walnut trees were growing luxuriantly throughout the country, attaining a size and beauty, without planting or pruning, which could not be surpassed in the irrigated and well-cultivated gardens of Spain." For critical notes on the plants cultivated by the American aborigines, see Gray and Trumbull, "American Journal of Science," Vol. XXV (April, May), Vol. XXVI (August). For an account of plant products used by the Indians, see G. K. Holmes, "Cyclopedia of American Agriculture," Vol. IV, p. 24.

"Fruit-growing among the Indians of Georgia and Alabama in the early history of these states," writes Berckmans, "is demonstrated by the large quantity of peaches which the Indian traders of the early colonial period found growing in the Creek, Cherokee and Choctaw villages. It is on record that Indians often made long trips to other tribes for exchanging various articles of their making, and thus the seed from those peach trees was undoubtedly procured from the Florida Indians, who, in turn, procured these from the trees planted by the Spanish explorers. The peculiar type of 'Indian peaches,' found throughout the South and recognized by the downy and striped fruit and purple bark on the young growth, was introduced from Spain and gradually disseminated by the Indians. Apple-growing was quite extensively carried on by the Cherokee Indians in the mountain regions of Georgia, Alabama and North Carolina. The trees being all seedlings, as grafting was likely unknown to the Red Man, vestiges of old apple trees originally planted by these denizens of the South are still occasionally found in upper Georgia. Sixty years ago a large collection of apples was introduced into cultivation, and today many of the best southern winter apples owe their origin to the Indians, who procured the first seeds from traders."

One of the earliest glimpses of plant-growing in the New World is an account in the "Philosophical Transactions of the Royal Society," early in the eighteenth century, by Chief Justice Paul Dudley, of Roxbury, near Boston. In the "Abridgement of the Transactions" are the following notes, amongst others, under the date 1724: "The plants of England, as well as those of the fields and orchards as of the garden, that have been brought over into New England, suit very well with the soil, and grow to perfection. The apples are as good as those of England, and look fairer, as well as the pears; but they have not all of the sorts. The peaches rather excel those of England, and there is no trouble or expence of walls for them; for the peach trees are all standards, and Mr. Dudley has had, in his own garden, 700 or 800 fine peaches of the rare-ripes, growing at a time on one tree. . . . The peach trees are large and fruitful, and commonly bear in three years from the stone. . . . The common cherries are not so good as the Kentish cherries of England; and they have no dukes, or heart-cherries, unless in two or three gardens." It was reported that people of "late years have run much upon orchards." The product of these orchards was chiefly cider. "Some of their apple trees will make six, some have made seven barrels of cider; but this is not common; and the apples will yield from seven to nine bushels for a barrel of cider: a good apple tree will measure from 6 to 10 feet in girt." Dudley mentions a bloomless apple, and "the tree was no graft." In common with other new countries, New England astonished persons with the luxuriant growth of the plants. "An onion, set out for seed, will rise to 4 feet 9 inches in height. A parsnip will reach to 8 feet; red orrice [orach will mount 9 feet; white orrice 8. In the pastures he measured seed mullen 9 feet 2 inches in height, and one of the common thistles above 8 feet." Record is made of a pumpkin vine which grew unattended in a pasture. It made a single stem which "ran along over several fences, and spread over a large piece of ground far and wide." "From this single vine were gathered 260 pumpkins; one with another as large as a half peck; enough in the whole, to fill a large tumbrel, besides a considerable number of small and unripe pumpkins." Indian corn was "the most prolific grain." The observations and experiences of John Lawson in North Carolina should not be overlooked. He was in the country 1700 to 1708, and wrote a history of the state, describing its natural productions. He found considerable success there in grape-growing.



1851. Bartram's house as it was in 1895. Built in 1730–31. In the margin is the Petre pear, raised by Bartram from a seedling sent from England in 1760 by Lady Petre.

The colonial ornamental gardens were probably unlike our own in the relative poverty of plants, absence of landscape arrangement, rarity of greenhouses, and lack of smooth-shaven lawns (for the lawnmower was not invented till last century). These gardens were of two general types: the unconventional personal garden, without form but not void, in which things grew in delightful democracy; the conventional, box-bordered, geometrical garden, in which things grew in most respectful aristocracy. There were many interesting and elaborate private gardens in the colonial days. One of the earliest and best was that of Governor Peter Stuyvesant, of New Amsterdam (New York, near Third Avenue), known as the "Bouwerie," where forty or fifty negro slaves, and also white servants, were kept at work. "The road to the city has been put in good condition, and shade trees were planted on each side where it crossed the Governor's property." The Bowery of these degenerate days has lost the Eden-like features that distinguished its illustrious progenitor.

Excellent gardens were attached to the residences of wealthy persons by the middle of the eighteenth century, and probably earlier, and they were said to have been encouraged by the example and precept of Washington. There are records of many meritorious collections of plants a century and more ago. William Hamilton's collection at Philadelphia was one of the best, and it contained a large collection of exotics. It flourished toward the close of the eighteenth century, and was broken up in 1828. William Jackson began "a highly interesting collection of plants at his residence in Londongrove," Pennsylvania, in 1777. About 1800 Joshua and Samuel Pierce, East Marlborough, Pennsylvania," began to adorn their premises by tasteful culture and planting," and by the establishment of an arboretum of evergreens. The most famous botanic garden which North America has had was John Bartram's, established at Philadelphia in 1728 (p. 530). It contained a great collection of native plants, and some of the trees are now amongst the most valued landmarks of the city. Bartram was a skilful farmer and gardener, and his sons, John and William, inherited his tastes and continued the garden. The elder Bartram was probably the first American to perform successful experiments in hybridization. Bartram's house (Fig. 1851), built by himself, is still one of the sights of the environs of Philadelphia, and the site of the garden, with many of the old trees standing, is now happily a public park. Bartram's cousin, Humphry Marshall, established a botanic garden at West Bradford, in Chester County, Pennsylvania, in 1773 (p. 348). John Bartram's name is preserved in the moss Bartramia, and Marshall's in the genus Marshallia, applied to small Compositæ of the eastern states. The Elgin botanic garden, near New York, was established in 1801 by David Hosack, a man of great learning and of the keenest sympathies with rural occupations. He is now remembered in the interesting genus Hosackia, one of the Leguminosæ. A botanic garden was established at Charleston, South Carolina, about 1804, and one in Maryland about the same time. The Botanic Garden at Cambridge, Mass., was begun in 1805, an institution which, together with the Professorship of Natural History at Cambridge, was founded largely through the efforts of the Massachusetts Society for Promoting Agriculture. The society subscribed $500 for the purpose, and raised more by subscription.

Development of horticulture in Canada in particular.

(W. T. Macoun.)

Horticulture in Canada is about 300 years old. Its development began with the French who settled in Acadia (now the province of Nova Scotia), and along the banks of the St. Lawrence River, and planted seeds and trees brought with them from France. Owing to the small population and the difficulty in transportation, it was not until about sixty years ago that commercial horticulture may be said to have begun (say about 1850), but with the rapid increase of population and transportation facilities the development in recent years has been rapid. The growth of the fruit industry in the province of Ontario may be given as an example of how rapidly horticulture is developing in Canada. In 1859 the Ontario Fruit-Growers' Association was formed. In 1881 the first coöperative shipments of fruit were made, but coöperation was slow in developing for some years after. Spraying with paris green for the control of codlin-moth was practised in 1889 and shortly afterward spraying with bordeaux mixture for the control of apple-scab was begun. In 1895 the Department of Agriculture began to give demonstrations in spraying. Now spraying is very general throughout Canada. In 1894, fruit experiment stations, mainly for testing varieties of fruits, were established in different parts of Ontario by the provincial government. By 1904, the coöperative movement was developing rapidly, by 1908 there were thirty-five coöperative organizations in the province, and in 1914 there were fifty-seven. In 1904, the first provincial fruit and flower show was held in the city of Toronto and there has been one annually ever since, its importance increasing every year. The agricultural college at Guelph, through its horticultural courses, has been of great assistance in the development of this industry. The district representatives who carry demonstration work and diffuse information throughout the counties have been of great service in the different provinces. In other provinces, especially in the provinces of Nova Scotia and British Columbia, there has also been great development in fruit-culture in recent years.

The Dominion government has done much to aid horticulture in Canada. The Experimental Farms were established in 1887, on an Act passed in 1886, and now there are eighteen scattered from the Atlantic to the Pacific (page 1195). The Fruit Marks' Act (now the Inspection and Sales Act), passed in 1901, has materially helped the fruit industry in establishing definite grades of apples and requiring more careful packing than in former years. Other Acts passed by the Dominion government in recent years have been a great aid. In recent years, fruit crop-reports have been published monthly, part of the year, which have been of great assistance to the fruit-growers.

The canning of fruit is developing rapidly in Canada and the outlook for still more extensive growth in this branch of the industry is very bright.

The census of Canada for 1911 gives the total number of fruit trees in Canada as 20,812,556; the area occupied by fruit trees as 376,322 acres and the estimated capital value of fruit trees as $127,000,000.

As Canadians have become better off, there has been a growing demand for flowers and vegetables out of season and there has been a fairly rapid increase in the area under glass. It is estimated that there are now over 6,000,000 square feet devoted to floriculture, with an estimated capital invested of $1,500,000, and an annual output of $1,800,000; but this will soon be much larger.

The growing of vegetables began with the first settlement of Canada, and as the villages, towns and cities multiplied, the vegetable-growers supplied their needs. Now there are large areas devoted to the commercial culture of vegetables. In the province of Ontario many vegetables are canned and large quantities of corn and tomatoes particularly are grown for this purpose. In recent years the vegetable-growers have organized and in Ontario there is a provincial association.

For further information, see *British North America*, Vol. I, pp. 559–76.

Early horticulture in California in particular.

(Charles Howard Shinn.)

California horticulture is in the main patterned after the south-European types, and to this extent it originated from Spanish-Mexican sources. The horticulture of California's high mountain valleys approximates more closely to that of colder regions, while the horticulture of the Pacific slope, north of California, becomes more and more different from the south-European types, but still has many characteristics of its own separating it sharply from that of the Atlantic slope. The first horticultural experiments in California were at the Missions of the Peninsula (Bajo or Lower California), where twenty-two Missions were founded between 1697 and 1797 (Fig. 1852). Here the Mission Fathers introduced the date palm; also oranges, lemons, limes, pineapples, bananas, olives, figs, pomegranates, peaches, quinces, plums, apples, pears and grapes. They shipped to Monterey and the northern missions large quantities of dried figs, grapes, dates, and peaches. The Upper California missions received seeds, cions, and so on, from those of Lower California, as well as from Mexico. The first of these missions was established in 1769 at San Diego by the Franciscans, under the leadership of Father Junipero Serra, whose name visitors to the California State Building at the World's Fair will recall in connection with the great date palm from the Mission Valley of San Diego. This palm was raised from seed which Junipero Serra planted about 1770. Twenty-one missions were founded by the Franciscans, the last one in 1823, and at all but one or two of them there were important collections of the fruits of southern Europe—olives, figs, oranges, lemons, pomegranates, wine grapes, and also apples, pears and peaches. Early in this century the Mission of San Gabriel had over 2,000 fruit trees, and others had more than a thousand. Fig. 1852 shows the yard of San Juan Capistrano Mission, as it existed in 1889. There are also some traces in California of the fruits of the few early Russian settlements. With the American occupation and the immigration from the east, came the eastern American types of fruits, and the state is now the seat of a wonderfully varied fruit-culture, although the small-fruits have not yet attained that prominence which they enjoy in older countries.

1852. One of the early California missions, where were the early promoters of horticulture on the western coast.—San Juan Capistrano.

The first official horticultural reports from California appeared in the second part of the United States Patent Office Report for 1851. In this report, A. Williams, of San Francisco, presented statistics from the Horner Ranch, near the Mission San Jose, Alameda County, where 800 acres were planted in vegetables and the crop of 1851 sold for upwards of $200,000. The crop of potatoes, onions, beets, turnips and tomatoes was 134,200 bushels. The same report noted an onion weighing twenty-one pounds, and at the Fair of 1853 the committee on vegetables reported a "white flat turnip" weighing thirty-three pounds, a squash that weighed one hundred and twenty-one pounds, and a tomato weighing five and one-half pounds. Thus early California began to boast of the mammoth productions of her soil. The first official report printed in California appeared in a document issued by the secretary of state for 1852. The capital then employed in "fruits and orchards" was given at $366,910. The market-garden interests were surprisingly large; among single items were "460,000 pumpkins, worth $46,000;" upward of 5,000,000 pounds of onions, "worth $186,000;" 30,000 bushels of beans, "worth $72,000." Santa Barbara County reported "1,370 barrels of olives, worth $27,500." Horticultural statistics are continued in the reports of the state surveyor general. In December, 1853, the State Agricultural Society of California was organized, after a successful exhibition in San Francisco, where almonds, figs, olives, walnuts, and many other fruits, as well as vegetables and flowers, were shown.

Fairs were held in 1854 and 1855, but were not officially reported. The state began to publish the proceedings of the agricultural society in 1858, when its membership was 856, and annual reports have continued till the present time. The California Horticultural Society was organized April 5, 1881; in 1883, the State Board of Horticulture was established. Reports of these bodies and of the state fruit-growers' conventions have appeared annually or biennially since 1882. The State Viticultural Commission was organized in 1881, and its reports continued until 1894. Upward of one hundred octavo volumes represent the official output of California since 1858 in lines of horticulture, including, of course, the California Experiment Station reports.

Among the special California horticultural literature that appeared prior to 1900, are the following: "California Fruits," E. J. Wickson, first edition, 1889; second edition, 1891; third edition, 1900. So many changes and additions have occurred in this book that all three editions will be found very useful in libraries. "California Vegetables," E. J. Wickson, 1897. "Gardening in California," Wm. S. Lyon, Los Angeles, 1897. This is a small volume of 156 pages. "Olive Growing," Pohndorff, San Francisco, 1884. "Olive Culture," A. Flamant, San Francisco, 1887. "The Olive," Arthur T. Marvin, San Francisco, 1888. "The Raisin Industry," Gustav Eisen, San Francisco, 1890. "The Wine Press and Cellar," E. H. Rixford, San Francisco, 1883. "Grape Culture, a Handbook for California," T. Hart Hyatt, San Francisco, 1876. "Orange Culture in California," Thomas A. Garey, San Francisco, 1882. Contains appendix on grape-culture, by L. J. Rose. "Orange Culture," W. A. Spalding, Los Angeles. "The California Farmer," established in January, 1854, and maintaining a spasmodic existence for a number of years, printed the first pomological and horticultural reports of committees, and the like. "The Pacific Rural Press" was established in 1871, in San Francisco, and still continues. "The Rural Californian," of Los Angeles, still in existence, was established in 1877. "The California Fruit-Grower," began in 1888, and survives as the "California Fruit News." "The California Cultivator," of Los Angeles, established in 1884, is still published. "The Pacific Tree and Vine," of San José, established in 1884, is no longer published.

Sometimes we are inclined to think that the literature of the garden began on the Pacific coast in the age of steam presses, telegraphs and transcontinental railroads. It is not so; and we should go farther back than the excellent writings listed above. The "first fine rapture" of discovery and conquest gave birth to a splendid enthusiasm for the flowers and plants of the vast unfenced wilderness stretching from Texas to Oregon, and one finds its expression in hundreds of books of travel, in ponderous government reports, in forgotten periodicals and, to some extent in the whole outdoor literature of Europe and America during the exciting period of the gold rush to California.

We once had many and very quaint publications in California, all dead and forgotten now, but still worth studying in the libraries. There was the old "Alta California," the "California Farmer," the "Golden Era," the "Hesperian," the "Pioneer," "Hutching's Pioneer Magazine." They contained stilted essays, sketches and stories, often modeled after forgotten literary patterns of New York and Paris. But their descriptive writings first broke away from these hampering traditions, and shaped themselves anew under California skies. Ewer, "Shirley," Hutchings, Wadsworth, Dr. Kellogg and a few others wrote of things as they saw them, and in some degree caught the outdoor charm of the new land as it was slowly yielding to spade and plow.

But there had been a still earlier discovery of the floral wealth of the Pacific coast. Long before Marshall's mill-race gleamed with that fateful flake of gold, the botanists and collectors had sent forth a cry of delight that stirred the pulses of Europe. The letters, journals and various contributions to descriptive and scientific literature, made by the long line of botanical explorers who visited this coast between 1790 and 1848, should be a part of this record. Among these enthusiasts were men like Langsdorf, who accompanied that unfortunate Count Rozanoff of Bret Harte's beautiful poem, and Chamiso and Eschscholtz. The last two, friends close-linked in literature and science, gave our orange-hued poppy its consonantal name.

The starting-point, however, for most students of the floral resources of California is with the extensive work done by David Douglas (1825–1833), under the auspices of the Royal Horticultural Society of England. In the proceedings of that Society one finds some of his reports and the first colored plates ever issued of many California bulbs. The second volume of Hooker's "Companion to the Botanical Magazine" contains his fascinating letters. After Douglas came Coulter, Nuttall, Hartweg and others, and then the famous groups of botanical explorers whose work appears in government publications, such as the Pacific Railroad and Boundary Survey reports. Men like Gray, Thurber, Newberry, Torrey, Engelmann and Parry wrote much that was a real gift to the literature of the period, and in many cases they had for illustrations those wonderful pen-and-ink drawings made by T. C. Hilgard.

But, if one says that government reports are only the "raw material" of outdoor literature, then turn to Edinburgh, in 1859–1860, when Dr. Andrew Murray published his two parts of "Notes on California Trees," compiled chiefly from the letters of his brother Wm. Murray of San Francisco, and illustrated with superb lithographs of the sequoias. It was in 1860, also, that Thomas Starr King wrote a very charming account of a trip "Around the Bay in the season of flowers," when, as he expressed it, there were "flowers by the acre, flowers by the square mile."

Here we begin to reach the modern way of looking at things. All through the pages of the publications of the State Agricultural Society between 1856 and 1860, the early reports of the State Surveyor General, the "State Register" for 1857–60, the rambling surveys of Dr. Trask, the first state geologist, we have had somewhat obscure glimpses of a land overflowing with growth and blossom. We have seen the pioneer surveyors, Day and Goddard and the rest, camping in the lily-beds of the high Sierra valleys; we have watched pioneer committees going around, away back in the early fifties, to tell us, all too briefly, of the glories of Shell Mound Nurseries, the New England Gardens, Hook Farm, Fontainbleau, and other places now, alas! in ruins. We hear of Fox, Sontag, Prevost, Macondray, Lewelling. These reports, though hardly the literature of the garden, are very excellent materials out of which, some of these days, the right man or woman will reconstruct the whole story, and give us our long-needed book on "California Floriculture."

The "modern note" in our garden literature, aside from the glowing essays of Thomas King, was also manifest in some of the California writings of Dr. Bushnell. Then it found fuller expression in the pages of the "Overland Monthly," where Muir, the LeContes, Avery, Williams, Miss Coolbirth, Bartlett and Sill, and a little later, some of Professor Sill's pupils, made for a few years a very striking presentation of the life, color, strength and beauty of outdoor California. Much of the best writing of this period between 1868 and 1875 appeared in the "Bulletin," "Argonaut," "California Horticulturist" and "Rural Press." It is notable historically, because it covers the whole field. Nothing that is now being written about gardens and flowers is in its way any better than some of the work, signed and unsigned, that appeared in the "Overland Monthly," and in other San Francisco publications in the days before the gaudy splendors of the sensational Sunday newspapers.

In the way of distinctive floral publications we have had two of importance: The first, the "California Horticulturist," founded by F. A. Miller in 1870, lasted ten years. One of its most interesting editors was the late E. J. Hooper, one of the owners of the "Western Farmer and Gardener," established by him in Cincinnati in 1839 and 1840. Plates of fruit and flowers, colored by his hands, appear in early volumes of the "California Horticulturist." The still earlier and yet more rare "California Culturist" of W. Wadsworth, which began with June, 1858, and continued two years, contained a good deal of floriculture.

In May, 1888, at Santa Barbara, appeared the "California Florist," an attractive publication which soon moved to San Francisco and there continued until May, 1889. Since that date, outside of trade publications, catalogues, and occasional pamphlets, the floral interests of California have been, most of the time, without a separate publication, but they have never lacked for space, whenever required, in other periodicals.

There have been few books in the past twenty-five years which deal other than casually with the floral field, but there have been many and excellent botanies, chiefly local, and more are being written, so that before long the whole field will be covered, and brought down to date with revised nomenclature and description. In these brief limits, one cannot expect even a partial bibliography, of either the popular or the technical writings of California botany or floriculture. Beginning with the writings of Kellogg, Bolander, Lemmon, Miller, Ludeman, Sievers, Wickson, Rixford, and others, the list ends with the many bright people who write for the press on these topics at the present time. The standard early work on California plants is Brewer and Watson's "Botany of California," comprising two volumes of the State Geological Survey, published 1876–1880. Books like Bartlett's "Breeze from the Woods," and Mary Elizabeth Parson's "Wild Flowers of California," and such pamphlets as Lyon's "Gardening in California" and Krause's "Sweet Pea Review" have a real historial value. Prominent among our notable books are Kellogg's "Forest Trees," his "West American Oaks," and Green's "Flora Franciscana." Later is Jepson's "Flora of Western Middle California," 1901, with a second edition in 1911. He is now preparing a "Flora of California," several parts of which have been issued.

Native species of fruits and vegetables.

Before passing to a discussion of the departments or subdivisions of the subject, we may pause to consider the general contribution that the North American continent has made to the species of food-plants of a horticultural character. The remarks are taken from Hedrick (presidential address, Society of Horticultural Science, 1913), who has presented an excellent running summary: "The continent is a natural orchard. More than 200 species of tree, bush, vine and small fruits were commonly used by the aborigines for food, not counting nuts, those occasionally used, and numerous rarities. In its plums, grapes, raspberries, blackberries, dewberries, cranberries and gooseberries North America has already given the world a great variety of new fruits. There are now under cultivation 11 American species of plums, of which there are 433 pure-bred and 155 hybrid varieties; 15 species of American grapes with 404 pure and 790 hybrid varieties; 4 species of raspberries with 280 varieties; 6 species of blackberries with 86 varieties; 5 species of dewberries with 23 varieties; 2 species of cranberries with 60 varieties and 2 gooseberries with 35 varieties. Here are 45 species of American fruits with 2,226 varieties, domesticated within approximately a half-century.

"Few plants grow under such varied conditions as our wild grapes. Not all have been brought under subjugation, though nearly all have horticultural possibilities. It is certain that some grape can be grown in every agricultural region of the United States. The blueberry and huckleberry, finest of fruits, and now the most valuable American wild fruits, the crops bringing several millions of dollars annually, are not yet domesticated. Coville has demonstrated that the blueberry can be cultivated. [See *Blueberry*, Vol. I, p. 515.] Some time we should have numerous varieties of the several blueberries and huckleberries to enrich pine plains, mountain tracts, swamps and waste lands that otherwise are all but worthless. A score or more native species of gooseberries and currants can be domesticated and should some time extend the culture of these fruits from the Gulf of Mexico to the Arctic Circle. There are many forms of juneberries widely distributed in the United States and Canada, from which several varieties are now cultivated. The elderberry is represented by a dozen or more cultivated varieties, one of which, brought to my attention the past season, produced a half hundred enormous clusters, a single cluster being made up of 2,208 berries, each ⅓ inch in diameter.

"These are but a few of the fruits—others which can only be named are: the anonas and their kin from Florida; the native crab-apples and thorn-apples; the wine-berry, the buffalo-berry and several wild cherries; the cloud-berry, prized in Labrador; the crow-berry of cold and Arctic America; the high-bush cranberry; native mulberries; opuntias and other cacti for the deserts; the paw-paw, the persimmon, and the well-known and much-used salal and salmon berries of the West and North.

"The pecan, the chestnut and the hickory-nut are the only native nuts domesticated, but some time forest and waste places can be planted not only to the nuts named, but to improved varieties of acorns, beech-nuts, butternuts, filberts, hazels, chinquapins and nut-pines, to utilize waste lands, to diversify diet and to furnish articles of food that can be shipped long distances and be kept from year to year. The fad of today which substitutes nuts for meat may become a necessity tomorrow. Meanwhile it is interesting to note that the pecan has become within a few decades so important a crop that optimistic growers predict in another half-century that pecan groves will be second only to the cotton-fields in the South. A recent bulletin from the United States Department of Agriculture describes sixty-seven varieties, of which more than 1,500,000 trees have been planted."

"There are a number of native vegetables worth cultivating. The native beans and teparies in the semi-arid and subtropical Southwest to which Freeman, of the Arizona station, has called attention, grown perhaps for thousands of years by the aborigines, seem likely to prove timely crops for the dry-farmers of the Southwest. Professor Freeman has isolated seventy distinct types of these beans and teparies, suggesting that many horticultural sorts may be developed from his foundation stock. The ground-nut, *Apios tuberosa*, furnished food for the French at Port Royal in 1613, and the Pilgrims at Plymouth in 1620, and as a crop for forests might again be used. There are a score or more species of Physalis, or ground-cherries, native to North America, several of which are promising vegetables and have been more or less used by pioneers. *Solanum nigrum*, the nightshade, a cosmopolite of America and Europe, recently much advertised under several misleading names, and its congener, *Solanum triflorum*, both really wild tomatoes, are worthy of cultivation and in fact are readily yielding to improvement. *Amaranthus retroflexus*, one of the common pig-weeds of gardens, according to Watson, is cultivated for its seeds by the Arizona Indians. In China and Japan the corms or tubers of a species of Sagittaria are commonly sold for food. There are several American species, one of which at least was used wherever found by the Indians, and under the name arrowhead, swan potato and swamp potato has given welcome sustenance to pioneers. Our native lotus, a species of Nelumbo, was much prized by the aborigines, seeds, roots and stalks being eaten. Sagittaria and Nelumbo furnish starting-points for valuable food-plants for countless numbers of acres of water-covered marshes when the need to utilize these now waste-places becomes pressing."

Early general writings.

The progress of horticulture may be traced in the books devoted to the subject. The earliest writings did not separate horticulture from agriculture.

It is difficult to determine the first North American book on agriculture. In 1710 "The Husbandman's Guide" was printed in Boston "by John Allen, for Eleazar Phillips." It is a small 12mo of 107 pages, in four parts. The first part contains "Many Excellent Rules for Setting and Planting of Orchards, Gardens and Woods, the times to Sow Corn, and all other sorts of Seeds." A second edition was "printed for & sold by Elea. Phillips Book-seller, in Boston, 1712." It is usual to begin the history of indigenous American book literature on agriculture with Jared Eliot, but the beginnings should have a special search. The preface to Eliot seems to indicate that he knew no writings applicable to North America. The "Essays upon Field-Husbandry," by Rev. Jared Eliot, of Killingworth, Connecticut, grandson of the famous apostle Eliot, were begun in 1748 and completed in 1759. (See "Cyclopedia of American Agriculture," Vol. IV, pp. 568, 569.) "There are sundry books on husbandry wrote in England," said Eliot, in his preface. "Having read all on that subject I could obtain; yet such is the difference of climate and Method of Management between them and us, arising from Causes that must make them always differ, so that those Books are not very Useful to us. Besides this, the Terms of Art made use of are so unknown to us, that a great deal they Write is quite unintelligible to the generality of New England Readers."

Just at the close of the Revolution, J. Hector St. John's "Letters from an American Farmer" appeared, although "the troubles that convulsed the American colonies had not broken out when . . . some of the . . . letters were written." For a period of twenty-five years following the close of the war the condition of our agriculture, and of all American institutions, was minutely unfolded to the world through the writings of many travelers, English and French, who made inquisitive journeys into the new country. Strickland, an English traveler, wrote in 1801 that "land in America affords little pleasure or profit, and appears in a progress of continually affording less. . . . Land in New York, formerly producing twenty bushels to the acre, now produces only ten. . . . Little profit can be found in the present mode of agriculture of this country, and I apprehend it to be a fact that it affords a bare subsistence. . . . Decline has pervaded all the states." There is abundant evidence, including a painstaking inquiry made by Washington, to show that agriculture was at a low state at the close of the century. It was in striking contrast to its status a hundred years later, notwithstanding the pessimistic writings of the later time.

There was early development of the garden desire in the South as well as in the North. In South Carolina appeared the earliest American horticultural book of which we have any record. This book is no longer extant, and it is known to this generation chiefly or wholly from the following page in Ramsay's "History of South Carolina," 1809: "The planters of Carolina have derived so great profits from the cultivation of rice, indigo [see *Indigo*] and cotton that they have always too much neglected the culture of gardens. The high price of their staple commodities in every period has tempted them to sacrifice convenience to crops of a marketable quality. There are numbers whose neglected gardens neither afford flowers to regale the senses, nor the vegetables necessary to the comfort of their families, though they annually receive considerable sums in money for their crops sent to market. To this there have been some illustrious exceptions of persons who cultivated gardens on a large scale, both for use and pleasure. The first that can be recollected is Mrs. Lamboll, who, before the middle of the eighteenth century, improved the southwest extremity of King Street [Charleston], in a garden which was richly stored with flowers and other curiosities of nature, in addition to all the common vegetables for family use. She was followed by Mrs. Logan and Mrs. Hopton, who cultivated extensive gardens in Meeting, George and King Streets, on lands now covered with houses. The former reduced the knowledge she had acquired by long experience and observation to a regular system, which was published after her death, with the title of 'The Gardener's Kalendar;' and to this day regulates the practice of gardens in and near Charlestown." Ramsay records that Mrs. Martha Logan was the daughter of Robert Daniel, one of the last proprietary governors of South Carolina. "Mrs. Logan was a great florist, and uncommonly fond of a garden. She was seventy years old when she wrote her treatise on gardening, and died in 1779, aged seventy-seven years."

Mrs. Logan's book was perhaps only a pamphlet. The first regular American gardening book, if Mrs. Logan's is excluded, is apparently Robert Squibb's "Gardener's Kalender," published in Charleston, South Carolina, in 1787 (see pp. 1520–1).

The opening of the nineteenth century may be taken as a convenient starting-point for a narrative of the evolution of American horticulture. At that time horticulture began to attain some prominence as distinct from general agriculture, and the establishment of peace after the long and depleting war with England had turned the attention of the best citizens afresh to the occupation of the soil. The example of Washington, in returning to the farm after a long and honorable public career, no doubt exerted great influence. His agricultural correspondence was large, and much of it was published at the opening of the century. His correspondence with Arthur Young and Sir John Sinclair will be found in volumes published in London in 1800 and 1801, in Alexandria in 1803, and in Washington in 1847. Details respecting the management of his plantations comprise Vol. IV of the "Memoirs of the Long Island Historical Society," 1889.

Apparently, it was not until 1790 that an indigenous and distinctly general agricultural treatise after Eliot's appeared in America. At that time, the Rev. Samuel Deane, vice-president of Bowdoin College, published his "New England Farmer, or Georgical Dictionary," a cyclopedic work of the state of American agriculture. This passed to a second edition in 1797, and to a third in 1822. As showing both the contents of this important book and the methods of reviewing of that day, the following comment is transcribed from the "Columbian Centinel," for 16th of June, 1790, printed in Boston. It is in the guise of a communication from a correspondent, as was then the custom. It must be one of the earliest reviews of an agricultural book to appear in this country:

> "Nothing has been more wanting in this Country than a book of Practical Husbandry. The late Dr. Elliot of Connecticut wrote some short essays, which were well received, but it was reserved for Mr. Deane, of Portland, to give the publick *a System of Husbandry for New England*. This valuable book is now published and on perusal exceeds the expectation which had been formed of it. It is founded on solid principles of natural philosophy and practical experiment. All that is valuable in European books of husbandry is selected and accommodated to the climate and seasons of this country. Many new and curious observations are introduced; and the whole is cast in such a form and expressed in such language as must render it useful to the plain husbandman, while the enlightened naturalist will find it an agreeable entertainment.
>
> "It not only contains a general system of agriculture, but treats of everything which usually falls under the care of the husbandman and his family, such as cattle, horses, sheep, bees, timber—gives the best directions for the care of the garden, the dairy and the cellar—and much of what is said may be extremely useful in all families where bees, cyder, fruit, milk and other necessary articles are preserved. In short it is a book which does honor to the ingenuity, and industry of its author, and deserves to be read by every person who wishes well to the best interest of this country."

In the Georgetown, South Carolina, "Gazette," March 13, 1799, is a half-column of proposals for publishing by subscription "'Notes on Agriculture adapted to the soil, climate, and markets of South Carolina,' by Louis DuPre. To be put to press as soon as 200 copies are subscribed for. Price one dollar specie." (See page 1520.)

In 1799, J. B. Bordley published in Philadelphia "Essays and Notes on Husbandry." Other early works need not be mentioned here. As early as 1785, Varlo's "New System of Husbandry" was printed in Philadelphia. It is in many ways a remarkable book, and it was written by a man who had had remarkable experiences. He was not an American, and the work first appeared in the old country; but Varlo had lived in this country, and was in sympathy with the American people. The book contained a "Farmer's and Kitchen Garden Calendar." In 1792 there appeared anonymously, from Burlington, New Jersey, the third edition of Arthur Young's "Rural Economy." He argues strongly for experiments and for the establishing of agricultural journals. This book first appeared in London, in 1770.

At the opening of the century (1800), Sir Humphry Davy had not illumined the science of agricultural chemistry, and men were even disputing as to what the food of plants is. The "burn-baking" or "devonshiring" of the land—burning the sod and scattering the ashes over the field—was still recommended; and in 1799 James Anderson's "Essays on Quick-lime as a Cement and as a Manure," was given an American edition in Boston. It is easy to see from these facts that the fundamental conceptions of the science of agriculture were vague and crude a century ago. Near the close of the 18th century, Deane wrote that "the alarming effect of the present low state of husbandry is, that we are necessitated to import much of our food and clothing, while we are incapable of making proportionable remittances in the produce of the soil, or in anything else."

Green's book on flowers, published in Boston in 1828, enables us to determine what were the leading ornamental plants in that early day. The full title of the book is "A Treatise on the Cultivation of Ornamental Flowers; Comprising Remarks on the Requisite Soil, Sowing, Transplanting, and General Management; with Directions for the General Treatment of Bulbous Flower Roots, Greenhouse Plants, etc." It comprises only sixty pages. The introductory pages give general directions, then follow two annotated lists, one of annuals and biennials and the other of greenhouse plants. These lists are interesting, also, for what they do not contain. All the plants they mention are here set down, under the names and with the spelling there employed:

ANNUAL AND BIENNIAL FLOWERS.

Althæa frutex.
Almond, double-flowering.
Amaranthus superbus.
Amaranthus tricolor.
Animated oats.
Aster, China.
Auricula.
Azalea nudiflora.
Box.
Brier, Sweet.
Canterbury Bell.
Carnation.
Cassia marylandica.
Catalpa.
Cherry, double-flowering.
Chrysanthemum indicum.
Clematis, Austrian (C. integrifolia).
Clethra.
Columbine.
Convolvulus.
Corchorus japonicus.
Crocus.
Cupid's Car, or Monk's Hood (Aconitum).
Dahlia.
Daisy.
Dwarf Basil.
Egg Plant.
Eupatorium, blue.
Euphorbia Lathyris.
Fading Beauty, or Morning Bride (Scabiosa).
Fir (Pinus balsamea).
Foxglove.
Fringe Tree.
Geranium (Pelargonium).
Garden Angelica.
Glycine, cluster-flowering.
Golden Coreopsis.
Golden Everlasting (Xeranthemum, lucidum).
Hollyhock.
Honeysuckle.
Hyacinth.
Hydrangea.
Ice Plant.
Impatiens Balsamina.
Iris.
Lagerstrœmia indica.
Laurel, broad-leaved (Kalmia latifolia).
Laburnum.
Larkspur.
Lilac.
Lily.
Lime Plant (Podophyllum peltatum).
Lychnadia (Phlox).
Mezereon (Daphne mezereum).
Mountain Ash.
Musk Geranium.
Myrtle, evergreen (Vinca minor).
Narcissus.
Nasturtium.
Passion Flower.
Pæony.
Pea, sweet.
Peach, double-flowering.
Pink.
Perennial Sunflower, double.
Polyanthus.
Pyrethrum parthenium.
Poppy.
Purple Hyacinth Bean.
Roses.
Rose Acacia.
Rose-colored Hibiscus.
Rudbeckia.
Scarlet Cacalia.
Scarlet Lynchis (L. chalcedonica).
Siberian Crab.
Snow-ball Tree.
Snowberry.
Spice-wood (Laurus Benzoin).
Spiderwort (Tradescantia).
Spiræa.
Syringa, or Mock Orange.
Strawberry Tree (Euonymus).
Sweet Bay (Laurus nobilis).
Sweet William, or Poetic Pink.
Tulip.
Venetian Sumac, or Fringe Tree.
Violet, blue fragrant.

GREEN HOUSE PLANTS.

Lilies of the valley.
Ranunculuses.
Anemones.
Single and Double Jonquils.
White Lilies.
Roses.
Tuberoses.
Persian Iris.
Mignionette.
Verbena trifoliata, or Sweet Vervain.
Fuhsia coccinea.
Cobæa scandens.
Camellia japonica, or Japanese Rose.
Myrtles (Myrtus communis).

These lists are much less ample than those of M'Mahon, over twenty years earlier, but they may be supposed to include the popular and most easily grown things. They will be suggestive to those who wish to make "old-fashioned gardens." M'Mahon's list was evidently largely compiled from European sources. Green says that the first list (strangely called "annual and biennial flowers") contains "such plants, shrubs and trees as are of easy cultivation, generally hardy." The second list comprises "a few different sorts of green house plants" "which are commonly grown in rooms."

The early writings clearly portray the tendencies of the floricultural interests,—from the formal-flower ideals of the dahlia and camellia to the enormous development of the cut-flower interest, and the growth within the last few years of the greater love of plants themselves. Palms and decorative plants are now almost household necessities, whereas seventy-five years ago they would have been luxuries. "There has been a radical change in the character of the flowers used for cut-flower purposes," wrote Alfred Henderson in 1895. "Fifty years ago, camellia flowers retailed freely for a dollar each, and during the holidays Philadelphia used to send thousands to New York florists, getting $500 per 1,000; while roses went begging at one-tenth these figures. Now, the rose is queen, and the poor camellia finds none so poor to do her reverence. . . . . I confidently believe that the time is not far distant when we shall compete seriously with the foreign grower in the production of new varieties of roses." William Scott, of Buffalo, in 1900 made the following comments on floriculture: "About the year 1880, tulips and narcissuses began to be forced, and during the next fifteen uears immense quantities of these bulbs were imported annually from Holland. As the methods of forcing were perfected the market became overstocked, and, although large quantities are still forced for the winter and spring months, they are not now in the same favor as formerly, and the rose, carnation, violet, lily-of-the-valley and mignonette are still the favorites. Orchids are not yet the flower for the million, but there is a yearly increasing demand for them, and at present the showy orchids, such as the Cattleyas and Lælias, are far short of the demand. As their cultivation is more generally understood, we look for a very steady increase in the number grown, and are confident that the supply will not soon exceed the demand. Within the past five or six years a marked increase is noticeable in the use of plants to adorn the home, and the demand is for an expensive class of plants,—palms, dracenas, araucarias and ferns being among those mostly used. Now few homes with any pretension to luxury or even comfort are without a few fine plants scattered through the rooms, and many of our modern houses are provided with either a bay window or small conservatory for the accommodation of plants." (See *Cut-Flower Industry* and *Floriculture.*)

America has not been favored with horticultural annuals to the extent equally with England and other countries. The first attempt of the kind seems to have been Woodward's "Record of Horticulture," edited by A. S. Fuller, which appeared in 1866 and 1867. The next venture was the "American Horticultural Annual," New York, for the years 1868 ,1869 and 1870, under the general editorial care of George Thurber. The attempt was not made again until the "Annals of Horticulture," was issued by Bailey, in 1889, and which was published for five years, the last volume containing an account of the horticulture of the Columbian Exposition.

Fruit-growing in particular.

Horticulture, in its commercial aspects, was nothing more than an incidental feature of farm management at the opening of the century. In fact, it is only in the past generation that the field cultivation of horticultural crops has come to assume any general importance in the rural economy of the nation. And even now, horticultural operations which are projected as a fundamental conception of land occupation are confined to relatively few parts of the country. It is only in certain regions or with certain persons that the farmer starts out with horticulture as a base, and with grain and stock and hay as accessories; and even in these places, many horticulturists are still drawing their practices and the reasons for them from the operations of general mixed agriculture. The history of fruit-growing in most of the older parts of North America is the history of the apple, and the subject is developed under that heading; but before proceeding to the apple specially we may pause to consider some of the dates in the extension of fruit-growing westward.

"It may not occur to many of our people," writes Charles W. Garfield, "that the horticulture of Michigan may have had its beginning as early as that of Massachusetts, as the French Jesuit missionaries visited Detroit the same year that the Mayflower landed its pilgrims at Plymouth Rock." The influence of the French missionaries must be well considered when the history of American horticulture is written, particularly of those parts that lie along the great waterways. The old pear trees along the Detroit River and in eastern Michigan attest the early French dissemination. The first planting of orchards in Michigan, according to Garfield, "were made at Detroit from stock secured across the river, the stock having originally come from France to Montreal, and progressed westward with the settlements. The varieties were Fameuse, Pomme Grise, and Red and White Colville." The first large importation of orchard trees was made about 1825, the stock having come from Grant Thorburn of New York. The spread of tree-planting to the westward followed regularly with the progress of settlement.

The above remarks about the Jesuits indicate that the early American fruit-growing was not all derived from British sources. Much of the influence was certainly French; on the Pacific coast and probably in parts on the southern borders of the present United States it was Spanish. It would be interesting to try to trace the influence of the Dutch and other colonizers.

The reader who desires to trace the beginnings of fruit-planting in some of the territory from Nebraska south and southwest should consult the "Proceedings of the American Pomological Society" for 1905 (pages 74-98). In Nebraska, apples were planted in 1853. It appears that in Kansas apple-tree planting has been recorded near Shawneetown, Johnson County, as early as 1827 by Rev. Thomas Johnson, the variety being the Newtown Pippin. In 1836, he planted pear trees. In Arkansas, J. B. Russell, of Cane Hill, had a small nursery of apple trees in 1835. A little after this date, Isaac Shannon originated the apple that bears his name. Before the close of the seventeenth century, the French at St. Genevieve, Missouri, had planted pears, grapes and a few apples. In New Mexico, the agricultural industry developed to some extent under Spanish rule, and continued under the Mexican rule from 1822 to 1845, but little reference is made to fruit. It is recorded that the Bishop of Santa Fé, early introduced apricots and apples from the States, and John Clark planted apple trees from Missouri in Rio Arriba County in 1859.

1853. Relic of early days—apple tree at probably 250 years

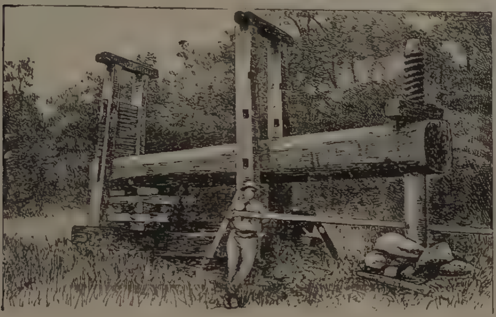
1854. Bartram's cider-mill, a relic of the last century.

It is said that the apples were placed in the circular groove in the rock and crushed by means of a weight rolling over them. The juice ran out the gutter at the farther side and was caught in a rock-hewn cistern.

The development of fruit-growing in the Northwest is sketched for this occasion by C. I. Lewis. The first authentic introducton of fruit into the Pacific Northwest (of the United States) was in 1824, when seed was brought from England by members of the Hudson Bay Company. This seed was planted near what is now Vancouver, Washington, then a trading-post of the Hudson Bay Company. Seeds of apples, grapes, pears, and peaches were planted. The apple trees which resulted from this seed are still standing on government lands occupied by the Vancouver barracks. There were other introductions by various persons, but they probably had no influence on the growth of the fruit industry in the Northwest. In 1847, Henderson Lewelling, of Iowa, brought several hundred yearling grafted sprouts of mixed fruits. The same year William Meek brought a sack of apple seed and a few grafted trees. These two men established the first nursery in the Pacific Northwest at Milwaukee, Oregon, and laid the foundation of our commercial fruit industry. In the following ten or fifteen years, many men brought trees and seed, and nurseries were started. From 1850 to 1870, fabulous prices were received for fruit, one box of apples selling for $75, while in 1855, 6,000 bushels of apples sold for prices ranging between $20 and $30 a bushel. The period between 1850 and 1870 also marked the introduction of plums and prunes into the Northwest country. The first Italian prune orchard was set in 1858 by Seth Lewelling. Between 1870 and 1890 was a period of decline. The former demand from California ceased and railroads were few, the freight rates being exorbitant. Beginning early in the 1890's the fruit industry of the Northwest began to revive. About 1900, the apple industry began to recover. In 1896, the Lambert cherry was introduced commercially, and has proved to be the greatest commercial cherry for shipping. J. R. Cardwell has been the principal historian of Northwest horticulture. He came out in the early days of the fruit industry and is still living. He has been very influential in building up the fruit industry in the Pacific Northwest.

The apple.

There was practically only one general horticultural commodity, at least in the northern states, a hundred years ago, and that was the apple. Pears, peaches, cherries, quinces and some other fruits were common, but there was little thought of marketing them. Even the apple was an incidental or even an accidental crop. Little care was given the trees, and the varieties were few, and they were rarely chosen with reference to particular uses, beyond their adaptability to cider and the home consumption. In parts of the East, very ancient apple-tree relics still stand, some of them perhaps existing from Colonial times (Fig. 1853).


1855. An early cider-mill in Pennsylvania.

Thacher, writing from Plymouth in 1821, says that "the most palpable neglect prevails in respect of proper pruning, cleaning, and manuring round the roots of trees, and of perpetuating choice fruits, by engrafting from it on other stocks. Old orchards are, in general, in a state of rapid decay; and it is not uncommon to see valuable and thrifty trees exposed to the depredations of cattle and sheep, and their foliage annoyed by caterpillars and other destructive insects. In fact, we know of no branch of agriculture so unaccountably and so culpably disregarded." Were it not for the date of Thacher's writing, we might mistake this picture for one drawn at the present day.

If one may judge from the frequent and particular references to cider in the old accounts, it does not seem too much to say that this sprightly commodity was held in greater estimation by our ancestors than by ourselves. In fact, the cider barrel seems to have been the chief and proper end of the apple. Of his thirty chapters on fruit-growing, Coxe (1817) devotes nine to cider, or forty-two pages out of 253. John Taylor's single epistle devoted to horticultural matters in the sixty and more letters of his "Arator" is upon "Orchards," but it is mostly a vehement plea for more cider. "Good cider," he says, "would be a national saving of wealth, by expelling foreign liquors; and of life, by expelling the use of ardent spirits." In Virginia, in Taylor's day, apples were "the only species of orchards, at a distance from cities, capable of producing sufficient profit and comfort to become a considerable object to a farmer. Distilling from fruit is precarious, troublesome, trifling and out of his province. But the apple will furnish some food for hogs, a luxury for his family in winter, and a healthy liquor for himself and his laborers all the year. Independent of any surplus of cider he may spare, it is an object of solid profit and easy acquisition." As early as 1647, twenty butts of cider were made in Virginia by one person, Richard Bennet. Paul Dudley writes of a small town near Boston, containing about forty families, which made nearly 3,000 barrels of cider in the year 1721; and another New England town of 200 families, which supplied itself with "near ten Thousand Barrels." Bartram's cider-mill, as it exists at the present day, is shown in Fig. 1854. An old mill in Pennsylvania is shown in Fig. 1855. It is a ponderous pine log, more than three feet through, raised and lowered by means of a great screw. "These presses" according to C. F. Shaw, "were 'neighborhood' affairs in cider-making time and the farmers would rise very early that they might reach the press before their neighbors, and so not have to wait long before their turn to have their cider made." It was not until well into the past century that people seem to have escaped the European notion that fruit is to be drunk. Jarvis writes (1910) of Connecticut conditions that in "the first half of the last century many commerical orchards of modest size were in existence, but they were composed mostly of seedling trees or 'native fruit,' the product of which was used largely in the manufacture of cider."

There have been several marked alternations of fervor and neglect in the planting of apples since the first settlement of the country. Early in the eighteenth century there appears to have been a great abundance of the fruit; but in 1821 Thacher declared that "it is a remarkable fact that the first planters bequeathed to their posterity a greater number of orchards, in proportion to their population, than are now to be found in the old colony," and he attributes the decline in orcharding largely to the encroachment of the "poisonous liquor" of the later times. Under the inspiration of Thacher, Coxe, Kendrick, Prince, Manning, and the Downings, orchards were again planted, and later there was another period of decline in the East, following the aging of these plantations. Two reminders of the Downings are shown in Figs. 1856 and 1857, made from photographs taken by the writer some twenty or more years ago.

Apple trees were very early planted in the New World. On Governor's Island, in Boston harbor, a few apples were picked in 1639. Trees were carried far into the frontiers by the Indians and probably also by the French missionaries, and the "Indian apple orchards" are still known in many localities even east of the Mississippi (see, also, *Appleseed, Johnny* page, 1563). At the opening of the nineteenth century, the Early Harvest, Newtown Pippin, Swaar, Spitzenburg, Rhode Island Greening, Yellow Bellflower, Roxbury Russet, and other familiar apples of American origin were widely disseminated and much esteemed. Apples had begun to be planted by settlers in Ohio before 1800. In 1817, Coxe could recommend a list of "one hundred kinds of the most estimable apples cultivated in our coun-

1856. One of the old Downing test apple trees as it stood about 25 years ago.

try;" and in 1825 William Prince offered 116 varieties for sale—at 37½ cents a tree—of which seventeen were set aside—after the custom of the time—as particularly adapted to the making of cider. Of these 116 varieties, sixty-one were considered to be of American origin. In 1872, Downing's list of apples which had been fruited and described in America, had swollen to 1,856 varieties, of which 1,099 were of known American origin. Of this great inventory, probably not over one-third were actually in cultivation at any one time, and very many of them are now lost. In 1892, the trade-lists showed that 878 varieties were actually offered for sale by the nurserymen of North America.

1857. The fruit-house of Charles Downing.

The style of illustration in these old books is well displayed in Fig. 1858, from Coxe, original size.

There has been a noticeable tendency toward the origination of varieties of apples in this country, and the consequent exclusion of varieties of European origin. As early as 1760, cions of American varieties were sent to England. Before the Revolution, apples were exported. The origination of indigenous varieties was, of course, largely accidental, and was a necessary result of the method of growing apple trees directly from seeds, and top-grafting them in case they should turn out profitless. A critical study of American horticulture will show that all species of plants which have been widely cultivated in this country have gradually run into indigenous varieties, and the whole body of our domesticated flora has undergone a progressive evolution and adaptation without our knowing it. By far the greater number of the apples of the older apple-growing regions of the country are indigenous varieties, and the same process is now operating in the Northwest, where the American seedlings of the Russian stock are proving to be more valuable than the original importations.

Pears were amongst the earliest fruits introduced into the New World, and the French, particularly, disseminated them far and wide along the waterways, as witnessed by the patriarchal trees of the Detroit River and parts of the Mississippi system (p. 1512). Bartram's Petre pear (Fig. 1851) is one of the patriarchs of the last century, although the tree is not large. The first American book devoted exclusively to the pear was Field's, published in 1859. The Japanese type of pears had been brought into the country from two and perhaps three separate introductions, early in the fifties, but they had not gained sufficient prominence to attract Field's attention. From this oriental stock has come a race of promising kinds represented chiefly by the Kieffer, LeConte and Garber.

Peaches were early introduced into the New World by various colonists, and they thrived so well that they soon became spontaneous. Nuttall found them naturalized in the forests of Arkansas in 1819, and the species now grows in waste and forest lands from Georgia and the Carolinas to the westward of the Mississippi. There is probably no country in which peaches grow and bear so freely over such a wide territory as in North America. The old Spanish or Melocoton type is now the most popular race of peaches, giving rise to the Crawfords and their derivatives.

Of late years there has been a contraction of some of the original peach areas, and many good people have thought that the climate is growing uncongenial, but it is only the natural result of the civilization of the country and the change in methods. Peaches had never been an industry, but the orchards were planted here and there as very minor appendages to the general farming. For generations insect pests were not common. There were no good markets, and the fruit sold as low as 25 cents a bushel from the wagon-box. In fact, the fruit was grown more for the home-supply than with an idea of shipping it to market. Under such conditions, it did not matter if half the crop was wormy, or if many trees failed and died each year. Such facts often passed almost unnoticed. The trees bore well, to be sure; but the crop was not measured in baskets and accounted for in dollars and cents, and under such conditions only the most productive trees left their impress on the memory. The soils had not undergone such a long system of robbery then as now. When the old orchards wore out, there was no special incentive to plant more, for there was little money in them. Often the young and energetic men had gone West, there to repeat the history perhaps, and the old people did not care to set orchards. And on this contracting area, all the borers and other pests which had been bred in the many old orchards now concentrated their energies, until they have left scarcely enough trees in some localities upon which to perpetuate their kind. A new country or a new industry is usually free of serious attacks of those insects that follow the crop in older communities. But the foes come in unnoticed, and for a time spread unmolested, when finally, perhaps almost suddenly, their number becomes so great that they threaten destruction, and the farmer looks on in amazement.

Oranges.—The orange is another tree that has thrived so well in the new country that the spontaneous thickets of Florida, known to be descendants of early Spanish introductions, are supposed by residents to be indigenous to the soil.

As to oranges and similar fruits on the Pacific coast, Coit writes in "Citrus Fruits" (1915) as follows: "Citrus seeds were first brought into California from the peninsula of Lower California, where peoples of Spanish descent have cultivated various kinds of European fruit trees and vines since the year 1701. In 1768 the Jesuit missionaries were supplanted by the Franciscans, some of whom under the leadership of Junipero Serra pushed northward into the territory which is now the state of California. These hardy pioneers founded the first Mission in Upper California at San Diego in 1769, and proceeding northward established a chain of Missions extending 400 miles along the coast, the last being established at Somoma in 1823."

Plums and cherries.—The progress of the plum in America nearly equals that of the grape in historic interest. The small spontaneous plums, known as

Damsons, the offspring of introductions from Europe, were early abundant in New England. Plum-culture has never thrived far south of Mason and Dixon's line or west of Lake Michigan, except, of course, on the Pacific slope and parts of the far southwestern country. There are climatic limitations which more or less restrict the area of plum-growing, and [illegible] leaf-blight fungus, black-knot, and fruit-rot have added to the perplexities. In these great interior and southern areas various native plums, offshoots of several indigenous species, have now spread themselves, and they have already laid the foundation of a new type of plum-culture. The first of these novel plums to receive a name was that which we now know as the Miner, and the seed from which it sprung was planted by William Dodd, an officer under General Jackson, in Knox County, Tennessee, in 1814. The second of these native plums to come into prominence, and the one which really marks the popularization of the fruit, is the Wild Goose. Some time before 1830, it is related, a man shot a wild goose near Columbia, Tennessee, and where the remains were thrown this plum sprang forth. It was introduced to the trade about 1850, by the late J. S. Downer, of Fairview, Kentucky. Over 200 named varieties of these native plums are now described, and some of them are widely disseminated and deservedly popular. In the South and on the plains, these natives are a prominent horticultural group. The complexity of the cultivated plum flora is now further increased by the introduction of the Japanese or Chinese type, which first came in by way of California in 1870. Finally, about 1880, the apricot plum, or *Prunus Simonii*, was introduced from China by way of France; and the American plum industry, with no less than ten specific types to draw upon and which represent the entire circuit of the northern hemisphere, is now fairly launched upon an experimental career which already has produced remarkable results.

The cherry was early introduced from Europe. In 1641 trees were planted in Virginia in the orchard of Governor Berkeley. As early as 1663 it was grown in Massachusetts. The commercial cherries of this country are derived from the same species as those of Europe, although the dwarf sand-cherry of the Plains has been improved or cultivated to some extent.

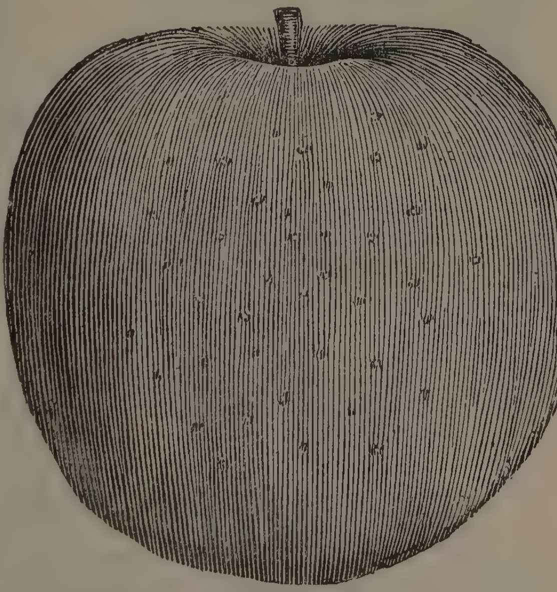
Grapes.—In America, no crop has been the subject of so much book-writing as the grape. Counting the various editions, no doubt a hundred books have appeared, being the work of at least fifty authors. Since the American grape is a product of our own woods within about a century, the progress in grape-growing has been ahead of the books. Most of the books are founded largely on European advice, and therefore are not applicable to American conditions. In general pomology, the books seem to have had much influence upon fruit-growing; but in the grape the books and actual commercial grape-growing seem to have had little relation one to the other. Some of the later books have more nearly caught the right point of view.

The grape of North America is of two unlike types,—the natives, which comprise all commercial outdoor varieties in the interior and eastern states; and the vinifera or Old World kinds, which are grown under glass and in California. The native types were developed within the nineteenth century. The oldest commercial variety is the Catawba, which dates from 1802; the cosmopolitan variety the Concord, which first fruited in 1849 (see p. 1374). A full review of the history is made in "Evolution of Our Native Fruits." With the first settlement of the country, efforts were made to grow the European wine-grape. Thus in 1619 vine-dressers and vines were sent from France to Virginia; the subsequent history of the wine-grape in North America is a record of repeated attempts and continuous failures; and these failures, due largely to phylloxera and mildew, finally forced the cultivation of the native species of Vitis. In Mexico and on the Pacific slope, however, the wine-grape established itself readily about the missions, and it is now the foundation of the grape-culture of California. It is very likely that these introductions of the padres preceded those in the eastern American colonies.

A very interesting error appears to have crept into North American history in connection with the native grapes. The "wineberry" found by the Norsemen on the American coast in the eleventh century has prevailingly been identified as grapes, and this interpretation has made it apparent that the explorers came south as far as the present New England. Recently, however, M. L. Fernald has concluded (Rhodora, xii, 17–38, Feb., 1910), that the wineberries of the Norsemen were certainly not grapes, but most likely the mountain cranberry, *Vaccinium Vitis-Idæa.*

To show how far we have come in grape-culture, the examples in Fig. 1859 will be interesting. This cut is from S. W. Johnson's "Rural Economy," 1806, published in New Jersey. It shows the method with the European wine-grape. Just twenty years later appeared Dufour's book on the grape; he also represents a foreign method (Fig. 1860).

Strawberry.—There was no commercial strawberry-culture in America, worthy of the name, until the introduction of the Hovey (Fig. 1861) late in the thirties of last century. This and the Boston Pine were seedlings of C. M. Hovey's, Cambridge, Massachusetts. They first fruited in 1836 and 1837, and from them are supposed to have descended many of the garden strawberries of the present day. These were seedlings of the old Pine type of strawberry, which is apparently a descendant of the wild strawberry of Chile. The Wilson, or Wilson's Albany, which originated with John Wilson, of Albany, New York, began to attract attention about 1856 or 1857, and it marked the beginning of the modern epoch in American strawberry-growing. In the Middle West, strawberry-growing was given a great impulse by Longworth and Warder.



1858. Example of the earliest illustrations of American fruits.
Esopus Spitzenberg, figured by Coxe in 1817.

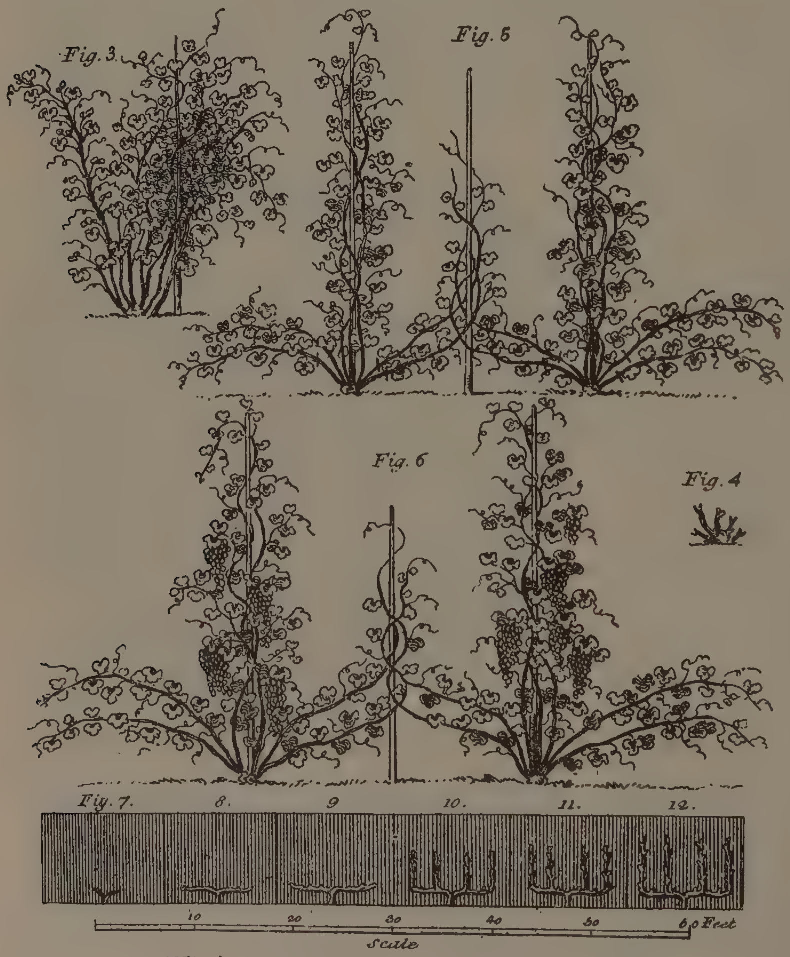
Bramble fruits.—Raspberries were grown in North America in the eighteenth century, but they were of the tender European species, of which the Antwerps were the common types. This type of raspberry is now almost wholly superseded by the offspring of the native red and black species, which first began to impress themselves upon cultivation about 1860.

The blackberry, an indigenous American fruit, first commended itself to cultivation with the introduction of the New Rochelle or Lawton, toward the close of the 1850's. The first named variety of native blackberry of which we have any record was the Dorchester, which was exhibited before the Massachusetts Horticultural Society in 1841.

The dewberry, a peculiarly American fruit, first appeared in cultivation early in the 1870's in southern Illinois under the name of the Bartel, which is a large form of the common wild dewberry of that region. It was first brought to the attention of the public in 1875. The following year the Lucretia, the most popular of dewberries, was introduced into Ohio from West Virginia, where it had been found wild some years before by a Union soldier.

Gooseberries.—The history of the gooseberry in America recalls that of the grape. It is a characteristic fruit of England and the Low Countries, and it was early introduced into America. But, like the European grapes, the gooseberries were attacked by a fungous sickness which rendered the cultivation precarious. An improved form of the native species must be introduced, and this was accomplished by Abel Houghton, of Massachusetts, who, from the seed of the wild berry, produced the variety which now bears his name (Fig. 1862). This variety began to attract some attention a little previous to 1850, although it was not planted freely until several years later. From seed of the Houghton sprang the Downing, still the most popular gooseberry in America, although Houghton is still much grown from Philadelphia south; and our gooseberry-culture is, therefore, but two removes from nature. With the advent of the bordeaux mixture and its related specifics, however, the English gooseberries are again coming to the fore. Hybrids of the English and American types, as in the Triumph or Columbia and the Chautauqua, may be expected to become more popular for home use and special markets, but the Americans will probably remain in favor for general market purposes.

The cranberry, most singular of American horticultural products, was first cultivated, or rescued from mere wild bogs, about 1810. Its cultivation began to attract attention about 1840, although the difficulties connected with the growing of a new crop did not begin to clear away until about 1850. Cape Cod was the first cranberry-growing region, which was soon followed by New Jersey, and later by Wisconsin and other regions. The varieties now known are over a hundred, and the annual product from tame bogs in North America is now upward of 1,000,000 bushels.

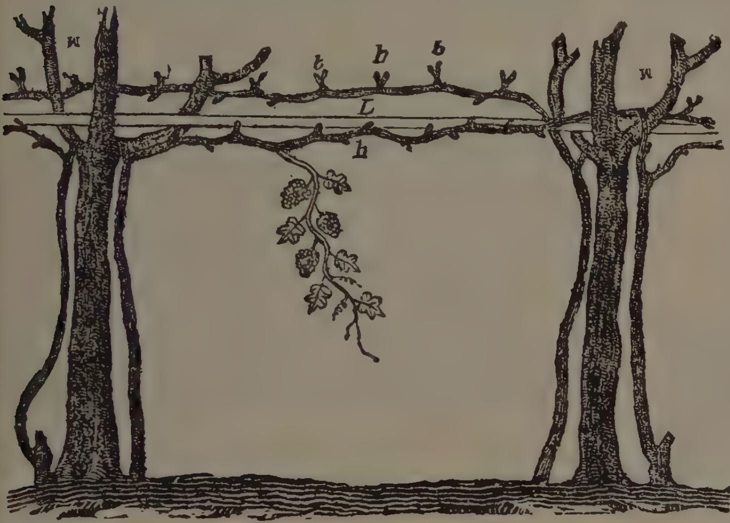


1859. An early American picture of grape-training (1806).

The nursery and seed business.

It is impossible to fix a date for the beginning of the nursery business in North America. Trees were at first grown in small quantities as an adjunct to general farm operations. Gov. John Endicott, of the Massachusetts Colony, was one of the best fruit-growers of his time, and he grew many trees. In 1644, he wrote to John Winthrop as follows: "My children burnt mee at least 500 trees this Spring by setting the ground on fire neere them;" and in 1648 he traded 500 apple trees, three years old, for 250 acres of land. The first nursery in Maine is thought by Manning to have been that of Ephraim Goodale, at Orrington, established early in the present century. Other early nurserymen of Maine were the brothers Benjamin and Charles Vaughan, Englishmen, who settled at Hallowell in 1796. An early nursery in South Carolina was established by John Watson, formerly gardener to Henry Laurens, before the Revolution. In Massachusetts, there were several small nurserymen toward the close of the eighteenth century, amongst others, John Kenrick, of Newtown, whose son William wrote the "New American Orchardist," published in 1833, and which passed through at least eight editions. The trees were usually top-grafted or budded, sometimes in the nursery and sometimes after removal to the orchard. Deane writes in 1797, that "the fruit trees should be allowed to grow to the height of 5 or 6 feet before they are budded or grafted." Stocks were sometimes grafted at the crown, and even root-grafting was known, although it is generally said that this operation originated with Thomas Andrew Knight, in 1811. It is probable, however, that the root-grafting of the eighteenth century was only grafting at the surface of the ground, and that it had little similarity to the method now in vogue.

One of the new trees something over one hundred years ago was the Lombardy poplar. John Kenrick had two acres devoted to it in 1797; and Deane writes, in 1797, that "the Lombardy poplar begins to be planted in this country. To what size they will arrive, and how durable they will be in this country, time will discover." He does not mention it in the first edition, 1790. The tree is said to have been introduced into America by William Hamilton, of Philadelphia, in 1784, although Mr. Meehan wrote that he remembered trees over sixty years ago that seemed to be a century old.



1860. Dufour's picture of grape-training (1826). Patterned after the South-European fashion of employing mulberry trees for supports.

Manning quotes a bill of sale of nursery stock in 1799, showing that the price of fruit trees was 33⅓ cents each. Deane speaks of raising apple trees as follows: "The way to propagate them is by sowing the pomace from cydermills, digging, or hoeing it into the earth in autumn. The young plants will be up in the following spring; and the next autumn, they should be transplanted from the seed-bed into the nursery, in rows from 2 to 3 feet apart and 1 foot in the rows, where the ground has been fitted to receive them." Nothing is said about grafting the trees in the nursery.

The first independent general nursery in the New World, in the sense in which we now understand the term, appears to have been that established by William Prince at Flushing, Long Island, and which was continued under four generations of the same family. The founder was William Prince. The second Prince was also William, the son, and author of the first regular American treatise on horticulture, 1828. The third generation was William Robert Prince. He was the author of "A Treatise on the Vine" (1830), "The Pomological Manual" (1831), and "Manual of Roses" (1846). In the first two he was aided by his father, the second William. This William Robert Prince is the one who first distinguished the types of the prairie strawberry into the two species, *Fragaria illinoensis* and *F. iowensis*. From a large catalogue of William Prince, second, published in 1825—and which contains, amongst other things, lists of 116 kinds of apples, 108 of pears, 54 of cherries, 50 of plums, 16 of apricots, 74 of peaches and 255 of geraniums—the following account is taken of the founding of this interesting establishment: "The Linnæan Garden was commenced about the middle of the last century by William Prince, the father of the present proprietor, at a time when there were few or no establishments of the kind in this country. It originated from his rearing a few trees to ornament his own grounds; but finding, after the first efforts had been attended with success, that he could devote a portion of his lands more lucratively to their cultivation for sale than to other purposes, he commenced their culture more extensively, and shortly after published a catalogue, which, at that early period, contained several hundred species and varieties, and hence arose the first extensive fruit collection in America." The elder Prince died in 1802, "at an advanced age." In October, 1790, a broadside was issued in New York, printed by Hugh Gaine, giving a list of a large collection of fruit trees and shrubs for sale by William Prince at Flushing Landing, on Long Island. The twenty-second edition of this broadside appeared in 1823. In Thomas "History of Printing," second edition, reference is made to an edition printed in 1771.

Amongst the nurseries which were prominent from 1820 to 1830 were Bloodgood's, Floy's, Wilson's, Parmentier's, and Hogg's, near New York; Buel and Wilson's at Albany; Sinclair and Moore's, at Baltimore. David Thomas, a man of great character, and possessed of scientific attainments, was an early horticulturist of central or western New York. His collection of fruits at Aurora on Cayuga Lake, was begun

1861. The original picture of the Hovey strawberry. "Magazine of Horticulture," August, 1840. (Original size)

about 1830. His son, John J. Thomas, nurseryman and author of the "American Fruit Culturist," which first appeared in 1846, died at a ripe old age in 1895. The nursery of Thomas Hogg, referred to above, was an important establishment. In a "Catalogue of the ornamental trees and shrubs, herbaceous and greenhouse plants, cultivated and for sale by Thomas Hogg, nurseryman and florist," 1834, there are sixteen small pages, double columns, of mere lists of species and varieties, comprising no less than 1,200 entries of great variety. These were offered at "The New York Botanic Garden in Broadway, near the House of Refuge." The first Thomas Hogg, an Englishman, procured land in 1822 in upper Broadway (where Twenty-third Street now is), and began business as florist and nurseryman. In 1840 they were removed to Seventy-ninth Street and East River, and here the sons, Thomas and James, assisted the father, who died in 1855. Later, James had a garden at the foot of Eighty-fourth Street, and here he grew many plants sent from Japan, by his brother Thomas, who resided and traveled in that country (page 1580).

1862. The original picture of the Houghton gooseberry. From the "Horticulturist" for September, 1868. (Original size)

The nursery firm of Parsons & Co., on Long Island, was founded in 1838. It was instrumental in distributing great quantities of fruit and ornamental stock at a formative time in American horticulture, and it was a pioneer in several commercial methods of propagation of the more difficult ornamental stock. It was a leading distributor of Japanese plants in the early days. Between 1840 and 1850 arose the beginnings of that marvelous network of nurseries, which, under the lead of Ellwanger & Barry, T. C. Maxwell & Brothers, W. & T. Smith, and others, has spread the name of western New York throughout North America. In 1857, Prosper J. Berckmans, who had then been a resident of the United States seven years, removed to Georgia, and laid the foundation of the very important business now conducted by his sons.

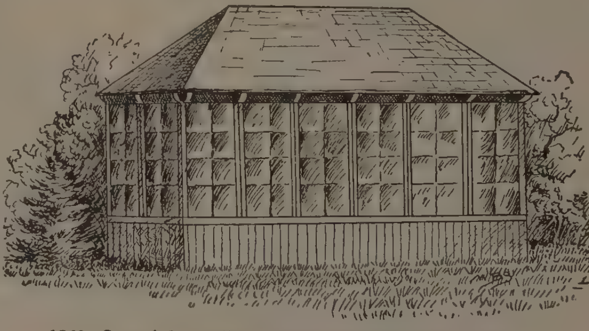
The oldest American seed house, David Landreth's, in Philadelphia, was established in 1784. Another was John Mackejohn's, 1792; others, William Leeson, 1794, and Bernard M'Mahon, 1800, all of Philadelphia. In 1802, Grant Thorburn's was established in NewYork, the first catalogue of four pages being published then. The first and last of these businesses still exist under the family names. M'Mahon did a large business in exporting seeds of native plants, and it was through his work that many American plants came into cultivation in Europe. His catalogue of seeds of American plants in 1804, for the export trade, contained about 1,000 species of trees, herbs and shrubs. He also announced at that time that he had "also for sale an extensive variety of Asiatic, South Sea Islands, African and European seeds of the most curious and rare kinds." "The prices shall be moderate, and due allowance will be made to those who buy to sell again." M'Mahon, through business and writing, had great influence on American horticulture in its formative period. He distributed seeds of the very important Lewis and Clark expedition; but Landreth is said to have shared these seeds, and also those collected by Nuttall. Those were days of the enthusiastic exportation of the seeds of American plants.

The development of the seed trade is coincident with the development of the postal service. Burnet Landreth writes that "it was not until 1775 that the New York city post office was first established, the mail passing once every two weeks between New York and Boston. In 1775, a through mail was established by Postmaster Franklin between Boston and Savannah, the letters being carried by post riders, each man covering 25 miles. Previous to that date, sixty days would frequently pass without a mail from Virginia."

The number of seed firms in North America is now in the hundreds. With the development of the plant-breeding enterprises, local or regional firms and associations are springing up, to do commerce with particular strains or lines of breeding. The demand for good seeds, with recognized merit, is one of the most hopeful developments in American agriculture. It is of the same order of excellence as the demand for pedigreed and well-bred live-stock.

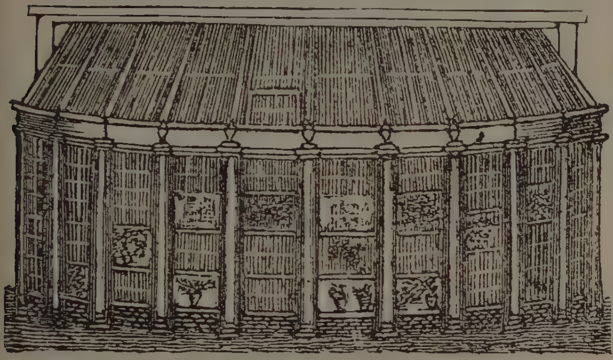
Greenhouses.

The first glasshouse in North America was probably erected early in the century before last, in Boston, by Andrew Faneuil, who died in 1737. This house passed to his nephew, Peter Faneuil, who built Faneuil Hall. The greenhouse which is commonly considered to be the first built in the country was erected in 1764 in New York, for James Beekman. A picture of this, from Taft's "Greenhouse Construction," is shown in Fig.



1863. One of the earliest American greenhouses (1764).

1863. Glasshouses were fully described in 1804 by Gardiner and Hepburn, and in 1806 by M'Mahon, but these authors do not state to what extent such structures existed in America. In Doctor Hosack's botanic garden, 1801, extensive glasshouses were erected. Compare Figs. 1749 and 1750. Fig. 1864 shows one of the earliest American pictures of a greenhouse. It is copied, full size, from Squibb's "Gardener's Calendar," Charleston, South Carolina, 1827. Fig. 1865 shows the first greenhouse in Chicago, as illustrated in "American Florist." Note the small panes, and the sash-construction. This was built in 1835 or 1836. With these pictures should be compared the modern greenhouses as shown in Fig. 1866; also in the pictures in the articles on *Greenhouse*.



1864. Greenhouse front.

With glass lights and door of glass at the end, to be 7 feet high, 35 in length by 12 in breadth. Brick foundation 2 feet high, half a foot of which to be underground.—Robert Squibb, "Gardener's Calendar," Charleston, S. C. (1827).

These early houses were heated by flues or fermenting substances. The use of steam in closed circuits began in England about 1820. Hot-water circulation seems to have been a later invention, although it drove out steam heating, until the latter began to regain its supremacy in this country thirty to forty years ago. The "New England Farmer" for June 1, 1831, contains a description of hot-water heating for hothouses, a matter then considered to be a great novelty.

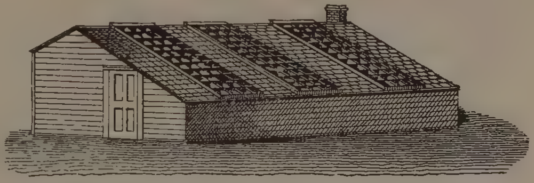
Most of the early houses had very little, if any, glass in the roof, and the sides were high. It was once a practice to build living-rooms over the house, so that the roof would not freeze. In the "modern" construction of the greenhouse of M'Mahon's day, 1806, he advised that "one-third of the front side of the roof, for the whole length of the house, be formed of glass-work," and in order that the tall, perpendicular sides of the house should have as "much glass as possible," he said that "piers between the sashes are commonly made of good timber, from 6 to 8 or 10 inches thick, according to their height." "The width of the windows for the glass sashes may be 5 or 6 feet; . . . the bottom sashes must reach within a foot or 18 inches of the floor of the house and their top reach within 8 or 10 inches of the ceiling." The panes in the roof should be 6 inches by 4, this size "being not only the strongest, but by much the cheapest, and they should lap over each other about ½ inch." But the sides or "front lights must be made with large panes of glass." Many or most of the early plant-houses had removable tops, made of sash. On the change from the old to the new ideas, Alfred Henderson writes as follows: "The first published advocacy of the fixed-roof system was made by Peter B. Mead, in the 'New York Horticulturist,' in 1857. Before that, all greenhouse structures for commercial purposes were formed of portable sashes, and nearly all were constructed as 'lean-tos,' with high back walls, and none were connected. All were separate and detached, being placed at all angles, without plan or system. Then, too, the heating was nearly all done by horizontal smoke-flues, or manure fermenting, although there was a crude attempt at heating by hot water by some private individuals as early as 1833. The first use of heating by hot water on anything like a large scale, however, was in 1839, when Hitchings & Co., of this city, heated a large conservatory for Mr. William Niblo, of New York; and yet for nearly twenty years after this time heating by hot water was almost exclusively confined to greenhouses and graperies on private places, as few professional florists in those days could afford to indulge in such luxuries. All this is changed now. The use of steam, hot water under pressure, and the gravity system of hot-water heating are almost universally in operation, the hot-air flue having been relegated to the past. The best evidence of progress is in the fact that the florist has not waited for the tradesman, but has brought about these improvements himself."

Much attention was early given to the slope of the roof, in order that the greatest amount of sunlight may be secured. Early in the past century the curvilinear roof came into use, as the various angles which it presents to the sun were supposed to catch the maximum number of the incident rays. The sides of the house remained high, for the most part, until near the middle of the century. All this shows that the early glasshouse was modeled after the dwelling or other buildings, and that it had not developed into a structure in which plants were grown for commercial purposes.

The modern commercial forcing-house, with direct roof, low sides, and heated by steam or hot water in closed circuits, is mostly a development of the last forty years. Its forerunner was the propagating-pit of the nurseryman. If anything is lost in sunlight by adopting a simple roof, the loss is more than compensated by the lighter framework and larger glass. In the forcing-house, all architectural ambition is sacrificed to the one desire to create a commercial garden in the frosty months.

Lettuce, cucumbers, tomatoes, carnations, violets, and various other plants are now grown as crops under glass roofs, whereas a generation ago they were usually not forced at all for market or were grown mostly under frames. With the simplifying and cheapening of the glasshouse, amateur flower- and vegetable-growing has acquired a new impetus, and the business of the retail florist has grown amazingly.

Some idea of the increase of the demand for plants may be obtained from the sale of flower-pots. A. H. Hews, of Cambridge, Mass., whose ancestors began the manufacture of pots before 1765, once reported that for a period of twenty-two years, from 1788 to 1810 the accounts of the sales of pots "cover about as many pages as we now often use in one day; and the amount in dollars and cents does not compare with single sales of the year 1894." He also compared the sales for 1869 and 1894 and "found the increase as ten to one; or, in round numbers, 700,000 flower-pots in the former year and 7,000,000 in the latter; and if the same factory can in 1920, twenty-five years later, produce and sell 70,000,000, we shall verily be living in a land of flowers."



1865. First greenhouse in Chicago (1835 or 1836).

One of the earliest greenhouse builders was Frederic A. Lord, who built his first houses, according to Taft, in Buffalo in 1855, and who, in 1872, entered into partnership with W. A. Burnham, at Irvington, on the Hudson. Several firms now make greenhouse building and heating a specialty. In very recent years a new impetus has been given to glasshouse building and work by the establishment of the agricultural experiment stations and the extension of horticultural teaching in the colleges.

The growing literature.

An important feature of American horticulture is its living literature. Persons may care nothing for books; yet the literature of any subject is the measure of its ideals. Persons may say that the books are theoretical and beyond them; yet good books are always beyond, else they are not good. There is no reason for literature if it does not inspire and point to better things. We measure the aspirations of any time by its writings. Whether the fact be recognized or not, the literature of our horticulture is an underlying force which slowly dominates the thoughts and ideals of men. A book is a powerful teacher. It states its propositions, and is silent; and in the silence its lessons sink into the mind.

1866. Interior of a modern commercial greenhouse.—Carnations.

Very many books have enriched American horticulture. Many of them have been poor, but even these may have challenged controversy and have done good. The early books were largely empirical and dogmatic. Downing, for example, in 1845, says that tillage makes better orchards, and he cites cases; but he does not give reasons. He does not mention nitrogen, potash, soil moisture, chemical activities. He does not even mention plant-food in connection with tillage. The horizon has widened since then. Men do not take up things actively until they know the reasons. The poor farmer, not knowing reasons for anything, has no inspiration and goes fishing. Forty years ago, Colonel Waring was the apostle of deep-plowing; yet one should plow neither deep nor shallow until he knows why. Our literature has been singularly devoid of principles and analysis. The great writer is he who catches the significant movements and ideas of his time and portrays them to inspire his reader. Henderson first caught the rising commercial spirit of our vegetable-gardening; his "Gardening for Profit" was the greatest American vegetable-gardening book, even if now out of date as a book of practice. American pomology has several strong names amongst its writers. Most of these writers have sacrificed fundamental considerations to varieties. The first sustained effort to write on fruit-growing from the point of view of underlying principles was by Charles R. Baker, who in 1866 published his "Practical and Scientific Fruit Culture." But the time was apparently not yet ready for a solid book of this kind, and much of the discussion lacked vital connection with the orchard. The book was suggestive of the study and the compiler. Coxe, Kenrick, Manning, Downing, Thomas, Warder, Barry, Fuller, are significant names in American pomological literature. In floriculture there have been many excellent treatises, but there is not yet a single great or comprehensive book. In recent years, the making of technical horticultural literature is passing more and more from the working horticulturist to the specially trained student and writer, particularly to those who are connected with colleges of agriculture and experiment stations. At the same time, the amateur and strictly popular writings are increasing rapidly, and the modern publisher has made many of the books very attractive in their mechanical execution.

The periodical literature is not to be overlooked, although we do not now have in America horticultural magazines and journals comparable with those of Europe. These serial writings, however, are voluminous and important, and must be taken into account when any complete estimate is made of American horticultural literature. On the writing of "gardening literature," Henry Ward Beecher wrote nearly fifty years ago: "We, in America especially, need men to write who devote time, thought and knowledge to this elegant department of knowledge as they do to the sciences of law, of medicine, or theology; and, although we are glad of transient and cursory writing, rather than none, I feel the want, in American horticultural magazines, of writing that is the result of long and close observation, and of ripe reflection." L. H. B.

HORTICULTURE, LITERATURE OF. The written record of American horticulture has not yet been carefully studied, although the collecting of books has lately assumed much interest and importance. There are no full lists of these writings; and it is to make a preliminary contribution to such lists that the present compilation is presented. The written word persists long after the word of mouth has been lost; and it admits of no doubt as to dates and statements of fact. It is essential that any people arrive at an appreciation of its records in a given subject, that it may have perspective and develop sound judgments.

In the preceding pages something has been said about the development of writing on horticulture in North America. The early general writings are discussed beginning on page 1509. The fruit-growing literature is reviewed from page 1513. The periodical literature occupies considerable space, beginning page 1559. The reports of horticultural societies are recorded from page 1553. In the present discussion, the regularly printed horticultural books are listed in detail, from the first book on horticulture in North America, so far as it may be known, to the current date. In the preceding accounts, some of the early writings on general agriculture are discussed, as bearing on the history; many other early writers might have been mentioned, if the subject had taken a wider field, as Binns (Frederick, Maryland, 1803), Spurrier (Worcester, 1792), Parkinson (Philadelphia, 1799), George Logan (Philadelphia, 1797), Du Pre ("Culture of Cotton," 1799, perhaps the book mentioned on page 1510), and others.

North American horticultural books.

In the introduction to the "History of the Massachusetts Horticultural Society" (1880) it is said that Mrs. Martha Logan, in South Carolina, "when seventy years old, wrote a treatise on gardening called the 'Gardener's Kalendar,' which was published after her death in 1779, and as late as 1808 regulated the practice of gardening in and near Charleston. She was a great florist, and uncommonly fond of a garden" (page 1510). In the Charleston library there is no separate book of this kind, but the "Gardener's Calendar by Mrs. Logan" appears in succeeding issues of the "Carolina and Georgia Almanac," comprising six pages. The earliest date there available is in the Almanac for 1798. It has been spoken of as a pamphlet, and it may have been reprinted separately. The first almanac printed in South Carolina was Tobler's for 1752. This almanac contains a "Gardner's Kalender, done by a Lady of this Province and esteemed a very good one." Perhaps this work was by Mrs. Logan. There does not appear to be any book by Mrs. Logan in the antiquarian libraries or lists, although, following Allibone, Evans apparently erroneously included it in Vol. IV of his "American Biblography" as of the date of 1772. Mrs. St. Julien Ravenel, in "Charleston, the Place and the People" (1906), writes that "Mrs. Logan was the daughter of the gallant Colonel Daniel. Her 'Gardeners' Chronicle,' written when over seventy, was in great demand formerly, but seems to have utterly perished, the most careful search failing to produce a copy."

The almanacs were important mediums of information in the early days, and it is probable that some of the first instruction in horticulture was given in them. In "Poor Will's Almanack" for 1787, printed in Philadelphia in 1786, there is a "Gardener's Kalender; or useful memorandums of work necessary to be done, monthly, in the gardens and orchards of the Middle States," according to Evans. The "Southern States Ephemeris" for 1788, printed in Charleston in 1787, contains "a new and copious gardener's calendar" for the southern states. In Isaac Brigg's "Georgia and South Carolina Almanac" for 1800, printed in Augusta in 1799, there is a calendar, according to Evans, by Robert Squibb. The agricultural matter in the New England almanacs is well known.

In 1796, there was printed at Newburyport, Massachusetts, by Blunt and March, for John Dabney, Salem, "An Address to Farmers" on a number of interesting subjects. It contains a part or chapter on the character of a complete farmer; one on the profits of a nursery; another on the advantages of an orchard. There are references in the appendix to apples, barley, cabbages, carrots, clover, and other subjects. The parts were "extracted principally from a variety of authors."

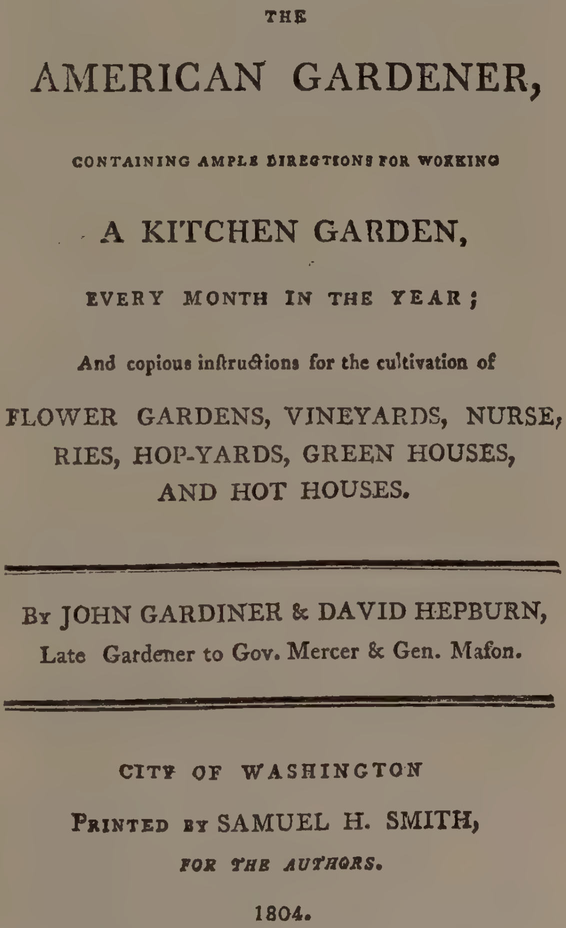
Apparently the earliest separate book on a horticultural subject published in North America (if the Logan is not counted), was Robert Squibb's "The Gardener's Kalender for South Carolina and North Carolina," published in Charleston in 1787, and again in 1809, 1827, and 1842 (Fig. 1864). The second work appears to be an American edition of Marshall's "Introduction to the Knowledge and Practice of Gardening," Boston, 1799. The second indigenous horticultural book, apparently, appeared in 1804, "The American Gardener," by John Gardiner and David Hepburn (Fig. 1867). It was published at Washington. This book had an extensive sale. It was revised by "a citizen of Virginia," and republished in Georgetown, D.C., in 1818 (see Hepburn, p. 1579). A third edition appeared in 1826.

This book was followed in 1806 by Bernard M'Mahon's excellent and voluminous "American Gardener's Calendar," in Philadelphia. This work enjoyed much popularity, and the eleventh edition appeared as late as 1857. For fifty years it remained the best American work on general gardening. M'Mahon, remembered in the Mahonia barberries, was an important personage. He was largely responsible for the introduction into cultivation of the plants collected by Lewis and Clark. These early books were calendars, giving advice for the successive months. They were made on the plan then popular in England, a plan which has such noteworthy precedent as the excellent "Kalendarium Hortense" of John Evelyn, which first appeared in 1664, and went to nine regular editions. Other early books of this type were "An old gardener's 'Practical American Gardener,'" Baltimore, 1819 and 1822; Thorburn's "Gentleman's and Gardener's Kalendar," New York, the third edition of which appeared in 1821.

As throwing some light on the processes of book-making in those days, the following announcement by Squibb in the "Charleston Evening Gazette," July 4, 1786, will be interesting:

> To the Public.
>
> From the frequent solicitations of a number of Gentlemen of this and adjoining states, the subscriber has been induced to undertake a work, entitled, "The South Carolina, Georgia, and North Carolina Gardeners Calendar," which, from its general utility, he flatters himself, will meet the approbation of the Public at large. The English publications hitherto made use of to point out and direct the best methods of Gardening by no means answer the purpose, as they tend to mislead instead of instruct, and suit only the European parts for which they were designed.—This work is deduced from practice and experience in this climate, wherein the most certain and simple methods are clearly pointed out, so as to render the art of Gardening easy and familiar to every capacity.
>
> The work will be comprised in an octavo volume of about 200 pages, which will contain ample directions for whatever is necessary to be done in the Kitchen and Fruit Garden for every month in the year.
>
> Terms of subscribing One Dollar; half on subscribing, the remainder on the delivery of the book, which will be printed with all possible dispatch. Robert Squibb Nursery and Seedsman.
>
> Subscriptions will be received at the subscriber's Garden, the upper end of Tradd street, at the Printers of this Paper, at Bower & Markland's Printing-office, Church street, and at the principal Taverns.

The first indigenous book written on the topical plan, treating subject by subject, is apparently Coxe's fruit book, 1817; the second appears to have been Cobbett's "American Gardener," published at New York in 1819,



THE
AMERICAN GARDENER,
CONTAINING AMPLE DIRECTIONS FOR WORKING
A KITCHEN GARDEN,
EVERY MONTH IN THE YEAR;
And copious inſtructions for the cultivation of
FLOWER GARDENS, VINEYARDS, NURSERIES,
HOP-YARDS, GREEN HOUSES,
AND HOT HOUSES.

By JOHN GARDINER & DAVID HEPBURN,
Late Gardener to Gov. Mercer & Gen. Maſon.

CITY OF WASHINGTON
PRINTED BY SAMUEL H. SMITH,
FOR THE AUTHORS.
1804.

1867. Title-page, exact size, of what is supposed to be the second or third indigenous American horticultural book.

in London in 1821, and which passed through subsequent editions. This William Cobbett is the one who edited the federalist paper in Philadelphia known as "Peter Porcupine's Gazette," and whose attack upon Dr. Rush's treatment of yellow fever brought against him a judgment for damages, and which decided him to return to England in 1800, whence he had come, by way of France, in 1792. In London he again took up political writing, and in 1817 he retreated to America to escape political penalties, and resided upon a farm on Long Island until 1819. He kept a seed store in New York in 1818, and we find Grant Thorburn disputing with him in the "Evening Post" as to which sold the better rutabaga seed at one dollar a pound. Cobbett, it seems, claimed to have been the introducer of this vegetable, also known as the Russian turnip, into this country; but Thorburn retorts that "in the year 1796 a large field of these turnips was raised by Wm. Prout on that piece of ground now occupied by the navy yard, at the city of Washington." He completed his life in England, becoming a voluminous author upon political and economical subjects. It is interesting to note, in connection with this dispute about the turnips, that the kohlrabi was introduced about the same time, and Deane says of it in 1797, that "whether this plant, which has but newly found its way into our country, is hardy enough to bear the frost of our winters, I suppose is yet to be proved." It was recommended to be grown as a biennial, which accounts for Deane's fear that it might not pass the winters.

Fessenden's "New American Gardener," made upon the topical plan, appeared in Boston in 1828, and went to various editions; and from this time on, gardening books were frequent. Some of the leading early authors are Thomas Bridgeman, of New York; Robert Buist, of Philadelphia, and Joseph Breck, of Boston.

The first American book devoted wholly to flowers was probably Roland Green's "Treatise on the Cultivation of Flowers," Boston, 1828 (p. 1511). Edward Sayers published the "American Flower Garden Companion," in Boston, in 1838. From 1830 to 1860 there appeared many of those superficial and fashionable books which deal with the language of flowers, and which assume that the proper way to popularize botany is by means of manufactured sentiment.

The first book devoted to a special flower was probably Sayers' treatise on the dahlia, Boston, 1839, which appeared only a year later than Paxton's well-known book in England. Sayers' book also included the cactus. The next special flower-book seems to have been Buist's "Rose Manual," Philadelphia, 1844, although a sentimental book on the "Queen of Flowers" had appeared in the same city in 1841. Buist's book went to at least four editions. It was followed by Prince's in 1846, and by S. B. Parson's "The Rose: Its History, Poetry, Culture and Classification," 1846. Parson's book went to a revised edition. Of later-date flower-books there are several of importance, but it is not the purpose of this paragraph to trace more than the beginnings of American floricultural writings.

In 1838 appeared a book in French in New Orleans. This was Lelievre's "Nouveau Jardinier de la Louisiane." It was a small book of 200 pages, with a calendar and brief directions for the growing of vegetables, fruits and flowers. Singularly enough, a French book also appeared at the other extreme of the country. This was Provancher's "Le Verger-Canadien," published in Quebec in 1872.

It is in the pomological writings that North America has made the greatest contributions to horticultural literature. William Forsyth's excellent "Treatise on the Culture and Management of Fruit Trees" appeared in London in 1802, and it was widely read, "an impression of 1,500 copies (of the first edition) in 4to having been sold in a little more than eight months." An American edition, by William Cobbett, appeared in New York and Philadelphia in 1802, and in Albany in 1803, and an epitome of it by "an American farmer," was published in Philadelphia in 1803. The first American pomological book was William Coxe's "View of the Cultivation of Fruit Trees," published in Philadelphia in 1817, a work known to students of horticultural literature for the uniform completeness and accuracy of its descriptions. A feature of this excellent work are the many woodcuts of varieties of fruits. Although not answering the requirements of the present day, they were considered to be very good for the time and for a new country. One of them is reproduced in Fig. 1858 to show the style of workmanship. Coxe had 100 woodcuts of apples, 63 of pears, 15 of peaches, 17 of plums, 3 of apricots, 2 of nectarines. This makes 200 engravings, which would be considered liberal illustration even at the present day.

James Thacher's "American Orchardist" appeared in Boston in 1822, and the second edition at Plymouth in 1825. The first edition was also bound with William Cobbett's "Cottage Economy," and the double volume was issued in New York in 1824 as "American Orchardist and Cottage Economy." "The Pomological Manual," New York, 1831 (second edition 1832), is a compilation of descriptions of varieties, by William Robert Prince and William Prince, son and father respectively. William Kendrick's "New American Orchardist" was published in Boston in 1833. The eighth edition appeared in 1848. Like all early works, it devotes most of its space to varieties. Robert Manning published his admirable "Book of Fruits," at Salem, in 1838, being aided by John M. Ives. Upon the death of Manning, Ives published a second edition in 1844 under the title of "The New England Fruit Book," and a third in 1847 as "The New England Book of Fruits." Downing's "Fruits and Fruit Trees of America" appeared in 1845 in two forms, duodecimo and octavo, although both issues were printed from the same type. One issue of the octavo form contained colored plates. Thomas' "Fruit Culturist," which is known in subsequent editions as "The American Fruit Culturist," appeared in 1846. Other pomological writings which appeared before 1850 are Sayers' "American Fruit Garden Companion," Boston, 1839; Hoffy's "Orchardist's Companion," Philadelphia, 1841; Bridgeman's "Fruit Cultivator's Manual," New York, 1845; Floy's American edition of George Lindley's "Guide to the Orchard and Fruit Garden," New York, 1846; Jaque's "Practical Treatise on the Management of Fruit Trees," Worcester, 1849; Goodrich's "Northern Fruit Culturist," Burlington, Vt., 1849; Cole's "American Fruit Book," and others. Barry's "Fruit Garden" appeared in 1851.

Of these pomological books, the first place should be given to those of Coxe, Kendrick, Manning, Downing, Thomas and Barry. The influence of Downing's "Fruits and Fruit Trees of America" probably has been greater than that of all others in extending a love of fruits and a critical attitude toward varieties. Begun by Andrew Jackson Downing—perhaps the fairest name in American horticultural literature—it was continued and revised by the elder brother, Charles, after the untimely death of the former. Most of these works were largely compilations. A notable exception was Manning's "Book of Fruits." In the introductory remarks to this volume is the following statement: "There is one circumstance to which we venture to call the attention of our readers—that while some recent works on pomology are compiled from earlier authors, or from information derived at second-hand, the writers themselves seldom having the means of observation in their power, we have in these pages described no specimen which we have not actually identified beyond a reasonable doubt of its genuineness." It was Manning who chiefly made known to Americans the pears of the Belgian, Van Mons. He was one of the most careful observers amongst American pomologists.

The awakening pomology of the region west of the Alleghanies found expression in Elliott's "Fruit Book," 1854, whose author wrote from Cleveland, and which went to a new edition in 1859 as "The Western Fruit Book," with the preface dated at St. Louis; and Hooper's "Western Fruit Book," 1857, written at Cincinnati. John A. Warder was a guiding spirit of the opening West.

The earliest separate grape book was published in Washington in 1823, by the prophetic Adlum, "A Memoir on the Cultivation of the Vine in America." This went to a second edition in 1828. Before this time (1806), S. W. Johnson had devoted much space to the grape in his "Rural Economy," published at New Brunswick, N. J., and he published interesting pictures of grape-training (Fig. 1859). Adlum's book was followed in 1826 by the "American Vine Dresser's Guide," by Dufour. This important work also gave pictures of grape-training, one of which is reproduced in Fig. 1860. The larger number of the grape books appeared before the close of the Civil War, although the larger part of the development of the subject has taken place since that time.

LIST OF AMERICAN HORTICULTURAL BOOKS

The purpose of the following list is to record all the regular publishers' or book-trade books, and their editions, on fruit-growing, flower-growing, vegetable-gardening, and closely related subjects, that have been published in the United States and Canada to the close of the year 1914. It does not include British or other imported books that apparently are printed abroad and then bound up in this country with a new title-page, or even those of foreign authorship that are merely reprinted in this country, for the reason that they do not represent American experience and are really not American works. Neither does the list contain all excerpts or separates of articles or addresses that may be put in pamphlet form, nor the reports and publications of government departments. Revisions and modified editions, as indicated by new copyright or changed title-page, are included, but not new impressions or re-issues.

The entries comprise the name of the author (or editor) as given on the title-page, the exact title, the phraseology of the subtitles, whether illustrated, place of publication, date (n. d. means that no date is given on the title-page), date of copyright (n. c. means that there is no copyright imprint), publisher, number of pages (roman numerals are those of prefatory pages), and size of the bound volume to one-quarter of an inch. It is intended that the capitalization and punctuation of the original shall be followed, but as the list has been compiled from several sources it has been impossible to be consistent in these details. The name of the author is intended to be given in the form in which it appears in the given book, on the assumption that the author's wishes and usage are to be respected.

Every pains has been taken to make this list accurate and complete. It was first put in type more than two years ago, and it has been gone over by many persons. Revised proofs have been taken and these have again been gone over. Special aid has been given by the Library of the United States Department of Agriculture, Library of Congress, and the Massachusetts Horticultural Society.

Abbott, Francis B. Hand-Book of Small Fruits. Illus. Chicago, Ill. n. d. Paper 5¾ x 3½. [1889?]

Adams, H. S. Flower Gardening. Illus. New York. 1913. [c. 1913.] McBride, Nast & Co. 253 pp. 5 x 7½.

———. Lilies. Being one of a series of flower monographs. Illus. New York, 1913. [c. 1913.] McBride, Nast & Co. 116 pp. 5 x 7.

———. Making a Rock Garden. Illus. New York. 1912. [c. 1912.] McBride, Nast & Co. 52 pp. 6½ x 4¼. (House and Garden Making Books.)

Adlum, John. A Memoir on the Cultivation of the Vine in America, and the Best Mode of Making Wine. Washington. 1823. [c. 1823.] Davis & Force. 142 pp.

———. The same. 2d ed. Washington. 1828. [c. 1828.] William Greer. 180 pp.

Agar, Madeline. Garden Design in Theory and Practice. Illus. Philadelphia. 1912. J. B. Lippincott Company. 272 pp. 9 in.

Agricola, P. The New York Gardener; or, twelve letters from a farmer to his son, in which he describes the method of laying out and managing the kitchen garden. White Creek. 1827. [n. c.] Published by A. Crosby. G. M. Davison, Printer, Saratoga Springs. 96 pp. 7 x 4½.

Albaugh, Benjamin F. The Gardenette; or, City Back Yard Garden by the Sandwich System . . . a complete Guide for the Amateur Gardener. Illus. Piqua, O. 1912. The Magee Bros. Co., Printers. 64 pp. 9 in.

Albee, Helen R. Hardy Plants for Cottage Gardens. Illus. New York. 1910. H. Holt & Co. vi + 309 pp. 8 in. (American Nature Series. Group IV. Working with Nature.)

Alderman, W. H. See Hedrick, U. P. The Plums of New York.

Allen, C. L. Bulbs and Tuberous-rooted Plants; their history, description, methods of propagation and complete directions for their successful culture in the garden, dwelling and greenhouse. Illus. New York. 1893. [c. 1893.] Orange Judd Company. vi + 311 pp. 8 x 5½.

———. Cabbage, Cauliflower and Allied Vegetables from Seed to Harvest. Illus. New York. 1901. [c. 1901.] Orange Judd Company. xvi + 127 pp. 7½ x 5.

Allen, John Fisk. The Culture of the Grape. Embracing Directions for the Treatment of the Vine, in the Northern States of America, in the open air, and under glass structures, with and without artificial heat. Illus. Boston. 1847. Dutton & Wentworth, Printers. 55 pp. 9¼ in.

———. A Practical Treatise on the Culture and Treatment of the Grape Vine; embracing its history, with directions for its treatment, in the United States of America, in the open air, and under glass structures, with and without artificial heat. Illus. 2d ed., enlarged. Boston. 1848. [c. 1848.] Dutton & Wentworth. 247 pp.

———. The same. Illus. 3d ed., enlarged and revised. New York. 1853. [c. 1853.] C. M. Saxton, Barker & Co. 330 pp. 7¾ x 5½.

———. Victoria Regia; or, the great water lily of America. With a brief account of its discovery and introduction into cultivation. With illustrations by William Sharp, from specimens grown at Salem, Mass., U. S. A. Colored plate. Boston. 1854. [c. 1854.] Dutton & Wentworth. 17 pp. 27 x 21.

Allen, Lewis F. Rural Architecture; being a complete description of farmhouses, cottages, and outbuildings, comprising wood houses, workshops, tool houses, carriage and wagon houses, stables, smoke and ash houses, ice-houses, apiary or bee house, poultry houses, rabbitry, dovecote, piggery, barns and sheds for cattle, etc., together with lawns, pleasure grounds and parks; the flower, fruit and vegetable garden; also, useful and ornamental domestic animals for the country resident, etc.; also, the best method of conducting water into cattle yards and houses. Beautifully illustrated. New York. 1863. [c. 1852.] C. M. Saxton. 378 pp. 8 x 5.

———. The same. A. O. Moore; also by Orange Judd & Co. 7½ x 5.

———. See Smith, C. H. J. Landscape Gardening.

Allen, Phoebe, and Godfrey, Dr. Miniature and Window Gardening. New York. 1902. J. Pott & Co. 100 pp. 7½ in.

Allen, Walter Fox. English Walnuts; what you need to know about planting, cultivating and harvesting this most delicious of nuts. Illus. Lawrenceville, N. J. [c. 1912.] W. F. Allen. 29 pp. 6½ in

Alwood, Wm. B. A series of bulletins on Orchard Technique. Bulletins 97–101. Virginia Agricultural Experiment Station. With notes on insecticides by J. L. Phillips and H. L. Price. Illus. Roanoke, Va. 1900. Stone Printing and Manufacturing Company. 125 pp. "Orchard Technique" on cover.

American Chrysanthemum Annual, 1895. See Barker, Michael.

American Florist Company's Directory of Florists, Nurserymen and Seedsmen of the United States and Canada. Chicago. 1890. [c. 1890.] Published by the American Florist Company. 123 pp. 8¾ x 6.

———. The same. 1892. 195 pp.

———. The same. 1894. 270 pp.

———. The same 1896. 335 pp. 7½ x 4¾.

———. The same. 1898. 351 pp.

——— The same. 1899. 358 pp.

———. The same. 1900. 384 pp.

———. The same. 1901. 397 pp.

———. The same. 1902. 416 pp.

———. The same. 1903. 415 pp.

———. The same. 1904. 407 pp.

———. The same. 1905. 451 pp.

———. The same. 1906. 475 pp.

———. The same. 1907. 496 pp.

———. The same. 1908. 507 pp.

———. The same. 1909. 544 pp.

———. The same. 1910. 566 pp.

———. The same. 1911. 586 pp.

———. The same. 1912. 645 pp.

American Fruits Pocket Directory for the year 1910. Rochester, N. Y. 1910. American Fruits Publishing Company. 168 pp. 6¾ x 3½.

American Fruits Year Book and Directory of Nurserymen for the year 1912. Portraits. Rochester, N. Y. [c. 1912.] American Fruits Publishing Company. 190 pp. 7¼ x 4.

American Horticultural Annual. A yearbook of horticultural progress for the professional and amateur gardener, fruit-grower, and florist. Illus. New York. 1867. [c. 1867.] Orange Judd Company. 152 pp. 7½ x 5.

———. The same, for 1868. 164 pp.

———. The same, for 1869. 152 pp.

———. The same, for 1870. 152 pp.

———. The same, for 1871. 152 pp.

American Rose Culturist, The. Being a practical treatise on the propagation, cultivation, and management of the rose in all seasons; with a list of choice and approved varieties adapted to the climate of the United States. To which are added full directions for the treatment of the dahlia. Illustrated with engravings. New York. n. d. [c. 1856.] Orange Judd Company. 96 pp. 7¼ x 5.

———. The same. 1866. [c. 1852.] C. M. Saxton & Co. 96 pp. 8 x 5½. (Bound sixth in Saxton's Rural Handbook, 2d series.)

———. The same. 1866. [c. 1856.] Orange Judd Company. 96 pp. 7¼ x 5.

Anders, J. M. House-Plants as Sanitary Agents; or, the relation of growing vegetation to health and disease; comprising, also, a consideration of the subject of practical floriculture, and of the sanitary influences of forests and plantations. Philadelphia. 1887. [c. 1886.] J. B. Lippincott Company. 334 pp. 7¾ x 5.

Anderson James. See Marshall, Charles. An Introduction to the Knowledge and Practice of Gardening.

Andrae, E. H. A Guide to the Cultivation of the Grape-Vine in Texas, and Instructions for Wine-Making. Illus. Dallas, Texas. [c. 1889.] Texas Farm and Ranch Publishing Company. Paper, 45 pp. 8¾ in.

———. The same. 1890. [c. 1890.]

Andrews, Walter E. See Farmer, L. J. Fall-bearing Strawberry Secrets.

Angier, Belle Sumner. The Garden Book of California. Decorations by Spencer Wright. San Francisco and New York. [c. 1906.] P. Elder & Co. vii + 141 pp. 8¾ in.

Arai, S. See Canada, J. W. How to Plant and Cultivate an Orange Orchard.

Arlie, C. H. See Greiner, T., and Arlie, C. H. How to Grow Onions.

Arnold, George. How to Grow Asters; a Manual on Asters. 6th ed., revised. Illus. Rochester, N. Y. 1912. J. Vick's Sons. 40 pp. 8¾ in.

Aspinwall, Britt. Loganberry Culture. Loganberry Juice, by C. I. Lewis. Written specially for use in the Pacific Horticultural Correspondence School, Portland, Ore. 1913. 15 pp. 9 in.

Aspinwall, John. Hints on the Culture of Pineapples. 2d ed. Eau Gallie, Fla. 1893. [c. 1893.] Published by John Aspinwall. 16 pp. 3 x 5.

Bailey, L. H. American Grape Training. An account of the leading forms now in use of training the American Grapes. Illus. New York. 1893. [c. 1893.] The Rural Publishing Company. 95 pp. (Republished and extended in The Pruning-Book.)

———. Annals of Horticulture in North America for the Year 1889. A witness of passing events and a record of progress. Illus. New York. 1890. [c. 1889.] The Rural Publishing Company. 249 pp. 8 x 5½.

———. The same, for 1890. 1891. [c. 1891.] 312 pp. 8¼ x 5½.

———. The same, for 1891. 1892. [c. 1892.] 415 pp. 8 x 5½.

———. The same, for 1892. 1893. [c. 1893.] 387 pp. 8¼ x 5½.

———. The same, for 1893, with an account of the horticulture of the Columbian Exposition. 1894. [c. 1894.] Orange Judd Company. vii + 179 pp. 7½ x 5.

———. Cross-Breeding and Hybridizing. The philosophy of the crossing of plants, considered with reference to their improvement under cultivation; with a brief bibliography of the subject. New York. 1892. [c. 1892.] The Rural Publishing Company. 44 pp. 8 x 5¼. (Vol. I, No. 6 of The Rural Library.) Incorporated in Plant-Breeding.

———. Cyclopedia of American Horticulture; comprising suggestions for cultivation of horticultural plants, descriptions of the species of fruits, vegetables, flowers and ornamental plants sold in the United States and Canada, together with geographical and biographical sketches. Assisted by Wilhelm Miller. Illustrated with over two thousand original engravings. New York. 1900–1902. [c. 1900.] The Macmillan Company. 4 vols. 2,016 pp. 11 x 8. 2d ed. 1904. 3rd ed. 1904. 6th ed. 1909.

———. The same. 4th ed. (bound in 6 vols. with additional preface, extra plates and a synopsis of the vegetable kingdom). New York. 1906. Doubleday, Page & Co.

———. Field Notes on Apple Culture. Illus. New York. 1886. [c. 1886.] Orange Judd Company. 90 pp. 7½ x 5.

———. The Forcing-Book. A manual of the cultivation of vegetables in glass houses. Illus. New York. 1897. [c. 1897.] The Macmillan Company. xiii + 266 pp. 7 x 4¾. (The Garden-Craft Series.)

———. Garden-Making. Suggestions for the utilizing of home grounds. Illus. Aided by L. R. Taft, F. A. Waugh, Ernest Walker. New York and London. 1898. [c. 1898.] The Macmillan Company. vii + 417 pp. 7 x 5. (The Garden-Craft Series.) Vegetables by Waugh.

———. The same. 3d ed., revised. 1899. vii + 417 pp.

———. The same. 4th ed., revised. 1901. vii + 417 pp. 10th ed., 1906.

———. The Horticulturist's Rule-Book. A compendium of useful information for fruit-growers, truck-gardeners, florists and others. Completed to the close of the year 1889. New York. 1889. [c. 1889.] Garden Publishing Company. 236 pp. 6½ x 4½.

———. The same. 2d ed., revised. Completed to the beginning of the year 1892. [c. 1892.] The Rural Publishing Company. 221 pp. 7½ x 5.

———. The same. 3d ed., revised and extended. New York and London. 1895. [c. 1895.] The Macmillan Company. ix + 302 pp. 7 x 4¼. (The Garden-Craft Series.)

———. The same. 4th ed. 1896. [c. 1895.] ix + 312 pp. 7 x 4.

———. The same. New and rev. ed. 1904. ix + 312.

———. Farm and Garden Rule-Book. A manual of ready rules and reference with recipes, precepts, formulas, and tabular, information for the use of general farmers, gardeners, fruit-growers, stockmen, dairymen, poultrymen, foresters, rural teachers, and others in the United States and Canada. New York. 1911. [c. 1911.] The Macmillan Company. xxiv + 587 pp. 8 x 5½. The 17th ed. of the Horticulturist's Rule-Book.

———. The same. 18th ed. 1912.

———. See Long, Elias. How to Plant a Place.

——— Manual of Gardening. A practical guide to the making of home grounds and the growing of flowers, fruits, and vegetables for home use. Illus. New York. 1910. [c. 1910.] The Macmillan Company. xvi + 539 pp. 8 x 5½. Founded on Garden-Making and the Practical Garden-Book.

———. The Nursery-Book. A complete guide to the multiplication and pollination of plants. Illus. New York. 1891. [c. 1891.] The Rural Publishing Company. 304 pp. 7½ x 5¼.

———. The same. 3d ed. New York and London. 1896. [c. 1896.] The Macmillan Company. xi + 365 pp. 7 x 4½. (The Garden-Craft Series.) 4th ed., 1900. 11th ed., 1907.

———. Plant-Breeding; being five lectures upon the amelioration of domestic plants. New York and London. 1895. [c. 1895.] The Macmillan Company. xii + 293 pp. 7 x 4½. (The Garden-Craft Series.) In French as La Production des Plantes, translated by J. M. et E. Harraca. Paris. 1901.

———. The same. 2d ed. 1902. xii + 355 pp.

———. The same. 3d ed. 1904. xiii + 334 pp.

———. The same. 4th ed., with a new chapter on current plant-breeding practice. 1906. xiv + 483 pp. Trans. into Japanese by D. Karashima. [Rev. ed., Bailey & Gilbert, 1915].

——— and C. E. Hunn. The Practical Garden-Book; containing the simplest directions for the growing of the commonest things about the house and garden. Illus. New York. 1900. [c. 1900.] The Macmillan Company. vi + 250 pp. 6¾ x 4¾. (The Garden-Craft Series.)

———. The same. 2d ed. 1901. vi + 250 pp.

———. The Principles of Fruit-Growing. Illus. New York and London. 1897. [c. 1897.] The Macmillan Company. xi + 508 pp. 7 x 4¾. (The Rural Science Series.)

———. The same. 2d ed. 1898. [c. 1897.] xvii + 514 pp. 3rd ed. 1900. 4th ed. 1901. [The 20th ed. appeared early in 1915.]

———. The Principles of Vegetable-Gardening. Illus. New York. 1901. [c. 1901.] The Macmillan Company. x + 458 pp. 7 x 5. Trans. into Marathi by L. Paranjpe, 1903. 2nd ed. 1903. 3rd ed. 1904.

———. The Pruning-Book. A monograph of the pruning and training of plants as applied to American conditions. Illus. New York and London. 1898. [c. 1898.] The Macmillan Company.i x + 537 pp. 7 x 5. (The Garden-Craft Series.) 2nd ed. 1899 (ix + 545). 3rd ed. 1901. 4th ed. 1902. 6th ed. 1904. 8th ed. 1907.

———. Sketch of the Evolution of Our Native Fruits. Illus. New York and London. 1898. [c. 1898.] The Macmillan Company. xiii + 472 pp. 8 x 5½.

———. The Survival of the Unlike. A collection of evolution essays suggested by the study of domestic plants. New York and London. 1896. [c. 1896.] The Macmillan Company. 515 pp. 8 x 5½.

———. The same, second issue. [Preface dated Nov. 17, 1896.]

———. The same. 2d ed. 1897.

Baker, Charles R. Practical and Scientific Fruit-Culture. Illus. Boston. 1866. [c. 1866.] Lee & Shepard. 523 pp. 8¼ x 5½.

Baker, Tarkington. Yard and Garden. A book of practical information for the amateur gardener, in city, town or suburb. Illustrated with photographs and diagrams. Indianapolis. n. d. [c. 1908.] The Bobbs-Merrill Company. 418 pp. 7½ x 5.

Barbara (pseud.). See Wright, Mrs. Mabel Osgood.

Barclay, J. O'C. (Trans.) See Persoz. New Process for the Culture of the Vine.

Barker, Michael, Editor. The American Chrysanthemum Annual. Portrait of John Thorpe. Illus. New York. 1895. [c. 1895.] The Mayflower Publishing Company. 44 pp. 10 x 7½.

Barkers, Samuel D. See Cleaveland, H. W. Village and Farm Cottages.

Barkers, William. See Cleaveland, H. W. Village and Farm Cottages.

Barnard, Charles. Charles Barnard's Works. My Ten-Rod Farm, etc. Household Library. Four volumes in one. Containing: I. My Ten-Rod Farm; or, how I became a florist. II. Ten Per Cent on the Investment; or, farming by inches. III. A Simple Flower-Garden. IV. $550 Net Income; or, the strawberry garden. New York. 1882. [n. c.] R. Worthington. 345 + 224 pp. 7½ x 5.

———. Farming by Inches; or, "with Brains, Sir." Boston. [c. 1869.] Loring, Publisher. 123 pp. 8 in. (Market-Gardening.)

———. Gardening for Money. How it was done, in flowers, strawberries, vegetables. Boston. n. d. [c. 1869.] Loring, Publisher. 345 pp. 8 x 5½. (Comprises My Ten-Rod Farm. The Strawberry Garden, Farming by Inches.)

———. My Handkerchief Garden. Size, 25 x 60 feet. Results: A garden, fresh vegetables, exercise, health and $20.49. 1st ed. New York. n. d. [n. c.] E. H. Libby. 69 pp. 7¼ x 5.

———. The same. [c. 1889.] Garden Publishing Company.

———. The same, 2d ed. Illus. 1893. [c. 1893.] The Rural Publishing Company. 75 pp. 7½ x 5. (The Rural Library, Vol. I, No. 17, April.)

———. My Ten-Rod Farm; or, how I became a florist. By Mrs. Maria Gilman. Boston. 1869. [c. 1869.] Loring, Publisher. 119 pp. 8 x 5.

———. A Simple Flower Garden; for country homes. A practical guide for every lady. How to start it; what it will cost; how to stock it to have flowers the year round. Boston. n. d. [c. 1870.] Loring, Publisher. 76 pp. 8 x 5.

———. The Strawberry Garden; how it was planted; what it cost; what came of it financially and sentimentally. A very practical story. Boston. n. d. [c. 1871.] Loring, Publisher. 104 pp. 8 x 5. (Another copy with "$2,000 a Year" printed on cover.)

———. Talks about Our Useful Plants. A book of observations and experiments for the use of schools, students, and all who are interested in the culture of plants for pleasure or profit. New York. 1894. [c. 1886.] Funk & Wagnalls Co. xvi + 133 pp. 6½ x 4½.

———. $2,000 a Year on Fruits and Flowers; or, My ten-rod farm and how I became a florist. To which is added: $550 a Year from the Strawberry Garden. Farming by Inches and with Brains. The Flower Garden and How to Manage It. Philadelphia. n. d. [n. c.] The Keystone Publishing Company. 345 + 76 pp. 7½ x 5.

———. The same. Contains: My Ten-Rod Farm (118 pp.); The Strawberry Garden (104 pp.); Farming by Inches (121 pp.); A Simple Flower Garden for Country Homes (76 pp.). H. T. Coates & Co.

Barnes, Parker T. House Plants and How to Grow Them. Illus. New York. 1909. [c. 1909.] Doubleday, Page & Co. 236 pp. 7½ x 5½.

———. The Suburban Garden Guide. New York and Harrisburg, Pa. [c. 1911.] The Suburban Press. 64 pp. 8 in.

———. The same. New York. 1913. The Macmillan Company. 147 pp. 7 in. (The Countryside Manuals.)

Barron, Leonard. Lawns and How to Make Them. Together with the proper keeping of putting greens. Illus. New York. 1910. [c. 1906.] Doubleday, Page & Co. 174 pp. 7½ x 5½.

———, editor. See Roses and How to Grow Them.

Barry, P. Barry's Fruit Garden. Revised, enlarged, and newly electrotyped. Illus. New York. n. d. [c. 1872.] Orange Judd Company. xvi + 491 pp. 7½ x 5.

———. The same. New edition. Revised and brought down to date, by the author. Illus. New York. 1883. [c. 1883.] Orange Judd Company. xvi + 516 pp. 7¾ x 5.

———. The Fruit Garden. A treatise intended to explain and illustrate the physiology of fruit trees, the theory and practice of all operations connected with the propagation, transplanting, pruning and training of orchard and garden trees, as standards, dwarfs, pyramids, espaliers, etc., the laying out and arranging different kinds of orchards and gardens, the selection of suitable varieties for different purposes and localities, gathering and preserving fruits, treatment of diseases, destruction of insects, descriptions and uses of implements, etc. Illustrated with upwards of 150 figures, representing different parts of trees, all practical operations, forms of trees, designs for plantations, implements, etc. New York. 1851. [c. 1851.] Charles Scribner. xiv + 398 pp. 7¾ x 5½

———. The same. Auburn and Rochester. 1857. Alden & Beardsley.

———. The same. New York. 1860. [c. 1851.] C. M. Saxton, Barker & Co.

———. The same. Rochester, N. Y. 1863. Published by the author.

Bassett, Mark S. The Cranberry: its cultivation, and how to turn the cedar bog of New Jersey into a profitable investment. Philadelphia. 1870. Brinckloe & Marot, Printers. 45 pp. 4¾ in.

Bateman, Lee La Trobe. Florida Trucking for Beginners. De Land, Fla. [c. 1913.] The E. O. Painter Printing Company. 205 pp. 7½ in.

Bates, Frank A. How to Make Old Orchards Profitable. Illus. Boston. 1912. The Ball Publishing Company. 123 pp. 7¾ in.

Batson, Mrs. Stephen. Summer Garden of Pleasure. With 36 illustrations in color by Osmund Pittman. Chicago, Ill. 1909. [c. 1909.] A. C. McClurg & Co. xiv + 213 pp. 9 x 6.

Beach, S. A., Booth, N. O., and Taylor, O. M. The Apples of New York. Report of the New York Agricultural Experiment Station for the year 1903. Illus. Albany. 1905. J. B. Lyon Company, Printers. 409 + 360 pp. 9½ x 6½. In 2 vols.

Beadle, D. W. Canadian Fruit, Flower, and Kitchen Gardener. A guide in all matters relating to the cultivation of fruits, flowers and vegetables, and their value for cultivation in this climate. Illus. Colored plates. Toronto. 1872. [c. 1872.] James Campbell & Son. xvi + 391 pp. 9 x 6.

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Warner, C. D. My Summer in a Garden. New York. n. d. Houghton, Mifflin & Co.

Washburn & Co's Amateur Cultivator's Guide to the Flower and Kitchen Garden; containing a descriptive list of two thousand varieties of flower and vegetable seeds; also, a list of French hybrid gladiolus, raised and imported by Washburn & Co. Boston. 1868. 148 pp. 9¼ x 6¼.

Watson, Alexander. The American Home Garden; being principles and rules for the culture of vegetables, fruits, flowers, and shrubbery; to which are added brief notes on farm crops, with a table of their average product and chemical constituents. Illus. New York. 1859. [c. 1859.] Harper & Bros. ix + 531 pp. 8 x 5½.

Watts, Ralph L. Market Garden Guide; containing reminders and timely hints for every month. Practical suggestions for growing and marketing the principal vegetable crops. With glimpses into some important trucking regions and successful market gardens. Compiled from letters and notes. Illus. Louisville, Ky. [c. 1912.] The Weekly Market Growers Journal. 123 pp. 9 in.

———. Vegetable Gardening. Illus. New York. 1912. Orange Judd Company. xiii + 511 pp. 8 in.

Waugh, F. A. The American Apple Orchard. A sketch of the practise of apple growing in North America at the beginning of the twentieth century. Fully illustrated. New York. 1908. [c. 1908.] Orange Judd Company. x + 215 pp. 7½ x 5.

———. The American Peach Orchard. A sketch of the practice of peach growing in North America at the beginning of the twentieth century. Fully illustrated. New York. 1913. [c. 1913.] Orange Judd Company. 238 pp. 7½ x 5.

———. Beginners' Guide to Fruit Growing; a simple statement of the elementary practices of propagation, planting, culture, fertilization, pruning, spraying, etc. Illus. New York. 1912. [c. 1912.] Orange Judd Company. xi + 120 pp. 7¾ in.

———. Dwarf Fruit Trees: Their propagation, pruning, and general management; adapted to the United States and Canada. Illus. New York. 1906. [c. 1906.] Orange Judd Company. xii + 125 pp. 7½ x 5.

———. Fruit-Harvesting; storing; marketing. A practical guide to the picking, sorting, packing, storing, shipping, and marketing of fruit. Illus. New York. 1901. [c. 1901.] viii + 224 pp. 7½ x 5.

———. House Plants; and how to grow them. Rutland, Vt. n. d. [c. 1896.] A. W. Perkins & Co. 21 pp. 5¼ x 3¼.

———. The Landscape Beautiful; a study of the utility of the natural landscape, its relation to human life and happiness, with the application of these principles in landscape gardening, and in art in general. Illustrated by Members of the Postal Photographic Club. New York. 1910. [c. 1910.] Orange Judd Company. 336 pp. 8½ x 6.

———. Landscape Gardening. Treatise on the general principles governing out-door art, with sundry suggestions for their application in the common problems of gardening. Illus. New York. 1899. [c 1899.] Orange Judd Company. viii + 152 pp. 7½ x 5.

———. The same. 1912. [c. 1912.]

———. Packing and Marketing Fruits; how fruits should be handled to carry to market in best condition and present most attractive appearance. Illus. St. Joseph, Mo. 1905. The Fruit-Grower Company. 62 pp. 5¾ in. ("Brother Jonathan" Series, No. 5.)

———. Plums and Plum Culture. Monograph of the plums cultivated and indigenous in North America; with a complete account of their propagation, cultivation and utilization. Illus. New York. 1901. [c. 1901.] Orange Judd Company. xix + 371 pp. 7½ x 5.

———. Rural Improvement. The Principles of Civic Art Applied to Rural Conditions, Including Village Improvement and the Betterment of the Open Country. Illus. New York. 1914. Orange Judd Company. 320 pp. 5 x 7.

———. Success with Stone Fruits, including chapters on the planting and cultivation of cherries, peaches, plums, apricots, etc., with description of some of the best-known varieties. Illus. St. Joseph, Mo. 1905. Fruit-Grower Company. 68 pp. 5¾ in. ("Brother Jonathan" Series, No. 10.)

———. Systematic Pomology. Treating of the description, nomenclature, and classification of fruits. Illus. New York. 1903. [c. 1903.] Orange Judd Company. x + 288 pp. 7½ x 5.

———. See Bailey. Garden-Making. Also Kemp, Edward. Landscape Gardening.

Webb, James. Cape Cod Cranberries. Illus. New York. 1886. [c. 1886.] Orange Judd Company. Paper. 41 pp. 7½ x 5.

Weed, Clarence Moores. The Flower Beautiful. Illus. Boston and New York. 1903. [c. 1903.] Houghton, Mifflin & Co. x + 137 pp. 9½ x 6.

———. Spraying Crops; why, when, and how. Illus. New York. 1892. The Rural Publishing Company. 110 pp.

———. The same. 2d (revised) ed. New York. 1894. [c. 1891.] Special edition of the Field Force Pump Company, Lockport. 130 pp. 6 x 4¼.

———. The same. 4th ed., revised, rewritten, and greatly enlarged. 1903. Orange Judd Company.

———, and Emerson, Philip. The School Garden Book. Illus. New York. 1909. Charles Scribner's Sons. ix + 320 pp. 7¾ in.

Weed, Howard Evarts. Spraying for Profit; a practical handbook of the best methods for suppressing the more common injurious insects and fungous diseases. Illus. Griffin, Ga. 1899. [c. 1899.] The Horticultural Publishing Company. 72 pp. 6 x 4½.

———. The same. "Sprayology" simplified. Revised and rewritten. Illus. Rogers Park, Chicago. 1906. [c. 1899, 1906.] The Horticultural Publishing Company. 61 pp.

Weidenmann, J. Beautifying Country Homes. A handbook of landscape gardening. Illustrated by plans of places already improved. New York. 1870. Orange Judd & Co. 40 pp. 13¾ in.

Wellcome, Mrs. M. D. An Essay on Roses; historically and descriptively considered. Classification of roses; what roses to plant; mode of culture; list of best hybrids; list of best ever-blooming. Illus. Yarmouth, Maine. n. d. [c. 1881.] J. C. Wellcome. 24 pp. 7 x 5.

———. Talks about Flowers. Illus. Yarmouth, Maine. Preface. 1881. [c. 1881.] J. C. Wellcome. 161 pp. 8 x 5¾.

Wellington, R. See Hedrick, U. P. The Grapes of New York.

Wharton, Edith. Italian Villas and Their Gardens. Illustrated with pictures by Maxfield Parrislh and by photographs. New York. 1904. Century Company.

Whipple, Orville B. See Paddock, Wendell. Fruit-Growing in Arid Regions.

White, Joseph J. Cranberry Culture. Illus. New York. n. d. [c. 1870.] Orange Judd Company. 126 pp. 7½ x 5.

———. The same. New and enlarged edition. New York. 1885. [c. 1885.] Orange Judd Company. 131 pp. 7½ x 5.

White, William N. Gardening for the South; or, the kitchen and fruit garden; with best methods for their cultivations, together with hints upon landscape and flower-gardening. Containing modes of culture and descriptions of the species and varieties of the culinary vegetables, fruit trees and fruits, and a select list of ornamental trees and plants found by trial adapted to the states of the Union south of Pennsylvania; with gardening calendars for the same. Illus. New York. 1856. [c. 1856.] C. M. Saxton & Co. Athens, Ga. Wm. N. White. vi + 402 pp. 7¾ x 5½.

———. The same. New York. 1859. A. O. Moore & Co.

———. Gardening for the South; or, how to grow vegetables and fruits. With additions by Mr. J. Van Buren and Dr. James Camak. Illus. New York. n. d. [c. 1868.] Orange Judd Company. 444 pp. 7½ x 5. (Second edition of above.)

———. The same. 3d ed., revised and enlarged. By P. H. Mell. With many illustrations. Richmond, Va. 1901. [c. 1901.] B. F. Johnson Publishing Company. 683 pp. 8¾ x 6¼.

Whitner, J. N. Gardening in Florida. A treatise on the vegetables and tropical products of Florida. Illus. Jacksonville, Fla. 1885. [n. c.] C. W. DaCosta. xv + 246 pp. 7½ x 5¼.

———. A Manual of Gardening in Florida. Fernandina, Fla. 1881. [c. 1881.] Published by the Florida Mirror. 73 pp. 6½ x 4½.

Whitten, J. C. Apple Culture, with a Chapter on Pears; suggestions for the planting and care of apple and pear orchards. Illus. St. Joseph, Mo. 1906. The Fruit-Grower Company. 88 pp. 6 in. ("Brother Jonathan" Series, No. 9.)

———. Hints on Pruning; some suggestions which will be found helpful in shaping and training fruit trees and plants and ornamental shrubs. Illus. St. Joseph, Mo. 1906. Fruit-Grower Company. 73 pp. 5¾ in. ("Brother Jonathan" Series, No 8.)

———. How to Grow Strawberries; a booklet designed to help those interested in the culture of this most excellent fruit. Illus. St. Joseph, Mo. 1905. The Fruit-Grower Company. 61 pp. 5¾ in. ("Brother Jonathan" Series, No. 3.)

Wickson, Edward J. California Illustrated, No. 1. The Vacaville early fruit district of California. 2d ed. Colored plates. San Francisco. 1888. [c. 1888.] California View Publishing Company. viii + 149 + viii pp. 10¼ x 7.

———. The California Fruits, and How to Grow Them. A manual of methods which have yielded greatest success; with lists of varieties best adapted to the different districts of the state. 1st ed. Illus. San Francisco. 1889. [c. 1889.] Dewey & Co. vi + 575 pp. 9 x 6.

———. The same. 2d ed., revised and enlarged. 1891. [c. 1889.] viii + 599 pp. 9 x 6.

———. The same. 3d ed., largely rewritten. 1900. [c. 1899.] Pacific Rural Press. viii + 477 pp. 9 x 6.

———. The same. 4th ed., revised and extended. 1909. [c. 1908.] 433 pp. 10¾ in.

———. The same. 5th ed., revised and extended. 1910. 604 pp. 9½ in.

———. The same. 6th ed., fully revised. 1912. [c. 1912.] 602 pp.

———. The same. 7th ed., fully revised. 1914. [c. 1914.] 513 pp.

———. The California Vegetables in Garden and Field. A manual of practice, with and without irrigation, for semi-tropical countries. Illus. San Francisco. 1897. [c. 1897.] Pacific Rural Press. viii + 336 pp. 9 x 6

———. The same. 2d ed., revised and extended. 1910. 367 pp. 9½ in.

———. The same. 3d ed., revised and extended. 1913. 326 pp.

Wight, J. B. Pecans: the what, when, how of growing them. Illus. Cairo, Ga. 1906. 15 pp. 9 in.

Wilcox, John. Peach Culture. A complete treatise for the use of peach growers; comprising the experiences of many of the largest growers in the country, describing the best mode of cultivation and how to ward off and cure the "yellows" and other diseases peculiar to the peach. Bridgeton, N. J. n. d. [n. c.] 86 pp. 7 x 5.

Wild, Henry. The Making of a Country Estate; practical suggestions and professional advice for planning and planting of the gardens and development of the landscape features for country homes and estates. Illus. New York. [c. 1913.] American Bank Note Company. 31 pp. 11¼ in.

Wilder, Gerrit Parmile. Fruits of the Hawaiian Islands. (Revised edition, including Vol. 1, 1906.) Illustrated by 121 half-tone plates with descriptions of same. Honolulu, T. H. 1911. [c. 1906, 1911.] Published by the Hawaiian Gazette Company, Ltd. 247 pp. 7 x 10½.

Wilder, Marshall Pinckney. The Horticulture of Boston and Vicinity. Substantially the same as the chapter prepared for the Boston Memorial Series, Vol. IV. Boston. 1881. Privately printed. Tolman & White, Printers. 85 pp. 9 x 6.

Wilkinson, Albert E. Modern Strawberry Growing. Illus. Garden City, N. Y. 1913. [c. 1913.] Doubleday, Page & Co. 210 pp. 7½ x 5.

Willard, Eleanor Withey. The Children's Garden. With illustrations from photographs by Fedora E. D. Brown. Grand Rapids, Mich. 1904. The Michigan Trust Company. 39 pp. 9¼ in.

Williams, Dora. Gardens and Their Meaning. Illus. Boston, New York. [c. 1911.] Ginn & Co. ix + 235 pp. 8½ in.

Williams, E. Address on Pruning and Training the Vine. An illustrated paper read before the American Horticultural Society, at New Orleans, January 16, 1885, and published in full in the transactions of the Society for 1885. Indianapolis. 1885. Carlon & Hollenbeck, Printers. 13 pp. 9 x 6.

Williams, Henry T. Window Gardening. Devoted specially to the culture of flowers and ornamental plants, for indoor use and parlor decoration. Illus. New York. 1872. [c. 1871.] Henry T. Williams. 302 pp. 8½ x 6.

———. The same. 4th ed. 1873. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 6th ed 1873. [c. 1871.] 302 pp. 8½ x 6.

———. The same 11th ed. 1875. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 12th ed. 1876. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 13th ed. 1877. [c. 1871.] 302 pp. 8½ x 6.

———. The same. 14th ed. 1884. [c. 1871.] 302 pp. 8½ x 6

Wilson, William. Economy of the Kitchen Garden, etc. New York. 1828.

Winkler, Herbert G. Vegetable Forcing; Parts I, II, and III. Columbus, Ohio. 1896. [c. 1896.] The Winkler Book Concern. 157 pp. 7¾ x 5½.

Winter, T. A Guide to Floriculture; containing instructions to the young florist, for the management of the most popular flowers of the day. Illustrated with colored plates. Cincinnati. 1847. [c. 1846.] Derby, Bradley & Co. iv + 226 pp. 6¾ x 4½.

Winter Gardening in a Bay Window. By an amateur. East Saginaw, Mich. 1879. L. S. Laing, Printer. 33 pp. 8½ in.

Witter, Georgetta. See Erwin, A. T. The Bush Fruits.

Wood, William H. S. See Thomas, John J. The American Fruit Culturist. 1897.

Woods, David R. Successful Floriculture. Illus. New Brighton, Pa. 1881. Published by the author. 108 pp. 9 in.

Woodward, Geo. E. and F. W. Woodward's Graperies and Horticultural Buildings. Illus. New York. [c. 1865.] Geo. E. Woodward & Co.; Orange Judd Company. 139 pp.

———. The same. New York. 1865. G. E. & F. W. Woodward. 7¾ in.

Woodward, R. T. Woodward's Book on Horticulture. The raising of large and small fruits. The diseases of the same, and the making and care of lawns. Boston. n. d. [c. 1897.] 74 pp. 7¾ x 5½.

Woodward's Record of Horticulture. See Fuller, Andrew S.

Woolson, G. A. Ferns and How to Grow Them. Illus. New York. 1905. [c. 1905.] Doubleday, Page & Co. 156 pp. 7½ x 5½.

Woolverton, Linus. The Canadian Apple Grower's Guide. Part I. A complete guide to the planting, culture, harvesting and marketing of apples. Part II. Apples of Canada carefully described and illustrated from specimens of the varieties grown in the Dominion. Part III. Varieties of apples recommended for planting in the various apple districts of the Dominion. Illus. Toronto. 1910. [c. 1910.] William Briggs. 264 pp. 9½ x 7.

Worthington, James T. Manual of Fig Culture in the Northern and Middle States. Chillicothe, Ohio. 1869. [c. 1869.] Scioto Gazette Office. 10 pp. 7¾ x 5¼.

Worthington, William. See Lowther, Granville.

Wright, Mrs. Mabel Osgood. The Garden of a Commuter's Wife, recorded by the gardener; with eight illustrations in photogravure. New York. 1901. The Macmillan Company. ix + 354 pp. 8 in.

———. The Garden, You, and I, by Barbara (*pseud.*). Illus. New York. 1906. The Macmillan Company. xii + 397 pp. 8 in.

Wright, Walter P. The New Gardening; a guide to the most recent developments in the culture of flowers, fruits, and vegetables. Illus. New York. 1913. Doubleday, Page & Co. 400 pp. 8 in.

Yates, Lucy H. The Gardener and the Cook. Illus. New York. 1913. McBride, Nast & Co. 260 pp. 7½ x 5½.

Year Book, The, of the Farm and Garden. A reliable guide to all important rural occupations, embracing concise directions for the improvement of the soil by draining, subsoil plowing, and trenching; implements of culture—their history, cost, and relative value; rural architecture, with directions for the embellishment of the mansion by ornamental gardening; laying out and cropping the esculent garden, fruit culture, with directions for planting; lists of fruits, seeds, plants; insects injurious to farm and garden; bee culture, and other valuable miscellaneous matters. With new and beautiful illustrations. Philadelphia. 1860. [c. 1860.[A. M. Spangler. 108 pp. 7¼ x 4.

Young, Ermentine. Canning and Preserving Fruits and Vegetables, and preparing fruit pastes and syrups. New York. 1892. [c. 1892.] The Rural Publishing Company. 31 pp. 7½ x 5. (The Rural Library, Vo. I, No. 8, June.)

Young Men's Christian Association, Portland, Ore. Apple Growing in the Pacific Northwest, a condensation of lectures, experiments and discussions conducted by the educational department of the Portland, Oregon, Young Men's Christian Association. Illus. Portland, Ore. 1911. The Portland, Oregon, Young Men's Christian Association. 215 pp. 9½ in.

Zvolanek, Art. C. Culture and History of Winter Flowering Sweet Peas. Illus. Bound Brook, N. J. n. d. Printed by A. T. De La Mare Printing and Publishing Company. Paper. 65 pp. 7½ x 5½.

Subject index to the foregoing lists.

To aid the consultant to find the books on special subjects in the preceding bibliography, the following classified list is appended. It is impossible so to classify the titles as to organize them into definite and distinct groups, but the index may nevertheless afford the reader some relief. Many of the books cover a great variety of subjects; these are mostly placed under "General gardening and horticulture." Many of the titles are of such a nature that they cannot be entered in the index, as here constituted. The index designates only the books wholly or chiefly devoted to the given subject, and does not refer to chapters or parts in the miscellaneous or general books.

Evergreens and hedges.—Butterfield; Harrison; Hoopes; Main; Powell, E. P.; Warder.

Flowers and flower-gardening.—Adams; Allen, J. F.; Arnold; Barnard; Bennett; Blanchan; Bourne; Breck; Bridgeman; Buist; Casey; Clark; Cobbett; Complete Florist; Crawford; Darlington; Darrow; Dearborn; Doyle; Eley; Elliott, W. R.; Ely; Flower Garden; Frothingham; Green, R.; Halliday; Halsham; Harrison; Hassard; Hatfield; Henderson; Hibbert; Hooper, L.; How to Grow Asters; How to Make a Flower Garden; Hunt; Jenkins, E. N.; Johnson, L.; Johnson, S. O.; Keeler; Kirby; Long; Long Bros.; Loudon; McGregor; Maeterlinck; Mathews; Morton; Newman, J. B.; Page; Peacock; Practical Florist; Rand, E. S.; Rexford; Rion, H.; Rion, M. C.; Ruston; Sayers; Saylor; Scott, W.; Shelton; Smiley; Smith, E. E.; Solly; Tabor; Tuberous Begonias; Turner, C. H.; Vick; Washburn & Co.; Weed, C. M.; Wellcome; Winter; Woods.

Bulbs, special books: Allen, C. L.; Dreer; Fuld; Henderson; Rand, E. S.; Rexford; Tabor.

Carnation, special books: Lamborn; Ward.

Chrysanthemum, special books: Barker; Herrington; Mathews; Morton; Powell, I. L.; Smith, E. D.

Lily, special books: Adams; Boardman; Childs.

Orchids, special books: Boardman; Burberry; Hansen; Miner; Rand, E. S.

Rose, special books: American Rose Culturist; Buist; Drennan; Ellwanger, H. B.; Good; Hatton; Hole; Holmes, E.; Jenkins, T. B.; Parkman; Parsons, S. B.; Prince, W. R.; Roses and How to Grow Them; Saylor; Shaw, H.; Thomas, G. C.; Wellcome.

Sweet pea, special books: Dick; Hutchins; Kerr; Sunset Seed and Plant Company; Zvolanek.

Violet, special books: Galloway; Saltford.

Fruits and fruit-growing.—Alwood; Aspinwall, J.; Bailey; Baker, C. R.; Barry; Bates; Bealby; Bell; Biggle; Brehaut; Bridgeman; Brinckle; Budd; Cellon; Chase; Cobbett; Cole; Collingwood; Complete Kitchen and Fruit Gardener; Coxe; Creighton; Culver; Downing, A. J.; Downing, C.; Dwyer; Dygert; Elliott, F. R.; Elliott, W. R.; Favor; Fletcher, S. W.; Forsyth; Galusha; Gilbert; Goff; Goodrich; Gray; Green, C. A.; Green, S. B.; Greening; Gregg; Gurney; Haines; Hansen, N. E.; Harcourt; Hedrick; Hendrick; Herrick; Hooper, E. J.; Hovey; Hurst; Jaques; Kenrick; Kiely; Kitchen and Fruit Gardener; Knowlton, D. H.; Lacy; Larsen; Lawson; Lelong; Leopold; Lindley; McNeil; Manning, R.; Maynard; Merchant; Moore, S. W.; Morris; Moulson; Narrigan; Pabor; Paddock; Parker; Phelan; Phillips; Poole; Powell, E. C.; Powell, E. P.; Prince, W. R.; Rivers; Rockwell; Sayers; Sears; Smith, J.; Stark; Stedman; Stringfellow; Strong; Teague; Thacher; Thomas, J. J.; Thornton; Turner, W.; Warder; Waring; Waugh; Wickson; Wilder, G. P.; Young.

Apples, special books: Bailey; Beach; Buell; Burritt; Cline; Fitz; Green, C. A.; Lawrence; Powell, G. T.; Todd; Waugh; Whitten; Woolverton; Young Men's Christian Association.

Date, special book: Popenoe.

Fig, special books: Eisen; Roeding; Van Velzer; Worthington.

Grape, special books: Adlum; Allen, J. F.; Andrae; Bailey; Barclay; Becker; Berneaud; Bright; Buchanan; Busby; Bush; Chapman; Chazotte; Chorlton; De Caradeuc; De Courtenay; Denniston; Du Breuil; Dufour; Eakin; Eisen; Emerson, E. R.; Engelmann; Fisher; Flagg; Fuller; Grant; Green, C. A.; Hamm; Haraszthy; Haskell; Hedrick; Heyne; Hoare; Hofer; Hoops; Husmann; Hyatt; Kecht; Keech; Knowlton, J. M.; Longworth; Loubat; McCollom; McMullen; McMurtrie; Mead; Millard; Mitzky; Mohr; Muench; Munson; My Vineyard at Lakeview; Nessler; Osborn; Persoz; Phelps; Phin; Preyer; Prince, W. R.; Rafinesque; Reemelin; Aiehl; Rixford; Rubens; Saunders; Sayers; Spooner; Strong; Tomes; Treatise on Cultivation of Grapes; Tryon; Van Buren; Viala; Wait; Warder; Williams, E.; Woodward, G. E.

Nuts, special books: Allen, W. F.; Dygert; Fuller; Hume; Lelong; Parry, J. R.; Price, E. M.; Risien; Roper; Stewart, H. L.; Wight.

Olive, special books: Bleasdale; Calkins; Chazotte; Cooper; Flamant; King; Lelong; Marvin; Pohndorff.

Oranges, lemons, and other citrous fruits, special books: Canada; Davis, G. W.; Fish; Fowler, J. H.; Gallesio; Garcelon; Garey; Hume; Lelong; Manville; Moore, T. W.; Prange; Spalding.

Peach, special books: Black; Fitz; Fletcher, R. R.; Fulton; Harker; Reinert; Rutter; Waugh; Wilcox.

Pear, special books: Berckmans; Black; Field, T. W.; Green, C. A.; Illustrated Pear Culturist; A New Treatise . . . . the pear tree; Parry, W.; Quinn; Thompson, W. W.

Plum and **prune,** special books: Clarke; Cope; Hedrick; Lelong; Waugh.

Quince, special book: Meech.

Small-fruits, special books: Abbott; Aspinwall, B.; Barnard; Bassett; Beede; Biggle; Blacknall; Boulton; Card; Cary; Clemmens; Crawford; Durand; Eastwood; Erwin; Farmer; Fragaria; Fuller; Galusha; Gillet; Green, C. A.; Grosvenor; Hall, D. M.; Hills; How to Grow Strawberries and other Fruits; Knapp; The Lawton or New Rochelle Blackberry; M'Kay; Merrick; Pardee; Parry, W.; Preyer; Purdy; Richards; Roe; Smith, M. O.; Snider; Starr; Strawberry Report; Terry; Trowbridge; Webb; White, J. J.; Whitten; Wilkinson.

General gardening and horticulture.—Adams; Agricola; Albaugh; Albee; Angier; Bailey; Baker, T.; Barnard; Barnes; Batson; Beadle; Beecher; Biggle; Bray; Bridgeman; Brooks; Brown, W. F.; Budd; Busch; Buschbauer; Church; Cleves; Clute; Cobbett; Collingwood; Copeland; Crosier; Davis, L. D.; Duncan; Earle; Edgeworth; Egan; Elder; Elliott, F. R.; Elliott, J. W.; Elwanger, G. H.; Ely; Fessenden; Field, F. E.; Field, H.; Fiske; Flint, E. D.; Flint, L. C.; Fullerton; The Garden; Gardiner; Gipson; Goff; Grundy; Hall, B.; Hall, G. P.; Hargrave; Harris; Harrison; Hawthorne; Hays; Hayward; Heikes; Hemenway; Henderson; Higgins; How to Grow Flowers, Fruit and Vegetables; Howard; Howe; Huber; Hunn; Jack; Jacques; Johnson, C.; Johnson, G. W.; Johnson, M. W.; Johnson & Stokes; Kains; Kirkegaard; Landreth; Laroque; Lelievre; Lindley, J.; Livingston, L. S.; Long; Lounsberry; Lowell; Lyon; MacGerald; McCauley; McLaren; M'Mahon; Marshall; Miller, C. H.; Miller, L. K.; Miller, T. B.; Miller, W.; Munro; Neill; Newman, J. S.; Oliver; Paine; Parsons, H. G.; Peek; Pierce; Powell, G. T.; Practical American Gardener; Prince, W.; Rand, A. C.; Rexford; Rion, H.; Rockwell; Roe; Rogers, J. E.; Rowles; Schenck; Scott, T.; Sedgwick; Seldon; Sewell; Seymour; Shafer; Shaw, E. E.; Shaylor; Sheehan; Shields; Shinn; Simson; Sinclair; Skinner, C.; Skinner, H.; Slade; Squibb; Stebbins; Stewart; Stewart, H.; Stewart, J. T.; Storke; Stringfellow; Tabor; Teat; Ten Acres Enough; Thaxter; Thomas, Mrs. T.; Thorburn; Tritschler; Underwood, L.; Urban; Utter; Verplanck; Warner, A.; Warner, C. D.; Watson; Weed, C. M.; White, W. N.; Whitner; Wilder, M. P.; Willard; Williams, D.; Woodward, R. T.; Woolson; Wright, M. O.; Wright, W. P.; Yates; Year Book of Farm and Garden.

Greenhouses.—Bryant; Dean; Field, F. E.; Fowler, A. B.; Hatfield; Herendeen; Leuchars; Rexford; Taft.

Landscape Gardening.—Agar; Allen, L. F.; Barron; Brown, G.; Cleaveland; Cleveland; Cunningham; Doogue; Downing, A. J.; Elliott, F. R.; Ferree; Follen; Greening; Hemenway; Hooper, C. E.; Humphreys; Johnson, J. F.; Kellaway; Kemp; Kern, G. M.; Kern, M. G.; Leland; LeMoyne; Long; Manning, W. H.; Maynard; Meier; Meyer; Miller, C. H.; Murmann; Oakey; Parsons, S.; Platt; Powell, E. P.; Repton; Rogers, W. S.; Root; Rose; Sawyer; Scott, F. J.; Skinner, H.; Smith, C.; Tabor; Underwood, Loring; Van Rensselaer; Vaux; Waugh; Weidenmann; Wharton; Wild.

Mushrooms.—Falconer; Gardiner; Hard; Jackson; Jacob; Milliken; Mushrooms for All; Palmer; Peck.

Plant-breeding.—Bailey; DeVries; Harwood.

Propagation.—Bailey; Fuller; Howard; Jenkins, J.; Lelong.

Pruning, grafting, and spraying.—Bailey; Couts; Des Cars; Dollins; Larsen; Lodeman; Northrop; Sargent; Stedman; Weed, C. M.; Weed, H. E.; Whitten.

Trees.—Davey; Des Cars; Dollins; Egleston; Fernow; Meehan; Peets; Powell, E. C.; Roe; Solotaroff.

Vegetables and vegetable-gardening.—Allen, C. L.; Bailey; Bateman; Bennett, Ida; Bridgeman; Buist; Burpee; Burr; Complete Kitchen and Fruit Gardener; Cook; Corbett; Darlington; Davis, J. R.; Dreer; Every Man His Own Gardener; Fessenden; Fitch; French; Fullerton; Green, S. B.; Gregory; Greiner; Halsted; Hogg; Holmes, F.; Kennerly; Kiely; Kitchen and Fruit Gardener; Kruhm; Landreth; Lloyd; McNeil; Morse; Oemler; Provancher; Quinn; Rawson, N.; Rawson, W. W.; Rockwell; Rolfs.; Sevey; Skinner, H.; Stringfellow; Thompson, F. S.; Tillinghast; Turner, W.; Vick; Waldin; Warner, A.; Washburn & Co.; Watts; Wickson; Wilson; Winkler; Young.

Asparagus, special books: Herrmann; Hexamer.

Cabbage, special books: Allen, C. L.; Cook; Gregory; Landreth; Lupton; Pedersen; Tillinghast's Plant Manual.

Cauliflower, special books: Allen, C. L.; Brill; Crozier; Gregory; Lupton; Pedersen; Suffa.

Celery, special books: Beattie; Crider; Greiner; Hollister; Landreth; Livingston; Niven; Pratt; Rawson, W. W.; Roessle; Schuur; Stewart, H. L.; Tillinghast's Plant Manual; Van Bochove; Vaughan's Celery Manual.

Cucumber, special book: Collins.

Melons, special books: Blinn; Burpee; Troop.

Onion, special books: Gregory; Greiner; Landreth; Onion Book: Onions; Underwood, J. P.

Potato, special books: Best; Bosson; Carman; Cultivation of the Potato; Fitz; Fraser; Grubb; McLaurin; Matchette; Price, R. H.; Rogers, E. A.; Tenbrook; Terry; Van Ornam.

Squash, special book: Gregory.

Tomato, special books: Day; Livingston; Mitchell; Smith, F. F.; Taylor, H.; Tracy; Van Camp.

Water-gardening.—Bissett; Conard; Tricker.

Window-gardening.—Allen, Phoebe; Barnes; Casey; Dorner; Heinrich; Hillhouse; Holmes, J. H.; Mulertt; Rand, E. S.; Randolph; Rexford; Rockwell; Rose; Waugh; Williams, H. T.; Winter Gardening in a Bay Window.

Reports of horticultural societies and organizations.

Although the present discussion aims only to supply librarians and collectors with information as to what reports and series have been published, a brief sketch of the beginnings of horticultural societies in North America may supply a useful background or setting.

Although the year 1785 witnessed the establishment of the Philadelphia Society for Promoting Agriculture and the Agricultural Society of South Carolina, 1889 the Nova Scotia Society, and 1792 the organization of the Massachusetts Society for Promoting Agriculture, it was apparently not until 1818 that the first horticultural organization came into existence; this was the New York Horticultural Society, now extinct. The second, organized in 1827, was the Pennsylvania Horticultural Society, which is still in vigorous existence. The third, according to Manning, was the Domestic Horticultural Society, organized at Geneva, New York, in 1828, and which was the forerunner of the Western New York Horticultural Society, the latter having continued for more than fifty years. The next organization was apparently the Albany Horticultural Society, established in 1829, but which expired long ago. In 1829, also, the Massachusetts Horticultural Society was organized, an association which, in the character of the men who have been members and in the large service it has rendered to the advancement of rural taste, stands without a rival in the country. The American Pomological Society was organized in 1850 by a union of the North American Pomological Convention and the American Congress of Fruit-Growers, both of which were established in 1848. The Congress of Fruit-Growers was a meeting held in New York on the 10th of October, 1848, at the call of the Massachusetts, Philadelphia, New Jersey and New Haven Horticultural Societies and the Board of Agriculture of the American Institute of the City of New York. The Pomological Convention held its first meeting on the 1st of September in Buffalo. The American Pomological Society is undoubtedly the strongest organization of pomologists in the world. A. J. Downing wrote in 1852, that "within the last ten years the taste for horticultural pursuits has astonishingly increased in the United States. There are, at the present moment, at least twelve societies in different parts of the Union devoted to the improvement of gardening, and to the dissemination of information on the subject." At the present time there are over 500 such societies, and the average attendance at the meetings cannot be less, in the aggregate, than 20,000. From a careful estimate made in 1891, it was concluded that the aggregate attendance for that year at the national, state, provincial and district societies "probably exceeded 5,000."

There are now more than a dozen national societies devoted to horticulture or some branch of it. The most gratifying feature of this movement toward organization, however, is the establishment of great numbers of local societies, florists' clubs, and the like, which sustain the interest in horticultural pursuits and foster pride in the personal surroundings of the members. All this great body of societies is proof enough that there is a rapidly expanding and abiding love of horticulture in America, and that it must increase with the increasing amelioration of the country.

There are few state or provincial departments of horticulture, but most of the states and provinces have bureaus of agriculture and these may publish horticultural matter. In this discussion, however, only those official establishments that are specially organized for horticultural work are included.

REPORTS OF BOARDS AND SOCIETIES.

In the following paragraphs an effort is made to give such information as a librarian needs in the collecting of the published annual reports of existing national, state, provincial and regional horticultural societies in the United States and Canada, and of the reports of state and provincial boards, commissions, or departments of horticulture. The publications of these various bodies follow so many methods and there is often such lack of continuity in them that it is difficult to follow them as a whole and, particularly, to know when sets and series are complete. As an aid in determining some of these points, corollary information of the societies and boards is given: these pieces of information are intended only as secondary aids to the librarian and not as descriptions or histories of the organizations.

American Association of Nurserymen. An annual report is published by the society. The first report was published in 1890 under the title, "Proceedings of the American Association of Nurserymen." The publication is continuous under the same title. Total number of volumes, 24. There have been no special reports. Organized 1876. Address, 204 Granite Building, Rochester, N. Y.

American Association of Park Superintendents. This association has published six reports for the years 1908–13 inclusive. It has also issued eleven bulletins on special subjects relating to roads, walks, planting of parks, and the like. Address, United States Department of Agriculture, Washington, D. C.

American Carnation Society. Annual reports are issued by the society. The first report was published in 1891 under the title, "Annual Report of the American Carnation Society." The publication still continues under this title. Total number of volumes, 23. There have been no special reports. Address, Indianapolis, Ind.

American Cranberry Growers' Association. A semi-annual report is issued by the society. The first report was published in 1879 under the title, "New Jersey Cranberry Growers' Association." The publication has been continuous with one exception. Report of January meeting is entitled, "Proceedings of the Annual Meeting;" report of August meeting, "Proceedings of Annual Convention." Total number of volumes, 70. Address, Hammonton, N. J.

American Genetic Association, formerly called the American Breeders' Association. Annual reports were published for the years 1905–12, under the title, "Annual Report of the American Breeders' Association." Total number of volumes 8. From 1910–13, the "American Breeders' Magazine" was published quarterly. Beginning January, 1914, its name was changed to the "Journal of Heredity," which is published monthly, and the reports of meetings are published herein. Address, Washington, D. C.

American Gladiolus Society. This society issues a bulletin from time to time. The first annual report was published in Bulletin No. 1, August, 1910; the second in Bulletin No. 7. The publication is still continued in the "Modern Gladiolus Grower." Address 538 Cedar St., Syracuse, N. Y.

American Peony Society. This society issues no regular publications. The Nomenclature Committee of the society, in coöperation with a representative of the New York State College of Agriculture, has prepared four bulletins which have been published by Cornell University. The first appeared in 1907 under the title "A Peony Checklist;" the second in 1908, as Bulletin No. 259, "The Peony;" the third in 1910, as Bulletin No. 278, "The Classification of the Peony;" the fourth in 1911, as Bulletin No. 306, "The Classification of the Peony." The society holds an annual meeting and exhibition in June. Address, Clinton, N. Y.

American Pomological Society. Biennial reports are published by the society. The first report (for 1850) was published in 1851 under the title, "Report of the American Pomological Congress," and was published by the Ohio State Board of Agriculture. The next report was issued in 1852 under the title, "Proceedings of the Second Session of the American Pomological Congress." The publication has been continuous under the title "Proceedings of the American Pomological Society," with the exception of the years 1866 and 1893, when no reports were published. Total number of volumes, 29. There has been one special report entitled, "The Cherry, together with reports and papers on pear, plum, peach, grape, and small fruit." A "Catalogue of Fruits" has also been published by this society. Organized in 1850 by the union of two other societies, both organized in 1848. Address, 2033 Park Road, Washington, D. C.

American Rose Society. This society issues an annual bulletin under the title, "Annual Proceedings and Bulletin," the first bulletin being issued in 1905. From April, 1912, until the middle of the year 1913, it also issued a quarterly journal entitled, "The Rose Journal." Organized 1899. Address, Beacon, N. Y.

American Society of Landscape Architects. Has published one report of the transactions for the years 1899–1908 inclusive. The official organ of the society is a quarterly journal entitled "Landscape Architecture." Address, 15 East 40th St., New York City.

American Sweet Pea Society. This society was originally organized in New York, July 7 and 8, 1909, as the "National Sweet Pea Society of America." Annual exhibitions and conventions are held every summer. Extensive trials of sweet peas are carried on under the auspices of the horticultural department of Cornell University, Ithaca, N. Y. Bulletins are issued by Cornell University, which go to the members of this Society. Address, New York City.

Canadian Seed Growers' Association. Annual reports are issued by the Association. The first report was published in 1904, under the title "Report of First Annual Meeting of the Canadian Seed Growers' Association." The publication still continues under this title. Special bulletins are issued from time to time, the last one being "Plant Breeding in Scandinavia." Address, Ottawa.

Chrysanthemum Society of America. Annual meetings and exhibitions are held in November of each year of which an annual report is published together with the work of the committees. The first annual report was published in 1902. Address, Morgan Park, Ill.

International Apple Shippers' Association. This society issues an annual year-book, and a monthly bulletin. The first report was published in 1896 under the title, "International Apple Shippers' Association Year Book." Reports for 1900–1902 have the title, "Year Book of the National Apple Shippers' Association;" those for 1903–1909, "Year Book of the International Apple Shippers' Association;" those for 1910–14, "Official minutes of the International Apple Shippers' Association." A monthly bulletin began February, 1911, under the title, "The Spy." Both are continuous. There are special monthly reports issued for members only. Address, 612 Mercantile Bldg., Rochester, N. Y.

National Association of Gardeners. Official organ is the "Gardeners' Chronicle of America," which contains all the association news. Address, Madison, N. J.

National Council of Horticulture. Has issued no regular report except in 1907 of the Jamestown Congress of Horticulture. Copies of short articles on horticultural topics are sent to several thousand newspapers each spring.

National Nut Growers' Association. This association issues an annual volume of proceedings and also a journal, "The Nut Grower," which is the official organ of the society, and consists of 24 pages monthly. It began publication in August, 1902. The first report was published in 1903 under the title, "Proceedings of the Second Annual Convention." There have been seven issues under the title "Proceedings of the Annual Conventions." There have been no special reports. Address, Cairo, Ga. Northern Nut Growers' Association. See *Nuts*, Vol. IV.

Railway Gardening Association. Reports of the annual meetings are published. The seventh report was issued in 1913. Address, Sewickley, Pa.

Society of American Florists and Ornamental Horticulturists. An annual report is published by the society. The first report was published in 1885 as "Proceedings of the Society of American Florists." After 1901, the title was changed to "Proceedings of Society of American Florists and Ornamental Horticulturists." Have also published a list of plants registered from July, 12, 1908 to August 1, 1914. National charter given March 3, 1901. Address 53 West 28th St., New York City.

Society for Horticultural Science. This society issues an annual report entitled, "Proceedings of the Society for Horticultural Science." The first report was published in 1905 under the title, "Proceedings of the Society for Horticultural Science. Preliminary meeting, September. 1903; first annual meeting, December, 1903; second annual meeting, 1904." Proceedings have been published annually since with the exception of the year 1908, which was published with 1909. Total number of volumes, 9. Address, College Park, Md.

Vegetable Growers' Association of America. The first report was published in 1909 under the title, "Year Book of the Greenhouse Vegetable Growers' and Market Gardeners' Association of America." The next report contained the proceedings of the conventions of 1909, 1910 and 1911 and appeared under the title, "Official Proceedings of the Vegetable Growers' Association of America." The proceedings of the 1912 convention will probably be published with those of 1913 and 1914. Address, Louisville, Ky.

ALABAMA

Alabama State Board of Horticulture. The first report was published in 1903–4 under the title, "First Annual Report of the Alabama State Board of Horticulture." Only the first two reports have been published and these by the state. They have been published under one cover and also separately. Those from 1905–6 to 1911–12 are typewritten reports submitted to the Governor. There have been no volumes or reports on special subjects. This board is chiefly concerned with nursery inspection and the enforcement of the horticultural law approved March 5, 1903. The board consists of the Commissioner of Agriculture, president of the State Horticultural Society, director of the experiment station (ex-off.). The horticulturist of the experiment station is secretary of the board and State Horticulturist. Address, Auburn.

Alabama State Horticultural Society. This society issues annual reports which are published by both the state and the society. The first report was published in 1904 under the title, "Proceedings of the Alabama State Horticultural Society, First Annual Meeting." The publication is still continued under the title, "Proceedings of the Alabama State Horticultural Society." The first, second, third, and fourth annual reports were published by the society; the fifth, sixth and seventh were published in one volume by the Department of Agriculture, Montgomery, as serial No. 36, and the eighth annual report as a Department bulletin, serial No. 42. The ninth, tenth and eleventh annual reports have recently been issued by the society. Total number of volumes, 11. There have been no separate reports on special subjects. Organized January 27, 1903. Address, Auburn.

ARIZONA

Arizona Commission of Agriculture and Horticulture. This commission issues annual reports and circulars, published by the state. The first report was published in August, 1909, under the title, "First Annual Report of the Arizona Horticultural Commission." Four reports have been published under the title, "Annual Report of the Arizona Horticultural Commission." In 1912, the name of the organization was changed as above and two reports have been published under the title "Annual Report Arizona Commission Agriculture and Horticulture." The annual reports of the State Entomologist are included in the reports of the commission. Sixteen circulars have been published on various entomological subjects. Address, Phoenix.

ARKANSAS

Arkansas State Horticultural Society. Annual reports are published by the society. The first report was published in 1900 under the title, "Annual Report of the Arkansas State Horticultural Society." The publication has been continuous under this title. Total number of volumes, 13, but this does not include two reports which were issued in 1894, (First and Second Annual Reports, 1893–4). At that time, a new society had been organized under the same name as the old horticultural society founded in 1879. The second society was finally merged into the first. Address, Horticultural Department, University of Arkansas, Fayetteville.

BRITISH COLUMBIA

British Columbia Fruit Growers' Association. An annual report is published by the province. The first report was published in 1890 under the title, "First Annual Report of the British Columbia Fruit Growers' Association." The reports from 1892–1895 have the title, "Annual report of the Horticultural Society and Fruit Growers' Association of British Columbia;" those from May, 1895, to August, 1897, "Report of the British Columbia Fruit Growers' and Horticultural Society;" those from 1908–9, "Annual and Quarterly Meetings of the British Columbia Fruit Growers' Association." The twenty-fourth annual report was issued in 1913. There have been no special reports, except a "Pest and Remedy" supplement, 1895–6, issued separately. Address, Victoria.

CALIFORNIA

California Association of Nurserymen. This organization has published four reports, the first entitled, "Transactions and Proceedings of the First Annual Meeting of the California Association of Nurserymen, held . . . 1911." Address, Los Angeles.

California State Board of Horticulture. The reports of this board have been published in six series. The first series consisted of one annual report published in 1883; the second of unnumbered biennial reports; the third of unnumbered annual reports; the fourth of numbered biennial reports beginning with No. 4; the fifth of numbered biennial reports beginning with No. 1. A series of bulletins have been published from 1883–1900 numbered from 1–71. It is doubtful, however, whether any were issued between 8 and 50. Five non-serial reports were issued between 1886 and 1901 consisting of reports of committees, library catalogues and the like. Separate reports have also been issued of the proceedings of the Fruit Growers' Convention. The first report issued by this board was published in 1883 under the title, ' Third Annual Convention of the Fruit Growers of the State of California." Reports of succeeding conventions have been published, either in separate form or in the report of the State Board (later in the report of the State Commission), with the exception of the twentieth to twenty-third conventions which were never published. At least three state conventions of olive-growers have been held under the auspices of the State Board of Horticulture, 1891–3, for which separate reports have been issued. These have appeared under the title "Olive Industry. Proceedings of the State Convention of Olive Growers, held under the auspices of the State Board of Horticulture." Organized March 4, 1881, as a subsidiary board to the State Board of Viticultural Commissioners. On March 13, 1883, became independent by Act of Legislature.

California State Board of Horticultural Commissioners. This board published a report in 1882 entitled, "First Report of the Board of State Horticultural Commissioners," covering the work from 1880–2; also proceedings of first and second Fruit Growers Convention.

California State Board of Viticultural Commissioners. Published seven annual reports for the years 1880–94. Of the first report, 1880, two editions were issued. The third report, 1882–4, was published in, or rather was identical with, the report of the chief viticultural officer for those years. There were also issued separately two annual reports of the chief viticultural officer, the first for 1881, published 1882, the second for 1882–3 to 1883–4 (being the one just mentioned). Later reports of the viticultural officer are contained in the annual reports of the board. Two publications, "Grafting to Muscats" and "Wines, Their Care and Treatment," issued in 1888 and 1889, are called Appendix 4 and 5 respectively of the report for 1888, but no report for 1888 seems to have appeared. However, there was issued a report of proceedings of sixth annual viticultural convention and the report of the president of this board. These may have constituted the report for this year.

California State Commission of Horticulture. This organization has grown out of the original State Board of Horticulture. It publishes a biennial report. The first report, 1903–4, was issued under the title, "First Biennial Report of the Commissioner of Horticulture." Total number of volumes, 6. Reports of the forty-third and forty-fourth State Fruit Growers' Conventions were not published. Monthly bulletins have been published since December 1911. Address, Capitol Building, Sacramento.

COLORADO

Colorado State Board of Horticulture. The first report was issued in 1884. Reports have been published continuously since then, with the exception of the year, 1895–6, which was never published. There has been considerable variation in the title, and the reports have been sometimes annual, sometimes biennial, the first covering three years. Up to 1886, the name of the body was Colorado State Horticultural Society; 1887–90, Colorado State Horticultural and Forestry Association; 1891–2, Colorado State Bureau of Horticulture; 1893 to 1913, Colorado State Board of Horticulture. In 1913, the State Board of Horticulture was abolished, and the office of State Horticulturist created. The report of the State Horticulturist will take the place of the Annual Report of the Board of Horticulture. Total number of volumes, 24. Address, Fort Collins.

CONNECTICUT

State Pomological Society. This society has published an annual report for the past 15 years. The first report was issued under the title "A brief record of the work of the Connecticut Pomological Society," in 1900. Total number of volumes, 16. Organized in 1891. Address, Milford.

DELAWARE

Peninsula Horticultural Society. An annual report is published by the society. The first report was published in 1888 under the title, "Transactions of the Peninsula Horticultural Society." The publication is still continued under this title. Total number of volumes, 27. Volume XIV was issued in two parts, Part I, the Proceedings of the annual session of 1901 and Part II, a pamphlet of 80 pages on "The Principal Pests and Diseases of the Apple Orchard." Address, Dover. (This society includes also a part of Maryland and Virginia.)

FLORIDA

Florida State Horticultural Society. An annual report is published by the society. The first report was published in 1892 under the title, "Transactions of Florida State Horticultural Society." This title was continued up to 1909 when it changed to "Proceedings of the Florida State Horticultural Society." The publication has been continuous. Total number of volumes, 22. Special papers on flowers, fruits, vegetables and the like appear in the reports but are not published separately Organized in 1887. Address, Jacksonville.

GEORGIA

Georgia State Horticultural Society. Annual reports are issued, now published by the society. The first report was published in 1877 under the title, "Proceedings of Georgia State Horticultural Society." The publication is still continued. The first to thirtieth reports were published by the society. The next five were published by the State Board of Entomology,—Bulletins Nos. 25, 27, 30, 33, 35. The report for 1912 was published by the State College of Agriculture as a part of the report of the Fourth Annual Farmers' Conference held in 1912. The thirty-eighth report, for 1914, was published as a bulletin of the State College of Agriculture, Vol. 2, No. 12. This report was afterward published separately by the society. Total number of volumes, 38. There have been no special reports. Address, College of Agriculture, Athens.

North Georgia Fruit Growers' Association. The society has issued two reports, the first entitled, "Proceedings of the Sixth Annual Session of the North Georgia Fruit Growers' Association . . . 1902." A report of the seventh session for 1904 is also published.

HAWAIIAN ISLANDS

There is no separate horticultural organization, only the Board of Commissioners of Agriculture and Forestry.

IDAHO

Idaho State Horticultural Association. An annual report is published by the society. The first report was published in 1904 under the title, "Annual Report of the Idaho State Horticultural Association." The publication has been continuous under this title. Total number of volumes, 9. There have been no special reports. Address, Boise.

ILLINOIS

Illinois State Horticultural Society. Annual reports are published by the society. The first report was published in 1856 under the title, "Transactions of the Illinois Horticultural Society." The publication is still issued under this title. The report of the first annual meeting was published in Volume II of the Illinois Agricultural Society Transactions. There was no report of the second annual meeting. The third meeting was published in Volume III, Illinois Agricultural Society Transactions, the fourth in the Prairie Farmer, the fifth in Volume IV, Agricultural Society Transactions, sixth, seventh (these two bound in one volume), and eighth in pamphlet form, ninth in Volume V, Agricultural Society Transactions, tenth in pamphlet form and the eleventh in a bound volume. The proceedings of the twelfth annual meeting were issued as Volume I New Series. There have been 47 issues in this series to date. Total number of volumes is as follows: Four reports bound in the Transactions of the Illinois Agricultural Society, 1 in the Prairie Farmer, 4 pamphlets and 46 bound volumes. The only special report ever published was of the Society's Exhibit at the World's Fair in 1893. Beginning with March, 1913, has issued a quarterly journal entitled "Illinois Horticulture." Address, Normal.

Horticultural Society of Central Illinois. This society issues annual reports that are published in the Transactions of the State Horticultural Society.

Horticultural Society of Northern Illinois. The annual report of this society is published in the transactions of the state society. The transactions of the first and fourth meeting, 1867–8, 1871, were also published in separate form. The first has the title, "Transactions of the Northern Illinois Horticultural Society embracing the first organization and meeting . . . December 18, 1867. With the proceedings and essays at the first annual meeting . . . February 13, 1868."

Horticultural Society of Southern Illinois. The annual report of this society is also published in the report of the state society.

INDIANA

Indiana Horticultural Society. This society issues an annual report published by the state. The first report was published in 1866 under the title, "Transactions of the Indiana Horticultural Society." The publication has been continuous under the one title. Total number of volumes, 53. Bulletins on special subjects were published by the society from 1904–11. Organized 1860. Address, W. Lafayette.

IOWA

Iowa State Horticultural Society. Annual reports, published by the state, are issued by this society. The first report was issued in 1868 under the title, "The Proceedings of the Iowa State Horticultural Society, for 1866–7." From 1871–7, the reports have the title "Annual Report;" from 1878–90, "Transactions;" and from 1891 to the present time, "Report." Total number of volumes, 47. The reports from 1866–70 were bound with the agricultural report and also in paper separates; since that time, they have been bound as separate volumes. The society has issued seven bulletins: "Forestry Manual," 1881; "Plants of Iowa," 1907; "Iowa Horticulture," 1908; "Proceedings Iowa Park and Forestry Association," 1904, 1905, 1906, 1907." Address, Des Moines.

KANSAS

Kansas State Horticultural Society. This society issues biennial reports published by the state. The first report was published in 1871 under the title, "Condensed Transactions of the Kansas State Pomological and Horticultural Society from its organization to its last annual meeting, and in full for the year 1871.' From 1877–86, the reports were issued under the title, "Kansas Horticultural Report;" from 1887–95, "Biennial Report of the Kansas State Horticultural Society." The reports up to 1887 and for 1896–1901 were published annually. Total number of volumes, 32. Special reports have been published on forestry, apple, peach, plum, grape, cherry and apricot. Address, State House, Topeka.

KENTUCKY

Kentucky State Horticultural Society. A few publications have been issued by this society at long intervals, but no complete records of these are available. In 1865, a report was published under the title "Report of the Kentucky State Pomological Society;" in 1881, "Proceedings of the Kentucky Horticultural Society at its annual meeting, Jan. 13, 14 and 15, 1880." The Proceedings for 1907 were published in the Report of the Bureau of Agriculture, Labor and Statistics for 1907. The report for 1911 was issued as "The Report of the Kentucky State Horticultural Society" and was also published in the Report of the Bureau of Agriculture, Labor and Statistics for 1911. There was no report for 1912. The report for 1913 was also published in the Report of the Bureau of Agriculture. etc. The report for 1914 was issued as "The Report of the Kentucky State Horticultural Society." Address, College of Agriculture, Lexington.

LOUISIANA

Louisiana State Horticultural Society. This society issues no reports at present and held no meetings from 1908–1912. Previous to this time, however, annual reports were issued by the state. The first report was published about 1901 under the title, "State Horticultural Society Proceedings." From 1904–8, five volumes were issued as "Proceedings of the Annual Meeting." The last meeting of the old horticultural society was held in 1908 and in 1912 it was reorganized and holds annual meetings at the State University, Farmer's Short-course in January of each year. Address, Baton Rouge.

MAINE

Maine State Pomological Society. Annual reports are published by the society. The first report was published in 1873 under the title, "Annual Report of the Maine State Pomological Society." Reports have been published continuously except for the years 1879, 1880 and 1881. Abstracts from the Transactions of these years were published as an appendix to the Transactions for 1890. In 1882, the title was changed to "Transactions of the Maine State Pomological Society." In most cases, these reports have also been contained in the report of the Commissioner of Agriculture. Organized in 1873. Address, Bowdoinham.

MANITOBA

Manitoba Horticultural and Forestry Association. Annual reports are published by the association. The first report was issued in 1898 under the title, "Report of Proceedings of the Western Horticultural Society for the years 1896–8." The publication is still continued but in 1911, the name of the society was changed to "Manitoba Horticultural and Forestry Association." They were published as biennial reports from 1896–8 and 1901–2, as a triennial report for 1902–5 and as annual reports from 1898–1900 and 1906–9. No report for 1910. Annual report for 1911 and biennial report for 1912–13 and 1914 have been published. Total number of volumes, 12. A few short papers have also been published by the Association. In April 1914, a monthly publication known as the "Manitoba Horticulturist" was issued by the association. Future annual reports will consist of bound copies of the year's issue of this monthly, together with a short account of the annual meeting. Address, Agricultural College, Winnipeg.

MARYLAND

Maryland State Horticultural Society. An annual report is issued, published by the society. The first report was published in 1898 under the title, "Report of the Maryland State Horticultural Society." The publication is continuous under this title. Total number of volumes, 16. There have been no special reports. Address, College Park.

MASSACHUSETTS

Massachusetts Asparagus Growers' Association. Formed in 1906 to promote the restoration of asparagus to its immunity from rust, or the discovery of a species that shall be rust-resistant, and the dissemination of information in relation to its growing and marketing. Is in close touch with the coöperative experiments carried out at Concord by the United States Department of Agriculture and the Agricultural Experiment Station at Amherst. The association holds an annual field-day in September and publishes a report of the proceedings. Bulletin No. 263, United States Department of Agriculture by J. B. Norton is devoted to these experiments. Address, Concord.

Massachusetts Horticultural Society. This society publishes its own annual report. The first report was issued in 1829 under the title, "Massachusetts Horticultural Society." One number, March, 1859, was published under the title, "The Journal of the Proceedings." The publications have been continuous since 1839. It was formerly published in one volume once a year, but since 1874 it has been published in two parts annually or occasionally in three, as in the case of 1895–7. There are numerous special articles in the Transactions on the culture of flowers, fruits and vegetables. The society has also issued the following publications: in 1862, "Properties of Plants and Flowers;" in 1864, "Proceedings on the occasion of the laying of the corner-stone of the new hall;" in 1873, a "Catalogue of the Library;" in 1880, "History of the Massachusetts Horticultural Society, 1829–78;" in 1889, "Window Gardening, and a list of some of the flowers found growing naturally in the vicinity of Boston." Address, Horticultural Hall, Boston.

MICHIGAN

Michigan State Horticultural Society. This society issues an annual report published by the state, and also a monthly journal called "Michigan Horticulture." The first report was published in 1870 under the title, "Annual Report of the Michigan State Pomological Society." The publication has been continuous with the exception of the year 1904, when no report was published. The report for 1905 is in the back of the report for 1906. The title was changed in 1881 to "Annual Report of the State Horticultural Society." Total number of volumes, 42. Address, Fennville.

MINNESOTA

Minnesota State Horticultural Society. An annual report and a monthly magazine entitled, "Minnesota Horticulturist," are published by the state. The first report was published in 1873 under the title, "History of the Minnesota Horticultural Society from the first meeting in 1866, to the last in 1873, comprising debates, addresses, essays and reports." Reports for 1874–82 have the title, "Transactions." The Minnesota Horticulturist began publication in February, 1894, with Vol. 22, the volume number of the annual report for that year, and continues this system of numbering. The publication is still continued, but in 1899 the title was changed to "Trees, Fruits and Flowers of Minnesota." This comprises the 12 monthly journals and the annual report of the society, bound together. Total number of volumes, 43. There have been no special reports. Address, 207 Kasota Block, Minneapolis.

MISSISSIPPI

A State Horticultural Society existed about twenty-five years ago and published one or two reports.

MISSOURI

Missouri State Board of Horticulture. The Board issues an annual report published by the state. The first report was published in 1907 under the title, "Annual Report of the State Board of Horticulture." The publication has been continuous under the same title. The publications of the State Horticultural Society since 1907 have been included in the Reports of the State Board. Total number of volumes, 7, the last being chiefly taken up by orchard census of the state of Missouri taken in 1913. There have been 67 bulletins published on various phases of fruit-growing, vegetable-growing and the like, most of which are reprints of special articles from the reports. Two circulars and ten pamphlets have also been issued Address, Columbia.

Missouri State Horticultural Society. From 1857–1907, annual reports were issued. These comprise 50 volumes, published by the state. They were published under the title, "Reports of the State Horticultural Society." The report is now embodied in the Report of the State Board. In the past ten years, this society has issued a number of special bulletins. Address, Mountain Grove.

MONTANA

Montana State Board of Horticulture. Biennial reports are published by the state. The first report was published in 1900 under the title, "First Biennial Report of the State Board of Horticulture." The publication is still continued under the above title. Total number of volumes, 6. There have been no special reports. Address, Missoula. The 1914 report will be combined in the volume of the report of the Horticultural Society.

Montana State Horticultural Society. This society issues annual reports published by the state. The first report was published in 1907 under the title, "Proceedings of the Ninth Annual Session of the Montana Horticultural Society." The publication has been continuous under the same title. In connection with the fifteenth report, is the first report of the Country Life Commission. In January, 1902, there was printed a series of papers in pamphlet form, including the constitution and by-laws of the society. Total number of volumes, 8. There have been no special reports. Address, Missoula.

NEBRASKA

Nebraska State Horticultural Society. An annual report is published by the society. The first report was published in 1870 under the title, "Annual Report of the State Horticultural Society," and was printed in the same volume as the report of the State Board of Agriculture. The publication is still published under this title. Thirty-two bulletins on particular phases of horticulture have been published. Since February, 1911, the society has published a monthly journal, "Nebraska Horticulture." Total number of reports, 45. Address, Capitol Building, Lincoln.

NEVADA

There are no horticultural societies in Nevada.

NEW BRUNSWICK

New Brunswick Fruit Growers' Association. This society issues annual reports published by the province. The first report was published in 1905 in the "Report on Agriculture for 1904," issued by the Department of Agriculture. The publication is continuous. Up to 1911, the reports were published in the annual report of the Department of Agriculture. The Report of the Horticultural Division, Department of Agriculture, was combined with the report of the association for 1910 and published as a separate document in that year. Total number of reports, 9. No special reports. Address, Fredericton.

Horticultural Division, New Brunswick Department of Agriculture. The first annual report was published in 1910 in the general report of the Department. In 1911, a separate report was published with the association report. The division publishes leaflets and bulletins on special subjects. Established in 1910. Address, Fredericton.

NEW HAMPSHIRE

New Hampshire Horticultural Society. Annual reports are published by the society. The first report was published in 1908 under the title "Annual Report of the New Hampshire Horticultural Society." The publication has been continuous under the same title, except for the year 1911. There have been no special reports. Organized in 1893. Address, Goffstown.

NEW JERSEY

New Jersey State Horticultural Society. This society issues an annual report published by the state. The first report was published in 1876 under the title "Proceedings of the New Jersey State Horticultural Society at its Annual Meeting." The publication is continuous under the same title. Total number of volumes, 39. There have been no special reports. Organized in 1875. Address, Riverton.

NEW YORK

Eastern New York Horticultural Society. This organization is now a part of the New York State Fruit Growers' Association.

Horticultural Society of New York. A quarterly journal containing the reports of proceedings and the like is published by the society. Also memoirs devoted to special subjects are issued. Vol. I. "Report of Second International Plant Breeding Conference," 1902; Vol. II. "Report of International Conference on Acclimatization," 1900. Address, New York Botanical Garden. Society organized 1900; incorporated 1902.

New York State Fruit Growers' Association. Annual reports and crop bulletins are issued, published by the society. The first report was published in 1903 under the title, "Proceedings of the Annual Meeting." The publication is still continued under this title. Total number of volumes, 13. There have been no special reports. Address, Penn Yan.

New York State Vegetable Growers' Association. Organized 1911; has published two volumes of proceedings. Address, Ithaca.

Western New York Horticultural Society. The first annual report was issued in 1874 under the title, "Proceedings of Western New York Horticultural Society." The publication still continues under the same title. Total number of volumes, 40. There have been no special reports. Established 1855. Address, 204 Granite Building, Rochester.

NORTH CAROLINA

Division of Horticulture of the North Carolina Department of Agriculture. The reports of the Division of Horticulture are included in the Department reports. Biennial reports have been published since 1900, making seven to date. Monthly bulletins have been issued since 1879 by the Department, only a few of which are strictly horticultural. There are 35 volumes in this series. Special horticultural circulars are also issued from time to time. Address, Raleigh.

North Carolina State Horticultural Society. This society has not been in active existence for some years but it is now in process of reorganization. A few annual reports, however, have been issued, those for 1886, 1893, 1894, 1898 and 1906. There have been issued separately five reports of the Experimental Farm of the society at Southern Pines. They have also published the following special bulletins: "The Cow Pea," "Plant Food," and "Truck Farming."

NORTH DAKOTA

North Dakota Horticultural Society. No reports published. Members receive those published by the Minnesota Horticultural Society.

NOVA SCOTIA

Nova Scotia Fruit Growers' Association. An annual report is published by the society. The first report was published in 1875 under the title, "Report of the Fruit Growers' Association and International Show Society of Nova Scotia." No other reports were published until 1883. Those from 1883–1894 bore the title, "Transactions and Reports of the Fruit Growers' Association and International Show Society of Nova Scotia;" those from 1895 to the present time, "Annual Report of the Fruit Growers' Association of Nova Scotia." The publication is continuous under the same title. Total number of volumes, 31. Address, Port Williams.

OHIO

Columbus Horticultural Society. Annual reports published by the society are issued. From 1845–1886, the proceedings of the monthly meetings were published in Columbus newspapers. From 1886–1890, a journal was issued monthly and from 1890–1895, this journal was issued as a quarterly. These publications were entitled "Journals of the Columbus Horticultural Society." From 1890 to the present time, the society has published an annual report under the title, "Proceedings of the Columbus Horticultural Society." Total number of volumes, 27. Address, Columbus.

Division of Horticulture of the Ohio Department of Agriculture. This organization has issued at least three bulletins, 1907–1909.

Ohio State Horticultural Society. This society was organized in 1847 as the "Ohio Pomological Society," whose first report was published in 1848. In 1866, the name of the society was changed to the "Ohio State Horticultural Society." This society issues an annual report. The first report was published in 1868 under the title "Annual Report of the Ohio State Horticultural Society (late Pomological Society)." Reports for 1907–8 are published in Bulletins Nos. 1 and 3 of the Division of Horticulture of the Ohio Department of Agriculture. Since 1908, the annual reports have been issued independently. Quarterly bulletins have been issued during the past three years. Total number of volumes, 47. Address, Newark.

OKLAHOMA

Oklahoma State Fruit Growers' Association. Issues no publications.

ONTARIO

Fruit Branch of the Ontario Department of Agriculture. Annual reports, published by the province, are issued. The first report was published in 1909 under the title, "Annual Report of the Fruit Branch of the Ontario Department of Agriculture." This publication is now incorporated in the annual report of the Minister of Agriculture. From 1894–1907, a separate report, "The Fruit Experiment Stations of Ontario," was published by the Department. This was merged with the Fruit Branch in 1908. Total number of volumes, 14. A special report on "Fruits of Ontario" was published in 1906 and revised in 1914. Special reports on fumigation and, orchard spraying were issued for a few years but are now combined with the Report of the Fruit Branch. Complete bulletins of every fruit grown in Ontario and also on special horticultural subjects are issued and revised from time to time as part of a regular series of bulletins published by the Ontario Department of Agriculture. Address, Parliament Buildings, Toronto.

Fruit Growers' Association of Ontario. This society issues an annual report published by the province. The first report was published in 1863 under the title, "Report of the Fruit Growers' Association of Upper Canada." The publication is continuous, but "Ontario" has been substituted for "Upper Canada." Total number of volumes, 49. Address, Parliament Buildings, Toronto.

Horticultural Societies of Ontario. This organization publishes an annual report. The first report was published in 1907 under the title, "First Annual Report of the Horticultural Societies of Ontario." Total number of volumes, 8. Address, Parliament Building, Toronto.

Ontario Vegetable Growers' Association. This society was organized in 1909 and has held annual meetings since that time. Proceedings of all the meetings are published. Address, Parliament Buildings, Toronto.

OREGON

Oregon State Board of Horticulture. This board issues biennial reports published by the state. The first report was published in 1891 under the title, "Biennial report of State Board of Horticulture." The publication is continued under the above title. Total number of volumes, 12. There have been special bulletins issued on fruits, spraying, orchard management and the like. They have issued at least nine numbered bulletins of which 1–3 may be found in the first biennial report and 5–7 in the second. Address, Portland.

Oregon State Horticultural Society. An annual report is published by the state. The first report was published in 1909 under the title, "Proceedings and Papers of the Twenty-fifth Annual Meeting of the Oregon State Horticultural Society." In 1892, one report was published in connection with the Report of the State Board of Horticulture. The publication is continued under the title "Proceedings and Papers of the Annual Meeting of the Oregon State Horticultural Society." Total number of volumes, 5. There have been no special reports. Address, Portland.

PENNSYLVANIA

State Horticultural Association of Pennsylvania. Annual reports are published, usually by the society, but from 1878–1894 they were published in connection with the reports of the State Board of Agriculture of Pennsylvania. The report for 1895 was issued as Bulletin 8 of the State Board of Agriculture; those for 1896 and 1899–1906 were published in the annual report of the Department of Agriculture. The first report was published sometime between 1860 and 1867 under the title, "Report of Eastern Pennsylvania Fruit Growers' Society." Later, it was issued under the title, "Report of Pennsylvania Fruit Growers' Society." After 1881, it appeared under the title, "Report of State Horticultural Association of Pennsylvania." The publication has been continuous with the exception of the year 1897, which was never published. There have been no special reports. Organized in 1860. Address, Flora Dale.

PORTO RICO

Porto Rico Horticultural Society. Only one report has been published, that of 1911–12, under the title, "First Annual Report of the Porto Rico Horticultural Society." From July, 1908, to October, 1910, the "Porto Rico Horticultural News" was issued monthly as the official organ of the Porto Rico Horticultural Society. In December, 1910, this journal was merged with "Porto Rico Progress" which has since been issued weekly. Address, Mayaguez.

PRINCE EDWARD ISLAND

Fruit Growers' Association of Prince Edward Island. This society issues annual reports published by the Department of Agriculture. The first report was published in 1896 under the title, "First Annual Report of the Fruit Growers' Association of P. E. I." The publication is still continued under this title. Some of the reports are bound with the Report of the Department of Agriculture and are not published separately. Total number of volumes, 15. There have been no special reports. Address, Charlottetown.

QUEBEC

Montreal Horticultural Society and Fruit Growers' Association of the Province of Quebec. This society published its first annual report in 1876 under the title, "First Report of the Fruit Committee of the Montreal Agricultural and Horticultural Society." The second report was entitled "Transactions and Second Report of the Fruit Committee, etc," and was published in 1877. From 1877–1882, the reports have the title "Report of Montreal Horticultural Society and Fruit Growers' Association of the Province of Quebec." Later reports have the same title with the words "Annual Report" substituted for "Report." The society has not been in active existence since about 1893 and no recent reports have been published.

Pomological and Fruit Growing Society of the Province of Quebec. Annual reports and pamphlets are issued, published by the society but paid for by the Government. The first report was published in 1895 under the title, "Annual Report of the Pomological and Fruit Growing Society of the Province of Quebec." The publication is continuous under this title. Total number of volumes, 21. There have been no special reports. Chateauguay.

RHODE ISLAND

Rhode Island Horticultural Society. This society issues no publications except premium lists for its exhibitions. Address, Providence.

SOUTH CAROLINA

Horticultural Society of South Carolina. This society is not now in existence. It published only one report in 1889 entitled "Report of the First Meeting of the State Horticultural Society."

South Carolina Fruit Growers' Association. This society was organized about six years ago but has held only one meeting. No publications have as yet been issued. Address, Greenville.

SOUTH DAKOTA

South Dakota State Horticultural Society. This society issues an annual report published by the state. The first report was published in 1904 under the title. "First Annual Report of the Thirteenth Meeting." The publication is continuous under the title, "Annual Report." Total number of volumes, 11. There have been no special reports. Incorporated under state law, January 9, 1890. Address, Brookings.

TENNESSEE

Tennessee State Horticultural Society. Annual proceedings are issued, beginning with 1914.

Tennessee State Nurserymen's Association. Proceedings are issued annually, the first appearing in 1914. Address, Knoxville.

TEXAS

Texas Nurserymen's Association. This association holds annual meetings, reports of which are published in the reports of the Texas Farmers' Congress. No special reports are issued. Address, Sherman.

Texas Nut Growers' Association. This association was organized in 1904 and continued until July, 1910, when it was merged into the State Horticultural Society. One bulletin on pecans was published with the proceedings of the Texas Farmers' Congress; "Pecans and Other Nuts in Texas," 1908. "The Pecan and Hickory in Texas," by E. J. Kyle was published by the Texas Department of Agriculture in bulletin form in 1911.

Texas State Horticultural Society. An annual report is published in the general proceedings of the Texas Farmers' Congress, published by the Department of Agriculture, bulletin form. In 1889, there was a report published by the society containing the reports of meetings from 1886–1889 under the title, "Initial Report of the Texas State Horticultural Society." No other reports were published until about 1905 when they were included in the Farmer's Congress Report. There are no special reports. Address, College Station.

UTAH

Utah State Horticultural Commission. This organization publishes a biennial report. The first report was issued in 1897 under the title, "Report of the State Board of Horticulture." Reports from 1897–1908 have the title, "Biennial Reports of the State Board of Horticulture;" 1909–1910, "Biennial Report of the State Horticultural Commission." Total number of volumes, 9. There have also been at least 9 numbered bulletins, the first six numbers of which appear also in the annual reports. Address, 412 Vermont Building, Salt Lake City.

Utah State Horticultural Society. An annual report is issued by the society. The first report was published in 1912 under the title, "Proceedings of the Sixth Annual Convention of the Utah State Horticultural Society." A report of the eighth annual convention, 1912, has been issued. Organized 1905. Address as above.

VERMONT

Vermont State Horticultural Society. This society issues annual reports published by the state in "Vermont Agriculture" and also as separates. The first report was published in 1896 under the title, "Report of First Annual Meeting of Vermont State Horticultural Society." No other report was published until 1905, when there was issued the "Second Annual Report of the Vermont State Horticultural Society, Proceedings of the Tenth Annual Meeting." The publication is continuous. Total number of volumes, 12. There have been no special reports. Address, Burlington.

VIRGINIA

Virginia State Horticultural Society. An annual report is issued by the society (which has state appropriation). The first report was published in 1898 under the title, "Annual Report of the Virginia State Horticultural Society." The publication is still continued under this title. The society issues four quarterly bulletins each year, the first issue containing a revised "Spray Calendar." Have also published "Fruit Growing in Virginia," and "Packing Apple Book." Address, Crozet.

WASHINGTON

Washington State Horticultural Association. Annual reports and bulletins are published by the society. The first report was issued in 1901 under the title, "Report of the Washington State Horticultural Association." The publication still continues under the same title. Total number of volumes, 9. There have been no special reports. Address, State Secretary's Office, Walla Walla.

WEST VIRGINIA

West Virginia State Horticultural Society. Up to 1913 this society issued an annual report published by the State Board of Agriculture as one of its quarterlies. The first report was published in 1894 under the title, "Special Bulletin No. 2, State Experiment Station." The second, third, fourth and fifth annual meetings were reported in the "Farm Reporter" (no longer published), sixth, seventh and eighth in the "Farm Review" (no longer published), ninth in pamphlet form, tenth, eleventh and twelfth in "Farm Review," and the thirteenth to nineteenth have been issued by the State Board of Agriculture. The twentieth report is published by the Commissioner of Agriculture, as the Board of Agriculture has been disbanded. There have been no special reports. Address, Morgantown.

WISCONSIN

Wisconsin State Cranberry Growers' Association. This association has issued twenty-seven annual reports and ten semi-annual reports. The first report was issued in 1887.

Wisconsin State Horticultural Society. An annual report is published by the state. The first regular report was published in 1871 under the title, "Transactions of the Wisconsin State Horticultural Society." Beginning with the report for 1889, the publication bore the title, "Annual Report." Since 1910, the report has been issued in two parts: Part I, containing constitution, by-laws, business transactions and list of members which are for distribution to members only. In 1868, a report was published entitled, "Report for the years 1864–8, with a short historical sketch since its organization." This society also issues a monthly magazine entitled, "Wisconsin Horticulture," the first issue of which appeared in September, 1910. Between 1896 and 1903, a monthly periodical, entitled "The Wisconsin Horticulturist," was issued. Nineteen numbered bulletins have appeared between March, 1903, and April, 1910. Address, Madison.

WYOMING

Wyoming State Board of Horticulture. Biennial reports are issued. The first report was published in January, 1907, under the title, "Biennial Report of the Wyoming State Board of Horticulture." The publication is continued under the same title. Special bulletins, alternating with the reports, are published—four have been issued thus far,—1908, 1910, 1912, 1914. Address, Laramie.

Wyoming State Horticultural Society. Proceedings are issued in publications of the above board, those bearing the odd numbers in the biennial reports, and the others in the special bulletins.

North American horticultural periodicals.

The periodicals of any subject are supposed to chronicle all the fleeting events of the days and years, and to preserve them for future generations, but it is the most difficult thing to remember and record the journals themselves. Horticultural journals probably have lived and died in this country without having attracted the attention of a single library or collector of books. It is probably no exaggeration to say that more than 500 horticultural journals have been started in North America. There are more than sixty in continuance at the present moment.

The "Massachusetts Agricultural Repository" was started in 1793, but it was as late as 1821 that a horticultural department was added to it. This was an organ of a society rather than a journal in the present sense. American agricultural journalism is usually dated from the establishing of the original "American Farmer" in Baltimore in 1819. The first journal to devote any important extent of its space to horticultural matters was the original "New England Farmer," which was established in Boston in 1822, and which was one of the chief instruments in the organization of the Massachusetts Horticultural Society. Its first editor was Thomas G. Fessenden, author of the "New American Gardener," a book which appeared in 1828, and passed through at least six editions.

A "Floral Magazine" was started in Philadelphia in 1832 and continued sometime afterward. It contained colored plates of ornamental plants. The entire work, except the illustration, was done by the two David Landreths and it was published by them. Tradition says that it was not a paying venture and after several years it was discontinued. The volume of 1832 comprises eighty pages, with descriptions and colored illustrations of thirty-one stove and other ornamental plants. The full title is "The Floral Magazine and Botanical Repository. Published by D. & C. Landreth, Nursery and seedsmen, Philadelphia." The bound volume is 8¾ x 11 inches. The "Horticultural Register and Gardener's Magazine," established in Boston in 1835, and edited by Fessenden and Joseph Breck, and "Hovey's Magazine," were among the first distinct horticultural periodicals. The former, although a magazine of more than ordinary merit, did not persist long. The latter was founded by C. M. Hovey and P. B. Hovey, Jr., and was called the "American Gardener's Magazine and Register of Useful Discoveries and Improvements in Horticultural and Rural Affairs," a journal which, in the third volume, became the "Magazine of Horticulture," and which enjoyed an uninterrupted existence until 1868, thus covering a third of a century of one of the most critical and interesting periods in American horticulture.

The next important journalistic venture was the "Horticulturist," begun in July, 1846, and continued under many changes and vicissitudes for some thirty years, and was finally represented, in line of descent, by "American Gardening," which ceased to exist in November, 1904. The "Horticulturist" had been published in Albany, Rochester, Philadelphia and New York. The first seven volumes were edited by A. J. Downing; the eighth and ninth by Patrick Barry; the tenth by Barry and J. J. Smith; the eleventh to fourteenth by J. J. Smith; fifteenth and sixteenth by Peter B. Mead; seventeenth and eighteenth by Mead and G. E. Woodward. Later it was continued by Henry T. Williams, in New York, until the close of 1875, when the "Horticulturist" was united with the "Gardeners' Monthly," of Philadelphia. This latter magazine started January 1, 1859, as a quarto, but became an octavo with its second volume. It continued until the close of 1887, when, upon the death of its publisher, Charles Marat, it passed into the hands of "American Garden," New York. It had a long and useful career under the editorial management of one of the most accomplished and conscientious of American horticulturists, Thomas Meehan, whom all the succeeding generation had learned to love.

The "American Garden" as such, before it absorbed the "Gardeners' Monthly," traced an independent descent from two other journals. The senior of these was "The Ladies' Floral Cabinet," the first number of which was issued January 1, 1872, by H. T. Williams, who was also editor and publisher of the "Horticulturist," at 5 Beekman Street, New York. Mr. Williams' idea was that the cultivation of flowers properly belonged to women, that they were by nature eminently fitted for it, and that a journal adapted to their wants would greatly aid them in their work, and prove a financial success to the publisher. For some time "The Floral Cabinet" was well sustained and well edited, but after about three years Mr. Williams became wholly absorbed in religious publications and his interest was gradually withdrawn from floriculture. In January, 1880, the "Cabinet" and all the personal effects of Mr. Williams passed into the hands of Adams & Bishop, who continued the publication with varied success, and who intended to close up the business as soon as they could do so to the best advantage. In June, 1882, the paper and good will were sold to Ralph H. Waggoner, who gave it new life; he secured the services of C. L. Allen as an advisory editor, the active work falling upon Miss S. A. Fraser. The last number under Waggoner's management was issued January 1, 1887, when it was absorbed by the "American Garden." The other independent journal absorbed by "American Garden" was known as the "Flower Garden," and the first number was published October 1, 1872; it was edited by C. L. Allen, and published quarterly by C. L. Allen & Co., 76 Fulton Street, Brooklyn, N. Y. It existed one year and was then sold to Beach, Son & Co., seed and bulb merchants, who removed its publication office to Barclay Street, New York, and changed its name to "The American Garden," the late Mrs. C. V. Beach becoming its editor. Beach & Son continued the publication as a quarterly till the year 1880, when B. K. Bliss & Sons secured possession of both the paper and the seed business. It was at this epoch that F. M. Hexamer became editor. Two years later (1882) the publication again became a monthly. In 1883, E. H. Libby secured possession of the property, but its publication was continued under the same editorial control till the end of 1885; during some part of this period the publication office was at Greenfield, Mass. Things stood as they were till 1890, when the magazine shape was adopted. In that year, L. H. Bailey became editor and continued in that capacity till 1893. In January, 1892, soon after the absorption of "Popular Gardening," of Buffalo, N. Y., the title was altered to "American Gardening," so as to unite and typify both names. Prior to this amalgamation, after having had a career of seven years under Elias A. Long, its founder, "Popular Gardening" had absorbed many minor magazines. For a time E. A. Long, in association with T. Greiner, edited the combined journal. After 1893, Leonard Barron assumed the editorship, the periodical having been taken over by the A. T. De La Mare Publishing Company, publishers of "The Florists' Exchange." In October, 1898, James Withers took over the publication. The American Gardening Publishing Company succeeded to the ownership in 1901. In 1903, the American Gardening Co., was organized, the business manager being Thomas B. Meehan; and with this organization the regular continuity of the periodical as a general horticultural magazine came to a close. The "Fruit Grower" of St. Joseph, Mo., took over the mailing list.

The "Philadelphia Florist" completed its first volume in 1852–3. The subsequent volumes (at least three) were known as the "Florist and Horticultural Journal." It was a very creditable monthly magazine, with colored plates. An early journal in the new West was Hooper and Elliott's "Western Farmer and Gardener," Cincinnati, September, 1839–45, with plates colored by hand.

The first pomological journal was probably Hoffy's "Orchardist's Companion," a quarterly, established in Philadelphia in 1841, and edited by Dr. Brincklé. It was a pretentious quarto, with colored plates, of which only one volume was issued. This was followed in 1860 by the "North American Pomologist" by Dr. Brincklé, an abler publication than the other. Other early horticultural periodicals were "Western Horticultural Review," Cincinnati, 1851–3, edited by John A. Warder; "American Journal of Horticulture," later known as "Tilton's Journal of Horticulture," Boston, 1867–71 (9 vols.), edited in its last three years by the younger Robert Manning; "Western Pomologist," Des Moines, Iowa, and Leavenworth, Kansas, 1870–72, by Mark Miller, J. Stayman, and others. The first attempt to establish a weekly, after the pattern of the great English journals, was "Garden and Forest," which appeared in New York in 1888, under the management of Professor Charles S. Sargent, of Harvard University. This journal continued till the close of 1897, comprising ten completed volumes of very high character and entitled to rank as one of the noteworthy undertakings in the entire field (see *Stiles*, p. 1597). Probably the first journal devoted to a particular fruit or plant was Husmann's "Grape Culturist," St. Louis, 1869–71.

The first florists' trade paper to persist is "The American Florist," issued August 15, 1885; this was followed by "Florists' Exchange," in 1889; and "Florists' Review," 1895. "Horticulture," established 1904, is also practically a trade paper. All of these are continuing.

On the Pacific coast, the earliest distinct horticultural periodical was the "California Culturist," the first number of which appeared in January, 1859. This ran through four volumes, and it records the marvels of the first era of modern fruit-growing upon the Pacific slope. Before this, however, "The California Farmer," had been established (January, 1854). It maintained a spasmodic existence for a number of years, and printed the first pomological and horticultural reports of committees. "The Pacific Rural Press" was established in 1871, in San Francisco, and still continues, devoted very largely to the horticultural interests. The "California Horticulturist" was established in 1870, and ran through ten yearly volumes, when, in 1880, it was merged into "The Pacific Rural Press." "The Rural Californian," of Los Angeles, still in existence, was established in 1877. "The California Fruit-Grower," commenced in 1888, still survives (1912) as "The California Fruit News." "The California Florist," first issued in Santa Barbara, then in San Francisco, began in May, 1888, and stopped in 1889. "The California Cultivator," of Los Angeles, established in 1884, is still published. See pages 1507, 1508 for further discussion of California journals.

EXTANT HORTICULTURAL JOURNALS

(With Date of Establishment)

IN CANADA

British Columbia Fruit and Farm Magazine. John Nelson, ed. M. 1909. Vancouver, B. C.

The Canadian Florist. H. B. Cowan, ed. Pub. by Horticultural Publishing Company. Every second Friday. $1. 1903. Peterboro, Ont.

The Canadian Horticulturist. H. B. Cowan, ed. Pub. by Horticultural Publishing Company. M. $1. 1878. Peterboro, Ont.

Fruit Grower and Farmer. James A. Livingston. S.-M. $1. 1907. Grimsby, Ont. (Formerly "Fruit Grower, Market Gardener and Poultryman.")

Le Journal d'Agriculture et d'Horticulture. Pub. by Minister of Agriculture of Quebec. H. Nagant, ed. M. $1. 1879. Quebec, Que.

Manitoba Horticulturist. Published by Manitoba Horticultural and Forestry Associations. M. $1. 1914. Winnipeg.

Maritime Apple. 1912. Kentville, N. S.

IN THE UNITED STATES

Acker und Gartenbauzeitung. The Herold Company. W. $1. 1869. Milwaukee, Wis.

American Florist. The American Florist Company, ed. and pub. W. $1. (Canadian subscription, $2.) 1885. Chicago, Ill.

American Fruit and Nut Journal. H. Harold Hume. S-Q. $1. 1904. Petersburg, Va.

American Fruits. R. T. Olcott. M. $1.50. 1903. Rochester, N. Y.

American Nut Journal. R. T. Olcott. M. $1.25. 1914. Rochester, N. Y.

American Pomologist. Pub. by American Pomological Society. Q. 45 cts.

Apple World, The. U. G. Border. M. $1. 1914. Baltimore. Md. Official organ of the Apple Advertisers of America.

Arkansas Fruits and Farms. E. N. Hopkins. Fort Smith, Ark. (First appeared under title "Ozark Produce Journal," then "Ozark Fruits and Farms.")

Better Fruit. E. H. Shepard. M. $1. 1906. Hood River, Ore.

California Cultivator. C. B. Messenger, ed. W. $1. 1884. Los Angeles.

California Fruit News. H. C. Rowley, ed. and pub. W. $3. 1888. San Francisco. (Formerly "California Fruit Grower.")

California Garden. Alfred D. Robinson, ed. M. $1. 1908. San Diego, Calif.

Carolina Fruit and Trucker's Journal. Z. W. & W. S. Whitehead. S-M. $1. 1897. Wilmington, N. C.

Eastern Fruit. S. M. Paschall. M. 50 cts. 1912. Philadelphia.

Farm and Orchard. R. W. Thrush, ed. M. $1 for 3 yrs. 1913. Keyser, W. Va.

Florida Grower. Florida Grower Publishing Company. W. $1.50. 1908. Tampa, Fla.

Florists' Exchange, The. A. T. De La Mare Printing and Publishing Co. W. $1. 1888. New York.

Florists' Review. H. B. Howard, ed. W. $1. 1897. Chicago, Ill.

Fruit and Produce Distributor. Distributor Publishing Co. W. $2. 1913. Portland, Ore.

Fruit Belt. Geo. W. Welsh. M. 50 cts. 1905. Grand Rapids, Mich.

Fruitman and Gardener. L. McCutcheon, ed. and pub. M. 50 cts. 1897. Mount Vernon, Iowa.

Fruitman's Guide. Fruitman's Guide, Inc. W. $1. 1896. New York.

Fruit Grower and Farmer. W. G. Campbell, ed. M. $1. 1897. St. Joseph, Mo. (Known as "Western Fruit Grower" until October, 1912.)

Fruit Trade Journal and Produce Record. Fruit Trade Journal Company. W. $1. 1889. New York.

Gardeners' Chronicle of America, The. Chronicle Press, Inc. M. $1.50. 1905. Madison, N. J.

Gardening. The Gardening Company, ed. and pub. S-M. $2. 1892. Chicago, Ill.

Garden Magazine. Doubleday, Page & Co. M. $1.50. 1905. Garden City, N. Y.

Green's Fruit Grower. Chas. A. Green, ed. M. 50 cts. 1881. Rochester, N. Y.

Gulf Coast Citrus Fruit Grower and Southern Nurseryman. Albert S. Leecraft. M. $1. December, 1910. Houston, Texas.

Horticulture. W. J. Stewart. W. $1. 1904. Boston.

House and Garden. McBride, Nast & Co. M. $3. 1901. New York, N. Y.

Illinois Horticulture. Pub. by Illinois State Horticultural Society. Q. 1913. Normal.

Intermountain Fruit Journal and Intensive Agriculturist. R. E. Turpin, ed. Alfred Patek, pub. $1. 1910. Grand Junction and Denver, Colo. (Now consolidated with "Western Farm Life.")

Landscape Architecture. Official organ of the American Society of Landscape Architects. Published by Lay, Hubbard and Wheelright. Q. $2. 1910. New York.

Market Growers' Journal. S. W. Severance. S.-M. $1. 1907, Louisville, Ky.

Michigan Horticulture. Pub. by Michigan State Horticultural Society. M.

Minnesota Horticulturist. Minnesota State Horticultural Society. M. $1. 1894. Minneapolis, Minn.

Modern Gladiolus Grower, The. Madison Cooper, ed. and pub. M. 50 cts. 1914. Calcium, N. Y.

National Nurseryman. National Nurseryman Publishing Co., Inc. M. $1. 1893. Rochester, N. Y.

Nebraska Horticulture. Published by Nebraska State Horticultural Society. M. $1. 1911. Lincoln.

Northern Fruit Grower. M. 1911. Howard Lake, Minn.

Northwest Farm and Orchard. R. E. White. M. 50 cts. Spokane, Wash.

Northwest Horticulturist and Dairyman. C. A. Tonneson, ed. and pub. M. 50 cts. 1888. Tacoma, Wash.

Nut-Grower. J. F. Wilson. M. $1. 1902. Waycross, Ga.

Orchard and Farm Irrigation. A. Dixon. M. $1. 1886. San Francisco, Calif. (Formerly "Orchard and Farm.")

Pacific Fruit World. M. V. Hartranft. W. $2. 1895. Los Angeles, Calif.

Pacific Garden. P. D. Barnhart, ed. M. $1. 1907. Pasadena, Calif.

Park and Cemetery and Landscape Gardening. Allied Arts Publishing Co. M. $2. 1891. Chicago, Ill.

Park's Floral Magazine. Geo. W. Park. M. 10 cts. 1871. La Park, Pa.

Peach Growers' Journal and Apple Trade Review. W. John Hinchey, ed. and pub. M. $1. 1899. Middleport, N. Y.

Southern Fruit Grower, The. R. S. Walker, ed. M. 50 cts. 1896. Chattanooga, Tenn.

Southern Orchards and Farms. J. W. Canada. M. 50 cts. 1907. Houston, Texas. (First appeared under title "Texas Fruits." From 1909–11 had the title "Southern Orchard and Homes.") Now appears under title "Southland Farmer," La Porte, Texas.

Tree Gold. Benjamin W. Douglass, ed. M. 50 cts. 1914. Indianapolis, Ind.

Trucker and Farmer. H. J. Hill, ed. M. $1. 1906. New Orleans, La. (Now "Modern Farming." A. B. Gilmore, ed. Established 1870.)

Truck Farmer of Texas. J. C. Loving. M. $1. 1899. Dallas.

Vegetable Grower. H. L. Freking, ed. M. 50 cts. 1911. Spencer, Ind.

Wisconsin Horticulture. Pub. by the Wisconsin State Horticultural Society. M. 1910. Madison.

EXTINCT HORTICULTURAL JOURNALS

IN CANADA

Acadian Orchardist. H. G. Harris, ed. and pub. W. $1. 1873. Kentville, N. S.

Courier and Okanagan Orchardist. Geo. C. Rose, ed. and pub. W. $1.50. 1904. Kelowna, B. C.

Farm and Garden Culturist. Richard Burke, ed. 1888–9. P. E. I.

Poultry, Garden and Home Advocate. H. B. Donovan. M. 50 cts. 1898. Toronto, Ont. (Now "Poultry Advocate.")

IN THE UNITED STATES

American Farm and Horticulturist. L. J. Thompson. Q. 25 cts. 1889–94. Lakewood, Ohio. Pub. at Richmond, Va., from 1891–93.

American Farm and Orchard. W. D. Bassford, ed. M. 1901–6. Mexico, Mo.

American Fruit and Farm. American Publishing Company. M. $1. 1908. Paonia, Colo.

American Garden. F. M. Hexamer and others. M. 1874–91. New York, N. Y.

American Gardening. Rural Publishing Company. $1. M. 1892–1904. New York. (Merged into "Western Fruit Grower" now "Fruit Grower.")

American Horticultural Advertiser.

American Horticulturist. Leavenworth & Burr Co. M. $1. 1885–6. Detroit, Mich. (Established as "Michigan Horticulturist." Combined with "Popular Gardening.")

American Horticulturist. M. 1891–8. Wichita, Kans. (Established as "Smith's Small Fruit Farmer.")

American Horticulturist. W. Douglas, ed. W. $1.50. 1910–11. Fowler, Ind.

American Journal of Horticulture and Florists' Companion. 1867. (Later changed to "Tilton's Journal of Horticulture.")

American Truck Farmer. W. T. Burkam, ed. M. October, 1903 to December, 1905. St. Louis, Mo. (Changed to "Farm Money-Maker.")

Apple Specialist. James McKinnay. M. 50 cts. 1903–8. Quincy, Ill. (Merged into "Green's Fruit Grower.")

Arkansas Fruits. D. E. Debou, ed. 50 cts. 1912–14. Fayetteville, Ark. (Now merged with "Arkansas Fruits and Farms.")

Boston Flower Market and New England Florist. (Changed to "New England Florist")

Bowditch's American Florist and Farmer. M. 1881–5. Boston. (Merged into "Orchard and Garden.")

Cactus Journal. M. 1894–8. Baltimore, Md.

California Culturist. M. 1858–63. San Francisco.

California Florist and Gardener. E. E. Smith, ed. M. 1888–9. San Francisco. (Merged into "Pacific Rural Press.")

California Fruit Exporter. Scott & Wood. M. $1. 1891. San Francisco.

California Horticulturist. M. 1871–80. (Merged into "Pacific Rural Press.")

Central States Fruit Grower. 1896–9. (Later "National Fruit Grower.")

Citrograph. Redlands, Calif.

Colorado Fruit Grower. Paonia and Grand Junction, Colo. (Title changed to "Irrigation Fruit Grower.")

Cranberry Grower. W. H. Fitch, ed. M. $1. 1903–5. Cranmoor, Wis.

Dahlia News. New England Dahlia Society. M. $1. 1907–11. Boston.

Eastern New York Horticulturist. Q. 1897–9. Chatham, N. Y.

Eastern Shore Farmer and Fruit Culturist. M. 1893–1902. Salisbury, Md., and Georgetown, Del. (Established in 1893 as the "Strawberry Culturist.")

Fancy Fruit. Granville Lowther, ed. and pub. M. $1. 1907–9. North Yakima, Wash. (Later changed to "Washington Fruit Grower.")

Farmer and Fruit Grower. Florida Publishing Co. W. Jacksonville, Fla.

Farm, Garden and Poultry. Farm, Garden and Poultry Company. M. 50 cts. 1902. Hammonton, N. J.

Field, Lawn and Garden. W. B. Davis, ed. M. 1874–5. Madison, Wis.

Floral Instructor. M. 1880–91. Ainsworth, Iowa.

Floral Life. Young & Bennett Co. M. 50 cts. 1903–8. Springfield, Ohio. (Merged into "Household Journal and Floral Life.")

Floral Magazine. John Lewis Childs. Floral Park, N. Y.

Florist and Horticultural Journal. H. C. Hanson. M. 1852–5. Philadelphia. (Established as "Philadelphia Florist and Horticultural Journal.")

Flower Garden, The. 1872–4. Brooklyn, N. Y.

Flowers, F. W. Stack, ed. Pub. by Suburban Press. M. $1. 1912. New York.

Fruit and Grape Grower. A. R. Blakey, ed. M. $1. 1886–9. Charlotteville, Va.

Fruit and Vegetable Grower. M. 1889–90. Cheswold, Del.

Fruit Grower. W. $2. 1892. Macon, Ga.

Fruit Grower and Horticulturist. E. R. McKenny, ed. M. $1. 1890–1. Lacon, Ill.

Fruit Grower's Journal. O. O. Buck, ed. and pub. W. from 1883–6.; S.-M. from 1887–1907; M. 1908. 50 cts. 1883. Pub. at Cobden, Ill., 1883–1907; at Treynor, Iowa. 1908. (Merged into "Green's Fruit Grower.")

Fruit Recorder and Cottage Gardener. A M. Purdy. M. $1. 1869–86. Palmyra, N. Y. (Established as "Small Fruit Recorder and Cottage Gardener." Absorbed by "Popular Gardening.")

Fruits and Flowers. D. H. Stearns, pub. M. $2. 1891–2. Portland, Ore.

Fruits and Flowers. A. W. Dyer. M. 10 cts. 1906. Chautauqua, N. Y. (Absorbed by the "Vegetable Grower.")

Garden and Forest. C. S. Sargent. W. $4. 1888–97. New York, N. Y.

Gardeners' Magazine. Joseph Breck. 1835. Boston.

Gardeners' Magazine. M. 1854–5. Boston.

Gardeners' Monthly. Thomas Meehan. M. January 8, 1859 to January, 1888. Philadelphia. (Absorbed by "American Garden.")

Grape Culturist. Geo. Husmann. M. 1869–71. St. Louis, Mo.

Home and Flowers. M. 1896–1904. Springfield, Ohio. (Established as "How to Grow Flowers." Continued under following title.)

Home and Flowers, formerly "How to Grow Flowers," consolidated with "Success with Flowers." M. 1890–1906. West Grove, Pa. (Established as "Success with Flowers." Merged into "Vick's Magazine.")

Home Florist. Q. 1898–1901. Springfield, Ohio. (Merged into "Home and Flowers.")

Horticultural Art Journal. T. B. Jenkins, ed. $2. 1886–91. Rochester, N. Y.

Horticultural Marketplace. John S. Gallagher. W. September, 1910, to October 31, 1910. Rochester, N. Y.

Horticultural Register. Thomas G. Fessenden. M. 1835–9. Boston.

Horticultural Review and Botanical Magazine. J. A. Warder, ed. M. 1853–4. Cincinnati, Ohio. (Established as "Western Horticultural Reveiw.")

Horticultural Visitor. (See "Our Horticultural Visitor.")

Horticulturist. A. J. Downing and others. M. 1846–75. Albany, Rochester, Philadelphia and New York. (United with "Gardeners' Monthly.")

Household Journal and Floral Life. W. A. Martin, ed. M. 25 cts. 1903. Central Publishing Company, Springfield, Ohio.

Hovey's Magazine of Horticulture. C. M. Hovey. M. 1835–68. Boston. Seems never to have had this title on title page. Title: 1835–6, "American Gardeners' Magazine and Register of Useful Arts;" 1837–68, "The Magazine of Horticulture, Botany and all Useful Discoveries and Improvements in Rural Affairs." United with "American Journal of Horticulture" to form "Tilton's Journal of Horticulture.").

How to Grow Flowers. 1896–1900. (Title changed to "Home and Flowers.")

International Horticulturist. 1889. Harrisburg, Pa.

Iowa Horticulture. Pub. by State Horticultural Society. M. Des Moines. January to December, 1908.

Irrigation Fruit Grower. R. H. Perry, ed. M. $1. 1905–11. Denver, Colo. (Established as "Western Slope Fruit Grower;" then as "Colorado Fruit Grower." Absorbed by "Intermountain Fruit Journal.")

Ladies Floral Cabinet. M. 1872 to January 7, 1887. New York. (United with "American Garden.")

Ladies Horticultural Magazine and Floral Register. M. Baltimore, Md. (Prospectus issued in June, 1833.)

Lewiston Orchards Life. H. H. S. Rowell, ed. M. 50 cts. 1912–14. Lewiston, Idaho.

Magazine of Gardening and Botany. M. 1834. Baltimore, Md.

Magazine of Horticulture, Botany and All Useful Discoveries and Improvements in Rural Affairs. (See "Hovey's Magazine of Horticulture.")

The Market Garden. Market Garden Publishing Company. M. 50 cts. First number published in January, 1894, and in July and in October the regular monthly journal began. Discontinued 1906. Minneapolis, Minn.

Mayflower. J. L. Childs. M. 50 cts. 1885–1906. Pub. at Floral, N. Y. 1885–6; Queens, N. Y. 1887–8; Floral Park, N. Y. 1889–1906. (Merged in "Floral Life.")

Meehan's Garden Bulletin. S. M. Meehan. M. $1. 1909–13. Germantown, Pa.

Meehan's Monthly. T. Meehan. M. $2. 1891–1902. Germantown, Pa.

Michigan Fruit Grower. Pub. by Practical Farmer Company. W. 1893–9. Grand Rapids, Mich. 1893–6 "Practical Farmer and Fruit-Grower."

Michigan Horticulturist. Chas. W. Garfield, ed. W. H. Burt Publishing Company, pub. M. 1885–6. Detroit, Mich. (Title changed to "American Horticulturist.")

Missouri and Arkansas Farmer and Fruitman. R. J. Profitt. M. 50 cts. 1888. Kansas City, Mo. (From 1888–94 had title "Kansas City Progress and Western Farm Journal.")

Montana Fruit Grower. 1896–1901. Missoula.

National Fruit Grower. Fruit Grower Publishing Company. M. 50 cts. 1894–1910. St. Joseph, Mo. (From 1896–9 had title "Central States Fruit Grower.")

National Fruit Grower. Chas. Greening. Monroe, Mich. (1896–9 "Central States Fruit-Grower.")

National Horticulturist. Q. 1890–3. Cambridge, Md.

National Horticulturist. National Horticulturist Company. M. $1. 1909 to March, 1912. Council Bluffs, Iowa.

Nebraska Horticulturist. J. G. Carpenter. Q. 25 cts. 1883–93. Blower, Neb.

New England Florist. New England Florist Company. W. 1896–9. Boston. (Established as "Boston Flower Market and New England Florist.")

New York Horticultural Review. 1855. New York.

North American Horticulturist. M. 50 cts. 1895–1907. Monroe, Mich.

Orange Belt. L. M. Holt. M. $2. 1890–4. Pub. at Alessandro, Calif. 1890–2; Rialto, 1893; Los Angeles, 1894. A weekly edition began in 1893 as "The Orange Grower."

Orchard and Garden. J. T. Lovett Company, pub. M. 50 cts. 1879–92. Little Silver, N. J.

Orchard Fruits. Wm. Dyke. M. 50 cts. 1892–3. Effingham, Ill.

Orchardists' Companion. A. Hoffy. Q. 1841–2. Philadelphia.

Ornamental and Forest Tree Grower. J. J. Pinney. M. 50 cts. Evergreen, Wis.

Our Horticultural Visitor. C. G. Mendenhall, ed. M. 50 cts. 1895–1906. Kinmundy, Ill. (First number had title, "Southern Illinois Horticultural Visitor"; 1895–1901, "Horticultural Visitor.")

Pacific Tree and Vine. 1882. San José, Calif.

Peach Grower. Mr. Bryan, ed. and pub. Savannah, Ga.

Peach Grower, Fruit Culturist and Truckers' Magazine. R. M. Martin, ed. and pub. M. 50 cts. 1903–1909. Savannah, Ga.

Philadelphia Florist and Horticulturist Journal. R. R. Scott, ed. 1852–3. (Continued as "Florist and Horticultural Journal.")

Pilot Point Horticulturist. M. Pilot Point, Texas.

Popular Gardening and Fruit Growing. Elias A. Long. M. 1885–91. Buffalo, N. Y. (Combined with "American Garden.")

Practical Farmer and Fruit-Grower. (See "Michigan Fruit Grower.")

Practical Fruit Grower. G. A. Atwood. M. 1894–1907. Springfield, Mo. (From 1894–1900 had title, "The Southwest." Merged into "American Fruit and Nut Journal.")

Practical Nurseryman and Horticultural Advertiser. M. 1893–1902. Huntsville, Ala.

Progressive Eastern Fruit Grower. John S. Gallagher. 1910-11. Rochester, N. Y.

Purdy's Fruit Recorder and Evaporator. A. W. Purdy. Q. 25 cts. 1889–94. Palmyra, N. Y.

Rogue River Fruit Grower. Charles Meserve. M. $1. 1909-12. Medford, Ore.

Rose Journal. Published by the American Rose Society. Q. 1912–13. Fishkill-on-Hudson, N. Y.

Science and Horticulture. C. R. Orcutt. M. $2. Orcutt, Calif. Also pub. at Los Angeles and San Diego.

Seed Time and Harvest. Isaac F. Tillinghast. M. (1880–2, Q.) 25 cts. 1880–94. La Plume, Pa. (Merged in "American Farmer and Farm News.")

Seed Time and Harvest. W. 1897–8. Scranton, Pa.

Seed Time and Harvest. M. 1905–8. Scranton, Pa.

Small Fruit Recorder and Cottage Gardener. 1869–71. (Later "Fruit Recorder and Cottage Gardener.")

Smith's Small Fruit Farmer. B. F. Smith. Q. 50 cts. 1891–4. Lawrence, Kans. (Later "American Horticulturist).

Southern California Horticulturist. Southern California Horticultural Society. M. 1877–9. Los Angeles. (Followed by "Semi-Tropic California;" then united with "Rural Californian.")

Southern Floral Magazine. Morton & Titus. M. 50 cts. Clarksville, Tenn.

Southern Florist and Gardener. M. 1894–9. Louisville, Ky. 1894–7; Chattanooga, Tenn., 1898–9.

Southern Fruit Journal. James Harrison, ed. and pub. M 50 cts. 1904. Montezuma, Ga.

Southern Horticultural Journal. S-M. 1888–91. Denison, Texas.

Southern Horticulturist. H. A. Swasey, ed. M. 1869–70. Canton, Miss., January and February, 1869; Yazoo City, Miss., March, 1869, to August, 1870; Tangipahoa, La., October to Dec., 1870. (Continued as "Swasey's Southern Gardener.")

Southern Horticulturist. M. 1892. Humboldt, Tenn.

Southern Horticulturist. M. Denison and Ft. Worth, Texas.

Southern Illinois Horticultural Visitor. (See "Our Horticultural Visitor.")

Strawberry. R. M. Kellogg Company. M. $1. 1906–7. Three Rivers, Mich. (Merged into "Fruitman and Gardener.")

Strawberry Culturist. (Changed to "Eastern Shore Farmer and Fruit Culturist.")

Strawberry Specialist. O. W. Blacknall. M. 50 cts. 1897–1903. Kittrell, N. C.

Success with Flowers. Dingee & Conard Co. M. 25 cts. 1890 to June, 1904. West Grove, Pa. (Combined with "Home and Flowers.")

Swasey's Southern Gardener. H. A. Swasey, ed. M. 187[illegible]. Tangipahoa, La. (Established as "Southern Horticulturist.")

Texas Fruits, Nuts, Berries and Flowers. (Now "Southern Orchards and Farms.")

Tilton's Journal of Horticulture and Florists' Companion. 1867–71. Boston. (Formerly "American Journal of Horticulture and Florists' Companion.")

Trade Journal and International Horticulturist. M. New York, N. Y.

Tri-state Farmer and Gardener. Tri-state Publishing Company. M. 50 cts. 1895–1907. Chattanooga, Tenn.

Vick's Magazine. Vick's Magazine Company. M. 50 cts. 1878–1906. Rochester, N. Y. Has also been pub. at Dansville, N. Y., and Chicago.

Vineyardist. J. H. Butler. S-M. $1. 1886–1903. Penn Yan, N. Y.

Washington Fruit Grower. E. L. Rorrey, ed. 1907–10. North Yakima, Wash. (Originally pub. under title, "Fancy Fruit.")

Western Farmer and Gardener. Hooper & Elliott. 1839–45. Cincinnati, Ohio.

Western Garden. C. N. Page. 1890–6. M. Des Moines, Iowa. (Is now published as "Poultry Success.")

Western Garden. 1893–4. Denver, Colo.

Western Horticultural Review. J. A. Warder, ed. M. 1850–3. Cincinnati, Ohio. (Continued as "Horticultural Review and Botanical Magazine.")

Western New York Apple. L. P. McNeeley. M. $1.50. 1908. Barker, N. Y.

Western Pomologist. Mark Miller, Dr. Stayman and others. 1870–2. Des Moines, Iowa, and Leavenworth, Kans. (Combined with "The Horticulturist.")

Western Slope Fruit Grower. Paonia, Colo. (See "Irrigation Fruit Grower.").

Wisconsin Horticulturist. Pub. by Wisconsin State Horticultural Society. M. 1896–1903. From 1896–1902 pub. at Baraboo and Madison; 1903 at Sparta and Madison.

Woodsman. Geo. W. Caldwell. M. 50 cts. Evergreen, Wis.

HORTICULTURISTS, NORTH AMERICAN. At this place are brought together brief biographical statements on persons not now living who have been eminent in horticulture in any of its branches in the United States and Canada. It is intended to include those who, by their own efforts, have had marked influence of a national scope, or at least an influence extending beyond state or provincial boundaries, in developing horticultural thought and practice as cultivators, tradesmen, authors, teachers, experimenters. As there is no standard list of such persons, or no recognized basis of judgment, so the present account is undoubtedly incomplete, and it may lack in uniformity. No doubt many other names should have been included; but the present list represents a large correspondence extending over nearly three years, and it is as extensive as circumstances will permit. It is particularly to be understood that this set of biographies does not attempt to constitute any standard by which the merits of individual horticulturists are to be judged. It does not represent an editorial judgment of persons who should finally be included in such lists, but only a collection of data of interest and value so far as it goes. There is need of a standard biographical work on American men and women who have been eminent and prominent in the development of agriculture in its widest sense; it is hoped that these biographies, and those contained in the fourth volume of the "Cyclopedia of American Agriculture," will be of service to editors who come finally to prepare such a work.

Adlum, John (Fig. 1868), grape experimenter, and author of "Memoir on the Cultivation of the Vine," 1823 and 1828, the first separately published American grape book, was born in York, Pa., April 29, 1759, and died at Georgetown, D. C., March 1, 1836. He was a soldier in the Revolution, major in the provisional army in the administration of the elder Adams, and later a brigadier-general in the militia of Pennsylvania. He was also a surveyor and civil engineer. He also held an associate judgeship in Lycoming County, Pennsylvania, having been appointed by Governor Mifflin. He was a friend of Priestly, and endeavored to apply the scientific knowledge of his time to agriculture. He early became interested in the amelioration of the native grapes, and established an experimental vineyard in the District of Columbia. He endeavored, but without success, to secure the use of certain public land in Washington for the purpose of "cultivating an experimental farm." He brought the Catawba grape to public notice. He was a pioneer in the awakening industrial activity of the new country. The botanist, Rafinesque, commemorated his name in the pretty genus Adlumia; but otherwise he has remained practically unknown until very recently. For further information, see Bailey, "Evolution of our Native Fruits." L. H. B.

1868. John Adlum.

Allen, Charles Linnæus, seedsman, florist and author, was born in Union Springs, New York, in 1828 and died at Floral Park, Long Island, May 21, 1909. He early evinced a love for flowers, especially the tree peony and gladioli when they were considered novelties in this country, and he soon made a horticultural and business specialty of these. At this time he lived in Brooklyn, New York, and was a communicant of Plymouth Church. He was superintendent of the Sunday-school for a number of years when Henry Ward Beecher was pastor of the church. Mr. Allen's pleasing ways and love for the children made him well fitted for the work. He was genial by nature, a pleasing conversationalist and a clever writer, an entertaining speaker, and devout churchman. In the early seventies he engaged in the wholesale seed trade at Queens, Long Island, under the firm name of C. L. Allen & Co., and erected an extensive plant for that day and time. The industry did not flourish as he had expected, and the seed business was sold to Hallock & Thorpe, a firm well known to the trade for many years. Mr. Allen then removed to Garden City, Long Island, and engaged to grow flower and vegetable seed by contract for many of the seedsmen, and it is here that he gained an international reputation as a scientific specialist on the culture of cabbage and cauliflower. His fame as a seedsman became worldwide. He wrote several books on horticultural subjects that were pleasing and practical and therefore popular. He spent his last years at Floral Park, New York, and was in great demand as a public speaker for horticultural organizations.

Mr. Allen possessed one of the finest private horticultural libraries in this country, many of the volumes of European origin and of rare merit, some tracing back to Holland and to 1497. Mr. Allen was a scholar and a linguist, and enjoyed the wealth of horticultural literature to the fullest extent. He was widely appreciated for his wisdom, geniality and his comradeship.

G. B. Brackett.

Ames, Frederick Lothrop, of the fourth generation of a family distinguished in the history of Massachusetts enterprise, was born in North Easton, in that state, June 8, 1835, and died September 13, 1893. He was graduated from Harvard College in the class of 1854, and devoted his life to the management of great commercial and industrial interests. Business did not occupy all his attention; he was a Fellow of Harvard College, a trustee of the Massachusetts Society for Promoting Agriculture, and of the Museum of Fine Arts; and an active and faithful director of charitable and benevolent institutions. A munificent patron of arts and sciences, he was successful in stimulating the increase of knowledge in many fields of human research. Devoted through his whole life to horticulture, he gained distinction for his wide and accurate knowledge of tropical orchids and their cultivation, and his collection of these plants at his country place in his native town was the most complete in the New World. His important services to botany and horticulture are commemorated in *Lælia Amesiana*, *Lælia anceps* var. *Amesiana*, *Phalænopsis F. L. Ames*, *Cypripedium Amesianum*, *Cypripedium insigne* var. *Amesianum*, *Vanda Amesiana*, *Stanhopea Amesiana*, *Miltonia vexillaria* var. *Amesiana*, *Odontoglossum Rossiæ* var. *Amesiana*, and *Cattleya Hardyana* var. *Amesiana*.

C. S. Sargent.

Appleseed, Johnny, an interesting and eccentric character, who sowed apple seeds in the wilds of Ohio and Indiana between 1801 and 1847. His real name was Jonathan Chapman. He was born in Boston in 1775, and died in 1847. For forty-six years he walked barefoot through the wilderness, and was never harmed by snakes, wild animals, or Indians. He was often clad in a coffee-sack, in which he made holes for the arms and legs. He would never kill any creature, and considered pruning and grafting wicked. Swedenborg and the New Testament he read aloud in many frontier log cabins. He had many peculiarities, but was always welcomed and respected everywhere. In the war of

1812 he saved many lives by warning the settlers of Hull's surrender and the approach of the Indians. He lived to see trees bearing fruit over a territory of 100,000 sq. mi. The story of this self-sacrificing and useful man is told by W. D. Haley in Harper's, 43:830–836 (1871). A movement is on foot in Ohio to erect a monument to Johnny Appleseed. His history has been the subject of a romance, "The Quest of John Chapman," by Newell Dwight Hillis, 1904. Wilhelm Miller.

Arnold, Charles, nurseryman and hybridist, was born in Bedfordshire, England, in 1818. In 1833 he removed to Paris, Ontario, and in 1853 established the Paris Nurseries. He was elected one of the first directors of the Fruit Growers' Association of Ontario and continued in office during the remainder of his life. He was an enthusiastic hybridist. Of his productions of grapes we note five varieties described in the Bushberg Catalogue for 1883, viz., Othello, Cornucopia, Autochon, Brant and Canada. In raspberries, he raised quite a number of crosses of Antwerp with a whitecap of high quality. Of his many apple seedlings, one especially has proved of standard value, viz., the Ontario, a cross of Spy with Wagener. In crossbred peas, he was very successful, one deserving especial notice, viz., Bliss American Wonder, a cross of Champion of England with Tom Thumb. For this he received from Messrs. Bliss & Son of New York, the handsome sum of $2,000. His death occurred in 1883. Linus Woolverton.

Avery, Robert, pioneer nurseryman, was born in 1796 and died December 30, 1879. He was the first nurseryman and orchardist in the state of Iowa, and in 1837 founded the largest nursery in the state. He himself planted and encouraged others to plant large numbers of fruit trees throughout the Mississippi Valley states.

Bancroft, George, the famous American historian (1800–1891), deserves remembrance among horticulturists for his notable collection of roses at his summer home in Newport, Rhode Island, an account of which may be found in the "American Garden," 1891. For a portrait and sketch, see "Appleton's Annual Cyclopedia" for 1890. In Bancroft's garden, George Field found a rose without a name, which is now known to be the French variety Mme. Ferdinand Jamin. It was introduced by Field & Brothers as the American Beauty.

Barry, Patrick (Fig. 1869), nurseryman, editor and author, was born near Belfast, Ireland, in May, 1816, and died in Rochester, New York, June 23, 1890. He came to America at the age of twenty, and after four years of service with the Princes, at Flushing, on Long Island, he founded in 1840, with George Ellwanger, at Rochester, New York, the Mount Hope Nurseries. Ellwanger and Barry introduced fruit-growing into western New York at a time when there were no collections of fruits, no railroad or telegraphic facilities, nor any fast ocean steamers to bring over their importations from Europe. From 1844 to 1852, Barry edited "The Genesee Farmer," an excellent and influential paper—afterward merged in "The Cultivator and Country Gentleman." After the death of A. J. Downing he succeeded to the editorship of "The Horticulturist," which he removed to Rochester, until June, 1855, after which this famous magazine had many vicissitudes until 1887, when it went to swell the number of periodicals now represented commercially by "American Gardening." In 1851 appeared his "Treatise on the Fruit-Garden," a new and thoroughly revised edition of which was issued in 1872, under the title of "Barry's Fruit-Garden." It is still one of our most popular books on pomology, and deservedly so. The catalogue of fruits which he compiled for the American Pomological Society is a monumental work. Mr. Barry did much to make Rochester a city of nurseries and western New York a famous fruit-growing region. The Western New York Horticultural Society, of which he was president for more than thirty years, and until his death, has long exercised a more than sectional influence. The work of Barry was truly national, and essentially that of a pioneer. He must be considered in the front rank of pomological authors, with the Downings, Warder, and Thomas, whose combined weight gave a great impulse toward establishing orcharding on a large scale in America. For a fuller account, see "Annals of Horticulture," 1890, 287–290.

Wilhelm Miller.

1869. Patrick Barry.

Bartram, John, called by Linnæus the greatest natural botanist in the world, was born at Marple, near Darby, Pennsylvania, March 23, 1699, and died September 22, 1777. He was a Quaker farmer, who became interested in botany after the age of twenty-four. In 1728, at Kingsessing, on the Schuylkill River, he established the first botanic garden in America (page 348, Vol. I), which, together with his house, built in 1731 of stone hewn by his own hands, is preserved as part of the park system of Philadelphia (Fig. 1851). He traveled much in America, and was for many years the chief medium of exchange between Europe and America of plants of all kinds, especially new and important species, as *Rhododendron maximum* and *Cypripedium acaule*. His correspondence with Peter Collinson lasted nearly half a century. The letters, preserved to us in Darlington's "Memorials of John Bartram and Humphrey Marshall," are rich in botanical, historical and general interest. "Observations on the Inhabitants . . . made by John Bartram in his Travels from Pensilvania to Onondago, Oswego, and the Lake Ontario . . . London, 1751," is similarly readable, and a document of great value in the study of aboriginal races.

At the age of seventy he undertook, with his son William, an expedition to Florida, which is recorded in the "Journal Kept upon a Journey from St. Augustine up the River St. Johns." Bartram was probably the first American to perform successful experiments in hybridization. His sons, John and William, continued his garden. For many years it was the largest and best collection of trees and shrubs in America, and the services of the garden to early American horticulture were very great. He is commemorated in Bartramia, a genus of mosses, and in "Bartram's Oak," for the literature of which see I. C. Martinale's "Notes on the Bartram Oak, *Quercus heterophylla*, Michx.," published at Camden, New Jersey, 1880. Bartram's garden is a unique spot in America. Many of the trees have attained great age, size and beauty. The garden also contains many quaint and picturesque relics which have associations of great interest. On the whole, John Bartram is one of the most illustrious, and by far the most picturesque, of the early botanists and horticulturists of America, and his simple, wholesome, powerful personality presents a picture that is altogether amiable. New editions of the works of Bartram and Darlington are much to be desired, and offer a promising field to critical labors. John Bartram's son William is well known to students of American history for his "Observations on the Creek and Cherokee Indians, 1789." It is very much to be regretted that no authentic portrait of John Bartram is known. For an excellent illustrated account of Bartram and his garden, see article by Miss M. L. Dock in "Garden and Forest," 9:121–124 (1895). See also "Harper's Magazine," 60:321–330 (1880). Wilhelm Miller.

Beadle, Delos W., scholar, horticulturist, writer, was the son of Dr. Beadle, St. Catharines, Ontario, one of the pioneer nurseryman of the province. He was graduated in Arts at Yale University in July, 1844, and two years later was granted B. A. (*ad cundem*) by the University of Toronto. In 1847, the degree of LL.B. was conferred upon him by Harvard University, and in 1848 he was called to the bar in New York City, where he practised law for about six years. In 1854, he was admitted to an interest in his father's business, and in this line he became widely known throughout Canada. In addition to his other business, Mr. Beadle accepted the position of horticultural editor of "The Canada Farmer," and in 1861, two years after its first organization in Hamilton, he was made secretary and treasurer of the Fruit Growers Association of Ontario, and himself contributed largely to its wonderful growth and usefulness, continuing to be its most important officer until his retirement in 1887. As a writer on horticultural and pomological subjects, Mr. Beadle occupies an important place, as shown by his numerous contributions to the reports of the above-mentioned society and to the "Canadian Horticulturist." Of this latter journal, he was practically the originator in 1878, and continued to edit it until 1887. In November, 1862, he was made corresponding member of the Entomological Society of Philadelphia, and in 1865 a corresponding member of the Horticultural Society of London, England. In 1872, Mr. Beadle published his "Fruit, Flower and Kitchen Gardener," and as late as the year 1903 contributed his final article to the "Canadian Horticulturist" entitled, "The Carnivorous Plants of Canada." He died in Toronto, Ontario, August 30, 1905. Linus Woolverton.

Berckmans, Prosper Julius (Fig. 1870), scholar, horticulturist, nurseryman, and botanist, was born in Arschot, Belgium, October 13, 1830, and died at Fruitland Nurseries, near Augusta, Georgia, November 8, 1910. His boyhood was spent upon the estates of his father, who was himself a horticulturist of some note. He secured his elementary education at Liers and Tourney; in 1845 he went to France, attending school at Saint Germain and graduating from Tours in 1847. While at Saint Germain, he took lectures on botany at the Jardin des Plantes in Paris, and whenever possible attended the meetings of the Royal Horticultural Society of France. In 1847 he returned to Belgium and spent three years overlooking the parental estates and studying botany at the Botanical Gardens of Brussels. It was during this period that he became acquainted with Bivort and other prominent European horticulturists.

For political and religious reasons, young Berckmans left Belgium for the United States in 1850; in 1851 he was joined by his family who soon thereafter purchased a farm near Plainfield, New Jersey. It was during his six years residence here that he first met Charles Downing and others prominent in American horticulture. In the fall of 1857, Mr. Berckmans moved to Augusta, Georgia, and established the Fruitland Nurseries by purchasing a one-half interest in the nurseries of D. Redmond. The following year, 1853, he bought the other half interest and started in business alone with about twenty-five acres of nursery stock. From that time until his retirement in 1907, Mr. Berckmans' sole object was the advancement and upbuilding of southern horticulture; and as a reward for his work the University of Georgia conferred the degree of Master of Science upon him in 1880.

Mr. Berckmans spent the major part of his life in an untiring effort to originate, introduce and disseminate fruits and ornamentals of value to the South. Plants, cuttings and seed were imported from all parts of the world to be tested at Fruitlands, and the nurseries became not only an experimental station but a botanical garden as well, from which disseminated many of the most valuable plants of the southern horticulturist, among which are the Honey and Peen-to peaches, Kelsey plum, Japanese persimmon, hardy lemon or *Citrus trifoliata* (Poncirus), Amoor River privet, *Biota aurea nana* (Thuja), besides other fruits and ornamentals.

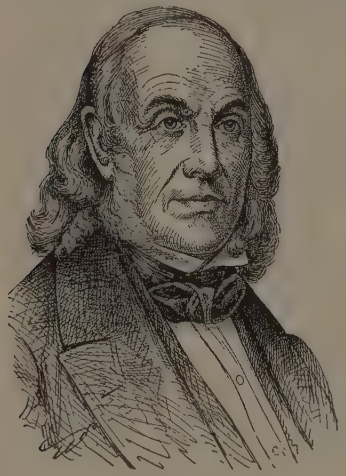
1870. P. J. Berckmans.

The society affiliations of Mr. Berckmans were numerous and in their volumes of proceedings are found most of his writings. In 1869 he first took an active part in the Americal Pomological Society and served on various important committees until 1887 when he was elected president, which office he held until resigning in 1897. He founded the Georgia State Horticultural Society in 1876 and was its president from that time until his death in 1910. The Massachusetts Horticultural Society made him a corresponding member; he was likewise honored by La Societé D'Horticulture et D'Histoire Naturelle de L'Hérault de Montpellier, France; La Societé Pomologique de France, La Societé D'Horticulture de la Gironde de Bordeaux, and La Societé D'Horticulture du Department du Gard, France. His position as president of the State Horticultural Society of Georgia made him a member of the State Board of Entomology, on which board he served from its foundation until his death. He was also a member of the Board of Control of the Georgia Experiment Station when it was organized, but served only a few years. In 1883–4 he went to Europe for the United States Government, to collect horticultural exhibits for the New Orleans Exposition. He was presiding officer over the Horticultural Congress in Chicago in 1893; Chairman of the Jury of Award at the Jamestown Exposition in 1907; and the only American representative to judge the fruit at the centennial of La Royale Societé d'Agriculture et de Botanique de Gand, at Ghent, in 1908. T. H. McHatton.

Brackett, George C., nurseryman, was born at Unity, Maine, October 26, 1830, and died at Fresno, California, April 18, 1903. In his early years, his family moved to Cincinnati, Ohio, and later to Denmark, Iowa, where his father commenced the nursery business. It was here that George became interested in horticulture. He was a graduate of Amherst College. In 1856, he went to Leavenworth, Kansas, and joined the army. He was in a law partnership from 1857 to 1859 and, after the dissolving of this partnership, he bought land near Leavenworth and opened up a nursery and fruit farm. This was the first nursery established in Kansas. Mr. Brackett was the first to introduce the cultivation of the strawberry and the first to grow pears in Douglas County. He was a charter member of the Kansas State Horticultural Society and its secretary for twenty-six years; also secretary of the American Pomological Society 1891 to 1898. For portrait, see "Trans. Kansas Horticultural Society," Vol. XXVII, p. 8.

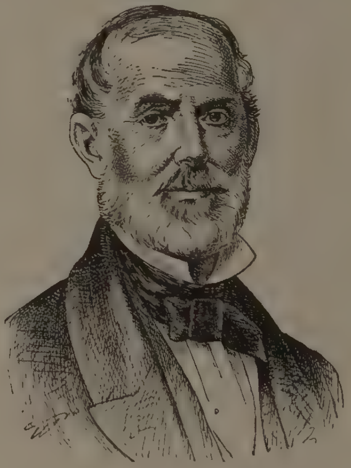
Breck, Joseph, 1794–1873 (Fig. 1871), Boston seedsman, and author of "The Flower Garden, or Breck's Book of Flowers," first published in 1851, and reissued in 1866 as the "New Book of Flowers." This was preceded, in 1833, by "The Young Florist." In 1822, he founded the seed business now conducted at 51 North Market Street, under the name of Joseph Breck & Sons. He was one of the original members of the Massachusetts Horticultural Society, and its president from 1859 to 1862. He edited the old "New England Farmer" for many years, but discontinued it in 1846, when he turned over his list of subscribers to Luther Tucker, of Albany, New York, at the time of the founding of "The Horticulturist," which was edited by the illustrious A. J. Downing. He also edited "The Horticultural Register" from 1836 to 1838, in company with Thomas Fessenden. The revision of his book in 1866 was undertaken when the author was seventy years old. It was a popular book in its day. Wilhelm Miller.

Bridgeman, Thomas (Fig. 1872), gardener, florist, seedsman and author, was born in Berkshire, England, and came to America in 1824, and established the business which is now conducted under the name of his son, Alfred Bridgeman, at 37 East Nineteenth Street, New York. An historical account of this business may be found in the catalogue of the present firm. In 1829, Thomas Bridgeman published "The Young Gardener's Assistant," which was many times reprinted and eventually enlarged to five times its original bulk. It was copyrighted in 1847, when it appeared as a large-sized work in three parts, covering fruit, vegetable, and ornamental gardening. Two of these parts were published separately in the same year as "The Kitchen Gardener's Instructor," and "The Florist's Guide." The first-named work was revised by Sereno Edwards Todd, and republished in 1866 by Alfred Bridgeman. Thomas Bridgeman died in 1850. Wilhelm Miller.



1871. Joseph Breck.

1872. Thomas Bridgeman.



1873. William Brincklé.

Brincklé, William Draper (Fig. 1873), physician and amateur pomologist, was born in Delaware. He began the practice of medicine at Wilmington in 1820, moved to Philadelphia in 1825, where he passed most of his life as a busy physician, and died at Groveville, New Jersey, in 1863, at the age of sixty-four. In a room of his Philadelphia home he hybridized strawberries, and had fruit at every season of the year. He also had a little garden about the size of a parlor. He produced the Cushing strawberry, the Wilder, President Cope, Cushing, and Orange raspberries, and the Wilmington and Catherine Gardette pears. Unfortunately, most of his work with raspberries was done with *Rubus Idæus*, the Old World species, which is not hardy in America, but his yellow-fruited variety of raspberry is still regarded by many as the acme of quality. He was for many years vice-president of the Pennsylvania Horticultural Society, and was regarded as a leader of American pomology. In raising pear seedlings, he was wont to graft and regraft annually, after the second or third year from seed. He thus produced new fruits in half the time required by Van Mons, many of whose novelties did not fruit within twenty years from seed. Dr. Brincklé gave away thousands of grafts to amateurs and tradesmen everywhere, and always prepaid the carriage. In 1860 he edited "Hoffy's North American Pomologist," a high-class periodical with colored plates, which, unfortunately, did not survive. Some sprightly anecdotes of Dr. Brincklé are reprinted from the "Gardener's Monthly" for 1863, in Bailey's "Evolution of Our Native Fruits." Wilhelm Miller.

Brown, Jacob G., pomologist, was born in Lewisburg, Pennsylvania, April 26, 1825, and died near Wyoming, Delaware, November 17, 1896. He came to Delaware in March, 1868, and purchased a farm of about 200 acres in central Kent County. He immediately planted a peach orchard of 2,700 trees. In 1870 he set another peach orchard and 200 apple trees. In 1872 he set about 20 acres in apples, another 20 acres in peaches, and commenced growing small-fruits, especially red raspberries, increasing until he had 50 acres of red raspberries, and in 1885 nearly the whole farm of 200 acres was set in fruit, 100 acres of it in apples. He planted nearly every variety of apples that he could find described in the catalogues of nurserymen. Mr. Brown made a close study of fruit-growing and carried on the business with a great deal of energy. He became a member of the Peninsula Horticultural Society soon after its organization in 1888, and took great delight in talking about his fruit-growing. He was especially enthusiastic about apple-culture. He was one of the pioneers in apple-growing in Delaware and became more sanguine of its great success year by year until his death in 1896. Mr. Brown took an active interest in every movement that was planned to develop fruit-growing, and was a public-spirited citizen.

Wesley Webb.

Bruner, Thomas Kincaid, was born in Salisbury, North Carolina, on January 17, 1855, and died in Raleigh in February, 1908. For many years his father was editor and owner of the "Salisbury Watchman." Young Bruner, who received his education at Finley's Academic School in Lenoir, North Carolina, early entered his father's office. His intelligence, industry, and initiative united to induce him to study nature and nature's works, along with his daily duties, and led him to be a reader and a thinker. In 1886 he was selected as secretary of the State Board of Agriculture, and thereafter he lived in Raleigh. His services as secretary were varied. He had devoted especial attention to the study of geology, crystalography, and arboriculture. In his new field he collected for the state and for various expositions specimens of ores, crystals, woods and other natural products that attracted attention wherever they were displayed. He was in charge of the state exhibits at Atlanta, Georgia, at Boston, at Omaha, at Chicago, at St. Louis, and in Paris. He was a member of the International Jury of Awards at New Orleans as representative for the Bulgarian government. He edited and wrote many articles on the resources of his native state. Mr. Bruner's interests were wide and his mental activities covered many subjects. Few men ever rendered more service to the agricultural and industrial life of their states. D. H. HILL.

Bryant, Arthur, pioneer nurseryman of Illinois, was born near Princeton, Illinois, on October 15, 1834, and died May 13, 1907. Early in life, he became interested in the nursery business as an aid to his father and later as owner of the business. Mr. Bryant was one of the founders of the Northwestern Fruit Growers' Association and at one time its president. He was also president of the Illinois State Horticultural Society and of the Northern Illinois Horticultural Society for a time.

Budd, Joseph Lancaster, horticulturist, investigator and educator, was born near Peekskill, New York, July 3, 1835 and died at Phœnix, Arizona, December 20, 1904. In 1859, he started in the nursery business at Wheaton, Illinois, and a few years later removed to Shellsburg, Iowa, where he established the Benton County Nurseries. He was successful as a nurseryman and fruit-grower, but in 1876, he accepted the professorship of horticulture and forestry at the Iowa Agricultural College where he remained for nearly twenty-two years. Professor Budd was instrumental in the importation of hardy trees, shrubs and fruits from Europe, especially from Russia, which he visited in 1882, with Charles Gibb, for this purpose. He also improved many native fruits, foremost amongst which was the plum. Professor Budd was the author of the "American Horticultural Manual." For a fuller account and portrait, see "Cyclopedia of American Agriculture," Vol. IV, p. 558.

Buist, Robert, florist, seedsman, and author, was born at Cupar Fyfe, near Edinburgh, Scotland, November 14, 1805, and died in Philadelphia, July 13, 1880. He was trained at the Edinburgh Botanic Gardens, came to America in August, 1828, and was employed for a time by Henry Pratt. In 1830 he became the partner of Hibbert, who had established the first notable florist's business in Philadelphia. He became noted for his successes with roses, which were at that time second in popular favor to the camellia with the Philadelphians. The great improvement of the verbena was largely due to him, and was immediately followed by the introduction into America of a distinct class of bedding plants. He introduced *Poinsettia pulcherrima* to the trade, and his sale of the double form is said to have been the first transaction of the kind accomplished by ocean telegraph. He was the author of "The American Flower-Garden Directory," in 1832, "The Rose Manual," 1844, and "The Family Kitchen-Gardener" (copyrighted, 1847), all of which were frequently reissued, and enjoyed a considerable sale for many years. An excellent account of his life may be found in "The Gardener's Monthly," 22:372 (1888). The frontispiece of the bound volume for the year is his portrait. WILHELM MILLER.

Bull, Ephraim W., the introducer of the Concord grape, lived a long, quiet, and useful life in Concord, Massachusetts, where he died September 27, 1895, in his ninetieth year. In commercial importance, the greatest event in the early history of American grapes was the introduction, early in the fifties, of this variety of the northern fox-grape. The first fruit of this grape was obtained in 1849. Its exact origin is obscure. In 1840, Mr. Bull bought the house in which he lived until his death. That year some boys brought from the river some wild grapes, and scattered them about the place. A seedling appeared from which Mr. Bull obtained a bunch of fruits in 1843. He planted seeds of this bunch, and a resulting plant fruited in 1849. This variety was named the Concord. It soon became the dominant grape in all eastern America, as it was the first variety of sufficient hardiness to carry the culture of the vine into every garden in the land. It is a pregnant type, and has given rise to no less than fifty honorable seedlings, which range in color from greenish white to purple-black. The quality of the fruit is excelled by many varieties, but the latter usually demand more careful cultivation. The Concord is the one most important type of American grape, and the really successful commercial viticulture of the country dates from its dissemination; and yet this grape is apparently only twice removed from the wild vine. (See Fig. 1709.) For portrait, see Bailey, "Evolution Native Fruits."

Ephraim W. Bull was loved of his neighbors and honored by every countryman who grows or eats a grape. He made very little money from his variety, and died in extreme poverty. The original vine is still preserved, as a sprout from the old root. L. H. B.

Burnet, Robert, minister and horticulturist, was born at Lady Kirk, Berwickshire, Scotland, 1823; died at Hamilton, Ontario, 1889. After his ordination, he volunteered as a missionary to Ontario, then Upper Canada. For twenty-six years, he was minister to St. Andrew's church, Hamilton, Ontario, during which time he took a very active interest in horticulture. His large garden was to him both a pleasure and a study and contained a very large and choice collection of varieties of dwarf pears and other fruits. From these, he gained many valuable notes for use at meetings of the provincial fruit growers' association. In the year 1869, Mr. Burnet was elected president of this association, an office which he filled with great credit for ten successive years. His annual addresses formed an important feature in the annual reports made to the Department of Agriculture for Ontario during those years. The reports also contain several prize essays by him, as for example in 1875 one on "The Cultivation of the Pear," and one on "Where and How to Market our Fruits;" also in 1876 an excellent paper entitled "Criteria for Fruit Judging."

LINUS WOOLVERTON.

Burr, Fearing, seedsman and author, was born in 1815 and died suddenly at his home in Boston, Massachusetts, October 4, 1897. He gained his horticultural experience in early life on the broad acres of the paternal homestead. This experience, added to his inherent tastes and his copartnership in the firm M. &. F. Burr, Seedsmen, Boston, gave him creditable notice as a prominent horticulturist throughout New England and the distant states and territories. His firm was among the early ones which exchanged international courtesies with seedsmen. In 1865 he published "The Field and Garden Vegetables of America." This was a very interesting and erudite contribution to horticulture at that day, and the book found ready sale. He was an author of some note and contributed to the horticultural columns of the press. He was elected a life member of the Massachusetts Horticultural Society in 1852 and did much excellent work for the society in the matter of judging fruits and vegetables, and making creditable exhibits. In 1857 his firm was awarded a silver medal for its display of "Sixty Varieties of Beans, all neatly and correctly labelled." He was diligent in business, a fluent conversationalist, a ready writer, an earnest lecturer and a man whose judgment and advice on horticultural topics was earnestly sought.

G. B. Brackett.

Bush, Isador, nurseryman and pioneer grape-grower, was born in 1822 at Prague, Bohemia. He died in the city of St. Louis, Missouri, August 5, 1898, having been a resident there for more than fifty years. In 1865, he established a grape nursery at the place he named Bushburg, Missouri, and devoted himself to the cultivation of this specialty with marked enthusiasm and success. He soon had a collection of all known species and varieties of our native grapes and with the assistance of the eminent botanist, George Engelmann, a very complete classification of various species was made and their characteristics were fully described in his valuable publication, the "Bushburg Catalogue and Grape Manual." It was through the enterprise of Mr. Bush that our immune grape roots were sent to Europe for the purpose of grafting the vinifera varieties upon them, and thus the ravages of phylloxera were prevented. The American grape industry owes a debt of lasting gratitude to the pioneer work of Mr. Bush.

G. B. Brackett.

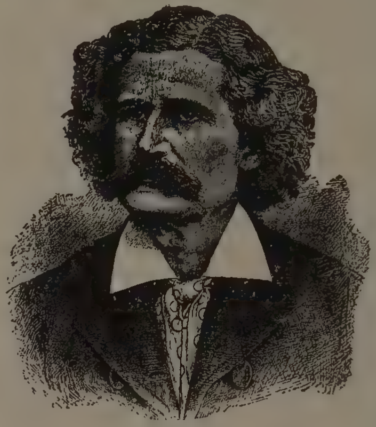
Butz, George C., horticulturist and educator, was born at New Castle, Pennsylvania, on February 1, 1863, of Swiss parentage, and died December 14, 1907. He was prepared for college at the New Castle High School and graduated from Pennsylvania State College in 1883. The following year he became an instructor in the preparatory department of the college; in 1887 he was elected to the position of assistant professor of horticulture, and in 1903 he was made professor of horticulture. During many years, he was also a lecturer at the farmers' institutes of the state, nursery inspector and adviser for the State Department of Agriculture, and horticulturist of the State Experiment Station. He is the author of a number of valuable bulletins and other publications upon subjects relating to his life work. A natural love for plants from his boyhood made Professor Butz an apt pupil and determined his life work. He was an authority on horticultural subjects. His opinion on the culture of grapes, peaches, ginseng and carnations was much sought after by state authorities, and his writings upon these subjects were highly valued.

Intellectually Professor Butz was a man of culture and broad horizon. His mental operations were painstaking, methodical, exact. Notwithstanding his lifelong practical experience in horticulture, he was a careful student of its rapidly developing literature and brought to his work the combined products of observation and wide reading. Always devoted to duty, cheerfully making the best of adverse conditions, spending himself unstintedly for the welfare of his college and of his state, his life of high ideals and unselfish service was an inspiration to all who knew him.

R. L. Watts.

Campbell, George Washington, horticulturist, was born in Cortland County, New York, January 12, 1817, and died at Delaware, Ohio, August, 1898. He is best known as the introducer of the Delaware grape. He originated and improved numerous other varieties of grapes, among which are Campbell's Early and Lady. For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 560.

Carman, Elbert S. (Fig. 1874), agricultural editor and experimenter, was born on Long Island in 1836 and died in 1901. He was educated at Brown University and after graduating was in business for a number of years. Always interested in gardening and fruit-growing, he finally associated with the late Andrew S. Fuller in conducting the "Rural New Yorker." A little later Mr. Carman bought the paper and established in connection with it the Rural Experiment Grounds in New Jersey. Here he tested with great care the varieties of farm and garden seeds offered by seedsmen. At that time, the ordinary seed catalogue was filled with gross exaggeration in text and illustration. Mr. Carman's accurate reports were largely instrumental in starting a genuine reform in catalogue-making. Later he spent much time at hybridizing and selecting new varieties of potatoes, grains and flowers. His most notable achievement in this line was the famous family of Carman potatoes, including the Rural New Yorker No. 2. At one time, it is probable that there were more of this variety grown than of any other known sort. In the markets today, the larger number of round, thick potatoes are known and sold as "Rurals." As a farm journalist, Mr. Carman was very successful, giving power and individual character to his paper. He wrote one book "The New Potato Culture" in which he recorded his exhaustive experiments with fertilizers, preparation of seed and methods of culture.



1874. Elbert S. Carman.

H. W. Collingwood.

Carr, Robert, was born in the parish of St. Andrews, County of Downs, in the north of Ireland, in 1767. He was but eight years old when he was brought to Philadelphia. In later years, William Bartram, proprietor of the celebrated Bartram Gardens became his friend, and later his father-in-law. At the death of Mr. Bartram, Mr. Carr continued the business of the Gardens, which were the cradle of botany and horticulture on the American continent. The Gardens gave these sciences a distinguished position in the literature of the old world, and they were also the pride of every Philadelphian for a great many years. At the formation of the first society of horticulture in 1827, Colonel Carr was a charter member, and in 1834 he was made its vice-president, a position he held until the time of his death, which occurred in 1866.

G. B. Brackett.

Cobbett, William (1762–1835), the once-famous English author, had two periods of enforced residence in America, and wrote "The American Gardener," which is one of the spiciest books in the whole history of American horticulture. He was of thorough Saxon ancestry, and while a gardener's lad and during eight years of military service, made strenuous efforts at self-education. In 1792 his personal liberty was endangered by the publication of "The Soldier's Friend" (an appeal for an increase of pay), and he came to Philadelphia in the autumn of that year. His first success was a pamphlet entitled, "Observations on Dr. Priestly's Emigration," a bitter attack on the French Revolution. He took the loyalist side in American politics, and is regarded as the founder of the American party press. His attack on Benjamin Rush, the leading physician of Philadelphia, for his advocacy of unlimited bleeding for yellow-fever, resulted in a libel suit, and damages of $5,000, which nearly ruined Cobbett, and sent him to England in June, 1800. In 1802 he began "Cobbett's Weekly Political Register," which he edited for thirty-three years, and until his death, except during an interval of imprisonment and a second withdrawal to America. His real work was domestic reform, and the circulation and influence of his journal were immense. He wrote extensively and entertainingly on a wide variety of subjects. As historical documents, his works are indispensable.

Cobbett's horticultural writings of chief interest to us are "Cottage Economy," "A Year's Residence in the United States of America," and, most of all "The American Gardener" (1821), which was reproduced with considerable modifications as "The English Gardener," in London, 1827. The American edition of Wm. Forsyth's excellent "Treatise on the Culture and Management of Fruit Trees," was published at New York and Philadelphia in 1802, and in Albany in 1803, and was one of the most influential books on fruit-growing in the period before orcharding over large areas gave rise to essentially American horticultural writings.

Wilhelm Miller.

Cole, Samuel W., nurseryman, author and editor, was born in the town of Cornish, Maine, in 1796, and died at Chelsea, Massachusetts, December 3, 1851. At about the age of twenty he left his native state and passed two or three years in New Jersey and Pennsylvania in teaching. Soon after his return he published the "Columbian Spelling Book," a collection of poems called "The Muse," and in 1835, the "Yankee Farmer;" the latter he removed to Portland, Maine, and continued there about three years, in connection with a seedstore and agricultural warehouse. In 1839 he came to Boston and continued connected with the agricultural press to the time of his death and was editor of the "New England Farmer" during the years 1849, 1850 and 1851. Mr. Cole published the "American Fruit Book" in 1849, and a book on "Diseases of Domestic Animals," which have passed through several editions. He also established and carried on the Winnisimmet Nurseries in Chelsea, Massachusetts, during the years from 1840 to 1850.

Wm. P. Rich.

Coleman, Norman J., lawyer, agricultural journalist, first Secretary of Agriculture, and horticulturist, was born near Richfield Springs, New York, May 16, 1827, and died in St. Louis, Missouri, November 3, 1911. He was granted the degree of Bachelor of Law from the University of Louisville (Kentucky), and for some years was a practising attorney at New Albany, Indiana, and later in St. Louis. With an intense love of rural pursuits, he gave up his lucrative law practice, purchased a country home near St. Louis, and began the publication of "The Missouri Valley Farmer," now known as "Coleman's Rural World," one of the pioneer agricultural papers of the Mississippi Valley. He was Lieutenant-Governor of Missouri, 1874 to 1878; served as a member of the Board of Curators of the Missouri State University for sixteen years and was, for a number of years, a member of the Missouri State Board of Agriculture. He was Secretary of Agriculture during the administration of President Cleveland, being the first to hold this position after its creation as a cabinet office. Through the "Rural World" he issued a call for "a meeting for the purpose of advancing and directing the fruit-growing interests of Missouri and the West." As a result, on January 5, 1859, "The Missouri Fruit Growers' Association," since 1868 known as the "Missouri State Horticultural Society," was organized. Mr. Coleman was the first president of this organization and served in this capacity for periods aggregating nearly a decade. This is the oldest, permanent fruit-growers' organization west of the Mississippi and its annual reports, covering a period of more than half a century, are an important adjunct to the literature of the horticultural development of the section. In his official positions, Mr. Coleman's energies were largely devoted to the organization of horticultural interests. His horticultural writings occur mainly in the Reports of the Missouri State Horticultural Society and in the columns of "The Rural World."

J. C. Whitten.

Conard, Alfred Fellenberg, nurseryman and original president of The Conard & Jones Co., of West Grove, Pennsylvania, was born in Philadelphia, in 1835, and died December 15, 1906. He was descended from German Quakers, who joined William Penn's Colony in 1683. His early life was spent on his father's farm near West Grove, where later he learned the nursery business under the personal supervision of Thomas M. Harvey. Soon after 1862, with Charles Dingee, he established a nursery business under the firm name of Dingee & Conard. This prospered, and about 1869, the firm turned its attention to the propagation of roses by a new process introduced by Antoine Wintzer, an expert Alsatian propagator. This was a success so far as the production of roses was concerned, but the wholesale demand at that time was small and the problem soon presented itself of how to market their rapidly increasing stock. With rare foresight Mr. Conard conceived the idea of disposing of it at retail through the mails.

The company issued at first a very modest catalogue. It was skilfully prepared, and offered bedding plants, shrubbery, bulbs, seeds, and the like, in addition to their attractive list of roses. This, accompanied by wise advertising, brought in orders quite satisfactorily, and strictly fair and honorable treatment of customers, good healthy stock and careful packing soon established for the company an enviable reputation, and their trade extended to all parts of the world.

About the year 1892, Mr. Conard and Mr. Wintzer having previously become separated from the Dingee & Conard Co., associated themselves with S. Morris Jones, and organized the Conard & Jones Co., for the purpose of continuing the growing and distribution of roses, flowering plants, and the like. As a specialty, they took up the improvement of the canna.

Mr. Conard was a man of very retiring nature, and for this reason was not so prominent in the trade generally as his long experience and extensive knowledge of the floral business would have warranted. He was scholarly in his tastes, methodical and precise in his habits, well read and well informed. He was particularly proficient as a mail-order salesman, and was the first advertiser in any line of business to contract with advertising concerns to place the business on a percentage basis, a plan that has now been almost universally adopted.

Thomas P. Conard.

Coxe, William, pioneer pomologist, was born in Philadelphia, May 3, 1762, and died on his farm on the Delaware River near Burlington, February 25, 1831. He deserves special remembrance for his excellent and now scarce book, "A View of the Cultivation of Fruit Trees, and the Management of Orchards and Cider," with accurate descriptions of the most estimable varieties of native and foreign apples, pears, peaches, plums and cherries cultivated in the Middle States of America. This was printed at Burlington, and published at Philadelphia in 1817. Grapes and small-fruits were not included in the scope of his book, but an article of his in the "American Farmer" for July, 1828, shows that he was acquainted with many varieties of grapes, and had done much grafting. His book was a standard until the time of the Downings, and was freely used by other authors. The illustrations were excellent for their time, but show only the size and outline of a fruit, and whether it was dotted, splashed or streaked. (Fig. 1858.)

Coxe said, 1817, that he had been "for many years actively engaged in the rearing, planting and cultivating fruit trees on a scale more extensive than has been attempted by any other individual of this country." He also had a national reputation for his cider at an age when it was a famous and characteristic beverage.

William Coxe belonged to one of the most refined families of Philadelphia. His early education was somewhat meager by reason of the Revolutionary War, but he became a cultured gentleman. John Jay Smith gives this pleasant picture of him: "Well do we remember his extensive library in his fine mansion on the 'Bank' at Burlington, when as a little boy we were assigned the duty of bringing away, or taking home, some book or pamphlet from his ever open stores of information. . . His person was handsome, and his bearing that of the 'old-fashioned' gentleman, improved by mixing in the best society, but retaining the forms of the greatest politeness and suavity, that modern usages are too rapidly casting off. An errand to Mr. Coxe's was a cherished privilege; never was the opportunity neglected by him to place in the hand of his visitor some fruit that he so well knew would be appreciated by a youthful appetite. The finest Seckel pears we have ever seen were not unfrequent deposits. He had an especial fondness for the Seckel pear, which is certainly among the half-dozen most famous pears of American origin, and which was pronounced by Downing to be the finest flavored of all pears." Coxe was made an honorary member of the Horticultural Society of London for making known the merits of this pear through Dr. Hosack. Either the first willow or the first poplar planted in Burlington is said to have been brought from Halifax in the hand of William Coxe. He planted many trees to beautify the town and, in particular, extended the front of the "Green Bank." Biographical details are unfortunately only too meager. A few other details may be gleaned from the "Horticulturist," 11:304–307 (1856). WILHELM MILLER.

Craig, John (Fig. 1875), horticulturist and educator, was born at Lakefield, Argenteuil County, Quebec, in 1864, and died at Siasconsett, August 10, 1912. He obtained his early education at Montreal High School and McGill College. Early in life he exhibited a taste for horticulture and later studied under one of the greatest pioneer horticultural teachers, J. L. Budd, of the Iowa Agricultural College. Shortly after graduation from this institution in 1887, Professor Craig was appointed horticulturist at the Central Experimental Farm at Ottawa. He was called to Iowa as professor of horticulture in 1899, and in 1900 became professor of extension teaching at Cornell University. In 1903, he was appointed professor of horticulture at this institution, which position he held until his death. During the latter years of his life, Professor Craig took great interest in the development of nut-culture, both for the North and South, and was the recognized authority on many kinds of nuts. He contributed largely to horticultural and agricultural magazines and was the editor of "The National Nurseryman" for several years. Professor Craig was a member of the advisory board of the American Civic League, and chairman of the nomenclature committees of the American Sweet Pea and the American Peony Societies. He was also elected a fellow of the Royal Horticultural Society of Great Britain. He was well known for his interest and work as a pomologist, having been early associated with Charles Gibb (p. 1576), and having followed the subject closely throughout life. In 1903, he was elected secretary of the American Pomological Society, which important position he held until his death. A. C. BEAL.

1875. John Craig.

Curtis, Joseph, pioneer fruit-grower of Illinois, was born in New Jersey, May 29, 1786, and removed with his parents when a boy, to Manchester, Ohio. He had never seen a nursery and had no horticultural experience, but he invented the arts of root-grafting and collar-grafting fruit trees through stern necessity for grafting stock. At the age of sixteen he had secured a piece of land on which to plant an orchard. He had grown some seedling trees but had an insufficient number for the ground he had. As the pieces of roots were plowed up, it occurred to him that he might make more trees by grafting these roots. He succeeded and immediately thereafter invented collar-grafting. He was from 1798 to 1817 collecting and testing twenty-seven varieties of apples in his Ohio orchard. In March, 1818, he built a log-cabin, selected a fine tract of land in what is known as the north arm of Grand Prairie, Edgar County, Illinois, and in 1818 established the first nursery in the state of Illinois and the first orchard of grafted fruit trees planted in Edgar County. He grew such varieties as Yellow Newtown, Smith (Cider), Newtown Spitzenberg, Milam, Priestley, Gilliflower, Rhode Island Greening, Rambo and Winesap. He originated a number of choice varieties of fruits, especially some of our leading varieties of apples. He did more than any other one man of his day to introduce choice fruits into southern Illinois and the adjacent territories. Among his most zealous contemporaries were Edson Harkness of Tivoli, Peoria County, Cyrus Overman, Canton, and Arthur Bryant, Princeton. To such men are due the credit of the organization of the Northwestern Fruit Growers Association in 1851, the first society of its kind west of the Alleghanies, embracing great extent of territory and demanding any great degree of public opinion. And through the united efforts of these men, with others, the Illinois Horticultural Society was organized at Decatur in 1856. G. B. BRACKETT.

Darlington, E. Dillwyn, was born on November 20, 1858, in Doylestown, Pennsylvania, and died March 26, 1908. As a boy he entered a small private school, later the Doylestown Seminary, and finally Swarthmore College at the age of sixteen. Intensive study up to this time had undermined his health to such an extent that after a few months he was obliged to leave school. An inborn desire for activity prompted him to seek and find a position in the office of the Doylestown "Intelligencer." But even this proved too confining so that, after a few weeks, he had to give up and seek occupation outdoors. A natural tendency started him growing plants for local markets. Soon he found out how much had to be learned in this line and he secured a position with the prominent firm of Hoopes, Bro. & Thomas, Nurserymen, of West Chester, Pennsylvania. After serving an apprenticeship of one year, he returned to Doylestown to start seriously in the business of growing plants for sale. This was in 1875. Steadily he grew and developed until in 1883 he became connected with what turned out to be his life's work—the trial-grounds of W. Atlee Burpee & Co., Seedsmen, Philadelphia. Mr. Darlington first conducted these trials on a vacant lot adjoining his property. As the Burpee business grew, the trial-grounds grew, and when, in 1888, a farm was acquired for the purpose of doing this important work, Mr. Darlington logically became superintendent of the new venture.

From that time until his death he served the American public with a keen, observing and analytical mind possessed by few men. For twenty-five years he studied the merits and faults of all sorts of vegetables and flowers. Tens of thousands of trials came under his observation every year. The best of European and American seed-breeders' efforts had to pass his critical decisions, and out of this tremendous "sifting" process rose scores of meritorious varieties of vegetables and flowers, the names of which have since become household words with planters throughout the country.

ADOLPH KRUHM.

Dartt, Edward Harvey Schuler, nurseryman, was born at Weathersfield, Vermont, November 24, 1824, and died at Owatonna, Minnesota, January 31, 1903. At the age of twenty, he moved from Vermont to Ripon, Wisconsin, where he attended college and taught school. About 1860 he moved to Kingston, Wisconsin, and engaged in general merchandising, holding at the same time the offices of postmaster and justice of the peace. In 1869 he removed to Owatonna, Minnesota, where he remained until his death. He engaged at once in the nursery business and continued in it more or less the rest of his life. He was one of the early members of the State Horticultural Society, and in 1889 was made an honorary life member for conspicuous efforts along horticultural lines.

In 1891 the Owatonna Tree Station was established by act of the legislature and Mr. Dartt was made its superintendent and continued in this capacity until his death. He conducted many experiments here and raised thousands of seedlings, contributing much to the horticultural knowledge of the state by his efforts. He was always active in the meetings of the society and much of the early advancement in horticulture in Minnesota is due to Mr. Dartt. He laid out and maintained a public park at his own expense for many years and was always interested in civic improvements in the town. He delighted to write short articles on civic and horticultural affairs for the press and in this way helped to mold public opinion.

LE ROY CADY.

Deane, Rev. Samuel, poet and agricultural writer, was born at Dedham, Massachusetts, July 30, 1733, and died at Falmouth (now Portland), Maine, November 12, 1814, where he had been pastor since October 17, 1764. While vice-president of Bowdoin College, he published, in 1790, his "New England Farmer, or Georgical Dictionary," the first American encyclopedic work on agriculture. This had a much wider circulation, probably, than Jared Eliot's "Essays upon Field-Husbandry," 1747. Its influence may be traced to the middle of the present century. Deane's work was freely quoted by F. G. Fessenden until his death, in 1837. The second edition, 1797, was entitled "The Georgical Dictionary." A third edition was published in 1822.

Deane and Eliot were the chief writers in that early stage of American horticulture when it was hardly important enough to be considered distinct from general agriculture. For biographical details, see Drake's "Dictionary of American Biography."

Dearborn, Henry Alexander Scammell, soldier, statesman and author (1783–1851), was also an ardent horticulturist. He was a moving spirit in the organization of the Massachusetts Horticultural Society, and was elected its first president March 17, 1829. He was partly instrumental in the establishment of an "experimental garden and cemetery at Mount Auburn," the parent of rural cemeteries. The plan of the cemetery was largely his. He "devoted himself to this work most assiduously," writes the chronicler of the society, "spending the greater part of the autumn [1831] at Mount Auburn, in laboring with hands as well as mind, without money and without price." The Abbé Berlese's "Monography of the Camellia" was translated by him, and published in Boston in 1838. He also translated from the French, in 1830, an account of the since famous *Morus multicaulis*. He left MS. writings on horticulture. For notes on his horticultural labors, see "History of the Massachusetts Horticultural Society," 1880, which contains a portrait; also John B. Russel in Tilton's "Journal of Horticulture," 7:88, 157, 276. Gen. H. A. S. Dearborn was son of Gen. Henry Dearborn, of Revolutionary and later fame.

L. H. B.

Dempsey, Peter C., pomologist and hybridist, was of United Empire Loyalist stock and was heir to the orchard and nursery left by his father at Albury, Prince Edward County, Ontario. About the year 1867, Mr. Dempsey decided that he would devote his life to horticulture, and especially to the cultivation of the apple. In 1859, he united with the Fruit Growers' Association of Ontario and being a pleasing and fluent speaker, full of information drawn from practical experience, he soon became a highly valued member and was elected vice-president in 1873 and again in 1875; and president in 1880 and again in 1881. In 1775, he was selected by the Ontario Department of Agriculture to superintend the Ontario fruit-exhibit at the Centennial exhibition in Philadelphia, and secured several medals for its excellence. But it is as a hybridist that Mr. Dempsey is most widely known among horticulturists, having originated among other novelties the Burnet grape, the Dempsey potato and the Trenton apple. His death occurred in August, 1892, at Albury.

LINUS WOOLVERTON.

Dixon, John N., pomologist, was born in Fayette County, Pennsylvania, on February 20, 1821, and died in 1883. When quite young, his parents moved to Ohio, and here at the age of twenty-two, he set out an orchard of 1,100 trees, a large orchard for those days. In 1855 he went to Iowa, expecting to make fruit-growing his specialty, but on account of the cold winters and tender varieties, lost most of his trees. He persisted, however, and in 1868 started the present orchard of 12,000 acres, of which he made a great success. He is said to have been the first man to use insecticides in the form of spray in a commercial way in fruit plantations.

Dorner, Frederick, florist, was born at Schilltach, Baden, Germany, on November 29, 1837. At the age of seventeen he emigrated to this country and joined his brother at Lafayette, Indiana, where he lived until his death, December 29, 1910. In 1870, after being employed at various occupations, he rented a small farm and became a market-gardener. In the small greenhouse on the place, he began raising potted plants for the retail market. In 1888 he became interested in some experiments in the breeding of carnations, which were being conducted at Purdue University. He quickly saw the possibilities of the work and became so deeply interested that he took up this line of work himself. From the first lot of seedlings, raised in 1889 and numbering about 500, came the varieties Christina Dorner, Tecumseh, Hoosier, Mrs. Harrison, Indiana, and Ben Hur. His work continued uninterruptedly for twenty-one years and during this time he grew over 150,000 seedlings. Of this number not more than seventy-five ever reached the market. Among the best of his productions were Mad. Diaz Albertini, Wm. Scott, Mrs. G. M. Bradt, White Cloud, Lady Bountiful, White Perfection, Pink Delight, and White Wonder. Fred Dorner was the first florist in the Middle West to disbud carnations. The method of supporting carnations by means of wires and cross strings also originated with him. His work, however, was not limited to carnations. He was also the originator of a number of good chrysanthemums of which Major Bonnaffon, disseminated in 1894, was the best.

H. B. DORNER.

Douglas, Robert (Fig. 1876), pioneer nurseryman in Illinois, was born at Gateshead, England, in 1813. He came to America in 1836, finally settling at Waukegan, Illinois, in 1844. Here he founded a small nursery where he raised conifer and other tree seedlings. This was the first attempt ever made in America to raise evergreen trees commercially. Through his efforts, many successful plantations of forest trees were established on the western prairies. He has been called "the apostle of tree-planting in the West." Mr. Douglas was also a good botanist and an authority on evergreens. He was an active member of the Illinois State Horticultural Society. He died in 1897.

1876. Robert Douglas.

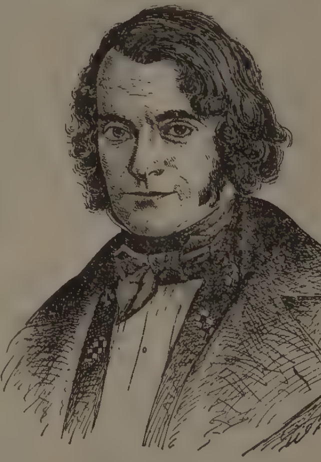
Douglas, Thomas Henry, nurseryman and forester, was born at Waukegan, Illinois, July 31, 1852, and died March 26, 1907. After completing his education at Racine College, he engaged in the nursery business with his father, the late Robert Douglas, whose early experiments and later his success in growing conifers from seed gave him a national reputation. Inheriting the natural qualities of a forester from his father and being a close student of nature, he soon acquired a wide knowledge of forestry which was recognized in 1886 when he was called to the State Board of Forestry of California as Head Forester and soon after was called to a similar position at Leland Stanford, Jr., University. While there he collected many plants then new to California, tested them out and introduced them. In 1892 he visited the home of the weeping spruce (*Picea Breweriana*) on the summit of the Siskiyou Mountains and succeeded in gathering the first seed and raising the first seedlings of this species. He cared little for publicity but was freely consulted on all matters pertaining to forestry, and his articles on this subject are considered an authority. Many of his introductions, notably the Smithiana Douglas, Douglas Pyramid and Douglas Golden arbor-vitæs are well known and widely planted today.

R. Douglas' Sons.

Downer, John S., pomologist and nurseryman, was born June 19, 1809, in Culpeper County, Virginia, and died in Kentucky in 1873. Like the man "born to fame" he seemed to evince a taste for horticulture from his earliest days. While yet a youth, without friends or fortune, he established and gradually built up the Forest Nursery, which gained an enviable reputation not only in Kentucky but in neighboring states. He was patient and painstaking and tested many varieties of fruits under his own inspection. He did much to improve pomology in the Central States. He paid special attention to the strawberry, and produced the well-known Downer (Prolific), (Chas.) Downing and Kentucky. These should perpetuate his fame, for it was at a time when the strawberry industry of the country was in its infancy. He introduced the Wild Goose plum and he conferred the blessings of pomology on the whole country by disseminating many choice varieties of fruit. He was quiet and unobtrusive, but was a man of worth and honesty. His nursery at Elkton, Kentucky, was for many years a fruit experiment station. He was vice-president for Kentucky of the American Pomological Society, and held other offices of trust and honor.

G. B. Brackett.

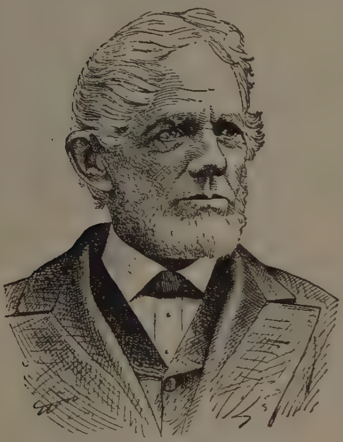
Downing, Andrew Jackson (Fig. 1877), the first great landscape gardener of America, was born at Newburg, New York, October 30, 1815, and perished by drowning July 28, 1852, at the early age of thirty-seven. As a boy, he was quiet, sensitive, and much alone with himself and nature. The Catskills, the Hudson, and his father's nursery had much to do with his development. His "Treatise on the Theory and Practice of Landscape Gardening," published 1841, when he was but twenty-six years old, is, in many respects, a unique production. It was the first, and is today one of the best American books on the subject, and has exerted a greater influence upon American horticulture, it is said, than any other volume. "Cottage Residences," 1841, also had great popularity. In 1845 appeared simultaneously in London and New York the first edition of "Fruits and Fruit Trees of America;" in 1846 he became connected with "The Horticulturist," which he edited from his home at Newburg until his untimely death. His editorials in this excellent periodical (later represented in succession by "American Gardening") were republished after his death, with a letter to his friends by Frederika Bremer, and a memoir by George William Curtis, under the title of "Rural Essays." It was not until 1850 that he had an opportunity to visit the great estates of England, to see with his own eyes the landscape gardening of Europe. On his return in 1851, he was engaged to lay out the grounds near the Capitol, White House, and Smithsonian Institution at Washington. On July 28, 1852, he left Newburg on the steamer Henry Clay for New York. The Clay took fire near Yonkers, while it was racing, and Downing's life was lost in an attempt to save others. It would be difficult to overestimate the influence of Downing. He created American landscape gardening. His only predecessor, André Parmentier, is little known, and his influence was not of a national character. Downing's quickening influence affected country life in its every aspect. He stood for the simple, natural, and permanent as opposed to the intricate, artificial, and ephemeral. He was the first great American practitioner of what is known in polite and technical literature as the English or natural school of landscape gardening in distinction from all artificial schools, as the Italian and Dutch. Downing's pupils are many, and his spirit still lives. He gave inspiration to Frederick Law Olmsted, our next great genius in landscape gardening, who, by his early work in Central Park, New York, aroused that popular enthusiasm which has culminated in the American idea of great municipal park systems, as opposed to the earlier Old World idea of exclusive pleasure-grounds and private parks. Downing's books have had large sales, and have gone through many editions. His intellectual successor in his purely pomological work was his brother Charles, whose modest labors in the revision of the "Fruits and Fruit Trees of America" have brought him little popular fame, but much sincere admiration from students. Most horticultural writings are, in reality, only records of progress; they do not create progress.


1877. A. J. Downing.

Few of our horticultural books are epoch-making. Downing's writings, however, started a great popular movement in America toward beautiful homes and home grounds. By many persons, Andrew Jackson Downing is considered the greatest single figure in the history of American horticulture, and one of the few persons who can be said to have had real genius. An appreciation of Downing's personality will be found in Frederika Bremer's "Homes of the New World." (See *Downingia*, for the genus of plants named after him).

WILHELM MILLER.

Downing, Charles, (Fig. 1878), distinguished pomologist and elder brother of Andrew Jackson Downing, the landscape gardener, was born at Newburg, New York, July 9, 1802. He was educated at the local academy, and from the age of thirteen to eighteen worked part of the time in his father's nursery. At the age of twenty he started in the nursery business on his own account. From 1834 to 1839 his brother Andrew was a partner in this business. About 1850, he sold out his nursery business and devoted himself to the study of varieties of fruits, on which subject he was the leading authority until his death. The "Fruits and Fruit Trees of America" is the monumental American work on varieties of fruits. The book was projected by Andrew, but the great bulk of the work was done by Charles in continuing and revising it. His test orchard contained trees and grafts of 1,800 varieties of apples, 1,000 pears, and other fruits in proportion. In 1896 a city street was put through it. Charles Downing was very modest and retiring. He would never make a public speech, but he wrote many pomological articles over the signature "C. D." All his work is marked by conscientious accuracy. He died January 18, 1885.


1878. Charles Downing.

WILHELM MILLER.

Dreer, Henry A., seedsman and florist, founder of one of the oldest American horticultural establishments, was born in Philadelphia, August 24, 1818, and died December 22, 1873, at the age of fifty-five. His parents were Frederick Dreer, of Hanover, and Fredericka Augusta Nolthenius, of Grossakenheim, Germany. They were married in America. The Nolthenius family emigrated to the United States in the last decade of the eighteenth century. Henry A. Dreer's education was largely in German, and obtained in Philadelphia. He was fond of gathering seeds and plants in the country, and would bring them home to cultivate. He was trained in his father's business, that of a cabinet-maker. In 1838, at the solicitation of a friend, he began as a seedsman and florist in a small way, at 59 Chestnut Street. In 1863 he moved his store to 714 Chestnut St., where the business has been conducted ever since with the addition of No. 716. His only son, William F. Dreer, succeeded his father and conducts the extensive business in Philadelphia and at Riverton, N. J.

Henry A. Dreer was of modest temperament and frail constitution, and confined himself to business rather closely. He was liberal in public matters, but always kept out of political life. He compiled several small works in connection with the business, and wrote frequently for the "Saturday Evening Post," of Philadelphia, and for Godey's "Ladies' Magazine."

WILHELM MILLER.

Dufour, John James, a Swiss vigneron, was at the head of a colony to grow the wine grape in Kentucky, and the author of "Vine Dresser's Guide," published in Cincinnati in 1826. The Kentucky experiment failed, and the colony then settled in southern Indiana, on the banks of the Ohio River; and this settlement is now the city of Vevay. Here Dufour died in 1827. This Indiana experiment brought out the merits of the Alexander grape, a native, and thereby did much to establish an American viticulture. For detailed account of the Dufours and their associates, and the results of their work, see Bailey, "Evolution of Our Native Fruits."

Eliot, Charles, landscape architect and author, passed away at Brookline, Massachusetts, early in the year of 1897. It is is said that no one of the present generation has shown greater ability in the art of landscape gardening on an extensive scale. From the time of his graduation until the time of his death, all his strength and energy had been given to the improvement of private grounds and public parks. A Harvard graduate, he took a post-graduate course at Bussey Institution, spending much of the time in studying the trees and shrubs in Arnold Arboretum. After familiarizing himself for a time with foreign parks and gardens, he entered the office of the late F. L. Olmsted, as a student. On completing his studies with Mr. Olmsted, he established his office in Boston and soon had a large clientele. He later became a member of the firm of Olmsted, Olmsted & Eliot and soon became identified with national undertakings with which he will long be remembered. While a member of the Appalachian Mountain Club, he was secretary and president of the corporation known as Trustees of Public Reservations, and from this organization sprang the admirable Metropolitan Park System. Mr. Eliot was the first landscape architect appointed by this Commission, and continued so until his death. To him, more than almost any other man, Massachusetts at least, is indebted for the improvement of her large tracts of land.

He was one of the best professional writers of his day on landscape gardening. His style was clear, earnest and convincing, and he allowed no minor matter to stand in the way of what he deemed the broadest and finest treatment, looked at from the future, and no other man during the past few years of Charles Eliot's life did so much toward crystallizing the better interests of the parking systems. To his work he brought vim, a trained intellect, a personal charm and a mature judgment. The public loss was great when Charles Eliot left his work.

G. B. BRACKETT.

Eliot, Jared, author of an early American book on agriculture, was born November 7, 1685, and died April 22, 1763. He was the grandson of John Eliot, the "apostle of the Indians," and was pastor at Killingworth, Connecticut, from October 26, 1709, until his death. He was a botanist, and the leading consulting physician in New England. He introduced the mulberry tree into Connecticut, wrote an essay upon the silkworm, and discovered a process of extracting iron from ferrugineous sands. His "Essays upon Field-Husbandry," begun in 1748, are generally regarded as the first important American book devoted exclusively to agriculture, although not actually the first work on the subject in the New World. It is now extremely rare. He was a high-minded, progressive and useful citizen. Many of his sermons were separately reprinted. Jared Eliot and Samuel Deane were among the few agricultural writers of note in the period before American horticulture was considered distinct from agriculture. See p. 1509; for portrait, "Cyclopedia American Agriculture," Vol. IV, p. 568.

WILHELM MILLER.

Elliot, Wyman, pioneer horticulturist, was born in Corinna, Maine, May 19, 1834, and died in Minneapolis, Minnesota, June 16, 1913. As a boy he helped his father about a grist-mill and on the farm and at odd times helped his mother in the fruit- and flower-garden, where he laid the foundation of his horticultural career. At the age of twenty the family went to Minneapolis, then a town of fifteen or twenty families. They purchased land and Mr. Elliot began raising vegetables and farm products. He was the first market-gardener in Minneapolis. In 1855 he took up a claim near Monticello in Wright County among the Indians, being one of the first farmers to till soil west of the Mississippi. In 1856 he returned to Minneapolis and took charge of the home place. He continued in the market-gardening business here for twenty-five years. He added fruits and ornamental stock to his crops and the place was known as the Minneapolis Garden Nursery for many years. By 1862 Mr. Elliot had built up a good market-gardening business. In 1864 he added a greenhouse and grew flowers and plants for sale. In 1866 a tree nursery was started and for many years supplied Minneapolis with trees, fruits and flowers. Many of the trees he planted will adorn the Minneapolis streets for many years and be a lasting monument to him.

In 1864 he helped organize the Hennepin County Horticultural Society and in 1866 helped organize and was a charter member of the State Horticultural Society. He was several times vice-president of the State Agricultural Society and held some office in the State Horticultural Society from its organization in 1866 until his death, serving as member of the executive committee, president six years, and from 1892 until his death he was chairman of the executive committee. Always of a quiet, unassuming character, he did work of untold value to the horticultural interests of the state.

LE ROY CADY.

Elliott, Franklin Reuben, died at Cleveland, Ohio, February, 1878. To him is due the honor of first suggesting and earnestly advocating the formation of state horticultural societies. He was secretary and a charter member of the Missouri Fruit Growers' Association, 1859; secretary of American Pomological Society, 1867, and a valued officer of the Ohio State Horticultural Society. He was a man of great ability in horticultural matters, and was the author of the "Fruit Book" and a well-known treatise on "Landscape Gardening." He was a valued contributor to the horticultural press at a day when American horticulture most needed advice.

G. B. BRACKETT.

Ellwanger, George, nurseryman, was born in Germany on December 2, 1816. His youth was spent in his father's vineyards where he acquired a love of horticulture and determined to devote his life to it. To this end, he studied horticulture in one of the leading institutions of Stuttgart. He came to the United States in 1835, and in 1839 settled at Rochester, New York. The next year he and Patrick Barry entered into partnership forming the nursery and seed firm, Ellwanger & Barry. Mr. Ellwanger was a member of the American Pomological Society, the Western New York Horticultural Society, and a corresponding member of the Massachusetts Horticultural Society. He died on November 26, 1906.

Emory, Robert Samuel, pomologist, was born April 2, 1832, near Centerville, on the Chester River, Maryland, and died June 2, 1906. His father was a lifelong agriculturist, carrying on that occupation most successfully until his death. Robert when a boy attended the public school, and later spent four years as a student in Dickinson College, Carlisle, Pennsylvania. Afterward he was employed as clerk in a wholesale drugstore in Pittsburgh, studying pharmacy, receiving a diploma, and remaining with the firm until he was twenty-one. He then returned home and engaged in agricultural work. In 1860, he settled near Chestertown, where he began the culture of fruit for market, on a considerable scale. He soon came to be regarded as an authority on all subjects connected with the production of fruit. His orchards comprised extensive plantings of pears and peaches, with a specialty of pears, and probably he raised more of this variety of fruit than any one east of California. In his orchard there were about 20,000 trees in bearing condition. His reputation as a skilful fruit-grower gained for him prominence, and his place on the Chester was the frequent resort of those concerned in fruit-culture from all sections desirous to see for themselves his well-managed orchards, to learn his methods, and to profit by his experience, the results of his own endeavors at individual research. In 1877, he was awarded the first prize for the best twenty-one varieties of pears by the American Pomological Society.

When the San José scale appeared in the East, he was among the first to recognize it as a deadly enemy, but by applying whale-oil soap saved his orchards until other remedies were discovered. All scientists were cordially welcomed to his home and orchards, enjoying the advantage which his experiences could give them. Captain Emory became a member of the Peninsula Horticultural Society a few years after it was organized and served as president during one year.

E. W. EMORY.

Ernst, Andrew H., nurseryman and pomologist, was born in Germany in the year 1796. He was proprietor of one of the earliest established and best nurseries in Ohio. He was a pioneer and champion of pomology in Ohio and the Northwest. Mr. Ernst established Spring Grove Cemetery in Cincinnati, one of the most beautiful cemeteries in the United States. He was vice-president of the American Pomological Society and president of the Ohio Pomological Society from 1847 until his death, which occurred on February 13, 1860.

Evans, James Calvin, one of the pioneer fruit-growers of the Mississippi Valley and for years one of the leading horticulturists of that section, was born in Jackson County, Missouri, April 25, 1833 and died in 1909. He was of a strictly pioneer family in western Missouri, being the son of Wm. B. Evans, who died in 1855, and nephew of the late Col. Milton McGee, so well and honorably known in the annals of Kansas City. In 1861 he acquired an extensive home plantation, in what is now North Kansas City. Being passionately fond of horticulture, he began its adornment and the development of extensive fruit-plantations. At the age of twenty-six he became a charter member of the Missouri Fruit Growers Association, organized in Jefferson City in 1859, its name being changed to the Missouri State Horticultural Society in 1862. This is the oldest permanent horticultural organization west of the Mississippi. He was elected president of this society in 1876 and served efficiently in this capacity for more than twenty years. He was also a charter member of the Missouri Valley Horticultural Society organized in 1868, and served as its president for twenty-three years. He was also a life member of the American Pomological Society and other horticultural bodies, which he has served from time to time as an officer or on important committees. In 1883 he organized the Olden Fruit Company and began planting the famous 1,400-acre orchard at Olden, which was the first extensive commercial orchard in the Ozark region. Due to the success of this enterprise and largely through his advice as to varieties and methods of orchard management found to be best adapted to that section, scores of extensive orchards began to be planted in the Ozarks. On his home plantation at Kansas City as well as at Olden, he maintained large areas for testing the adaptability of varieties of fruits to the western section. He was also ever on the alert to locate promising specimens of wild fruits of the state, especially grapes, raspberries, wild crabs and persimmons. The orchards which he planted still contain (1914) a large collection of these wild fruits, which were in process of amelioration at the time of his death. Among his special contributions to the list of varieties originated in the state may be mentioned the Miller persimmon, Evans peach, Evans raspberry and Evans crab, the latter being a large-fruited form of the native crab *Pyrus ioensis*. It was largely through his assistance and advice that an extensive experiment in breeding apples was inaugurated at the South Missouri Fruit Experiment Station in the nineties. As a result of this work hundreds of varieties, crosses between leading commercial sorts, were originated with the hope that some might combine the more desirable characteristics of both parents. This work is now being conducted by Colonel Evans' oldest son, who is disseminating these new sorts, many of which have much promise in the state. The writings of Colonel Evans consist largely of horticultural papers which have appeared during the past fifty years in the Reports of the Missouri State Horticultural Society. J. C. WHITTEN.

Fessenden, Thomas Green, editor and author, 1771–1837, founded "The New England Farmer" at Boston in 1822, and edited it until his death. The present "New England Farmer" is not the lineal successor of Fessenden's paper. Fessenden is chiefly noted as a satirical poet, and he was more of a literary man than a gardener. He was born at Walpole, New Hampshire, was graduated at Dartmouth College in 1796, and studied law. He went to England in 1803, and there published his humorous poem, the "Terrible Tractoration." He settled in Boston about 1804. In addition to "The New England Farmer," he edited the short-lived "Horticultural Register," and "The Silk Manual." He wrote "The Complete Farmer and Rural Economist," "The New American Gardener," and "The American Kitchen Gardener," three books of a cyclopedic nature designed to cover the fields of agriculture, horticulture and vegetable-gardening respectively. They adhered very closely to the contemporaneous English type of horticultural writing. These books appear to have passed through many editions, but they were little altered from issue to issue. They often seem to lack the enthusiasm of direct contact with growing plants. Fessenden's time was one of general farming, and the viewpoint of gardening was mostly that of the home or amateur. He lived before the days of specialized farming on a large scale, and of commercial horticulture and floriculture. During the greater part of his editorship of "The New England Farmer" there was but one other important American agricultural paper, "The American Farmer," which was published at Baltimore, beginning 1819. The most important contemporaneous American writings on horticulture of a cyclopedic nature were "The American Gardener's Calendar," by Bernard M'Mahon, Philadelphia, 1806, and "The American Gardener" of John Gardiner and David Hepburn, Georgetown, District of Columbia, 1804. For a copy of "The Country Lovers," Fessenden's once famous song to the tune of Yankee Doodle, together with Hawthorne's pen-picture of the man, and an account of his interesting life, see Duyckinck, "Cyclopedia of American Literature," 595–599. WILHELM MILLER.

Fuller, Andrew S. (Fig. 1879), horticultural writer, was born in Utica, New York, on August 3, 1828, and died May 4, 1896, at his home at Ridgewood, New Jersey. At the age of eighteen he went to Milwaukee, Wisconsin, where he worked at the carpenter's trade, and became particularly skilful in the construction of greenhouses, and built a small one for himself on a city lot. Here he brought together a varied collection of plants, the care of which founded the nucleus of his later attainments and renown as a horticulturist. In 1855, he moved to Flushing, Long Island, when William R. Prince offered Mr. Fuller the management of his greenhouses. But his ambition did not allow him to remain long in the employ of others, and in 1857 he removed to Brooklyn, and engaged in grape and small-fruit culture, which were then in their infancy. Here he gave particular attention to the improvement of the strawberry by cross-fertilization and selection of the best of the many thousands of seedlings raised by him. The most famous of these were Brooklyn Scarlet, Monitor and Colonel Ellsworth, the first of which was generally recognized as the highest-flavored strawberry in existence at the time, although too soft for market. The entire stock of 300,000 plants was purchased by the "New York Tribune," which sent them out as premiums to its subscribers, in consequence of which they have been widely known as the "Tribune strawberries." It was during this period that Fuller wrote his first book, the "Strawberry Culturist." Realizing the necessity of having more ground for experimentation, and in order to escape the noise and turmoil of the city, he bought a large piece of land near Ridgewood, New Jersey. This, when he moved on it, early in the sixties, was little more than a barren waste, but it developed into one of the most charming homes and interesting and instructive garden spots in the country. Almost every species and variety of ornamental trees and shrubs hardy in the locality were represented, and his collection of small-fruits was the most complete in the country. Immediately after the publication of the "Strawberry Culturist," he began working on the "Grape Culturist." This was followed by the "Small Fruit Culturist," "Practical Forestry," "Propagation of Plants," and the "Nut Culturist." The last of them he was fond of calling his "monument," as he did not intend to write another book, and so fate decided that it should be. He died a few days after he had finished his manuscript, and never saw the completed book, of which he was perhaps more proud than of any other of his works, yet in the history of horticultural literature his "Small Fruit Culturist" will, no doubt, occupy the foremost rank. It was more instrumental in the development and building up of the great industry to which it is devoted than any book written before or after, and in any land. It was translated into German and published in Weimar in 1868. His books contain but a small part of his writings. His editorial and other contributions to the "American Agriculturist," to "The Rural New-Yorker," of which he was part owner for a time, the "New York Sun," of which he was agricultural editor for twenty-six years, "American Gardening" and other periodicals would fill hundreds of volumes. He was also editor of the "Record of Horticulture," 1866 and 1867. While Mr. Fuller was principally known as a horticulturist, there was hardly a branch of natural science to which he had not devoted more or less attention. His entomological collection, especially that of coleoptera, was one of the most complete in the country; his mineralogical and archeological collections contained many rare specimens, and his horticultural library was one of the best

1879. Andrew S. Fuller.

in the United States. In later years, although in good health, Mr. Fuller left his place but seldom, but in his earlier years he traveled considerably, and took an active and leading part in the meetings of the American Pomological Society, the American Institute Farmers' Club, the Fruit-Growers' Club, and many kindred societies, of which he was an active or honorary member.
F. M. Hexamer.

Fulton, J. Alexander, lawyer and horticulturist, was born at his father's farm in Armstrong County, Pennsylvania, November 11, 1822, and died in 1895. He removed from Pennsylvania to Dover, Delaware, in 1865. Although a lawyer by profession, he was much interested in fruit-culture and was known as a horticulturist far beyond the limits of his state. His book on "Peach Culture" was long a standard work. He was one of the early members of the Peninsula Horticultural Society and participated in its meetings until the end of his life.
G. B. Brackett.

Gale, Elbridge, pastor and horticulturist, was born on Christmas Day, 1824, in Bennington, Vermont. and died at Mongonia, Florida, in 1907. He attended Brown University and was later graduated from the Baptist Theological Seminary at New Hampton, New Hampshire. His first pastorate was at Johnson, Vermont; from thence he accepted a call to the Baptist church of Pavilion, Illinois, and on going to Kansas in 1864, became the pastor of the Baptist church at Manhattan. He remained in this pastorate until he accepted the chair of horticulture at the Kansas State Agricultural College. He was greatly interested in the free schools of Kansas and was County School Superintendent of Riley County for several terms. He was one of the founders of the Manhattan Horticultural Society. He removed to Lake Worth, Florida, November, 1884, on account of his failing health. His interest in horticulture grew apace in the Lake Worth section. He was first president and an active member of the Lake Worth Horticultural Society as long as it was in existence, and it was largely through his efforts that the United States Government procured from India some Mulgoba mangoes and from Italy some mangosteens, durians and figs for distribution to the planters connected with the Society. Of all the Mulgoba mangoes planted, Mr. Gale was the only one who succeeded in keeping the trees alive, and the Mulgoba mango still remains a living monument to his success as a Florida horticulturist. His skill and energy has given to the western world another fruit that adds much to tropical luxuriance and American finance.

His was a busy life. At the college at Manhattan he planted the college arboretum east of Horticultural Hall and the forest plats on the old college farm. In 1879 he was candidate for Congress from the First Kansas District, greenback platform.

To his activity, usefulness and teachings, thousands of pioneer Kansans and students of the College are indebted to this grand old man who sleeps beneath the live oaks and the palms of his new home State in the Southland.
G. B. Brackett.

Gano, William Groves, pioneer horticulturist of the Missouri Valley and introducer of new varieties of fruits, was born in Winchester, Virginia, in 1839 and died at Parkville, Missouri, in 1910. In 1867 he moved to Parkville, Missouri, where he planted one of the notable early orchards of that section and spent most of the active working part of his horticultural career. He was associated with J. C. Evans and others in establishing and planting the Olden Fruit Farm, the pioneer large commercial orchard of the Ozark region. Throughout his residence in Missouri, he was a member of the Missouri State Horticultural Society and served frequently as an officer of this body. He was also a charter member of the Missouri Valley Horticultural Society and held membership in other state and national organizations. He was actively identified with collecting state fruit exhibits at all of the leading national and interstate expositions which have been held during the past fifty years. He was awake to the desirability of introducing and testing large numbers of varieties of fruits on his farm at Parkville. His orchard served largely as a model for the guidance of other orchardists in his own section and his advice and judgment as to what varieties to plant and how to adapt orchard management to this pioneer section of the Missouri Valley was sought throughout several states. In addition to giving his time and his resources freely to this type of work, he was zealously interested in the production of new seedling varieties of fruits. Several of these have gained local prominence because of their adaptation to local conditions. His most celebrated contribution to our list of varieties was the Gano apple, named in honor of the originator by Charles Downing. The Gano apple is similar to that most cosmopolitan Ben Davis, equal to it in every respect, but due to its superiority over Ben Davis in color and beauty of appearance, it is now displacing the latter in commercial orchards of the West. The annual reports of the Missouri State Horticultural Society contain many of his papers dealing with the problems and practices of fruit-growing which he helped to shape in the region in which he did his work.
J. C. Whitten.

Garey, Thomas Andrew, nurseryman, was born in Cincinnati, Ohio, July 7, 1830, and died at Los Angeles, California, August 21, 1909. He was of German stock and spent his boyhood partly in Hagerstown, Maryland, and partly in Iowa. In the spring of 1850, Mr. Garey moved to New Mexico, traveling by ox-team over the Santa Fe trail. In 1850, after having married in New Mexico, the Gareys crossed the mountains and settled at El Monte in Los Angeles County, California, where he engaged in farming. In 1865 Mr. Garey purchased 72 acres of land on what is now South San Pedro Street, Los Angeles, and entered the nursery business. He soon built up a large and thriving business and was very active in introducing many kinds of tropical and semi-tropical fruits from various parts of the world. It was Mr. Garey who first demonstrated to the citrous growers that budded trees of improved varieties were better than the seedlings which were commonly grown. Hearing of the Bahia Navel orange, Mr. Garey attempted to introduce it from Australia, but was unfortunate in securing an undesirable type (Australian Navel) which was subsequently displaced by the true Bahia or Washington Navel. Recognizing the value of a seedling lemon grown by C. R. Workman, Mr. Garey bought the original tree and introduced the variety in 1877 under the name Eureka. This variety is now the leading commercial lemon in California. Mr. Garey did a large business in importing all kinds of plants and seeds and had wonderful success with many of the novelties he brought in. He served for a time as president of the Los Angeles Pomological Society and was one of the founders of the city of Pomona. In 1882 he published "Orange Culture in California," which for years was considered a standard reference book.
J. Eliot Coit.

Gibb, Charles, Canadian horticulturist, and author of important works on Russian fruits and other hardy trees, was born at Montreal June 29, 1842 (Woolverton says 1846) and died at Cairo, Egypt, March 8, 1890, while returning from a collecting trip in China and Japan. In 1872 he brought to Montreal the first canned fruit exhibited in Canada. His farm at Abbotsford, Province of Quebec, contained the best collection of hardy fruits, trees and ornamental shrubs in Canada. His trip to Russia in 1882 with Professor Budd, the subsequent importations, his second trip to Russia, and his various publications on hardy trees make part of a chapter of great interest and significance in the history of American horticulture. His travels were extensive. His chief works are "Ornamental and Timber Trees not Natives of the Province of Quebec" (a comprehensive list of species of possible value for Canada), "Report on Russian Fruits," "Hasty Notes on the Trees and Shrubs of Northern Europe," "Russian Apples Imported by the Department of Agriculture, Washington, in 1870" (an elaborate comparison of Russian opinions and American experience), "Nomenclature of the Russian Apples," "Of Translating and Rendering into Euphonious English Unpronounceable Russian Names, also Throwing Out Synonyms," and "Fruits for the Cold North." For a fuller account, with portrait, see "Annals of Horticulture," 1890, 287–290. Wilhelm Miller.

Gideon, Peter M., pioneer pomologist of the northern Mississippi states, 1818–1899, resided since 1853 on Lake Minnetonka, Minnesota, and devoted his efforts to the production of apples of sufficient hardiness to withstand the climate. He was born in Ohio. He afterward lived in Illinois. From boyhood he seems to have been possessed of the idea to raise seedling fruits. He was one of those rare individuals who sets a distinct ideal and strives for it throughout a lifetime in spite of every adversity. These are persons of strong and uncompromising will. They often antagonize their fellows; but their works are usually beneficent. Gideon conceived that the amalgamation of the Siberian crab and the common apple would give the perfect apple for the Northwest. His seedlings were numerous. Several of them have been named and disseminated, and are of value. But his greatest achievement, the Wealthy apple, was of pure *Pyrus Malus* stock. This variety is now one of the standard apples of his geograpical region, and it is also in favor elsewhere. It is a boon to the Northwest. Even when in poverty, it is said that Mr. Gideon spent his last dollar to buy the seeds from which this apple came. He was instrumental in distributing 10,000 apple seedlings in Minnesota, and some of these are now attracting attention. His work was wholly empirical, yet he did so much and continued his work for so long a time that the results have contributed to the knowledge of plant-breeding. Probably no other American has labored so long and devotedly for the attainment of a specific ideal in the apple. Portrait and eulogies will be found in "The Minnesota Horticulturist," January, 1900. L. H. B.

Goff, Emmett Stull, horticulturist, was born on a farm near Elmira, New York, in 1852. In 1882, he was appointed horticulturist at the Agricultural Experiment Station at Geneva. In 1889, he was called to the University of Wisconsin as professor of horticulture and horticulturist of the experiment station. He did valuable work in producing new and hardy varieties of plums for the colder portions of the Northwest. He was a pioneer in spraying and invented the kerosene attachment for spray pumps. Professor Goff performed the first successful experiments with fungicides for the control of the apple-scab fungus. He was the author of "Principles of Plant Culture," and "Lessons in Pomology" and wrote the first classifications of vegetables published in America. He also published many bulletins and papers in horticultural publications. He was a good systematic botanist as well as a horticulturist. He died at Madison, Wisconsin, on June 6, 1902. For portrait and fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 576.

Goodrich, Chauncey, bookseller and horticulturist, was born September 10, 1798, and died September 11, 1858, at Hinsdale, Massachusetts. At nineteen years of age he entered a publishing house, but a few years later took up bookselling and publishing on his own account, finally settling at Burlington, Vermont. He was very much interested in gardening, testing fruits for hardiness in the Champlain Valley and maintaining a nursery on his farm. He did much to improve and extend the culture of fruits in northern New York and Vermont. He was a contributor to horticultural magazines and author of "The Northern Fruit Culturist, or Farmer's Guide to the Orchard and Fruit Garden." For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 579.

Green, Samuel B. (Fig. 1880), horticulturist and educator, was born in Chelsea, Massachusetts, September 15, 1859, and died in Itasca Park, Minnesota, July 11, 1910. His father was one of the early mayors of Chelsea and held many offices of trust. As a boy, Professor Green spent his summers on a New Hampshire farm and early developed a liking for farm life, culminating in his taking the agricultural course at Amherst, in spite of strong opposition from his family and friends, who wanted him to take up other work. He worked a large part of his way through college, graduating in 1879. Immediately after he graduated, he became superintendent of the Vine Hill Dairy Farm, of West Hartford, Connecticut. After a year's experience, he decided there was not a great future for agriculture in the East and took up gardening and nursery work. He worked for a market-gardener near Boston one season, then took a six-months' post-graduate course at Amherst. The next season he worked for James J. H. Gregory, and in the winter, for William C. Strong, a rose-grower and nurseryman of Brighton, Massachusetts. About 1884 he took charge of the Horticultural Department of Houghton Farm Experiment Station, at Cornwall, New York. He made many interesting experiments here and also had the opportunity to get some landscape gardening training under Samuel Parsons, Jr., who was employed to develop the Houghton Farms of over 1,000 acres. Thinking that he was not getting enough experience here, he returned to Mr. Strong's nursery especially to learn summer propagation of plants, later becoming foreman of Newton Cemetery nurseries. From here he returned to Massachusetts Agricultural College as foreman of the horticultural department. He remained here until 1888 when he accepted the position of professor of horticulture and applied botany in the University of Minnesota and horticulturist of the experiment station. Later his title was changed to professor of horticulture and forestry, and in 1910 he was made dean of the College of Forestry. He was a member of the Executive Board of the Horticultural Society, Forestry Board, American Pomological Society, Society of American Foresters and American Forestry Association. At the time of his death, he was president of the State Horticultural Society and of the State Board of Arbitration.

1880. Samuel B. Green.

Professor Green wrote many books and bulletins and contributed to the agricultural literature generally.

His best known publications are: "Amateur Fruit Growing," 1894; "Vegetable Gardening," 1896; "Forestry in Minnesota," 1898; "Principles of American Forestry," 1903; "Farm Hedges and Windbreaks," 1906; "Popular Fruit Growing," 1909.

He was one of the pioneers who helped to put agriculture in its proper place in the state of Minnesota. He was instrumental in establishing the College of Forestry and started the summer work in Itasca Park, thus giving the forestry students six months of practical work under good supervision. Le Roy Cady.

Gregory, James J. H., farmer, seedsman, and author, was born at Marblehead, Massachusetts, November 7, 1827, and died February 20, 1910. He was educated in the public schools at Marblehead, two years at Middlebury College, and graduated from Amherst College in 1850. He taught in Marblehead, Hingham and Lunenberg. The starting of the seed business was almost an accident. He was reading the "New England Farmer" and saw the request for a good winter squash, and as his father had recently raised some splendid squashes from seed that "Old Marm Hubbard" had given him, he sent the inquirer some of this seed. The man was so well pleased that he wrote articles for several papers extolling these squashes, and soon the Gregory Seed Business was thriving, sending Hubbard squash seed to all parts of the United States. Naturally the business started in the home, the attic being used for the purpose; in a very short time it was necessary to move to larger quarters. He branched out with other seed, both vegetable and flower, and at the time of his death was carrying on one of the largest seed establishments in the country. During his career he introduced many new varieties of vegetables, several of which are the standards in the market today. His seed-farms comprised over 400 acres where he grew pedigreed stock; he always felt that by growing his own seeds he was less liable to mistakes and could, himself, select the most perfect types. His reputation for choice varieties was so renowned that the firm became the headquarters for stock seeds for other well-known concerns.

He wrote and distributed many thousands of copies of treatises on various agricultural subjects, such as: "Onion Raising," 1865; "Squashes: How to Grow Them," 1867; "Cabbages and Cauliflower," 1870; "Carrots, Mangold Wurtzels and Sugar Beets," 1877; "Fertilizers," 1885. In his early life he lectured extensively on agricultural and horticultural subjects.

Mr. Gregory was a philanthropist of renown. He gave large sums of money for the establishment of southern schools and colleges, the Gregory Institute of Wilmington, North Carolina, being founded by him. He served his native town in many responsible capacities and filled many public offices. Edgar Gregory.

Hall, Dr. George R., plant collector, was born in Bristol, Rhode Island, in 1820, and died in Milton, Massachusetts, December 24, 1899. He was a graduate of Trinity College, Hartford, Connecticut, in the class of 1842. He studied medicine at the Harvard Medical School, class of 1846, and on receiving his degree went to China, where he practised medicine in the foreign settlement in Shanghai. He abandoned the practice of medicine in 1854 and went to Japan, where he traveled extensively and collected the plants which bear his name, among which may be mentioned *Lonicera japonica* var. *Halliana*, *Pyrus Halliana*, *Magnolia stellata* (*M. Halliana*), *Zelkova Keaki*, *Retinospora*, *Thujopsis*, and *Lilium auratum* which flowered in this country one month earlier than in England. In 1864 he planted at Bristol many Japanese evergreens at that time very rare in this country. In 1876 he made a second visit to Japan.

Harris, John S., horticulturist and pomologist, was born in Seville, Ohio, August 17, 1826, and died at La Crescent, Minnesota, March 24, 1901. His ancestors were hardy pioneers of Massachusetts and Connecticut, and his own parents were pioneers in Ohio. Mr. Harris early became a skilful propagator of plants under the direction of his father and at the age of eleven had a small nursery and garden of his own. After his father's death in 1844, he was apprenticed to a cabinet-maker to learn the business. In 1847 he enlisted for the Mexican war and served under General Scott in the campaign resulting in the capture of Mexico City. After his return from the war, he stayed in Ohio a year or so and then went west to Wisconsin, traveling over Wisconsin, Iowa and Illinois. In 1851 he settled at La Crosse and engaged in market-gardening. The soil proving too poor and sandy, in 1856 he removed to La Crescent and started in the fruit, garden and florist business.

He planted his first orchard in 1857 and continued planting trees, plants and shrubs until the last few years of his life. It was his pride that he had tried nearly every variety of apple that offered any likelihood of being valuable to Minnesota planters. The winters of 1872 and 1884 destroyed nearly all of his trees but he continued planting. He began to attend fairs and exhibit fruits of his own growing in 1864. In 1866 he helped organize the State Horticultural Society and his is the first name on the roll of the Society. In 1868 he was elected vice-president and in 1869, president. He held the office of president until 1871, and again from 1881 to 1884. He was a member of the executive committee from 1884 until his death. He was elected to the Board of Managers of the State Agricultural Society in 1875 and held the office for twelve years. Mr. Harris exhibited at the state fair every year and his exhibits were always interesting and valuable as showing the pomology of the state. He was one of the first men to be made an honorary life member of the Horticultural Society. He enjoyed writing for the agricultural papers and conducted a column in the "Farm, Stock and Home" for many years. Mr. Harris probably had a closer knowledge of pomology in the Northwest than any other man in the United States and did his full share in the development of horticulture throughout Minnesota.

Le Roy Cady.

Heikes, William Fletcher, nurseryman, was born at Dayton, Ohio, on April 2, 1837. He succeeded his father in the nursery business near Dayton, in 1839. In 1872 he established near Huntsville, Alabama, what eventually became the largest nursery of its kind in the United States. He was instrumental in introducing systematic grading and was the first nurseryman to use a caliper to determine tree grades. He was also the first nurseryman to cellar nursery stock and keep it in cold storage during the shipping-season. Mr. Heikes originated the double root-grafting method of propagation of nursery stock. He was state vice-president for Alabama of the American Pomological Society for many years. He was president of the Alabama Horticultural Society from its origin in 1903 to the time of his death in Cleveland, Ohio, on Friday, August 25, 1911.

P. F. Williams.

Henderson, Peter (Fig. 1881), leading market-gardener, florist, seedsman and author, was born at Pathhead, near Edinburgh, Scotland, in 1822, and died in Jersey City, January, 17, 1890. He was trained in Old World methods of gardening, came to America in 1843, worked under Thorburn and Robert Buist, and then in 1847 began business in Jersey City as a market-gardener, with a capital of $500, saved by three years' hard work. He continued to live there until his death. The publication of "Gardening for Profit" in 1865 marks an era in American horticulture. It was the first American book devoted entirely to market-gardening, and it helped to induce many persons to enter the business. By the time of his death about 150,000 copies of the book are said to have been distributed. It was written in an aggregate of 100 hours, when the author was working 16 hours a day, largely at manual labor. At the noon intervals and late at night he wrote this work lying on his back, with a pillow under his head. The secret of its success and of the author's, was the invention of new methods adapted to operations on a large scale. The second edition in 1874, and the third in 1887, are both thorough revisions.

1881. Peter Henderson.

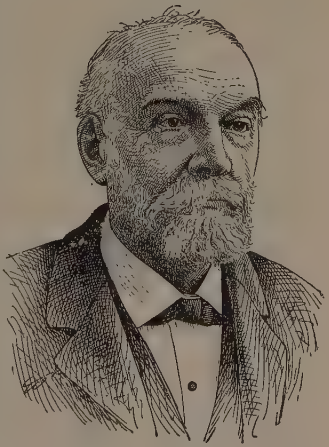
"Henderson's Practical Floriculture," 1868, was an epoch-making book in commercial floriculture. Up to this time most works on flower-gardening had been written for the amateur. This point of view is necessarily the commoner one, and Henderson's contribution to it was "Gardening for Pleasure," 1875. In the compilation of "The Handbook of Plants," in 1881, he was largely aided by C. L. Allen, and in the second edition, 1890, by W. J. Davidson. "Garden and Farm Topics" was issued in 1884, and in the same year appeared "How the Farm Pays," a stenographic report of conversations between Wm. Crozier and Peter Henderson. It is said that nearly a quarter of a million copies of his various works have been sold. His seed business was founded at New York in 1865.

Few men, if any, have done so much to simplify and improve methods of handling plants for commercial purposes. His greenhouses were an object lesson to many visitors, his methods were widely copied, and his business successes were the goal of ambitious market-gardeners and florists, among whom he was for many years the most commanding figure. He was a frequent contributor to the horticultural and agricultural magazines, and during his forty-two years of business life is supposed to have written or dictated at least 175,000 letters. Two-thirds of these letters were written with his own hands, and he always replied promptly to inquiries about methods of cultivation. An account of his life is published in a memoir of forty-eight pages by his son, Alfred Henderson. Wilhelm Miller.

Hepburn, David, was joint author with John Gardiner of a very early American book on horticulture. This was published at Washington, D. C., in 1804. The name of Gardiner appears first on the title page, but it may be inferred that the practical experience in the book is almost wholly Hepburn's. He had had forty years of experience in gardening, half of the time in England and half in America. He was employed by General J. Mason for six years on Mason's Island, Georgetown. He had also been employed by Governor Mercer. The book was well made for the time. It is a 16mo, and contains 204 pages of practical directions. The calendar style is used. The first part (100 pages) is devoted to the kitchen garden. The second part consists chiefly of fruits, flowers, and shrubs (82 pages). This is followed by a few pages on hops, hot-houses and greenhouses. The second edition (Georgetown, 1818) contains 348 pages. It includes "A Treatise on Gardening, by a citizen of Virginia." This occupies 80 pages. The copy owned by the Massachusetts Horticultural Society possesses this manuscript note: "This treatise is by John Randolph, of Williamsburg, father of Edmund Randolph, Secretary of State during the administration of General Washington." Robert Manning said that this note may have been made by General Dearborn. A third edition was published at Washington in 1826, and contained 308 pages. For a further account of the book by Gardiner and Hepburn, see page 1521. Wilhelm Miller.

Hexamer, Frederick M. (Fig. 1882), physician, nurseryman and editor, was born at Heidelberg, Germany, on June 21, 1833. He died at Stamford, Connecticut, May 29, 1909. When only sixteen years of age, he joined Siegel's army which was disbanded in 1848, and he, the youngest in the ranks, being exiled, went to Switzerland, where he became acquainted with the elder Froebel with whom he studied medicine and botany in the Zurich botanical gardens. Having secured his M.D. degree, he explored the Swiss Alps and the Tyrol and made a very large collection of Alpine plants. The remains of this collection are now in the herbarium of the botanical gardens at Bronx Park, New York City. About the middle of the last century, he came to New York and began the practice of medicine, which, however, he soon dropped to enter the nursery business at Chappaqua, New York, in partnership with his father-in-law, a leading physician of New York City, under the name of Reisig & Hexamer. The firm's principal business was the growing of new varieties of plants to be distributed as premiums with the "New York Tribune," to which paper Dr. Hexamer became a contributor through his friendship with Horace Greeley. His writings were upon horticultural and agricultural topics. Thanks to his friendship with B. K. Bliss, he became editor of the "American Garden" in 1880. In 1885 he succeeded Dr. George Thurber as editor of "American Agriculturist," to which paper he had contributed frequently during many years. He continued as editor of the "Agriculturist" until the early years of this century, when he was made editor emeritus. His activity during his connection with the "Agriculturist" had also to do with the editing of a large number of books on rural affairs published by the Orange Judd Company. His only book, "Asparagus," the sole work on this subject published in America, was printed in 1901.

In addition to the influence which he exercised on American farm affairs as editor, Dr. Hexamer was a leading spirit in horticultural and agricultural associations. He was for years on the New Fruits Committee of the American Pomological Society and was president of the Farmers' Club of the American Institute of New York City, his immediate predecessor being Horace Greeley. In this institution, he mapped the policy of the club which practically took its life and usefulness from him. However, owing to his excessive modesty, his hand was not often seen and only too frequently others seized the credit which was really due to him.


1882. F. M. Hexamer.

Some of his achievements in the commercial line had to do with the growing of strawberries and potatoes. He was the first man to grow the former on a business basis for the New York market. He also grew the epoch-making Early Rose potato for the introducers and was awarded a medal at the Centennial Exposition at Philadelphia in 1876 for a collection of 550 named varieties of potatoes. M. G. KAINS.

Hiester, Gabriel, horticulturist, was born at "Estherton," near Harrisburg, Pennsylvania, April 28, 1850, and died in his lifelong home, January 18, 1912. His father, Augustus Otto Hiester, was a prominent citizen and an influential trustee of the Pennsylvania State College. Gabriel Hiester graduated from this institution in 1868 and served as a trustee from 1878 until his death. No member of the board did more for the promotion of agriculture, and especially horticulture, in the college and in the agricultural experiment station. He was elected President of the State Horticultural Association in 1905 and was serving his eighth term on the evening before his death. Mr. Hiester was widely known as an unusually successful horticulturist. He produced fruits and vegetables on a large scale for the markets of central Pennsylvania and frequently attended Farmers' Institutes and horticultural meetings in this and other states where he gave his hearers the benefit of his many years of experience as a grower of choice products. Gabriel Hiester was a man of sterling qualities, being broad-minded, unselfish, and thoroughly devoted to all interests which concern the welfare of mankind. R. L. WATTS.

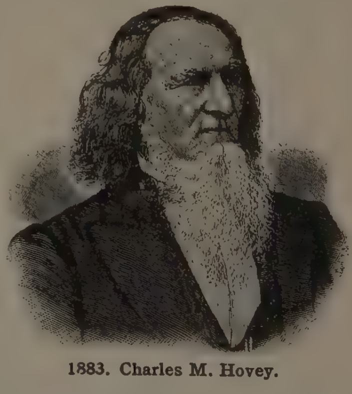
Hogg, Thomas, Senior and **Junior**, plantsmen. The second Thomas Hogg, born in London, February 6, 1820, died in New York, December 30, 1892, was known for his introductions of Japanese plants. His father removed to this country in 1820, when the child was nine months old, and early in 1822 took up a piece of land outside the city of New York, at what is now Broadway and Twenty-third Street, and here established himself as nurseryman and florist. In 1840, the nurseries were removed to Seventy-ninth Street and East River, where young Thomas and his brother James assisted in the business. The father died in 1855, and the sons took charge of the business. Thomas Hogg was appointed by President Lincoln, in 1862, United States Marshal, and in this capacity he resided eight years in Japan. He returned to Japan in 1873, and remained two years in the Japanese customs service. "His close relations with the authorities gave him opportunities for exploring the islands which other foreigners did not possess, and he collected many plants and seeds of horticultural value and sent them home. The garden of his brother at the foot of Eighty-fourth Street, where most of these treasures were cultivated for the first time in America, was, for many years, the most interesting spot in the United States to the lovers of Japanese plants. Many of the very best trees, shrubs and herbaceous plants which have come to us from Japanese gardens were thus brought to America before they were sent to Europe, and not a few of them are now among the most familiar inhabitants of our gardens." Hogg left Japan in 1875, and subsequently traveled in China, Ceylon, South and Central America, as well as in Europe and California. In later life he devoted himself to his favorite studies. He never married.—Extract from "Garden and Forest," Vol. VI, p. 24.

Hoopes, Josiah, nurseryman, was born in West Chester, Pennsylvania, November 9, 1832, and died January 16, 1904. He was reared principally in Philadelphia and received a superior English and classical education in the high schools of that city. His chief delight was in botany, and from early childhood he pursued that line of study with interest. It was in pursuance of his inclinations along this line that he built in 1853 a small greenhouse on his father's property and proceeded, at great labor and considerable expense, to fill it with specimens of the flora of this continent and of the world. To this collection he added as opportunity permitted and naturally began propagating them and found his products in demand. From that small beginning, the great and prosperous nursery business of today was developed. Josiah Hoopes wrote much on horticulture, botany and kindred subjects, for many years being a regular contributor to the horticultural department of the "New York Tribune" and other publications. He was the author of the "Book on Evergreens."

Hoskins, Thomas H., physician, horticulturist and writer, was born at Gardiner, Maine, in 1828 and died at Newport, Vermont, in 1895. He was well known in horticulture as the introducer of Russian fruits. He was also a contributor to all the the leading horticultural papers. For a fuller account, see "Cyclopedia of American Agriculture," Vol. IV, p. 585.

Hovey, Charles Mason (Fig. 1883), horticultural journalist and nurseryman, was born in Cambridge, Massachusetts, October 26, 1810, and died there September 1 or 2, 1887. He is best known as editor of the "Magazine of Horticulture," which had an uninterrupted existence from 1835 to 1868. It was founded as the "American Gardener's Magazine," by C. M. Hovey and his brother, Phineas Brown Hovey. In its third volume (1837) it changed its name, and continuously thereafter was known as the "Magazine of Horticulture," and was edited by Charles M. Hovey alone. It enjoyed the longest period of prosperity of any American horticultural journal. It is a record of the budding stage of New World horticulture. It was modeled after Loudon's "Gardener's Magazine," although its spirit was essentially American. Essays, records of current events, reviews of books, descriptions of varieties, were prominent features. It had very few illustrations. Mr. Hovey was author of the "Fruits of America," issued in parts from 1852 to 1856, completing two volumes and making more than a beginning on a third. Its purpose was to give "richly colored figures and full descriptions of all the choicest varieties cultivated in the United States." The volumes contain more than 100 colored plates. Handsomely printed and bound, these volumes are a fine type of the amateur's art-book of varieties.

Mr. Hovey was also nurseryman and seed merchant. Until 1840, his grounds at Cambridge are said to have comprised only an acre, but at that time his premises were greatly enlarged. His epoch was a time of knowledge of varieties. Straightway he began assiduously to collect varieties, until he exhibited pears, apples and camellias by the hundreds, and plums, grapes, chrysanthemums and many other things by the score. These things were shown before the Massachusetts Horticultural Society which was the center of horticultural influence of the country. He raised many seedlings. *Thuya Hoveyi* is still prized as a garden conifer. His greatest contribution to horticultural varieties was the Hovey strawberry, which first fruited in 1836, and which is generally regarded as the starting-point of American commercial strawberry-growing. For many years this berry was the standard of market excellence (Fig. 1861). He continued to grow it and cherish it until the end. Mr. Hovey was long an active member, and for a time president, of the Massachusetts Horticultural Society. He was one of the active projectors



1883. Charles M. Hovey.

of the building which gave the Society a new and more commodious home.

A portrait of Mr. Hovey will be found in the first volume of the "Fruits of America." Another occurs in "Gardeners' Monthly" for 1886 (frontispiece) and "American Garden," November, 1887; and a reduction of this appears in Fig. 1883. L. H. B.

Hunnewell, Horatio Hollis (Fig. 1884), philanthropist and horticulturist, was born in Watertown, Massachusetts, July 27, 1810, and died in 1902 at Wellesley, Massachusetts. He was the eighth in line of descent from Roger Hunnewell, who came to this country from England in 1640. Hollis Hunnewell was educated at Harvard University and in Paris. At twenty-five years of age, he became a partner in the banking-house of Wells & Co., a Parisian bank for the accommodation of American tourists. He was later identified with the banking and railroad interests of the United States and many philanthropic movements, but the singular fact remains that he did not manifest a taste for arboriculture and horticulture, his favorite pastime, until he was over forty years of age. He was first to introduce the use of *Catalpa speciosa* for railroad ties, and hundreds of acres of catalpas were planted on the treeless plains along the lines of western railroads. Through his efforts, the first open-air exhibition of rhododendrons and azaleas was given in Boston in 1873. No previous attempt had been made in this country to bring together a large collection of these plants for landscape effect. The increased excellence and extent of arrangement of grouping of plants hitherto unused made him a landscape artist of first degree, and he gave a new impetus to American botany and horticulture. He was president of the Massachusetts Horticultural Society for 1875 and through his numberless benefactions helped to make horticulture a household word, not only in his beloved state, but throughout the country. G. B. Brackett.

1884. H. H. Hunnewell.

Husmann, George, grape-grower and author, was born at Meyenburg, near Bremen, Germany, November 4, 1827, and died at Napa, California, November 5, 1902. He came to the United States at an early age and was practically self-educated. His horticultural career began at Herman, Missouri, where he established the largest and oldest American vineyard that turned grapes into wine, with the exception of the Longworth vineyard in Ohio. He served with distinction in the Civil War, was a presidential elector in 1866, and was a member of the convention for revising the constitution of the state of Missouri. He established extensive nurseries and a model fruit farm that was the pride of the state, and the fruits and wines received first awards at all the fairs and expositions held at that time. In 1866, he published his first book, "Grapes and Wine." About 1869 he began the publication of the "Grape Culturist." In 1880 his second book, "Grape-growing and Wine-making," was published, and in 1888 "Grape-culture and Wine-making" was issued, and it became so popular that it was revised and published through four editions. He was president of the Bluffton Wine Company, Bluffton, Missouri, a member of the Board of Curators of the Missouri State University, a charter member of the Missouri State Horticultural Society and the Missouri State Board of Agriculture; professor of pomology and forestry, Missouri State University; a member of the Viticultural Congress that convened at Washington, D. C., and State Statistical Agent for the state of California. He was one of the first men to ship American phylloxera-resistant grape-vines to France to re-establish her vineyards. In coöperation with Parker Earle, he originated and helped to organize the Mississippi Valley Horticultural Society.
G. B. Brackett.

Jack, Mrs. Annie L. (Fig. 1885), was born in Northamptonshire, England, January 1, 1839, and died in February, 1912. Her maiden name was Annie L. Hayr. In 1852 she came to America and pursued her studies at a ladies' seminary in Troy, New York. She taught school at Chateauquay Basin, Quebec, about a dozen miles from Montreal, and later was married to Robert Jack of that place. Acting under her influence, their farm, known as "Hillside," was largely planted to small-fruits and vegetables, to which was in time added a greenhouse for floriculture. Thus were demonstrated the capabilities of that section for market-gardening, and others were led to follow the example so successful at the "Hillside" farm. But it was as a writer on horticultural subjects that Mrs. Jack is most widely known. Her "Garden Talks" and other contributions to the press have much value, being the product of her own practical experience. Her handbook entitled "The Canadian Garden" is of especial value to Canadian gardeners.
Linus Woolverton.

1885. Mrs. Annie L. Jack.

Jaeger, Herman, pioneer grape-grower of the Ozarks and grape-breeder, was born in Brugg, Switzerland, in 1844, and died in 1896. He went to Missouri in 1867 and settled at Neosho, where, until 1896, he lived and engaged in viticulture. In Europe he was trained as a viticulturist. At Neosho, in 1869, he planted a large vineyard. It was composed largely of Concord and other eastern types of grapes. In 1873 "blight" (probably downy mildew) destroyed his crop of grapes. In 1874 he began spraying to control this blight or mildew, using sulfur, iron sulfate and copper sulfate He was undoubtedly the first to begin spraying for fungous diseases in this western section. This pioneer work in which he contemplated the use of fungicides, which became general with the introduction of bordeaux mixture a few years later, is an indication of his resourcefulness and his vision. The failure of eastern grapes to resist mildew turned his attention also to the native wild grapes of the Ozarks, which he observed to be resistant of disease. As a result, for a third of a century, he searched the Ozarks for promising wild forms. From these he originated many promising native seedlings and also crossed many of the latter with Concord and other eastern sorts. He advocated the use of the native post oak and summer grapes *Vitis Lincecumii* and *V. æstivalis* as the foundation stock upon which to build the future viticulture of the Ozarks. He originated upward of one hundred varieties worthy of trial in the neighborhood and many of his pioneer varieties have become the foundation stock upon which other grape-breeders base their work. He also observed that the native Ozark grapes were free from the phylloxera which threatened the grapes of his native Europe. He was one of the first to make use of this observation by propagating millions of cuttings and sending them to Europe where they were used as resistant stocks upon which to graft European varieties.

He wrote but little and shrank from giving the results of his work before horticultural gatherings. He taught by personal contact and by results attained. His acquaintances, during his life regarded him as the leading grape-breeder and viticulturist of the Ozarks.

J. C. Whitten.

Kennicott, John A., doctor and pioneer horticulturist, was born in 1800 and died in 1863. When the greater part of Illinois was a wilderness of grass prairie and when Chicago was a straggling village, Dr. Kennicott was planting shade and ornamental trees at his home. He was a leading spirit in the organization of the Cook County Agricultural and Horticultural Society in 1856, and held the first successful fair in 1857 on forty acres that later held solid blocks of sky-scrapers. This horticultural society was short-lived, but Dr. Kennicott did much to stir up the farmer and the fruit-grower to the possibilities wrappd up in horticulture in Illinois. He was a ready writer and a good talker; he was first president of the Northwestern Fruit-Growers' Association and president of the Illinois State Horticultural Society in 1861. Dr. Kennicott was well educated, painstaking and self-denying. He did much for Illinois horticulture and the present generation owes him a lasting debt of gratitude for his noble, far-reaching pioneer work in horticulture.

G. B. Brackett.

Kenrick, William, nurseryman and author, was born in 1795, and was the oldest son of John Kenrick, one of the pioneer American nurserymen. His father commenced his nursery in the year 1790 on Nonantum Hill, near the line of the towns of Newton and Brighton, Massachusetts, and on the very ground where the apostle Eliot began his labors for the Indians, under Waban, their chief. The raising of peach seedlings was the commencement of Mr. Kenrick's work. He soon acquired the art of budding, and thus offered named varieties for sale. In the year 1823 his son William became a partner in the nursery, and we find the first advertisement of the stock in the October number of the "New England Farmer" of that year. It named thirty varieties of finest budded peaches 5 to 8 feet high at 33⅓ cents each; ten varieties of European grapes; four American: Isabella, Catawba, Bland and Scuppernong; currants, horse-chestnut, catalpa, mountain-ash, lilacs, roses and a few other ornamental trees. It was stated that the trees would be packed with clay and mats. The son, William, appears to have assumed early control, having planted in 1823 two acres in currants alone. In 1824 they made 1,700 gallons of currant wine, increasing the amount to 3,000 gallons in 1825 and to 3,600 in 1826. Mr. Kenrick was an enthusiast in whatever he did, his extensive cultivation and introduction of the Lombardy poplar being an illustration of his sanguine temperament. A still more marked instance was his culture of the *Morus multicaulis* about the year 1835, and his advocacy of silk culture. For a time he found this to be a more profitable venture to himself than to his patrons. But it should be said that, however sanguine and confident were his opinions, they were honestly held and with no intent to mislead. In the year 1835, Mr. Kenrick published "The American Silk-Growers' Guide," a small treatise on mulberry-culture. In 1833 appeared the "New American Orchardist." This is a larger work, and is a full description of the fruits of that date. The author acknowledges his large indebtedness to other cultivators, especially to Mr. Robert Manning, of Salem, who published his "Book of Fruits" in 1838. Mr. Kenrick died in February, 1872.

Wm. C. Strong.

Kerr, Jonathan Williams, fruit-grower and nurseryman, was born in York County, Pennsylvania, in 1842. In 1867, after the Civil War, in which he was a Union soldier, he went to Maryland, where he made his home. Prior to his soldier's life, he had taught school. After more than fifty years devoted to horticulture, he died on July 31, 1913, of heart disease. Not only did he devote time to the growing of nursery stock for sale and of fruit for market, but spent much of his energies in the testing of new fruits and nuts to determine their value, especially in the Chesapeake Peninsula. He was one of the most diligent of watchers and students of nature as affected by art, his constant effort being to improve by cross-fertilization and selection those fruits, nuts and other plants that gave promise of being satisfactory either from the commercial or the amateur's standpoint.

This work involved an enormous amount of labor in collecting and trying out thousands of plum, apple, peach, and other fruit varieties, the plum receiving the lion's share of his study and effort. In this work, Mr. Kerr was perhaps the leading specialist in the development and improvement of our native plums. Whenever and wherever a variety of reputed superiority came to his attention he spared no pains or money to procure it and no efforts to give it a fair test. He passed careful judgment on more than 400 named varieties, the labor involved being as nothing compared to the pleasing and fascinating task he imposed upon himself. His farm at Denton, Maryland, was "a veritable little plum heaven" visited by other enthusiasts from all over the world.

Mr. Kerr also tested more than 400 varieties of apples collected with the object of ascertaining their adaptability to the peculiar conditions of the Chesapeake peninsula. The larger part of these were varieties of reputation established elsewhere, though many were comparatively new. He was also especially interested in nuts which could be grown in the peninsula—Persian and Japanese walnuts, chestnuts, chinquapins, filberts, pecans, and so on. At the time of his death, scores of experiments were still in process of completion.

At fruit-growers' meetings, more especially those of the Maryland State and the Peninsula Horticultural Societies, Mr. Kerr was one of the leading spirits. His intimacy with all branches of horticulture and his fluent speech combined with his dry humor and aptness of tongue made his remarks particularly pleasing, interesting and instructive. His writings are characterized by extreme conservatism and care.

M. G. Kains.

Kirtland, Jared P., doctor, pomologist and naturalist, was born in Wallingford, Connecticut, November 10, 1793 and died near Cleveland, Ohio, December 11, 1877. His love for nature and all living things manifested itself in his early boyhood, and he was familiar with the flowers, the trees and the birds around his home. His grandfather bequeathed him his medical library and the funds for a medical education. He was the first student to matriculate at Yale College for a course in the Medical Department. No branch of scientific study came amiss to him. Prominent in medicine, he was in every chosen department of science a teacher and a leader. In the geologic survey of Ohio he brought to bear his extensive and familiar knowledge of the flora and fauna, the pomology, ornithology and entomology of the state. Every department of life received his particular care. He filled the chair of Theory and Practice in the Ohio Medical College for some years with great ability. As far back as 1810 he was studying the seedling pear trees in the nurseries in northern Ohio, and was trying to solve the perplexing problem of pear blight. He grew many varieties of pears and by a series of hybridizing produced many new varieties of pears and more than thirty new varieties of cherries; among the latter are the noted Governor Wood, Kirtland's Mary, Black Hawk, Pontiac, Powhatan, Tecumseh, Osceola and Red Jacket. The varieties were introduced by Ellwanger & Barry, of Rochester, New York. The Governor Wood and the Rockport are the two varieties of all the long list that are today most widely cultivated. In 1874 the Ohio Horticultural Society, in its session at Akron, sent a vote of thanks to Dr. Kirtland at Cleveland for his success and skill as a cultivator of new fruits. He was one of the most distinguished men ever connected with the Society. He replied that his highest aspiration in this matter was to awaken and develop a love for horticulture in the youth of the state. He had been actively engaged in the great work since July 4, 1812, and at the time of this meeting had not wearied of the well-doing for a period of sixty-two years! The hybrids of fruit gave him many new varieties of rare excellence. His flower-garden—always an object of interest—contained many specimens rare and beautiful, native and exotic. He succeeded in grafting the sweet bay on the magnolia and the rare flowers and fine fruits were his special care. He was a careful weather observer, and took accurate observations many years before the United States Weather Bureau charted the country. G. B. Brackett.

Landreth, David, founder of the oldest seedhouse in America, was born in 1752 at Haggerston, Northumberland County, England. He came to America late in the eighteenth century, making Philadelphia his home, and establishing there, in 1784, a nursery and seed business. Its location, on what was then known as High Street, is now covered by the building 1210 and 1212 Market Street. The raising of trees and production of seeds were conducted on land nearby, particularly on a tract at Twelfth and Filbert streets. This locality proving too contracted for the purpose, the nursery and seed grounds were removed in 1789 to the "Neck," then considered far out of town, the place chosen being not far distant from the site of the present arsenal.

The younger David Landreth was born in Philadelphia in 1802. When of suitable age he entered actively into his father's business, which had considerably extended in Philadelphia, while a branch house had been opened in Charleston, South Carolina. The young man's early duty was that of manager of this Charleston branch. Of the Charleston business, it will suffice here to say that it continued till the era of the Civil War, when it came to a sudden end by the act of the Confederate States District Court, which confiscated the real estate and merchandise alike, on April 22, 1862. Burnet Landreth.

Landreth, David, the younger, in 1828 succeeded his father as proprietor of the well-established and thriving business in Philadelphia, a business which was to remain highly prosperous for half a century afterward under his fostering care. His time, however, was not wholly occupied with the details of business, but was turned at an early age toward the literature of husbandry and to enterprises of public interest. Among the latter may be mentioned the Philadelphia Horticultural Society, of which, in 1827, he was one of the founders and a vice-president, and in 1828 was elected corresponding secretary, which office he held for seven years. At a subsequent date he was made president of the Philadelphia Society for the Promotion of Agriculture, and vice-president of the United States Agricultural Society, and became an active member of many other organizations.

His literary labors included the publication of the "Floral Magazine," started in 1832, and an advanced work for that period (see page 1559). At a later date he wrote much upon husbandry, his graceful style as a writer and his technical knowledge of the subject making his views of much value in the progress of the industry. He edited an American edition of George W. Johnson's "A Dictionary of Modern Gardening," a volume of 635 pages, published at Philadelphia in 1847.

In 1847 the Landreth nursery was removed to Bloomsdale, Bristol, Pennsylvania, where Mr. Landreth established what is believed to be the most complete seed-farm in the United States, and where he planted an arboretum which for years stood unequaled in this country in the development of its trees. He was an early breeder of the Channel Island cattle, then styled Alderneys, and was among the earliest manufacturers of mowing and reaping machinery. In 1872–3 he experimented in steam-plowing with a Scotch engine, and in the following year with an American engine. Subsequently, steam-digging and steam-chopping were experimented with at Bloomsdale, and many improvements produced in the machine-shop of that model farm. In early life he had lived amid the plantations of the Landreth nursery, one of the show places of Philadelphia—the site now marked by the Landreth School—and his virtues and character were those of one brought up in intimate contact with nature. Burnet Landreth.

Legaux, Pierre (or *Peter*), an early vigneron, who made one of the first attempts to establish the wine-grape and to make wine in this country. From his plantation at Spring Mill, near Philadelphia, Dufour secured vines for the great experiment in Kentucky (see Bailey, "Evolution Native Fruits").

The following information about Legaux is taken from Samuel Gordon Smyth, in the "Philadelphia Press," September 10, 1899:

"At the close of the Revolution there appeared among the French colonists in Philadelphia a man of superior talents and reputation, a political refugee who sought the hospitable shores of America to escape the impending doom which afterward swept over France. Pierre Legaux belonged to an aristocratic family of ancient lineage in Lorraine. By the scanty light thrown upon his early personal history we have been able to learn that he was born and educated in Metz; had been a counsellor in the Parliament there; a patron of the arts and sciences, member of several foreign academies, besides enjoying the personal friendship, favor and confidence of his sovereign Louis XIV. Under the régime, Legaux had filled positions in the Government with honor and distinction. Prior to the time of his escape to America, he had been in the diplomatic service of the king at one of the French West Indian Islands, and it was while there, through the intrigue and malevolence of his official superior, that he was forced to fly Guadaloupe to save his life. We begin to hear of his presence among his compatriots of Philadelphia, about 1786. He was spoken of as distinguished for his culture, scientific accomplishments and gentility. Mingling with the best society and finding friends among the men who were shaping the destinies of the nation, Legaux allied himself with the foremost, partaking actively in public affairs and appearing with the dignitaries in the social functions which enlivened the metropolis of America. Citizen Legaux became a member of the American Philosophical Society in 1787, at a time when his doing so would indicate the close touch he had with the ablest men of the day. It was in February, 1786, when Pierre Legaux bought from Augustine Prevost, a fine plantation on the Schuylkill River near Spring Mill. The property called 'Mt. Joy,' contained 206 acres.

"Noting the remarkable growth, productiveness and sweetness of the native grapes which thrived so luxuriantly on the warm banks of our forest-bordered rivers, and confident of a great destiny for this country in the cultivation of the grape, he argued that these latitudes compared favorably with those of sunny France and Italy in climatic and physical conditions favorable to its introduction and development. With this aim before him, he proceeded to demonstrate his theories. Importing a lot of the best varieties of stocks from Europe, even from distant Africa, he began the growing of vines on his plantation in 1787. He set out several acres on the warm southern slopes of the farm and gave most careful attention to their propagation. He talked learnedly about them to those whom he met and impressed his views upon the large circle of friends who gathered about and watched the progress of his new venture. As we glance over the pages of the newspapers of a century ago and read columns of matter concerning the vineyard, one naturally wonders at its vast importance. In fact, the 'Letters of a Farmer,' the news of the Old World by the latest packet and events transpiring within the borders of the infant Republic seemed subordinate to the paramount interests of the viniculturists."

The Pennsylvania Wine Company was organized to take over the enterprise, the stockholders comprising prominent men of the time. But the venture fell on bad ways. Dissensions arose, and litigation followed. "The devoted but aged Legaux, humbled and chagrined, became like a hewer of wood and a drawer of water where once he had been a gentle and influential host. In these latter days, the Sheriff came and went,—for the property was saved to the family by John Righter, Legaux's son-in-law, who by dint of picking up the shares here and there and buying off the claimants and so on, kept the estate intact. But before this had been accomplished Pierre Legaux, harassed, disappointed, and even robbed by his malicious servants, annoyed by the petty persecutions of neighbors, misunderstood and maligned, finally succumbed to the combination, and the spirit of the once cultured and ambitious Frenchmen passed into eternity, September 25, 1827." He was buried at Barren Hill, Montgomery, Co., Pa.

Lewelling, Henderson, pioneer nurseryman, was born in Salem, North Carolina, April 25, 1809, of Welch ancestry. At an early date he removed to Ohio and there founded the town of Salem; he removed to Indiana in 1831, founded another Salem, and to Iowa, 1839, there founding the town of Salem, and being of a roving spirit and a horticultural turn of mind, he left Salem, Henry County, Iowa, April 1, 1847. He joined one of the first colonies of emigrants to cross the Rocky Mountains to Oregon, where he left to posterity the name of "Salem," now the capital of that great state. True to his native inclinations, he took with him on his long journey westward from Salem, Iowa, by wagon-box and ox-team, in carefully prepared soil, 700 trees, vines and shrubs, representing a large number of leading varieties of apples and pears, a few varieties of plums and cherries and one Isabella grape-vine and one gooseberry plant. His scheme to establish a nursery in the densely wooded Northwest was so bold as to be audacious and the trip by ox-team across the plains, on a hitherto untraveled route, was long and arduous. He was advised repeatedly that his undertaking was hopeless. The trip through dry, thirsty land and over lofty mountain ranges was accomplished about the first of October, and Mr. Lewelling arrived at the Dalles with most of the trees alive. From that point he proceeded by water route to the town of Milwaukee, where he established the first nursery in the Pacific Northwest. George Himes, historian of Oregon pioneer days says it is an unquestioned fact that no other importation made by the early settlers did so much to add to the wealth and income of the people of Oregon as did Henderson Lewelling's traveling nursery. Ralph Geer, also a pioneer of 1847, in later years said: "That load of trees contained health, wealth and comfort for the old pioneers of Oregon. It was the mother of all the orchards west of the Rocky Mountains, and gave Oregon a name and fame that she never would have had without it. That load of living trees brought more wealth to Oregon than any ship that ever entered the Columbia River." Henderson Lewelling removed to California in 1854 and lived quietly until the termination of his life, December 28, 1878.

G. B. Brackett.

Lewelling, Seth, was born in South Carolina, March 6, 1819, and died at Milwaukee, Oregon, February 21, 1897. He was joint owner of an orchard on Cedar Creek, near Salem, Iowa, with his brother Henderson, and remained in charge of this orchard until 1850 when he crossed the plains to Oregon and became partner in the business of Lewelling & Meek, Milwaukee, Oregon. The nursery was not at first a success owing to the lack of stock on which to graft; but in 1850 seeds were brought to the territory by Mr. Pugh, and these were purchased by Lewelling & Meek and in 1851 they grafted 18,000 trees, and these apple trees sold readily for $1 apiece, and plum, cherry, pear and peach trees $1.50 each.

Seth Lewelling began his horticultural career with the beginning of the fruit industry in Oregon. He lived to see the pioneer cabins replaced by stately mansions; he lived to see the squatter claims become flourishing orchards and fruit-farms; he lived to see the populous East buy fruit from Oregon by trainloads and amounting to many millions of dollars; all this in fifty years. He was a horticulturist of the old school but he was not averse to teaching the younger men the road to success. He sold fruit in San Francisco in 1851 at $1 a pound, and it was then that the sister state of California realized that the gold in the mines was as nothing compared to the revenue she could reap from fruit orchards. She has steadily planted and is now the leading fruit-growing state in the Union. Mr. Lewelling was the originator of a number of fruits that have added materially to the wealth of Pacific coast horticulture; among these are the well-known Black Republican and Bing cherries and the Golden prune. He records the fact that he saw no fruit pests in Oregon until 1880; this is true of all new countries; insect pests and fruit diseases seem to follow colonization. Mr. Lewelling was a prominent figure in the fruit industry on the Coast, and he was one of the last survivors of the four pioneers who started the first orchards in Oregon.

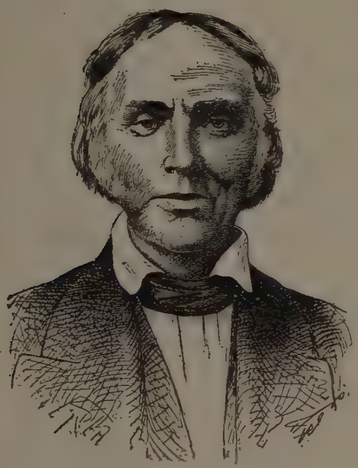
G. B. Brackett.

Lodeman, Ernest Gustavus (Fig. 1886), horticultural investigator and writer, was born in Neufchâtel, Switzerland, May 3, 1867, and died December 2, 1896, when connected with Cornell University, Ithaca, New York. His parents came to America when he was two years old, his father becoming, in 1870, professor of modern languages in the State Normal School of Michigan. The son entered the Agricultural College of Michigan, where he graduated in 1889. Modest and lacking in self-assertion, he needed encouragement and stimulus to

1886. Ernest G. Lodeman.

make a strong investigator and teacher. In a real estate venture in Florida, before his entering the Agricultural College, he became interested in agricultural problems and resolved to devote his life to them. In 1890 he undertook work as private assistant to the writer; and from this he became assistant and instructor in Cornell University. In the extension work amongst New York farmers he had charge of the investigations on grapes and strawberries. He was an originator of the spray-calendar idea. In 1896 he published "The Spraying of Plants," which is yet the fullest presentation of the subject. This was prepared after a most thorough traversing of the subject, both as author and experimenter, including a visit to Europe for the purpose of tracing the French history of the subject. He was an accomplished scholar, speaking German and French with fluency and possessing a working knowledge of other languages. His early death deprived American horticulture of a promising leader. L. H. B.

Longworth, Nicholas (Fig. 1887), (1783–1863) has been called the "father of American grape-culture." He was born in Newark, New Jersey. He early went to Cincinnati, then in the young and growing West, and engaged in banking and other business. He early became interested in agricultural affairs, and particularly in the grape. From John Adlum he received the Catawba, and became the means of making grape-growing a commercial success in the Ohio valley. He was a leader in the company of horticultural experts and writers which made Cincinnati famous in the middle of the century. Longworth was one of the first to perceive that many strawberries are infertile with themselves, and to suggest the planting of pollinizers, although the imperfect nature of the strawberry blossom had been known long before his time. He also introduced the Ohio Everbearing raspberry, the first improved variety of *Rubus occidentalis*. Longworth was a pioneer of horticulture in the expanding West, and more than that he was a guiding spirit in horticultural affairs of national importance. In 1846 he published a pamphlet on "The Cultivation of the Grape, and Manufacture of Wine. Also, Character and Habits of the Strawberry Plant." He also contributed a chapter on the strawberry to Buchanan's "Culture of the Grape." For further notices, see Hovey's "Magazine of Horticulture" 29:160, and Bailey's "Evolution of Our Native Fruits." The portrait in Fig. 1887 shows Mr. Longworth at seventy-four years of age. L. H. B.



1887. Nicholas Longworth.

Lord, Orville Morell, horticulturist and plum specialist, was born in the town of China, Wyoming County, New York, April 20, 1826, and died at Minnesota City, Minnesota, July 21, 1906. The Lord family moved to Lapeer County, Michigan, in 1842. After two years' training at a private school in Pontiac, Mr. Lord taught public school for four years in the country near his home. In 1852 he moved west with his family to Minnesota and was one of the first settlers in the Rollingstone Valley near Winona where he lived till his death with the exception of the years from 1861 to 1864 when he returned to a farm near Kalamazoo, Michigan. He was a member of the Territorial Legislature of Minnesota in 1853–4 and served in the State Legislature in 1873–4. He was active in many lines of public service throughout his life. In 1884 he became a member of the State Horticultural Society of Minnesota and was elected an honorary life member in 1899. He conducted a sub-experiment station for the society at his home for many years. He was considered one of the leading authorities in the Northwest on all lines of horticulture and enjoyed a national reputation as a plum specialist. He cultivated the well-known "Rollingstone" plum from a wild variety growing in the Rollingstone Valley. He also established several varieties of very good hardy apples. Mr. Lord was a lecturer on horticulture in the Minnesota Farmers' Institute for a number of years and also horticultural editor of "Farm, Stock and Home." He always carried on an extensive correspondence with other horticulturists all over the country. E. G. Cheyney.

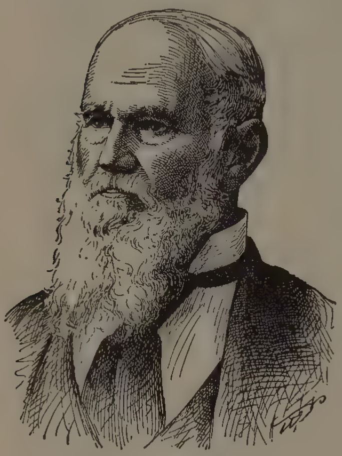
Lyman, Henry Martyn, pioneer horticulturist, was born at Easthampton, Massachusetts, September 13, 1828, and died at Excelsior, Minnesota, January 4, 1902. He was a descendant of Richard Lyman, who came to America in 1630 from England. Mr. Lyman received his education in the public schools and at Williston Seminary in Easthampton. His father died when he was fourteen years old and with the assistance of his mother and older brother he carried on the New England farm. Mr. Lyman came to Taylors Falls, Minnesota, in 1850. After remaining a year and a half, he returned to Massachusetts. In 1853 he came west again and landed at St. Anthony. He purchased an ox-team, a wagon and a little lumber and drove west to the site of the Lyman Homestead at Chanhassen, Carver County. He made this his home until his death in 1902.

Mr. Lyman was for years postmaster of one of the first post-offices in the county. He was interested in fruit-growing and planted the first apple trees in Carver County in 1853. These trees were not adapted to Minnesota and were winterkilled in 1856. In 1867 he planted more apple seed and from this lot came the "Lyman's Prolific" crab. From apple seed planted in 1876 and later came the Evelyn and other seedlings that are promising well for Minnesota conditions and are good keepers. Mr. Lyman was much interested in evergreens and early planted many varieties. He was one of the first settlers to realize their value as windbreaks and some excellent specimens are still to be found on the homestead.

In 1891 a trial station was located on his farm and is still in operation. He was treasurer of the State Horticultural Society in 1900. As a pioneer horticulturist, Mr. Lyman did very much to establish horticulture on a sound basis in Minnesota. Le Roy Cady.

Lyon, Theodatus Timothy (Fig. 1888), pomologist, was born in Lima, New York, January 13, 1813, and died in South Haven, Michigan, February 6, 1900. He was the son of a farmer. His school-going was very limited. In 1828, his parents went to the territory of Michigan, where he was employed in many pioneer pursuits, as farming, lumber-making, post-boy, tanner, merchant. He became more and more interested in farming, and in 1844 started a nursery on the farm at Plymouth, Michigan. He collected varieties from the local orchards, and found their names much confused. His interest was challenged, and gradually he became absorbed in a study of pomology, which in that day meant mostly knowledge of varieties. Articles on the varieties of Michigan apples in the "Michigan Farmer" attracted the attention of Charles Downing, and a correspondence and exchange of varieties resulted.

His name appears in the list of correspondents in the revised editions of Downing's "Fruits and Fruit Trees." For some years, Mr. Lyon was president of a railway company. In 1874, he moved to the "fruit-belt" of southwestern Michigan, where he became president of the Michigan Lake Shore Nursery Association, and where he lived until his death. The nursery association was not successful financially. In 1888, Mr. Lyon wrote a full (412 pages) and careful "History of Michigan Horticulture," which was published in the seventeenth report of the State Horticultural Society, a society of which he was president from 1876 to 1891, and honorary president until his death. In 1889, he took charge of the South Haven sub-station of the Michigan Experiment Station; and here, with his fruits and trees, he lived quietly and happily to the last.



1888. T. T. Lyon.

Mr. Lyon was one of the last of the older generation of pomologists. Like his colleagues, he was an expert on varieties. He was one of that sacred company which placed accuracy and cautiousness before every consideration of ambition or personal gain. His friends knew that he had not the temper of a commercial man. At one time it was said of him that he was the most critical and accurate of American pomologists. The fruit-lists of the Michigan Horticultural Society, his labors in revision of nomenclature for the American Pomological Society, and his various bulletins of the Michigan Experiment Station, show his keen judgment of varieties.

L. H. B.

McIntosh, John, originator of the McIntosh apple, was a farmer, born in 1777, near what is now known as the village of Dundela, in Matilda Township, Dundas County, Ontario, near the river St. Lawrence, and died in 1843. As a horticulturist he is noted only as the originator of the McIntosh apple. Little is known of his life, but the facts in connection with the McIntosh apple are as follows:

In 1796 he found growing in the clearing, a number of seedling apple trees. He took them home and planted fifteen or twenty of them in an orchard near his log house. One of these was named the McIntosh Red. The original tree lived until 1908. It was bearing apples until 1907, but its death was hastened by a hailstorm during that year. Ten years before it died it had been badly injured by a fire burning an adjacent building. The introduction of the McIntosh apple is mainly due to Allan McIntosh, the son of John, who was born in 1815 and died in 1899. He, during his long life, propagated and disseminated many trees, beginning the propagation in 1835. In 1912 a monument was erected on the old McIntosh homestead to commemorate the tree and its originator (see Vol. I, p. 317).

W. T. Macoun.

M'Mahon, Bernard (about 1775 to September 16, 1816), horticulturist, was born in Ireland and came to America, for political reasons, in 1796. He settled in Philadelphia, where he engaged in the seed and nursery business. He early began the collection and exportation of seeds of American plants. In 1804 he published a catalogue of such seeds, comprising about 1,000 species. He was the means of making many of our native plants known in Europe. He enjoyed the friendship of Jefferson and other distinguished men, and his seed store became a meeting-place of botanists and horticulturists. He was interested in all branches of horticulture. It is thought that the Lewis & Clark expedition was planned at his house. At all events, M'Mahon and Landreth were instrumental in distributing the seeds which those explorers collected. In 1806, he gave to America its first great horticultural book, "American Gardener's Calendar" which was long a standard cyclopedic work. The editor of the eleventh edition of this book (1857) makes the following reminiscence of M'Mahon:

"Bernard M'Mahon was no common man. He sought the American shores from political motives, as is understood. but what these were has not been determined; most probably it was necessary to fly from the persecution of government. He found American gardening in its infancy, and immediately set himself vigorously to work to introduce a love of flowers and fruit. The writer well remembers his store, his garden and greenhouses. The latter were situated near the Germantown turnpike, between Philadelphia and Nicetown, whence emanated the rarer flowers and novelties, such as could be collected in the early part of the present century, and where were performed, to the astonishment of the amateurs of that day, successful feats of horticulture that were but too rarely imitated. His store was on Second Street, below Market, on the east side. Many must still be alive who recollect its bulk window, ornamented with tulip-glasses, a large pumpkin, and a basket or two of bulbous roots; behind the counter officiated Mrs. M'Mahon, with some considerable Irish accent, but a most amiable and excellent disposition, and withal, an able saleswoman. Mr. M'Mahon was also much in the store, putting up seeds for transmission to all parts of this country and Europe, writing his book, or attending to his correspondence, and in one corner was a shelf containing a few botanical or gardening books, for which there was then a very small demand; another contained the few garden implements, such as knives and trimming scissors; a barrel of peas and a bag of seedling potatoes, an onion receptacle, a few chairs, and the room partly lined with drawers containing seeds, constituted the apparent stock in trade of what was one of the greatest seed-stores then known in the Union, and where was transacted a considerable business for that day. Such a store would naturally attract the botanist as well as the gardener, and it was the frequent lounge of both classes, who ever found in the proprietors ready listeners, as well as conversers; in the latter particular they were rather remarkable, and here you would see Nuttall, Baldwin, Darlington, and other scientific men, who sought information or were ready to impart it."

M'Mahon's name was given to west-coast evergreen barberries by Nuttall in 1818, and these shrubs are still known as Mahonias. See pp. 1511, 1518, 1521.

L. H. B.

Manning, Jacob Warren, nurseryman, was born at Bedford, New Hampshire, February 20, 1826 and died at Reading, Massachusetts, September 16, 1904. Until the age of twenty-one, he remained on his father's farm. At that time he went to Chelmsford, where he was engaged in farm, fruit and nursery work. In 1849, he became superintendent of the Winnesemitt Nursery at Chelsea, of which the proprietor was S. W. Cole. He remained here less than a year and until June, 1854, he was employed as a gardener in Dorchester, Massachusetts, Burlington, and Brattleboro, Vermont. At that time, he moved to Reading, where he established a nursery in his own name. He introduced many large and small fruits and ornamental trees and shrubs, prominent among which are the Rocky Mountain blue spruce (*Picea pungens*), the Cutter seedling strawberry, the Dracut amber grape, the John Sweet and the Granite Beauty apple. Mr. Manning made a specialty of evergreens and also established a large department of hardy herbaceous plants. He was a member of the Massachusetts Horticultural Society and the American Pomological Society for over forty years. He was also a member of the American Nurserymen's Association, the Massachusetts Fruit-Growers' Association and others. He served on many fruit committees, making exhibits in various parts of the country.

Manning, Robert (July 18, 1784, to October 10, 1842), was one of the most thorough and accurate of American descriptive pomologists. In 1823 he established his "Pomological Garden" at Salem, Massachusetts, for the purpose of collecting and proving varieties of fruits. At the time of his death this garden contained more varieties of fruits than had ever been collected in America. Pears were his specialty, but he had all the fruits which would thrive in his climate. These fruits numbered nearly 2,000 varieties, of which about one-half were pears. These varieties were gathered from all parts of this country, and also from Europe. The new pears of Van Mons, the Flemish scientist and propounder of a theory of plant variation (see "Survival of the Unlike," Essay V), were introduced largely by him. He also received valuable acquisitions from Robert Thompson, of the fruit department of the London Horticultural Society. In 1838, Manning published at Salem his "Book of Fruits, being a descriptive catalogue of the most valuable varieties of the pear, apple, peach, plum and cherry for New England culture." It also contained bush-fruits, grapes and hardy trees and shrubs. It was published as "First Series for 1838," which indicates that its author intended to issue other parts. All the descriptions were drawn from the fruits themselves. The book was illustrated. In this work he was assisted by John M. Ives; and Ives made a second edition of the work in 1844 under the title "The New England Fruit Book," and a third in 1847 as "New England Book of Fruits." At this day it is difficult to appreciate the work of a man like Manning. In those days, varieties were all-important. The scientific management of orchards had not yet arisen. Varieties were confused. Manning and his compeers opened the way for correct nomenclature and systematic pomology, and established the idea of testing varieties. His decisions on nomenclature were accepted as final. He was one of the founders of the Massachusetts Horticultural Society. For a reference to the position of Manning's work in our history, see page 1522; also Tilton's "Journal of Horticulture," 7, pp. 157, 158.

L. H. B.

Manning, Robert, Jr., was born at Salem, Massachusetts on July 6, 1827, and died on February 17, 1902. He and his brother, Richard, succeeded their father in the work of the "Pomological Garden." In 1869, he was appointed editor of Tilton's "Journal of Horticulture," which position he held until this magazine was discontinued in 1871. He was Secretary of the Massachusetts Horticultural Society for twenty-six years. Under his editorship, the "History of the Massachusetts Horticultural Society" was completed in 1880. For a fuller account, see the "Cyclopedia of American Agriculture," Vol. IV, p. 594.

Meehan, Thomas (Fig. 1889), writer, editor, state botanist, vegetable biologist, legislator and nurseryman, was born in London, England, March 21, 1826. He died at Germantown, Philadelphia, November 19, 1901. His father, Edward Meehan, was head gardener for Col. Francis Vernon Harcourt, at St. Clare, near Ryde, Isle of Wight, and there Thomas spent his boyhood. He was self-educated, acquiring Latin, Greek, French and the elements of botany by studying at night.

Mr. Meehan's first published paper was at the age of twelve on the production of double-flowered stocks from single. His first scientific discovery published was on "The Sensitive Nature of the Stamens of the Portulaca," at fifteen years of age. At the same age, he produced St. Clare, the first hybrid fuchsia known to the horticultural world. Numerous scientific papers followed, resulting in his being elected member of the Royal Wernerian Society of Edinboro, without making application or the Society being aware that he was a boy. Thomas Meehan became a student at Kew Gardens, and after graduation came to America, landing on his twenty-second birthday. Here he was employed by Robert Buist, Sr., in Philadelphia; was superintendent of Bartram's Gardens, and later gardener to Caleb Cope, Holmesburg, and while there flowered the *Victoria Regia*, the second time blossomed in America. In 1853, he established Meehan's Nurseries, afterward famous for their fine collection of American trees. He was sole editor of the "Gardener's Monthly" for the thirty years of its life, beginning in 1859 (p. 1559). He founded "Meehan's Monthly" in 1891, which survived him. For sixteen years he was agricultural editor of "Forney's Weekly Press," and at one time was agricultural or horticultural editor or regular contributor to more than half a dozen weekly and monthly papers and magazines. For thirty years he was the regular scientific editorial contributor to the "New York Independent." He was appointed State Botanist by Governor Hoyt and held that position until his death. For many years he was a member of the Board of Visitors of Harvard University. He was a prolific contributor to the publications of the Academy of Natural Sciences of Philadelphia, of which institution he was senior vice-president for twenty-three years; to the proceedings of the American Association for the advancement of Science, of which he was one of the early Fellows, and to the American Philosophical Society, the Pennsylvania Horticultural Society, the Pennsylvania Agricultural Society, in all of which he was an active member. He was recognized as the leading vegetable biologist of his day. He was the originator of the doctrine of evolution that self-sacrifice plays as important a part in nature and evolution as the struggle for existence and the survival of the fittest. For his scientific attainments in horticulture he was awarded the Veitch medal by the Veitch Memorial Fund of England, the third American so honored. He was the author of "Native Flowers and Ferns of the United States." He was elected a member of the Common Council of Philadelphia in 1882, and was reëlected biennially thereafter as long as he lived. As councilman, he inaugurated a movement for numerous small parks in Philadelphia. He was a member of the Germantown school board for eighteen years, and during that period secured the establishment of seven new schools, two exclusively for colored teachers. Other of his activities that may be mentioned are as follows: He

1889. Thomas Meehan.

discovered the Englemann Cañon in the Wasatch Mountains; in Alaska, he discovered the movements of plants in connection with the movements of glaciers; at the close of the war, he went South as a member of a committee to restore confidence and business relations between the two sections; he made what is supposed to be the first complete list of plants in Kew Gardens, over 1,600 plants being recorded; he was largely instrumental in the establishment of the Department of Forestry in Pennsylvania.

W. E. Meehan.
in Cyclo. Amer. Agric.

Miller, Samuel, pioneer plant-breeder, horticultural writer and plant-disseminator, was born at Lancaster, Pennsylvania, in 1820, and died at Bluffton, Missouri, in 1901. At Calmdale, Pennsylvania, he began the breeding of grapes, about the time of the introduction of the Concord. In 1867 he removed to Bluffton, Missouri. Here he brought together a notable collection of the various types and varieties of fruits and ornamentals. He did notable work in testing the adaptability of varieties to the central West, and his advice as to what sorts to plant in this section was sought by horticulturists, not only in Missouri but in surrounding states. Scores of plant-breeders sent him their new varieties to be tested, knowing that he would not only express a frank and honest opinion but that his judgment was sound, due to his extensive acquaintance with existing varieties. In addition to his work in introducing and testing varieties originated by others, he gave an important share of his time and energy to plant-breeding, most notably with grapes. No less than half a dozen varieties of his grapes have found a place in our pomological list, among them Martha, Black Hawk, Eva and Louise. He was an advocate of close breeding, for the reason, expressed by him, that his hybrids "broke up into many forms, giving uncertain results," while his close-bred seedlings, particularly of Concord and its descendants, "gave a large percentage of promising sorts." He originated the Captain Jack strawberry, which for two decades was largely used as a pollinator of Crescent in the berry fields of the West. During the later years of his life he was engaged in the amelioration of the native persimmon, of which he propagated a score of promising sorts, among them the Josephine.

For a third of a century Judge Miller was an officer of the Missouri State Horticultural Society, modestly declining to accept its presidency, often tendered him by its members. The annual reports of this organization contain many papers by Judge Miller. For a third of a century he also contributed regularly to the horticultural columns of "Coleman's Rural World." His writings are clear and sound. They were a distinct contribution to the horticulture of the author's generation.

J. C. Whitten.

Moon, James, and his descendants, have been of importance in the development of ornamental horticulture in America. Descended from English parentage, James Moon came to America in 1681 and purchased a tract of land near Morrisville. His grandson, also James Moon, took up a large tract in Bucks County, Pennsylvania, in 1749, and devoted a part of his time to the raising of fruit trees. Records of his transactions as early as 1769 are still in possession of the family, although no extended commercializing was attempted by any of the decendants until 1849, when Mahlon Moon purchased a tract near the Delaware River at Morrisville, Pennsylvania, and engaged in the nursery business, issuing his first catalogue in that year. With no desire for an extensive business, he laid substantial foundations for promoting a more general planting of ornamental trees and from the start largely specialized in these. He was the originator of the Numbo chestnut and introducer of *Exochorda grandiflora* and *Azalea amœna*, all of which he propagated very extensively. Mahlon Moon was born 1814 and died 1887.

Wm. H. Moon, oldest son of Mahlon Moon, was born in the nursery homestead of his father, Morrisville, Pennsylvania, 1849, and after completing his education continued for a time in the business of his father, but in 1872 established nurseries of his own in the same community, putting a strong spirit of commercialism into his business and from the first specializing in ornamental trees, especially in evergreens. He was probably one of the first persons to make a strong plea for more extensive use of this valuable class of trees and did more than any one man to promote new methods of culture and development into plants of individual merit and perfect outline. The business which he had thus started in a small way grew steadily through his persistent efforts until the time of his death in 1911. With his business activities Wm. H. Moon always found time to take a keen interest in affairs aside from his business. He was much interested in educational matters, giving his time and interest for their benefit. He was an active member of the Pennsylvania Horticultural Society and for seven years its president. In 1905 he was very active in founding the Pennsylvania Nurserymen's Association and was its first president. He was also a member of the National Nurserymen's Association and was one of the organizers of the Ornamental Growers' Association. His strong desire from the time of engaging in business was to put the utmost commercialism into horticulture and he was rewarded by the very extensive growth of his business.

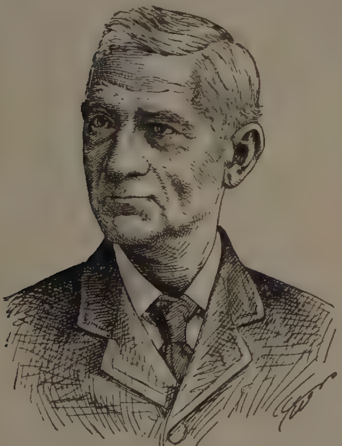
Samuel C. Moon (1854–1911), the second son of Mahlon Moon, continued the nursery business established by his father. He was a thorough lover of horticulture and his trees were his friends, his home being surrounded with many rare specimens planted by his father or collected and established by his own hands. His main development was in the line of ornamental horticulture, of which he was a rare student, contributing frequently to literature on the subject and occasionally addressing audiences on plant life. He was an authority on evergreens. Samuel Moon devoted many years to the best welfare of his community. He was active in educational and religious work. At the time of his death Samuel Moon was president of the Pennsylvania Nurserymen's Association.

Henry T. Moon.

Moore, Jacob, pomologist, was born at Brighton, New York, in 1836. His life-work was the development of new fruits, which he produced in large numbers by scientific plant-breeding. He was the originator of the Diploma currant, Red Cross currant, Hooker strawberry, Brighton, Diana-Hamburg and Moore's Diamond grapes, Barr Seckel pear and thousands of other fruits which have enriched the fruit-growers of America many thousands of dollars, but which brought him hardly a sufficient pittance to keep body and soul together. He also expended a competent private fortune in the work. He passed much of the late years of his life in trying to secure congressional legislation that would protect originators of fruit varieties, but his efforts were, unfortunately, without avail. Mr. Moore was a member of the Western New York Horticultural Society for nearly fifty years and was widely known among horticulturists. He died at Canandaigua, New York, in the winter of 1908.

G. B. Brackett.

Munson, Thomas Volney (Fig. 1890), nurseryman, grape-grower and author, was born September 26, 1843, near Astoria, Illinois, and died January 21, 1913. He received his education from the public schools of Illinois, the academy at Lewiston, Bryant-Stratton Business College and the University of Kentucky. In 1906 the University of Kentucky conferred upon him the degree of D.Sc. Dr. Munson located at Denison, Texas, where all his industrial, scientific and literary work was done. He established one of the most famous vineyards in the South, besides building up a reliable and well-known nursery business. He was the acknowledged authority on the native wild grapes of North America, and Bulletin No. 3, Division of Pomology, United States Department of Agriculture, "Classification and Generic Synopsis of the Wild Grapes of North America," which he wrote and which was published in 1890, is one of the most painstaking pieces of botanical work ever done in this country. It made the way for his later and greater work on "Grape-Culture." His horticultural and scientific work in hybridizing and perfecting the American Vitis won for him a diploma from the French Government in 1888, and the decoration of the Legion of Honor with the title of Chevalier du Merit Agricole for the aid he had rendered France in viticultural matters. He was also a member of the American Academy of Science, the National Agricultural Association of France, vice-president of the American Pomological Society, member of the American Breeders' Association, the Association for the Advancement of Science, and vice-president of the Texas Horticultural Association. In 1903–4 he was a member of the Texas World's Fair Association and the chairman of the committee of Texas Industrial Institutes. He was also a member of the jury of awards at the St. Louis Exposition in 1904 and an honorary member of the American Wine-Growers' Association and also a vice-president of the Society for Horticultural Science.



1890. T. V. Munson.

The most complete botanical display of the whole grape genus ever made was prepared by Dr. Munson and exhibited at the World's Columbian Exposition, Chicago, in 1893. This collection, now in the United States Department of Agriculture, will ever be a striking record of his wonderful patience, painstaking care and skill. His splendid book "Foundations of American Grape-Culture" is regarded as the most practical, complete and satisfactory account of the American grape yet issued, and is a lasting monument of his zeal, energy and scientific investigation. He knew the philosopher's stone, and left a last message to mankind to the effect that each individual should strive to be as useful and as free from blemish as a tree or a flower.

G. B. Brackett.

Nelson, A., pomologist, was born in Oneida County, New York, September 8, 1830, and died at Lebanon, Missouri, November 10, 1901. His early years were spent on a farm, where he always took great interest in horticulture. In 1858, he moved to Buffalo, where he engaged in the grain and coal business. After twenty-five years residence in that city, he went to Lebanon, Missouri, as an agent of the Ozark Plateau Land Company. Mr. Nelson was a very enthusiastic horticulturist, and was particularly interested in apples, being an authority on the varieties. He contributed to all the great fruit exhibits of the state, and for many years was treasurer of the Missouri State Horticultural Society. For portrait, and a fuller account, see forty-fourth report of Missouri Horticultural Society, of 1901.

Newman, James Stanley (Fig. 1891), was born December 11, 1835, in Orange County, Virginia. He passed his early life on the farm, working under the direction of his father, a highly educated and skilful agriculturist. In a private home school he was prepared for the University of Virginia where he studied four years, 1855–9. He served as a Confederate soldier in the Thirteenth Virginia Regiment. From 1865 to 1875, he farmed and taught; from 1875 to 1883 he was connected with the Georgia State Department of Agriculture, preparing publications, collecting agricultural statistics, and directing experiments. For nine years, he was professor of agriculture and director of the experiment station of the Alabama Polytechnic Institute, and for three years president of the Alabama State Agricultural Society. For over twenty-five years he was a life member of the American Pomological Society.

1891. J. S. Newman.

When Clemson College, at the old farm home of Jno. C. Calhoun, was organized in the early nineties, Colonel Newman was elected professor of agriculture and director of the agricultural department of that institution. He resigned in 1894, and ran a truck farm near Atlanta until July, 1897, when he was called back to Clemson College, where he served as professor of agriculture and director of the agricultural department and vice-director of the South Carolina Experiment Station, and (for three years) director of farmers' institutes, until his resignation in July, 1905.

Colonel Newman was the author of "The Southern Gardener's Practical Manual" and of several other useful works on agriculture and live-stock.

The last five years of his life were passed, as he had often expressed a wish they might be, in his own home, amid the fruits and flowers he loved so well. He was widely known in the South Atlantic States as a pioneer in the cause of the new agricultural education and uplift. He died at Walhalla, South Carolina, May 11, 1910.

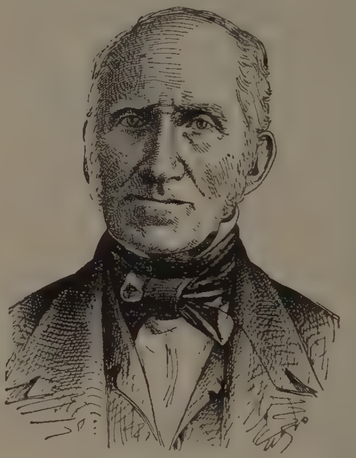
Wm. S. Morrison.

Olmsted, Frederick Law, landscape architect, was born April 26, 1822, at Hartford, Connecticut, and died August 28, 1903. He was educated in private schools, with private instructors in surveying and civil engineering. He was a special student at Yale College, a working student on crack farms, with seven years' farming on his own farms. He took several trips abroad for study of many parks and fine private places. He was superintendent and landscape architect of Central Park practically in partnership with Calvert Vaux, a young English architect who had been associated with Andrew Jackson Downing (in his time the leading landscape gardener of the United States) most of the time from 1857 to 1878. From 1865 to 1872, he was in partnership with Mr. Vaux and F. C. Withers, then alone, and later with various other partners. Some of his principal works were the parks of New York, Brooklyn, Buffalo, Chicago (South Parks), Milwaukee, Rochester, Louisville, Boston, Detroit, and many other cities and towns, the United States capitol grounds at Washington, World's Fair at Chicago, the great estate of George W. Vanderbilt at Biltmore, North Carolina, and the grounds of many public and semi-public institutions and of private individuals. He wrote a number of standard books of travel and he did a large amount of technical writing, most of which is scattered in the files of park commissions and other public and semi-public boards, and in periodicals, encyclopedias, and reports to owners of private estates. While he was familiar with the architectural and engineering, arboricultural and horticultural branches of his profession, and often designed the minutest details, yet in general, it was his practice himself to evolve the general designs for works of landscape architecture and to direct partners, assistants, superintendents, engineers and gardeners, working intimately and sympathetically with him, in the elaboration of general plans, working drawings, specifications and in superintendence. In this way he was associated in design with scores of architects, engineers, landscape gardeners and other technical men so intimately that in many cases it would be impossible to distinguish where the work of his assistants began and his ended. In the execution of his ideas in landscape planting, for example, he was assisted in the work on Central Park by Ignaz A. Pilat, and during the second period of his employment by W. L. Fischer, who also worked under his direction on the Boston parks; on the Brooklyn parks by O. C. Bullard; on the Buffalo parks by William McMillan; on the United States Capitol grounds by William Cogan, and on many other parks, grounds of institutions and of private individuals by Warren H. Manning, and so on. Mr. Olmsted took the greatest interest in and secured the adoption of what may be called the naturalistic style of planting, confining the use of the architectural style of planting almost invariably to gardens in close connection with important public or semi-public buildings or private residences. He may fairly be said to have been the originator in this country of the extensive use of shrubbery borders and masses as a main feature of landscape planting instead of planting individual shrubs as mere decoration. His influence throughout the whole country has been very great, as shown by the adoption by a host of imitators of the irregular, informal, picturesque or naturalistic landscape style, with the prevalence of curvilinear roads, walks, and the like. Some of these imitators often applied this style where it was distinctly inappropriate and where the formal or architectural style should have prevailed, as in the grounds of several universities and other semi-public institutions having usually large buildings. For portrait and further details, see "Cyclopedia of American Agriculture," Vol. IV, p. 601. JOHN C. OLMSTED.

Parsons, Samuel B., nurseryman, landscape gardener and author, was born in New York City, February 14, 1819, and died at Flushing, New York, on January 4, 1906. In 1899, he established a nursery with his brother Robert at Flushing, giving special attention to the introduction and propagation of ornamental trees and shrubs. They were the first nursery firm to introduce the Japanese maples and also to propagate rhododendrons in the United States. Mr. Parsons was an expert landscape gardener and the author of numerous essays on this and related subjects. He was also the author of a book on "The Rose, its History, Poetry, Culture and Classification." He was a charter member of the American Pomological Society and an honorary member of the Massachusetts Horticultural Society from 1856. For a fuller account and portrait, see "Cyclopedia of American Agriculture," Vol. IV, p. 602.

Pettit, Murray, fruit-grower, was born on March 13, 1843, at Saltfleet, Ontario, Canada, and died at Winona on March 3, 1910. On reaching manhood, he engaged in farming, in 1872 taking up fruit-growing as a specialty. He first took up the growing of peaches, and later branched into the culture of apples, pears, plums and grapes. He was particularly distinguished as a grape specialist, and was one of the first to plant Niagara grapes in Ontario. He carried on a number of experiments with grapes and other fruits and in 1894 was appointed director of the Experimental Station at Winona, which office he held until his death. Mr. Pettit was always among the first to take up new ideas, and was the third man in Ontario to use the spray-pump. He was very active in all the local fruit-growers' societies and a member of the Ontario Fruit-Growers' Association, having at one time served that body as president for a period of two years.

Prescott, Charles Rammage (Fig. 1892), pomologist, was born of Loyalist parents in Lunenburg County, Nova Scotia, the latter part of the eighteenth century. He was a successful merchant for many years in Halifax, but in 1812 closed his business and moved to the Annapolis Valley near Wolfville, Kings County, where he bought a farm and developed a fine estate. The old house still stands in good repair, though the gardens, orchards and vineyards, once the pride of the province, have largely disappeared. The work for which he is especially remembered is the introduction and dissemination of choice varieties of fruits. He is credited, among apples, with the introduction of Ribston, Blenheim, Gravenstein, Baldwin, Rhode Island Greening and Northern Spy, six out of the ten leading commercial varieties of the province today. The list of his introductions among other fruits is almost equally important. He was very generous with cions from his trees, and many of the earlier orchards of the province can be traced directly to his influence. He died in the autumn of 1859. F. C. SEARS.


1892. Chas. R. Prescott.

Prince, William, the second proprietor of the Prince Nursery at Flushing, Long Island, was born about 1725 and died in 1802. The nursery, which was perhaps the first large commercial one in America, was established about 1730 by his father, Robert Prince.* The Huguenots who settled at New Rochelle and on the north shore of Long Island brought with them a variety of French fruits, and the interest thus created in horticulture resulted in the establishment of his first nursery. For a number of years attention was confined chiefly to the fruit trees with which to stock the new country, and it was only when more settled conditions came that the culture of ornamental trees and shrubs was introduced. Under William Prince, the nursery grew rapidly in importance until the Revolution. A return of peace brought with it increased trade, to make good the depredations of the soldiery as well as to restock the orchards of those who for seven years had paid more attention to the science of war than to the pursuits of horticulture; and a catalogue of 1794 contains as many varieties of fruit as those of some nurseries of the present, apricots and nectarines, for example, each being represented by ten varieties.

Not only was everything of merit imported, but the origination of new varieties by a careful selection of seedlings was enthusiastically conducted. Two plums, still well known, date from this period, Prince's Yellow

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*The founding of the establishment is usually attributed to William Prince, rather than to his father Robert. Page 1517.

Gage being originated in 1783 and the Imperial Gage in 1794. The "Treatise on Horticulture" mentions that in 1790 no less than twenty-five quarts of Green Gage pits were planted, from which seedlings were obtained of every color and shape, it being probable that the Washington plum was originated in that year. Before the death of this William Prince, the nursery business had been taken up by his sons, William and Benjamin; the former on new ground, called the Linnean Botanic Garden and Nursery, the latter at the original place, called The Old American Nursery. L. B. Prince.

Prince, William, third proprietor of the Prince Nurseries at Flushing, was born November 10, 1766, and died April 9, 1842. During his lifetime, the Prince Nursery was one of the centers of horticultural and botanic interest in America, and reached the height of its fame. He continued the work of his father in the introduction of all foreign trees and plants of value, the discovery of unknown American species and the creation of new varieties from seed. One of the trees introduced to great popularity by William Prince was the Lombardy poplar. In 1793, he bought additional property of 80 acres at Flushing. For fully fifty years, the nursery was conducted much less for profit than from a love of horticulture and botany. It was designed to contain every known kind of tree, shrub, vine and plant known to England and America that possessed any horticultural merit. The catalogues from 1815 to 1850 ranked among the standard horticultural publications of the country. The number of varieties of fruits cultivated seems scarcely credible in these days, when many nurseries are conducted solely for profit, and only the trees or plants which find a ready sale are propagated. In 1828, Mr. Prince wrote and published the "Treatise on Horticulture," which was the first work of the kind produced in America. L. B. Prince.

1893. Wm. Robert Prince.

Prince, William Robert (Fig. 1893), fourth proprietor of the Prince Nursery at Flushing, was born November 6, 1795, and died March 28, 1869. He inherited his father's love of botany and his great energy. He was connected with the American Institute, National Pomological Society, Massachusetts Horticultural Society, and many other important organizations, in whose transactions he took a prominent part. In 1830 he wrote, with the assistance of his father, the "Treatise on the Vine," a work of high importance. In 1831 he issued the "Pomological Manual" in two volumes, an important treatise on all fruits except apples. In 1846 he published the "Manual of Roses."

In his early manhood, Mr. Prince botanized through the entire line of Atlantic States in company with Professor Torrey, of Columbia, and Professor Nuttall, of Harvard. The oldest cedar of Lebanon in the United States, as well as the oldest Chinese magnolias, salisburias, Mt. Atlas cedars, paulownias and purple beeches are to be found today in the grounds of the Prince homestead, together with many other unique specimens. When the disease of the Irish potato caused a fear that it would have to be replaced by some other vegetable, he imported the Chinese yam or potato (*Dioscorea Batatas*), paying $600 for the tubers. About the same time he introduced sorghum, or Chinese sugar-cane. He was unwearied in his endeavors to promote silk-culture in the United States. He imported not only the silk-worms but the mulberry trees to feed them, and built a large cocoonery for their accommodation. L. B. Prince.

Pringle, Cyrus Guernsey (Fig. 1894), plant-breeder and botanist, was born in Charlotte, Vermont, May 6, 1838; died in Burlington, Vermont, May 25, 1911. He early devoted himself to horticultural and botanical lines of study and work. In the late sixties, he converted the home farm into a nursery, specializing on hardy bulbs, and had growing at one time over one hundred species and varieties of Iris and nearly all known species of Lilium. From the more usual types of plant-culture, he turned to the then relatively new field of plant-breeding. He first worked with the potato, later with the cereals, garden vegetables and fruits. During the decade 1869–79, he devoted practically all his attention to this work with rare skill, insight, and success. Among his many productions the following are notable (see article by Wm. Stuart in "The Country Gentleman," June, 1905): Potatoes—Snowflake (Early Rose × Excelsior, introduced 1873), Alpha (Early Rose × Sebec, introduced 1874), Ruby (Early Rose × White Peachblow, introduced 1875), Trophy (Early Rose × Excelsior). Tomato—Conqueror. Wheats—Defiance (Gold Drop × White Hamburg, introduced 1877), Grandee (Little Club × Lost Nation), Champlain (Black Sea × Gold Drop, introduced 1879), Green Mountain, Pringle's Nos. 5 and 6: Oats—Pringle's Progress, Pringle's Hulless, American Wonder.

1894. Cyrus Guernsey Pringle.

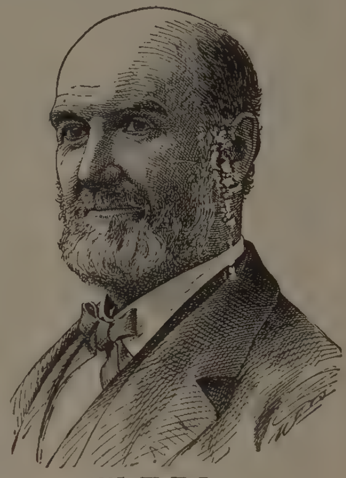
He was at the same time training and inspiring others in this work and generously distributing his hybridized potato seed. This early work entitles him to a leading place among the pioneer plant-breeders in America, and he would no doubt have continued in this field and become one of its greatest leaders had not family griefs driven him from home. He then, following the advice of Asa Gray, turned to botanical explorations. He secured many of the specimens for the Jesup collection of North American woods in the American Museum of Natural History, New York City, the finest collection of its kind in existence, together with much of the field data on the distribution of the forest trees for the "United States Census Report" of 1880. He had previously begun collecting Vermont plants for Dr. Gray and soon achieved a world-wide reputation as the "prince of botanical collectors." His journeyings extended from northern New England into Canada, across the Continent to the Pacific mountain regions and southward into Mexico. For twenty-six years, his work was chiefly in the latter country, continued under the patronage of the Mexican Government, the United States National Museum and other scientific institutions, and especially supported by Harvard University, on the botanical staff of which he was in 1893 appointed official collector by act of the Corporation. As a result of it, he not only enriched the leading herbaria of the world with extensive sets of choice specimens, especially of Mexican plants, but he amassed one of the largest and unquestionably the best private collections ever made. The Pringle Herbarium, of over 150,000 choice specimens, will remain his most fitting monument. During the last ten years of his life, he was Keeper of the Herbarium of the University of Vermont, and the Pringle Herbarium remains the property of that institution. L. R. Jones.

Purdy, A. M., horticulturist and author, was born in Macedon, Wayne County, New York, May 31, 1835, and died January 4, 1908. His father was a merchant in Macedon, but the son preferred outdoor life and in his boyhood was intensely interested in the raising of fruits and flowers. He was educated in the common school of Macedon Village, the Macedon-Center Academy, and at the Nine Partners Boarding School near Poughkeepsie, New York. In early manhood he went to South Bend, Indiana, where he engaged in growing fruits for about twelve years. Near the year 1865 he returned to New York state and purchased a farm on the Canandaigua road three miles south of Palmyra, and again engaged in growing fruits and nursery stock. On that farm over forty years of his life were spent, with the exception of three years' residence in Rochester. Soon after moving to New York State he began the publication of "The Fruit Record and Cottage-Gardener" and continued to issue the paper for over twenty-five years. He also published a small book entitled, "The Fruit Instructor." They were well received and many thousands sold. He also published as premiums three or four excellent fruit and flower chromos.

Mr. Purdy was a great worker, energetic, working early and late, and was a frequent contributor to agricultural and religious journals. He always took a great interest in politics and public affairs, and gave of his time and money for the advancement of the principles he thought to be right. He was a member of the Society of Friends (Quakers), and was recorded as one of their ministers. Wm. W. Miner.

Ragan, Reuben, pioneer nurseryman and pomologist, was born in Louisa County, Virginia, on October 6, 1793, and died August 19, 1869. Left an orphan at an early age, he was indentured by the Orphan's Court to Elisha Thomas, a Shaker, but the indenture was soon revoked. He was then apprenticed to a tanner. Through his early association with Edward Darnaby, a nurseryman, Reuben became interested in horticulture and determined to devote his life to this pursuit. He established a nursery in Indiana in 1820, from which he disseminated many hardy varieties of fruit around the state. Mr. Ragan was a charter member of the Indiana Horticultural Society and a leader in the pomological work of the state. For portrait and fuller accounts, see "Report of Indiana State Horticultural Society," 1870.

Ragan, William Henry (Fig. 1895), nurseryman, horticulturist and pomologist, was born on March 29, 1836, in Putnam County, Indiana. His father obtained land from the government by entry in 1822, and was widely known as a pioneer nurseryman, fruit-grower and horticultural enthusiast. William Henry Ragan grew to young manhood amid the primitive conditions of pioneer days, helping his father in the nursery work and engaging in the usual pursuits of the farm boy. His formal education was all received at the local log schoolhouse of the district. About the year 1860, he engaged in the nursery and fruit business on land he purchased near Fillmore. From 1869 to 1871 he was in the fruit business in Indianapolis, having formed a partnership with John Wineberger of that city. In 1871 he moved to Clayton, Indiana, and continued in the nursery business with his cousin, W. A. Ragan, as partner. In 1881 he became a trustee of Purdue University. In 1883 he was appointed superintendent of the experimental station at the University and for a few months later in the same year acted as superintendent of the campus and weather station. He left Purdue University in 1884 to accept the chair of practical horticulture and the position of superintendent of parks at DePauw University, Greencastle, Indiana, which was in that year reorganized from the Indiana Asbury Academy. He had disposed of his nursery business on leaving Clayton and purchased property at Greencastle where he lived until 1899, leaving to accept a position in the Department of Agriculture at Washington. He became assistant pomologist and expert in pomological nomenclature in the Bureau of Plant Industry and won a world-wide reputation, not only for his wonderful work in nomenclature, but for his numerous other written contributions and for his personal services in the advancement of horticulture. He continued his work with the Bureau of Plant Industry until his death, which occurred in Washington, D. C., August 6, 1909.


1895. W. H. Ragan.

During his later years, William Henry Ragan was one of the foremost and best-loved figures among the horticulturists of the country. He was one of the founders of the Indiana Horticultural Society and continued his active membership until his death. He was secretary of this organization from 1869 to 1882 with the exception of 1873, and again from 1891 to 1895 inclusive. He became a trustee of Purdue University for the second time in 1888 and served until 1892. He was superintendent of the Division of Pomology at the Cotton Centennial at New Orleans in 1884–5 and served as secretary of the Committee on Awards in the Department of Horticulture at the Columbian Exposition at Chicago in 1893. He was secretary of the Mississippi Valley Horticultural Society in 1883–4 and, when the name of the organization was changed, continued the same work for the American Horticultural Society until 1888. From 1897 until his death he was chairman of the Committee on Revision of Catalogue of Fruits for the American Pomological Society. As a member of the Indiana State Board of Agriculture from 1873 until 1882, and as president in 1880, he did much to foster the cause of fruit-growing in his native state. C. G. Woodbury.

Rand, Edward Sprague, lawyer and horticulturist, lost his life in the accident that befell the steamship "City of Columbus" in the early winter of 1884. Mr. Rand was for many years vice-president of the Massachusetts Horticultural Society. His exhibits of new and rare species of plants were of the best, and secured at considerable expense of time and money, an outlay he

made cheerfully for the good of horticulture. His collection of orchids was one of the largest and rarest of that time, and was donated to the Boston Botanic Garden. He was the legal counsel of the Massachusetts Horticultural Society, and an extremely prudent counsellor. To Mr. Rand's knowledge of books is due much of the success of the Society's excellent and voluminous library.
G. B. Brackett.

Rawson, Warren W., market-gardener, was born in Arlington, Massachusetts, January 23, 1847, and died August 9, 1908. He was educated in the schools of Arlington, Cotting Academy and Commercial College. He entered into partnership with his father in the market-gardening business in 1867, and in 1872 bought out the business, which he continued with success until his death. His plant is now the largest in New England devoted to market-gardening.
H. W. Rawson.

Reasoner, Pliny Ford, florist, horticulturist and nurseryman, was born at Princeton, Illinois, May 6, 1863, and attended the common and high schools of his native town. He was very fond of plants when quite young and had the largest and finest garden in his neighborhood. He went to Florida in 1882, settled near Manatee, devoting his life to collecting and cultivating tropical and semi-tropical plants. Not long after reaching Florida, he was joined by his younger brother Egbert N. Reasoner, and together they established the Royal Palm Nurseries under the firm name of Reasoner Bros. He began an extensive correspondence in many languages with directors of botanic gardens and plant-lovers and -growers in various parts of the world, and he introduced many hundreds of tropical and semi-tropical exotics. These were tested in the nursery and sent out to plant-growers in general. He was horticultural commissioner in permanent charge of the sub-tropical exposition at Jacksonville, Florida, 1887–8, and one of the three Florida commissioners at the Cotton States Centennial Exposition at Atlanta in 1888. He died at Manatee of yellow fever September 17, 1888, at the age of 25. At the time of his death, he was gathering together materials and notes with the intention of writing a great encyclopedia of tropical horticulture and floriculture. He had a genial, kindly disposition and his intense enthusiasm for the cultivation of plants was contagious. His plant importations may be found scattered all over the lower South in all the extensive collections of that region.
Chas. T. Simpson.

Rock, John (Fig. 1896), nurseryman, was born in Germany in 1836 and died August 8, 1904. His name was Johann Fels, which he translated into English on coming to America at the age of 15. He began in New York at once, at the bottom of the florist and seedsman business and rose slowly until 1861 when he volunteered (5th New York Zouaves) and fought till the close of the Civil War. Returning to horticulture, he settled in California in 1866 and built up one of the best and largest nurseries in the United States. He went to Europe many times, was in touch with nurserymen, botanists, horticulturists, all over the world, had extensive experiment grounds, tested thousands of new things, originated or brought into notice innumerable varieties of worth and at the time of his death, had 500 acres in nursery, at Niles, California. John Rock's scientific spirit, his wide and ever-increasing knowledge, his very high standards of business and his unselfishness made him during his long life the leader of Pacific coast nurserymen. He introduced more valuable plants and varieties to American horticulture than any other man of his period. His connection with Japan, India, Australia and with the great establishments abroad was close and constant. He did much to encourage men like Luther Burbank, and his collections were always at the service of students and the public.
C. H. Shinn.

1896. John Rock.

Roeding, Frederick Christian, nurseryman, was born in Hamburg, Germany, on December 31, 1824, and died July 18, 1910. His boyhood and early training were passed in Germany which fitted him for the successful commercial career which he subsequently achieved. He went to Chile and Peru in 1846. Three years later he left for California where he first went in for mining, but he soon abandoned this and became a member of the firm of Larco & Co., which afterward became known as the firm of R. Feurstein & Co., of which he was the senior member. He re-organized, and was one of the prime movers of the German Savings and Loan Society of San Francisco, and was vice-president and cashier for a period of twenty-five years. As early as 1869, his far-seeing judgment in the future of California's basic industry led him, with a number of other German associates, to buy 80,000 acres of land in Fresno County in the San Joaquin Valley. Shortly after this body of land was acquired, two sections, 1,280 acres, was deeded to the Southern Pacific Railroad Company for a town-site, by him and his associates, and it was on part of this land which comprises the best business and residential section of Fresno City today.

It was not until 1883 that he became actively engaged in horticultural work. It was in that year that the Fancher Creek Nursery was established. Possibly the chief event associated with his name is in connection with his work in the introduction of the Smyrna fig in California in 1886, and his untiring efforts in proving the necessity for caprification of this fig in order to produce it successfully. The first Smyrna figs, now known as Calimyrna, were produced through artificial pollenization in 1890, but it was not until 1901 that the first commercial product consisting of thirteen tons was placed on the market as a result of the pollenization of the little fig wasp, *Blastophaga grossorum*, which was imported the year previous with the assistance of the United States Department of Agriculture and established in some Capri fig trees on the Roeding place.

His name will always be associated with the City of Fresno, through his donation in 1903 of a piece of land for park purposes known as Roeding Park, consisting of 117 acres of ground in the immediate vicinity of the town.
George C. Roeding.

Rogers, Edward Staniford, grape-hybridizer, was born in Salem, Massachusetts, June 26, 1826, and died in Peabody, Massachusetts, March 29, 1890. He was the originator of forty-five seedling grapes known as the Rogers' hybrids. He was the first man to recognize the possibility of the probable value of *V. Labrusca* × *V. vinifera* hybrid varieties. For the female plant he used Carter or Mammoth Globe and fertilized with Black Hamburg and White Chasselas from an adjacent cold grapery; this work was accomplished in the summer of 1851, and the clusters were carefully inclosed in sacks. As a result of these pollinations, he secured about

150 seeds, which he planted in an old garden at Salem. He succeeded in fruiting forty-five seedlings, of which one to five were of Carter Black Hamburg; six to fourteen were Carter × White Chasselas; and the numbers fifteen to forty-five were of Hamburg parentage. In 1858 Mr. Rogers sent these varieties, under original numbers to various sections of the country for testing. He lacked room for a fair test in his small garden; the dissemination led to confusion, and the nurserymen to this day have never gotten the matter straightened out, so far as mere numbers are concerned. Mr. Rogers then gave the most promising varieties names, and these names were selected for persons noted for literary or scientific attainments or else for the towns and counties in his native state. Leading horticulturists of the day thought all the varieties should be named, as they possessed equal merit to a remarkable degree; but Mr. Rogers' preferred list is as follows: No. 1, Goethe; No. 3, Massasoit; No. 4, Wilder; No. 9, Lindley; No. 14, Gaertner; No. 15, Agawam; No. 19, Merrimac; No. 28, Requa; No. 39, Amini; No. 41, Essex; No. 43, Barry; No. 44, Herbert; No. 53, or No. 22, Salem, but not the Salem of the present day. There was a meritorious standard of excellence about these hybrids that Mr. Rogers was unable to obtain with subsequent crosses. These hybrids brought about a new era in grape-culture, and while not so intrinsically valuable as some later varieties, the work of Mr. Rogers, in one way and another, has added millions of dollars to the grape industry of America.

G. B. Brackett.

Sargent, Henry Winthrop (Fig. 1897), a son of Henry Sargent, an artist of reputation in his time and a grandson of Daniel Sargent, a Boston merchant of a prominent Massachusetts family, was born in Boston in 1810. Graduating from Harvard in 1830, Mr. Sargent studied law, which he never practised, and in 1841 purchased a small estate on the plateau above Fishkill Landing, New York, overlooking the Hudson River. Inspired and instructed by his neighbor, A. J. Downing, the landscape gardener, then at the height of his brilliant career, Mr. Sargent began to lay out a garden. This soon became distinguished for its beautiful distant views and vistas obtained by the removal of some of the native trees which originally covered it, for the arrangement of the shrubberies which made a piece of ground of only twenty-two acres in extent appear like a large park, and for the collection of conifers in which Mr. Sargent was particularly interested and which in its day was the most complete in the United States. Mr. Sargent traveled extensively in Europe for the purpose of studying the arrangement of country places, and to secure plants for his collections. As one of the results of these journeys he published "Skeleton Tours," a guide to the most interesting estates and gardens in England, with directions how to reach them and what to see in each. To the sixth edition of A. J. Downing's "Theory and Practice of Landscape-gardening," published in 1859, Sargent added an important supplement in which he described the making of Wodenethe, the name of his own place, and the estate in Wellesley, Massachusetts, of his relative, H. H. Hunnewell, to which was added an account of the many new trees and other plants which had first been tested in this country at Wodenethe; and for the seventh edition, published in 1865, he extended this supplement to include descriptions of the most recently introduced trees. For many years and during the life of its genial, accomplished and hospitable owner, Wodenethe was one of the best-known country places in the United States, and its influence in teaching correct principles of the art of garden-making and in increasing the love of country-life in the United States and the knowledge of trees was great and of lasting value. Mr. Sargent died at Wodenethe in 1882.

1897. H. W. Sargent.

C. S. Sargent.

Saul, John, nurseryman, was born at Castle Martyr, County Cork, Ireland, on Christmas Day, 1819, and died in Washington, D. C., on May 11, 1897. As he grew up, he was trained in the science of landscape gardening, and soon after becoming of age removed to the Isle of Wight, and subsequently to Bristol, England, in which place he was manager of extensive nurseries. Mr. Saul arrived in Washington in May, 1851, and was at once engaged by the Government to lay out the Smithsonian Grounds, Lafayette Square and other public squares, and also by W. W. Corcoran to plan the beautifying of Harewood Park. In 1852 he bought the property in which he spent the remainder of his life, 120 acres of which he set out in nursery stock, all kinds of evergreens, fruit, shade and ornamental trees and shrubs. He imported all new varieties from Europe as soon as they appeared. He equipped twenty greenhouses with large stock of new and rare plants, orchids and the like. He imported new plants from Europe as soon as they were offered for sale, and orchids from Africa, Mexico, Central and South America. He shipped plants to all parts of the country and some native plants to Europe.

He was appointed a member of the Parking Commission by Gov. Alexander R. Shepherd, and was reappointed by the District Commissioners after the office of governor was abolished, and was continued in office by each succeeding Board until his death, serving as chairman of the commission until the last.

B. F. Saul.

Saunders, William, nurseryman, landscape gardener and horticulturist, was born in St. Andrews, Scotland, in 1822, and died in Washington, D. C., September 11, 1900. He was educated in Scotland and England and spent some years in practical horticultural training at Kew Gardens. He came to America about the same time as Wm. R. Smith, former Superintendent of United States Botanic Gardens, 1848. He wrote many practical and timely articles on horticulture and kindred topics for the "Gardener's Monthly," "Hovey's Magazine," the "Horticulturist" and other periodicals. In 1854 Mr. Saunders entered into partnership in the nursery business, general horticulture and landscape gardening, with the late Thomas Meehan of Philadelphia. While there he originated and introduced fixed roofs for greenhouses which marked a great improvement over the movable sash formerly employed. He was a landscape gardener of note, and finished the planting of some of the national capital's park system which had been previously begun by Andrew Downing. He planned many parks through the eastern portion of the United States, among the most noted of which were Clifton, the country home of the late Johns Hopkins at Baltimore; Rose Hill Cemetery, Chicago; Oak Ridge Cemetery, Springfield, Illinois, and the National Cemetery, Gettysburg, Pennsylvania.

In 1862 Commissioner Newton appointed Mr. Saunders the Botanist and Superintendent of Horticulture of the newly created Department of Agriculture at Washington, D. C. The Department was at first called a Bureau and did not become a cabinet office until 1889. Mr. Saunders aided materially with advice and good work in shaping and developing the Department of Agriculture, and he was one of the ablest and most influential men the Department has ever had. He was one of the seven founders of the order of Patrons of Husbandry in 1867, and wrote its preamble and constitution. He was Master of the National Grange during the first six years of its existence.

He introduced into this country many fruits of economic importance. His knowledge of the flora of the world was extraordinary. He was one of the first to direct public attention to the proper environment for fruits; southern fruits for southern states, northern fruits for northern states. He introduced the hardy Russian apples for the extreme North in 1870. Mr. Saunders imported economic plants and trees of various kinds from almost every part of the globe. The *Poncirus trifoliata*, widely grown as a hardy stock for citrous fruits in the South and West, was obtained by him in 1869. He was endeavoring to secure a hardy type of Japanese orange, and the trees froze in transit from San Francisco to Washington, but the stocks survived, and these proved to be the now well-known *P. trifoliata*. He enlisted the aid of the late Prof. P. J. Berckmans of Augusta, Georgia, in the work of saving and perpetuating this stock. Mr. Saunders introduced the kaki or Japanese persimmon into this country and disseminated it widely in the South. His greatest success, however, was the introduction of the Bahia or Washington Navel orange, the seedless orange from Brazil that practically revolutionized the orange industry in California at that time, and brought in a subsequent revenue of millions of dollars.

G. B. Brackett.

Saunders, William (Fig. 1898), economic entomologist, horticulturist and the founder, and for quarter of a century Director, of the Experimental Farms of the Dominion of Canada, was born in England in 1835, and died in London, Ontario, September 13, 1914. He came with his parents to Canada when a boy of twelve. He started in business as a chemist and druggist and, as years went by, prospered to such an extent that he was able to devote his spare time and means to his favorite pursuits of botany, entomology and horticulture. He was one of the founders of the Entomological Society of Ontario, editor of the "Canadian Entomologist" for thirteen years, and author of the standard work, "Insects Injurious to Fruits," which is regarded as a classic by economic entomologists and fruit-growers.

Deeply interested in horticulture, he established a fruit-farm near London, and began his experiments in hybridizing and originating new varieties. His earliest efforts were devoted to the production of improved kinds of small-fruits, and he succeeded in obtaining satisfactory results with gooseberries, currants, raspberries and grapes, and also with roses and other ornamental shrubs. Many of his varieties are widely known and extensively cultivated, and his Emerald grape was considered the best of the Canadian sorts at the Colonial Exhibition in 1886. During this period he was an enthusiastic member of the Ontario Fruit-Growers' Association, which he was largely instrumental in maintaining during its day of small things, and of which he was president for some years.

In 1886 he was appointed Director of the Experimental Farms, and by his untiring energy, remarkable administrative ability, wide knowledge, both scientific and practical, long business experience and agreeable personality, he succeeded in establishing the chain of stations in all the provinces of Canada from the Atlantic to the Pacific, and prescribing for each its sphere of work in adaptation to its climate and local conditions. The immense value of the results obtained cannot be over-estimated; they will long continue to sustain the reputation of this man of genius to whose energy and ability they were due.

1898. William Saunders.

Among the many aspects of work which claimed his attention, horticulture continued to have a foremost place. For a long series of years Dr. Saunders carried on hybridizing experiments in order to produce apples hardy enough to withstand the rigors of the northwestern provinces, and of good size and quality. Taking the wild Siberian crab, which grows freely in Saskatchewan, as the female parent and crossing it with the hardiest Canadian and Russian apples, he gradually succeeded in obtaining hardy varieties nearly 2 inches in diameter which thrive in the far North and withstand a temperature of even 60° below zero. His efforts with cereals were equally successful; his Marquis wheat has proved to be the best variety in all respects of those grown in the western provinces, and has added millions of dollars to the value of their farm products. C. J. S. Bethune.

Sharp, Francis Peabody, the leading pioneer pomologist of New Brunswick, and perhaps of Canada, was born at Northampton, New Brunswick, in 1825, and removed to Upper Woodstock in 1844, at which place he resided until his death in 1903. Practically all of this time he was engaged in commercial orcharding, the growing of nursery stock, the testing of varieties and the creation of new fruits. He was the first man to introduce most of the standard varieties in the province—this being prior to 1858; obtaining cions from Canada, the United States and England. He devoted many years toward the production of varieties specially adapted to the New Brunswick climate and soil, the necessity of which he always emphasized. He early recognized the possibility of obtaining new and improved varieties from seed, and he imported seed from many sources for testing. In this manner he originated Sharp's New Brunswick apple, which many have regarded as being the Duchess of Oldenburg. Later, Sharp started to produce better varieties by hybridizing. Using the New Brunswick as one parent in most cases, he made upward of 2,000 crosses, originating a number of varieties of proved local worth, of which the best known is the Crimson Beauty. The date of the starting of this work does not seem to be definitely known but appears to have been about 1866. In an address given before the Farmers' and Dairymen's Association at Fredericton in 1896, Sharp stated that he and Peter M. Gideon were the first two men in America scientifically to hybridize the apple and pear. It would appear from this that Sharp was by many years the first man to begin this important work in Canada. Photographs and particulars are given in the report of the New Brunswick Fruit-Growers' Association for 1911.

A. G. Turney.

Shaw, Henry (Fig. 1899), founder of the Missouri Botanical Garden, popularly known as "Shaw's Gardens," was born at Sheffield, England, July 24, 1800, and died at St. Louis, Missouri, August 25, 1889. He came to the United States in 1819 and engaged in the hardware business until 1840 in St. Louis, where he continued to reside until his death. After retirement from active business he traveled for a number of years, and in 1849 laid out a modest garden about his country house in the suburbs of St. Louis, which, nine years later, he extended so as to include some forty-five acres, about half of this area constituting an arboretum.

By special act of the General Assembly of the state of Missouri, approved in March, 1859, Mr. Shaw was empowered to provide for the conveyance of his property, either during his life or after his demise, to trustees, for the perpetual maintenance of his garden as a scientific establishment. In 1885 he endowed a department in Washington University, known as the Henry Shaw School of Botany, and on his death left nearly all of his property, valued at some $5,000,000, to a board of trustees for the maintenance, improvement, and enlargement of the Missouri Botanical Garden.

Mr. Shaw, though not a botanist, was a lover of plants for themselves and a firm believer in their influence in molding desirable traits in human character. His garden was always open to visitors, among whom he particularly welcomed the self-respecting poor. Thirty years before his death he gave to the city of St. Louis a park site adjacent to his garden, which, like the latter, was improved under his personal supervision.

1899. Henry Shaw.

Special provisions in Mr. Shaw's will, aside from the general arrangements for the development of the garden—in details of which he allows his trustees a very free hand—are for an annual sermon "on the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom;" premiums for an annual flower show; and two annual banquets, respectively for the trustees and gardeners of the institution. These banquets are the occasion for annual gatherings of men distinguished in botany and horticulture. See Vol. I, p. 531. Wm. Trelease.

Shepherd, Robert Ward, horticulturist, was born in 1848 and died at Montreal in November, 1912. For nearly forty years Mr. Shepherd was closely and prominently associated with the development of horticulture in the province of Quebec. Although he was for many years connected with the Ottawa River Navigation Company, his great love for horticulture was always evident and early in his life he planted extensive orchards at his home at Como on the Lake of the Two Mountains. His specialty was apples and he grew most of the varieties recommended for the province of Quebec and was continuously testing new sorts. His favorite variety was the Fameuse and he developed a high-class trade with this variety in England, shipping the fruit in special compartment cases. He unceasingly advocated the planting of Fameuse in the province of Quebec in preference to any other variety on account of its high quality. He originated the Rochelle apple, a promising hardy variety. As early as 1877 he was a director of the Montreal Horticultural Society and when the Quebec Pomological Society was formed in 1893 he was one of the most active in its organization. He was president of this Society in 1895 and again in 1906 and a director for many years, and on many occasions prepared papers for the meetings. He was Fruit Commissioner for the province of Quebec at the World's Fair in Chicago in 1893, and on three occasions was one of those who represented the province of Quebec at Dominion Fruit Conferences. Because of his prominence as a fruit-grower and his enthusiasm, he was on many other occasions appointed on important horticultural committees. W. T. Macoun.

Shepherd, Mrs. Theodosia B., and her husband were among the pioneers who left their homes in the Middle West to settle in California in the year 1873. Mr. Shepherd was an attorney and in this new country found little use for his services. His wife rose to the emergency and being of an artistic temperament, manufactured works of art out of the fauna and flora which she had collected. Her descriptive writings of flowers are among the finest this country has produced. The encouragement of Peter Henderson was incident to her entering this field. In 1881, she sent him a package of curiosities among which were a few choice flower seeds grown in the open. He wrote back saying that he believed California would be the great seed- and bulb-producing country of the world and that the conditions were ideal. Some of the products of her labor are a class of shrubby begonias of unequal vigor; a tea rose called "Oriole;" the perfection of cosmos; nasturtiums, California poppies and others were increased in size and beauty; the evolution of the petunia from a small flower of dull color to those of mammoth size and beautiful color. Mrs. Shepherd died September 6, 1906.

Shinn, James, pioneer nurseryman, was born at Salem, Ohio, September 29, 1807, and died October 29, 1896. He lived in several western and southern states and moved to California (from Texas) in 1855, establishing an orchard and nursery at Niles. He had studied and practised horticulture, had kept up a correspondence with specialists and at once took rank among the best-equipped men of the Pacific coast in his line of work. His introductions of Persian walnuts, Smyrna figs, Japanese plums and persimmons, the carob, Uinshiu oranges and many ornamentals were widely useful in the West and in the South as well as in California. His correspondence, and his newspaper writings, were extensive; he helped to found, and led in, the State Horticultural Society; his trials of new fruits and plants were extensive and thorough, and his coöperation with the experiment stations and with agricultural education was active. For more than forty years his influence broadened over the entire Pacific coast region. He was, with the exception perhaps of John Rock, the best known of California nurserymen. C. H. Shinn.

Smith, Andrew Murray, nurseryman, was born in Brandon, Vermont, September 24, 1832. The family removed to western New York in 1844, where Andrew made the best of his rather brief opportunities at a district school, and at Yabes Academy, Lockport. In 1852 Andrew engaged in work for Mr. E. Moody, near Lockport, and thus became acquainted with the nursery business, in which he afterward associated himself with Charles E. Woolverton, of Grimsby, Ontario, under the title of Woolverton & Smith. Finding a few old peach trees still bearing fruit in the garden of Dennis Woolverton about the year 1857, the firm decided to plant an orchard of six hundred trees, in addition to their nursery stock. The venture proved so successful that farmers about followed their example to such an extent that this Niagara District is now known as the "Peach Garden of Ontario." Mr. Smith continued the nursery business at Grimsby, Niagara and St. Catharines until the year 1900, when he retired at the age of seventy. He was one of the first members of the Fruit-Growers' Association of Ontario which was formed in 1859 and continued his active membership until his decease at St. Catharines, Ontario, October

19, 1910. For ten years, Mr. Smith was a director of the Association, of which he was made president in 1889, and a life member in 1900. No man in Canada has done more initiatory work in the development of the fruit industry of the province than A. M. Smith, insomuch that he has been called "the father of the commercial peach industry of Ontario." LINUS WOOLVERTON.

Smith, William Robertson, botanist, bibliographer, horticulturist, philanthropist, was born at the village of Athelstaneford, East Lothian, Scotland, March 21, 1828, and died July 7, 1912. He was educated in the schools of his native village. His earliest practical work in horticulture was done on the grounds belonging to the Earl of Wemyss, and later at Airthrie Castle and still later at Kew Gardens. On coming to America he located in Philadelphia, but was soon called to take charge of the work of the United States Botanic Gardens. These Gardens, nestling at the foot of the Capitol of the United States, were conceived by George Washington and are all that remains of his grand scheme of a national college and a national church. In 1822 a Botanical Society was formed and some planting was done on the drier portion of the marshy reservation. This society published what is now a very rare book entitled "Prodomus Columbiana," and it contained a list of the plants then in the District of Columbia. To this collection, John D. Breckenridge, prominent botanist of his day, added large quantities of plants of interest. The plants secured by the Wilkes' expedition around the world, placed in the Patent Office conservatory, were consigned to the United States Botanic Gardens in 1850 and Mr. Breckenridge was employed to give them expert attention, and with him was associated Dr. Asa Gray, botanist. All expenditures for the Gardens from 1851 to 1854 were paid from funds accredited to the Wilkes' expedition. William R. Smith became Superintendent of the Botanic Gardens in 1853. The times were troublous, and the first appropriation from Congress, including the pay of the superintendent and assistants was but $3,000. At this time the gardens were marshy, and ague-breeding. His first work was the filling in of 500,000 yards of soil. The development of the Gardens was necessarily slow and tedious, but in the period of Mr. Smith's tenure they were developed from a tiny flower-garden and botanical collection to the largest horticultural collection, public or private, in America. The work of Mr. Smith is well known to students of horticulture everywhere, and through this great work he came to be styled "the father of horticulture." G. B. BRACKETT.

Stark, James Hart, nurseryman and fruit-grower, was born July 30, 1792, in Hutchison, Bourbon County, Kentucky. He was the son of Capt. James Stark, who came to Hutchison, Kentucky, in 1785 from Virginia. The Starks were originally from Glasgow, Scotland, one brother settling in New England and the other in Virginia. Both were enthusiastic horticulturists. On a fly-leaf of one of the old law books of the Kentucky lawyer, preserved by the family, is a planting record of the family orchard which was probably the first orchard of grafted apples planted west of the Alleghanies.

For his military service in the war of 1812, Judge Stark was given script for land, in what is now Pike County, Missouri, where he located in 1815. Here, near the present site of Louisiana, he cleared a large tract of land, and went back to Kentucky for cions from the old family orchard in order to establish a nursery and orchard in Missouri. From this stock was started in 1816 the pioneer nursery west of the Mississippi. From the trees produced, the first commercial orchard in this section of the country, 45 to 50 acres in extent, was established. Northern buyers came each year and bought the crop of apples from this orchard, amounting annually to several thousand barrels. The nursery which he established in 1816 has been maintained and augmented by Mr. Stark and his descendants until today it is said to be the largest nursery in the world. Judge James Stark at first furnished trees for planting by his neighbors. In this way he began the dissemination of grafted stock of the best-known varieties of the time. The district in which he was located was also somewhat famous for wild plums, berries, grapes, and other fruit, and this stimulated in him an interest in the introduction and dissemination of new and superior varieties. The business which he established then has been responsible for the introduction into the Mississippi Valley and the far West of a very large number of the leading varieties of commercial fruits now being grown in western orchards.

Judge Stark in his day was regarded as the horticultural leader in his section of the country. That he knew thoroughly and loved his work, that he believed in it fully and got daily inspiration from it, is perhaps best emphasized by the fact that instead of his work dying with him, his inspiration, zeal and energy for it has been handed down through his descendants who have ably followed in his footsteps. J. C. WHITTEN.

Starr, Robert W., eminent fruit-grower of Nova Scotia, was born in 1830 at Starr's Point on the shore of Minas Basin. He came of an old United Empire Loyalist stock of Connecticut, a family which for four generations furnished militia officers. He was educated at Sackville Academy, New Brunswick. About the year 1860 Major Starr settled down to a life of fruit- and fruit-tree-growing, a line in which he became not only successful himself, but also of great service to his province. In addition to his vocation, he continued to serve in the militia as adjutant and later as major. In 1873 he was appointed Justice of the Peace for King's County. Major Starr was one of the original founders of the Nova Scotia Fruit-Growers' Association, which was started in 1863. Several times he was made president, and in 1873 was made a life member. In 1876 he was sent to the Centennial Exhibition, Philadelphia, with a large exhibit of Nova Scotia fruit, and in 1893 he was sent by his province to the World's Fair, Chicago, with a similar charge. Major Starr has been much in demand as a judge of apples, at exhibitions in Nova Scotia, New Brunswick, Prince Edward Island, and Ontario, and is considered the leading authority on the apple in the province of Nova Scotia. LINUS WOOLVERTON.

Stayman, Joseph, physician and pomologist, was born in Cumberland County, Pennsylvania, October 17, 1817 and died October 4, 1903. He studied medicine and in 1846 began to deliver lectures on scientific subjects. He engaged in the practice of medicine until 1858. In 1859, he established a nursery in Illinois but later in the year moved to Leavenworth, Kansas. For forty years, he engaged in experimental work on fruits, producing hundreds of hybrids and testing many varieties produced by others. The best known of his original productions are the Clyde and Stayman strawberries, the Stayman Winesap apple and the Ozark grape. Dr. Stayman was a charter member of the Kansas State Horticultural Society and was appointed as the Kansas delegate to the Centennial Exposition at Philadelphia in 1876.

Stiles, William Augustus, journalist, editor and park commissioner, was born March 9, 1837, at Deckertown, Sussex County, in northern New Jersey, and died October 6, 1897, in Jersey City. His grandfather settled on a farm near Deckertown in 1819, where his father, Edward A. Stiles, in 1833, founded Mount Retirement Seminary, a successful school of the highest rank during the following thirty years. William A. Stiles graduated at Yale in 1859 in a class which included many men who have since attained high rank in public affairs. Prevented from taking up the profession of law by constitutional weakness and defective eyesight, he found expression in diversified activities. He was in turn a teacher, assistant superintendent of public schools, surveyor on the Pacific coast, writer of political articles, secretary of the Senate of New Jersey, actuary of a life insurance company, and gauger in the New York custom house. During a long period of illness and almost total blindness he acquired systematic knowledge of plant-life from readings by his sisters, and this gave impulse toward subsequent study on broader lines. He brought together many rare and choice species of plants, and made interesting experiments on the farm. His articles in the daily press of New York on the various interests of country life attracted wide attention, and led to his appointment as an editorial writer of the New York "Tribune," a relation which continued throughout his lifetime. In 1883 he became agricultural editor of the Philadelphia "Press." Keenly interested in introducing scientific discoveries and improved methods into general practice, he established relations with the foremost agriculturists abroad and at home, and made his department a useful and valuable exponent of the best knowledge of the time. His masterly conduct of the page during the next five years set a high standard for journalism in this field, and established his reputation as a specialist in agriculture and cognate subjects. On the founding of "Garden and Forest" in 1888, William A. Stiles was invited to be the managing editor. For nearly ten years, to the close of his life, he devoted himself to this journal through vigorous editorial writing and management, and steadily maintained the high character of the most able and influential periodical in American horticultural journalism. For many years he rendered conspicuous service in working for the establishment of small parks easily accessible to the poor, and for the wise conduct of the larger parks and their preservation from invasion and despoilment. His special ability and influence received public recognition in 1895, when he was appointed a park commissioner of New York city, a position in which he rendered signal and valuable service until the time of his death.

M. B. Coulston.

Strauch, Adolph (Fig. 1900), landscape-gardener, was born in Prussia, August 30, 1822, and died at Cincinnati, Ohio, April 25, 1883. He began the study of landscape gardening at the age of sixteen, and perfected his knowledge and taste by travel and by working in many places, including Vienna, Schoenbrun, Luxemburg, Berlin, Hamburg, The Hague, Amsterdam, Ghent and Paris, spending several years at the latter place. In 1848 he went to London where he found employment in the Royal Botanic Gardens. In 1851 he came to the United States, landing at Galveston, Texas. From there he found his way to Cincinnati, and made that his home during the rest of his life. Mr. Strauch designed portions of the parks and many of the private grounds in Cincinnati. "Clifton" in that city, owed its beauty to his skill and good taste. Mr. Strauch's chief claim to distinction however, was in originating the park-like treatment of cemeteries. He developed his ideas in Spring Grove, which became the most beautiful cemetery in the world. His skill as a landscape gardener was called into requisition in many places, among which are included Buffalo, Cleveland, Toledo, Detroit, Chicago, Indianapolis, Nashville and Hartford. Frederick Law Olmsted used to say that when he needed inspiration he visited Spring Grove. Perhaps no man in the United States since A. J. Downing's time has done more for the correction and cultivation of public taste in landscape gardening than Adolph Strauch. He loved nature and tried to preserve her natural beauty. He was especially successful in grading land surfaces and securing beautiful rolling lawns, the shaping of which was done almost entirely by eye. He would say "When it pleases the eye, it is right." He also said that the lawn at the margin of a road should be tangent to the road's surface. He believed in the picturesque arrangement of trees and shrubs, and was very careful to use species that harmonize with each other.

1900. Adolph Strauch.

O. C. Simonds.

Stringfellow, Henry Martyn (Fig. 1901), was born at Winchester, Virginia, January 31, 1839, and died on June 17, 1912, at Fayetteville, Arkansas. He was graduated from William and Mary College in 1858. Later he attended the Virginia Theological Seminary at Alexandria, 1858–61. Enlisting in the Confederate Army in 1861, he soon rose from the rank of private to the rank of captain in the Ordinance Department. He studied law for several years. Much of his life was spent in Texas, where he was a pioneer in discovering and demonstrating the rich horticultural possibilities of the Gulf coast. He planted the first pear orchard on the coast in 1882. In 1884, he planted the first Satsuma orange trees in Texas—trees which he obtained from Japan. These plantings were at Hitchcock. In this single instance, he rendered American horticulture a service of vast importance, since during the past few years millions of Satsuma orange plantings have been made all along the Gulf coast and a vast industry has been created. By demonstrating the value of drainage and by other methods, he opened up the horticultural possibilities of the country lying between Houston and Galveston, previously regarded as waste land. This is now the pear and strawberry country of Texas. He was a frequent contributor to horticultural publications and the press. Some of his articles appeared in the press of some foreign countries. His book "The New Horticulture" was written and published at Galveston in 1896. Most notable of the new practices which he advocated in this book was a severe method of pruning young fruit trees, both tops and roots, preparatory to transplanting. This practice, which he called "close root-pruning," sometimes called the "Stringfellow method," again "stub-pruning," proved successful in sandy types of soil southward, and was adopted by many planters, especially of large peach orchards in the South.

1901. Henry M. Stringfellow.

Ernest Walker.

Strong, William Chamberlain, lawyer and pomologist, was born at Hardwick, Vermont, August 18, 1823, and died in New York City, May 11, 1913. He was a graduate of Dartmouth College and then entered the Harvard Law School, for several years practising law.

His interest in horticulture, however, caused him to give up law as a profession, and buy an estate at Waban, Massachusetts. He did much for American fruit-culture, especially the grape and pear industries, and he was regarded as a leader among old-line pomologists. He was also a benefactor in the introductions of new plants and trees from foreign countries. He was among the first to discover the immense floral value of rhododendrons and azaleas for the vicinity of Boston. He also did much to aid in the establishment of the Arnold Arboretum in 1872. Mr. Strong was the author of several valuable books on horticulture, some of which are "Fruit-Culture," "Grape-Culture," and the "Gardener's Manual." He was a member of the Massachusetts Horticultural Society, and in 1872 was sent to Paris as a delegate to the Pomological Congress. He was also a member of the American Pomological Society. G. B. Brackett.

Sturtevant, Edward Lewis, agricultural experimenter and writer, was born in Boston, Massachusetts, January 23, 1842, and died at South Framingham, Massachusetts, July 30, 1898. Though holding the degree of M. D. from the Harvard Medical School, Dr. Sturtevant never practised the profession of medicine, but devoted his life to agricultural work, first specializing on Ayrshire cattle, then on pedigree corn (Waushakum) and muskmelons (New Christiana), and afterward devoting particular attention to the modifications which cultivated plants have undergone as shown by such records as occur in the older books. In connection with these studies, Dr. Sturtevant brought together a rare collection of books dealing with plants published before the time of Linnæus (say 1753), which, with his index cards and herbarium, is now preserved at the Missouri Botanical Garden in St. Louis

As first director of the New York Experiment Station at Geneva, Dr. Sturtevant drew the broad plans on which the successful work of that establishment has been conducted and which have served largely as models for subsequently organized agricultural stations over the country. He was a man of active mind, and his career is suggestive of worthy work to an unusual degree. A biographic sketch and a list of his principal writings are printed in the "Tenth Report of the Missouri Botanical Garden." See also "Cyclopedia of American Agriculture," Vol. IV, p. 616.

Teas, John C., nurseryman, was born in Indiana, of Quaker parentage, in 1827 and died in Carthage, Missouri, July 29, 1907. At the early age of ten, he evinced his love of horticulture by planting and tending a garden of his own. He lived in Indiana until 1869, when he moved to Missouri, where he engaged in the nursery business. He originated and introduced many new and valuable novelties in all branches of horticulture, including pomology, forestry, floriculture and the like. He was one of the first to recognize the good qualities of *Catalpa speciosa* and at all times advocated the careful conservation of our natural forests, and the planting and care of new forests. Mr. Teas was an active member of the American Pomological Society and one of the organizers of the Indiana Horticultural Society. He was also a frequent contributor to the current literature of horticulture and pomology.

Terry, H. A., one of the pioneer horticulturists of the prairie region west of the Mississippi, was born in Cortland, New York, in 1826. At the age of ten he moved with his parents to Michigan, where he lived on a farm until he was nineteen. He then went west stopping a year in Illinois, reaching western Iowa in 1846. After that the most of his life was spent in the vicinity of Council Bluffs, not far from which city he established a nursery in 1857, where he carried on the work in breeding fruits and flowers which has given him special claim to recognition as one of the notable horticulturists of his region. In addition to carrying on his regular business as a nurseryman, he endeavored to add to the list desirable varieties which should be particularly adapted to his region at a time when such work was greatly needed. He named and distributed more than 100 of his seedling peonies, but doubtless his most important work was the origination of improved varieties of the native plum. Among the more important of his plum seedlings, classed under the americana species, are Admiral Schley, Bomberger, Bryan, Champion, Golden Queen, Hawkeye, Nellie Blanch, Terry and White Prune. Among his notable seedlings of the Munsoniana species are Downing, Hammer, Milton, all three from seed of the Wild Goose. Mr. Terry was long an active member of the State Horticultural Society and for several years was in charge of one of its trial stations. He died February 14, 1909. S. A. Beach.

Thomas, John Jacobs (Fig. 1902), one of the three pomologists who may be said to have created the science in this country (the others being Patrick Barry and the elder Downing), was born January 8, 1810, near the lake in central New York—Cayuga—on the shores of which he passed his life; and died at Union Springs, February 22, 1895. He was much more than a pomologist, his studies covering nearly every branch of rural industry except the breeding of live-stock, and his labors in the direction of adorning the surroundings of country life entitling him to rank in that department with the younger Downing. Two of his works, "Farm Implements and Machinery," and the series of nine volumes called "Rural Affairs," deal with the practical every-day matters of life on the farm in a manner at once pleasing and original, there being nothing that could quite fill their place in the whole range of our agricultural literature; and his incessant stream of inspiring editorials in "The Cultivator" and "The Country Gentleman" for nearly sixty years covered a wide and diversified range of rural topics. But pomology was his chief delight, and his fame rests mainly on his treatise on that subject, "The American Fruit Culturist." This immensely useful book first appeared, in 1846, as a paper-covered 16mo of 220 pages, with 36 wood-cuts, which must have been well received, inasmuch as a fourth edition (dignified with muslin binding) was published in the following year, and in 1849 another, enlarged to 424 duodecimo pages, and "illustrated with 300 accurate figures." This edition appears to have been reissued a few years later, with slight modifications and on larger paper, and was then called the seventh. Up to this time, changes in the work had been chiefly in the direction of natural growth. But horticultural knowledge was undergoing great modification; and in 1867, the public still calling for the book, it reappeared in different style, newly arranged and mostly rewritten, filling now considerably more than 500 pages, and accompanied by almost that number of illustrations. Rather unfortunately, this was called the "second edition," all its predecessors being probably regarded as different forms of the same book, while this was substantially new.

1902. John Jacobs Thomas.

The next edition, called the "eighth revised," appeared in 1875, and had nearly 600 octavo pages and over 500 engravings,—not to mention a colored frontispiece and highly pictorial binding; and this was followed, ten years later, by a revised reprint in plainer and more tasteful style, illustrated with the largest number of engravings yet reached, 519. This edition, the last issued during the life of the author, sold well, like all the others, and was long out of print and much sought for. A so-called "twentieth" edition, revised and enlarged by Mr. William H. S. Wood, with the assistance of a number of high authorities, appeared in 1897, and contains over 700 pages and nearly 800 illustrations. A "twenty-first" edition has also appeared.

Gilbert M. Tucker.

Thorburn, Grant (Fig. 1903), founder of the seed house of J. M. Thorburn & Co., New York, and horticultural author, was born in 1773 in Dalkeith, Scotland, and early came to New York to seek his fortune. His father was a wrought-nail maker, and the son engaged in the same trade in this country. He soon married, and his wife attended a store which he established in Nassau Street, near Liberty, for the selling of "tape, ribbons, thimbles, thread, scissors, and Oxbery's needles." The living-rooms were in connection. "A glass door opened opposite the fireplace, where she rolled the dumpling or broiled the steak with one eye, and kept a squint on the store with the other." The introduction of cut-nail machines deprived young Thorburn of his trade, and the establishment of a pretentious grocery business on the corner of Nassau and Liberty streets took away his customers. He therefore gave attention to other means of livelihood. The women of the city had begun to show a taste for flowers. These were grown in pots, and the pots were sold by grocers. In the fall of 1802, there being various pots in his stock, Thorburn thought to attract the attention of purchasers by painting the pots green. Four pots were first painted. They sold quickly. Then he painted twelve. They sold; and thus the pot business grew. Thorburn had been in the habit of buying his meat at the Fly Market, at the foot of Maiden Lane. In April, 1803, he bought a rose geranium there, thinking to be able by its means still further to advertise his pots. But the next day a customer bought both pot and plant; and Thorburn quickly returned to the market and bought two more plants. These sold; and thus the plant business grew.

1903. Grant Thorburn.

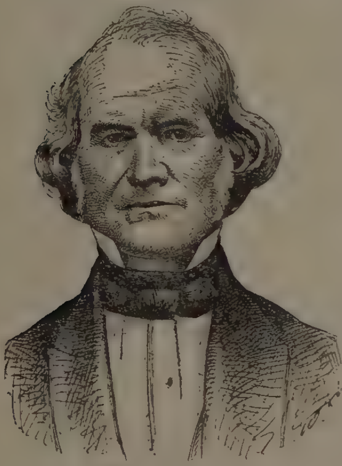
The man, George Inglis, of whom Thorburn bought the plants, was also a Scotchman, and it was soon agreed that one should grow the plants and the other sell them. But the customers also wanted to grow plants, and they asked for seed; and, as there was no seedstore in New York, it was arranged that Inglis should grow seeds also. This was in 1805; and in that year Inglis, as an experiment, had grown a lot of seeds. Thorburn bought these seeds for $15; and thus arose the first regular seedstore in New York, and one of the first in the United States.

The seeds and plants continued to sell, and Thorburn was obliged to import seeds. In 1805 or 1806 he obtained a catalogue of William Malcolm & Co., London, the first plant catalogue he had ever seen, and he then published one of his own. This led to more pretentious writing, and "The Gentleman and Gardener's Kalendar" was the first outcome. The third edition of this, in 1821, by "Grant Thorburn, Seedsman and Florist," contains the advertisment of "G. Thorburn & Son," dealers in seeds, implements and rural books.

Grant Thorburn was a prolific writer for the current press on a variety of topics, under the *nom de plume* of Laurie Todd. He was a unique character, and his history,—"mixed with much fiction," as he himself says,—was the basis of John Galt's tale in three volumes (London, 1830) of "Lawrie Todd, or Settlers in the Woods." Thorburn left a most interesting autobiography, which was published in New York in 1852. He died in New Haven, Connecticut, January 21, 1863, at the age of 90. The portrait in Fig. 1903 is reproduced from his autobiography. See p. 1518. L. H. B.

Thurber, George, botanist, naturalist and editor, was born in Providence, Rhode Island, September 2, 1821, and died at his home near Passaic, New Jersey, April 2, 1890. In his early years he devoted himself eagerly to the study of chemistry and natural sciences in general, but especially to botany, so that at an early age he was already well known as one of the most prominent botanists of the country. This brought him in close intimacy with John Torrey, Asa Gray, George Engelmann, Louis Agassiz and other eminent scientists, whose warm friendship he enjoyed until his death. In 1850 he obtained the appointment as botanist, quartermaster and commissary of the United States Boundary Commission for the survey of the boundary between the United States and Mexico. During the following four years his botanical work consisted mainly in the exploration of the native flora of these hitherto unknown border regions. His herbarium collected there comprised a large number of species new to scientists, some of which have been named after their discoverer, *Cereus Thurberi* being one of the most important; it is now cultivated for its fruit in the desert regions of North Africa. This historical herbarium formed the subject of Dr. Asa Gray's important work "Plantæ Novæ Thurberinanæ," published by the Smithsonian Institute. After his return to New York in 1853, Dr. Thurber received an appointment to the United States Assay Office, of which Dr. John Torrey was the assayer. In this position he remained until 1856, when owing to his strong sympathies with Gen. John C. Fremont, who was the first presidential candidate of the Republican party, he preferred to resign rather than sacrifice his principles. During the following three years he was connected with the Cooper Union and the College of Pharmacy of New York City as lecturer on botany and materia medica. In 1859 he was appointed professor of botany and horticulture at the Michigan Agricultural College, which position he held for four years. This position he resigned in 1863 to accept —on the urgent invitation of Orange Judd, the publisher—the editorship of the "American Agriculturist," which he held to within a few years of his death, when failing health prevented him from continuing his ardent labors. In this position he found his most congenial work and the real mission of his life, for which his previous training had fitted him so admirably. Few men have exerted so powerful and effective an influence on progressive horticulture and agriculture. The amount of his writings in the "American Agriculturist" during the twenty-two years of his connection with it was enormous, but as his name but rarely appeared with his articles it would be impossible to estimate the aggregate, yet whatever he wrote bore the stamp of accuracy of detail and naturalness of style. While in Michigan he revised and partly rewrote Darlington's "Agricultural Botany," which was published under the title of "American Weeds and Useful Plants." He wrote also the entire botany of Appleton's "New American Encyclopedia." An important part of his contributions to horticultural literature consisted in editing, revising and bringing out the horticultural and agricultural books of the Orange Judd Company. After the death of Dr. Torrey, he was elected president of the Torrey Botanical Club. He was also president of the New Jersey Horticultural Society; vice-president of the American Pomological Society for New Jersey; and honorary member of many scientific societies throughout the world.

F. M. Hexamer.



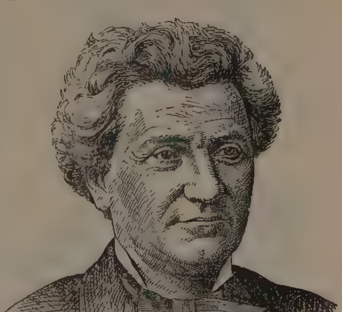
1904. Luther Tucker.

Tucker, Luther, (Fig. 1904), editor, was born at Brandon, Vermont, May 7, 1802, and died January 26, 1873. He was the founder of "The Horticulturist" and the proprietor of that valuable and unique magazine during the period of its greatest glory—from July, 1846, until the autumn of 1852. To A. J. Downing, however, belongs the credit for the distinguished interest and value of the magazine, as he conducted it according to his own ideas, with which the proprietor never interfered, the latter having indeed enough to do in putting it before the public with enterprise and vigor. It was issued simultaneously in Albany, Boston, New York and Philadelphia, with twenty-two special agencies at other points, including what was then the distant western town of Cleveland, Ohio, as well as Hamilton and Cobourg in "Canada West." Luther Tucker also founded, at Rochester, New York, October 27, 1826, the first daily paper published west of New York, "The Advertiser," which is still, under a slightly extended name, an influential journal; also at Rochester, January 1, 1831, "The Genesee Farmer," a weekly, the first agricultural periodical in the world written directly from the standpoint of practical experience. It has undergone some changes in name, as its scope extended far beyond the Genesee Valley, being now called "The Country Gentleman." It was published in Albany by the founder and his sons, from January, 1840, until July, 1911, when it was sold to the Curtis Publishing Company of Philadelphia. This is one of the ten American agricultural periodicals that were started before 1850 and outlived the nineteenth century, the others being these: "Maine (Kennebec) Farmer," 1839; "American (Boston) Cultivator," 1839; "Southern Planter," 1840; "Massachusetts Plowman," 1841; "Prairie Farmer," 1841; "American Agriculturist," 1842; "Southern Cultivator," 1843; "Indiana Farmer," 1845; "Rural World," 1848; "Ohio Farmer," 1848. It was natural that Luther Tucker should be interested in the New York State Agricultural Society, which he found at a low ebb on his coming to Albany, and of which, only a year later, he was the chief reorganizer, getting on foot the long series of annual fairs beginning in 1841 and still continued. He served the Society without any compensation or even reimbursement for his own expenses, for eleven years.

Gilbert M. Tucker.

Vaux, Calvert (1824–1895), an American landscape gardener, was born in London. Together with Frederick Law Olmsted he planned Central Park, New York, the prototype of large, accessible, nature-like city parks. The following account of his life-work is taken with slight changes from an obituary notice by Wm. A. Stiles in "Garden and Forest" 8:480. He had achieved success in architecture before the age of twenty-four, when he came to America as business associate of Andrew Jackson Downing. At the time of Downing's untimely death in 1854 the two men were designing and constructing the grounds about the Capitol and Smithsonian Institution, the most important work of the kind that had yet been attempted in America. Meanwhile, the gathering sentiment in favor of spacious and accessible city parks which had found expression in eloquent letters of Downing, at last secured, through legislative action, the purchase for a public pleasure-ground of the rectangular piece of ground now known as Central Park, New York. In 1858 the city authorities selected, out of thirty-three designs offered in competition for the new park, the one signed "Greensward," which was the joint work of Frederick Law Olmsted and Calvert Vaux, and Central Park as we know it today is the realization of this design in its essential features. It may be added that this "Greensward" plan, together with other reports on Central Park, on Morningside and Riverside Parks, in New York, on parks in Brooklyn, Albany, Chicago, San Francisco and other cities, both in this country and the Dominion of Canada, by the same authors, contain a consistent body of doctrine relating to public pleasure-grounds which is unique and invaluable. Calvert Vaux was a member of many important commissions, and he acted as landscape gardener for the Niagara Falls Reservation, but for more than thirty years his best work and thought were steadily given to the parks of New York City. He had the genuine creative faculty which gave the stamp of originality to all his work, and a severity of taste which preserved it from anything like eccentricity or extravagance. As a city official he was a model of intelligent zeal and sturdy integrity. Several times he resigned his lucrative position rather than see his art degraded, but he was always quickly reinstated by a demand of the people. See *Olmsted*, p. 1589; also *Landscape Gardening*, Vol. IV.

Wilhelm Miller.



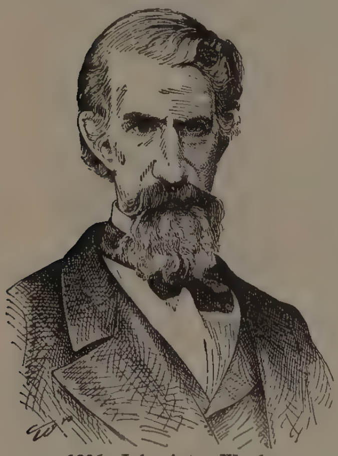
1905. James Vick.

Vick, James (Fig. 1905), seedsman and editor, was born at Portsmouth, England, November 23, 1818, and died at Rochester, New York, May 16, 1882. He came to America at the age of twelve, learned the printer's trade, and in 1850 became editor of the "Genesee Farmer," then published at Rochester by Luther Tucker and subsequently absorbed by "The Cultivator." In 1853 he purchased Downing's magazine, "The Horticulturist," and published it for a time, the editor being Patrick Barry. In 1860 Vick entered the seed business and his trade soon grew to large proportions. For about twenty years his name was a household word, being associated especially with flowers. In 1878 he founded "Vick's Magazine." Vick's personality was thoroughly amiable, and his letters in "Vick's Magazine" to children and to garden-lovers everywhere show the great hold he had on the hearts of the people.

Wilhelm Miller.

Warder, John Aston (Fig. 1906), physician, author, horticulturist and forester, was born at Philadelphia, January 19, 1812. His early life was spent in a suburban home, where he evinced a love of nature which he cherished through life. Bartram and Darlington were among his neighbors and he met in his father's house men like Audubon, Michaux and Nuttall. In 1830 his parents moved to Springfield, Ohio, where he helped clear up a farm and first became interested in agricultural sciences and comparative anatomy. He was graduated at Jefferson Medical College, Philadelphia, in 1836. He settled in Cincinnati in 1837 and began the active practice of medicine. He was early elected a member of the school board and did faithful service for many years, making it his business to travel through the eastern states and cities to study systems of teaching in order to introduce improved plans into the Cincinnati schools. He was actively interested in and a prominent member of the Cincinnati Astronomical Society, the Western Academy of Natural Sciences, the Cincinnati Society of Natural History. He was one of the founders of the Cincinnati Horticultural Society and the Wine-Growers' Association. He was also prominent in the old Cincinnati College and afterward in both the Ohio and Miami Medical Colleges. He was for many years president of the Ohio Horticultural Society and vice-president of the American Pomological Society. He was among the first to draw public attention to the improvement of public grounds, private parks and cemeteries. The present interest in landscape-gardening in this country is largely due to his efforts and writings. He was interested in establishing the famous Spring Grove Cemetery, one of the earliest and best of landscape or lawn cemeteries, and was one of the first residents of Clifton, whence he moved to a farm near North Bend, Ohio, formerly owned by President Harrison. There he spent most of his time in testing varieties of fruit and methods of culture, and prepared numerous practical papers for horticultural societies and other readers, and in fact established a private experiment station.

In 1850 he began the publication of the "Western Horticultural Review," which continued four years. In one number is contained the first description of the *Catalpa speciosa*, now recognized as one of the valuable forest trees. His report of the Flax and Hemp Commission, published by the Government in 1865, was the result of much patient study and investigation. "Hedges and Evergreens" appeared in 1858. "American Pomology—Apples," published in 1867, was the result of more than sixteen years of careful study, aided by hundreds of correspondents in various parts of the central states. It is still considered a standard authority on description and varieties of apples, containing a table of varieties and synonyms of over 1,500 names.



1906. John Aston Warder.

A report upon forests and forestry was the result of his visit to the World's Fair at Vienna in 1873, as United States Commissioner. In 1875 he issued a call for a convention at Chicago to form an American Forestry Society, which organization was completed at Philadelphia in September, 1876. The public was not yet impressed with the importance of the subject, but this pioneer association gave impetus to the plans for united effort. In 1879–80, with the approval of various societies, Dr. Warder memorialized Congress, asking for a commission for the study of forestry in Europe, but general interest was not thoroughly aroused until, largely through his efforts, the American Forestry Congress held its meeting in Cincinnati in April, 1882. He was honorary president of the Ohio State Forestry Society, prepared strong memorials to Congress on behalf of the forests and was shortly afterward appointed agent of the Department of Agriculture to report upon forestry of the northwestern states. He was devoted in his interest in all which concerns rural life and industry; his efforts had a great and marked effect on the horticulture and outdoor art of the great central states. Death ended an active and useful life July 14, 1883.

R. H. Warder.

Wellhouse, Frederick, judge and pomologist, was born in Wayne County, Ohio, November 16, 1828, and died at Topeka, Kansas, January 10, 1911. He was the son of a pioneer and received his early education in the typical log schoolhouse of the early days. He got his knowledge of farming at first hand on his father's 300-acre farm. In 1858 he published the "Indiana Farmer," a monthly agricultural paper, which he sold to his partner, J. N. Ray, in 1859, and afterward moved to Leavenworth, Kansas, and engaged in horticulture. During the Civil War, he was captain of the 19th Regiment, Kansas State Militia. He was elected county commissioner of Leavenworth County in 1861 by an almost unanimous vote. He was the Republican nominee for senator in 1864, but was defeated. He served two terms in the Kansas legislature, 1884–8. He was an active member of the State Horticultural Society, almost from its organization, and was for fifteen years its treasurer and four years its president. He represented the state of Kansas in the fruit display for the World's Columbian Exposition, Chicago, 1903, and did much pioneer work in Kansas horticulture in early days when that work demanded a leader. He represented the state's fruit industry at the various state fairs and the national expositions. He planted the largest commercial orchard in Kansas, and it was for many years the largest apple orchard in the world, an orchard of over 1,600 acres, that justly entitled him to the name of the "Apple King." This initial orchard was planted in 1876, and he added to the plantings for a number of years. In 1880 the yield from his orchard was 80,000 bushels besides the culls and it required 200 cars to ship them east. The yield for eleven years, from his first plantings, was 239,135 bushels which sold for $125,118.25. In the twenty-five years' trial of his commercial orchard he found Jonathan the most profitable variety; Missouri (Pippin) second best; Ben Davis third and Winesap fourth.

G. B. Brackett.

Wharton, Silas, pioneer nurseryman and pomologist, was born in 1775 in Bucks County, Pennsylvania. He removed to Waynesville, Ohio, about 1820 and was a celebrated pioneer nurseryman of that state. He grew Morello, May Duke and Carnation cherries, Red June, Summer Pearmain, Trenton Early, Summer Rose, English Hagloe, Ribston, Golden Pippin, Pennock and many other well-known apples. The Miami Valley and the neighborhood about Dayton, Ohio, are more indebted to Silas Wharton for intelligent fruit-growing at an early day, than perhaps to any other man. He was a warm friend of Coxe, the pioneer pomologist and author, and doubtless Coxe secured much valuable data from him for his book, "A View of American Fruits." Silas Wharton died in 1858.

G. B. Brackett.

White, William Nathaniel, teacher, horticulturist and editor, was born in Stamford, Connecticut, November 28, 1819, and died in Athens, Georgia, July 14, 1867. He was a graduate of Hamilton College, New York, a teacher in Atlanta, Georgia, and upon removing to Athens, he became one of the most prominent horticulturists of the South. He was a contributor to many agricultural and horticultural periodicals, both North and South, and before and during the time of the Civil War, he was owner and editor of the "Southern Cultivator." He was also author of "Gardening for the South," which book was published in 1856; after his death two more editions were published, one in 1867, and the last in 1901. His useful life was spent in the upbuilding of southern horticulture and agriculture. For a more detailed account see "Cyclopedia of American Agriculture," Vol. IV, p. 625.

T. H. McHatton.

Wilder, Marshall Pinckney (Fig. 1907), distinguished amateur pomologist and patron of horticulture, was born at Rindge, New Hampshire, September 22, 1798, and died at his home near Boston, December 16, 1886. His inherited love of country life soon showed itself, and at the age of sixteen he chose farm work in preference to a college course. At twenty-seven he moved to Boston, where he was long known as a prosperous merchant and president of many societies and institutions. His active interest in horticulture may be dated from 1832, when he purchased a suburban home at Dorchester, where he lived for more than half a century. His pear orchard at one time contained 2,500 trees, representing 800 varieties. During his life he tested 1,200 kinds of pears and in 1873 he exhibited 404 varieties. He produced several new pears. In 1844 he introduced the Anjou. He imported many fruits and flowers new to America, and from 1833 to the end of his life he was constantly contributing to the society exhibitions the products of his garden. He carried a camel's-hair brush in his pocket and was always hybridizing plants.

1907. Marshall P. Wilder.

He delighted in floriculture, and his camellia collection, comprising at one time 300 varieties, was the best in America. He raised many new kinds of camellias, though he lost 500 seedlings by fire. His *Camellia Wilderi* he sold to florists for $1,000. He also had a notable collection of azaleas. As early as 1834 he produced a double California poppy. Among the many floral novelties which he was first to import, cultivate or exhibit in America were *Diervilla rosea* (1851), hardy kinds of *Azalea mollis* (1874), *Cissus discolor* (1854), "the harbinger of the infinite variety of ornamental-leaved plants now so generally cultivated and admired," *Clematis cærulea* var. *grandiflora* (1841), *Lilium lancifolium* var. *album*, the first of Japanese lilies, *Gladiolus floribundus* (1836), and *Oncidium flexuosum* (1837), a plant of which bore ninety-seven fully expanded flowers and was the first orchid reported at any American exhibition. The Marshall P. Wilder rose makes his name familiar to a later generation.

Wilder's greatest services to horticulture were connected with the Massachusetts Horticultural Society and the American Pomological Society. Of the former he was a member for fifty-six years, and president from 1841 to 1848. He was one of the founders of the American Pomological Society, and with the exception of a single term was its president from its organization in 1850 until his death in 1886. He is counted one of the founders of the Massachusetts Board of Agriculture and of the Massachusetts Agricultural College, and of the United States Agricultural Society (1852). He was president of the last from its foundation until 1857, and from 1868 until his death he was president of the New England Historic Genealogical Society. At twenty-six he was a colonel, and in 1858, after declining the nomination four times, he was elected commander of the Ancient and Honorable Artillery Company. He was a trustee of the Massachusetts Institute of Technology.

In 1883 Marshall P. Wilder urged upon the American Pomological Society the necessity of a reform in the nomenclature of fruits. He took an active part in the great work that followed.

In the early days when the conflicting interests of the Massachusetts Horticultural Society and the Mount Auburn Cemetery required separation, he was an important factor in solving the complicated and delicate problem. The settlement of this difficulty laid the foundations of the wealth of the Massachusetts Horticultural Society.

At his death he left the American Pomological Society $1,000 for Wilder Medals for objects of special merit and $4,000 for general purposes. He left the Massachusetts Horticultural Society $1,000, to encourage the production of new American varieties of pears and grapes.

Wilhelm Miller.

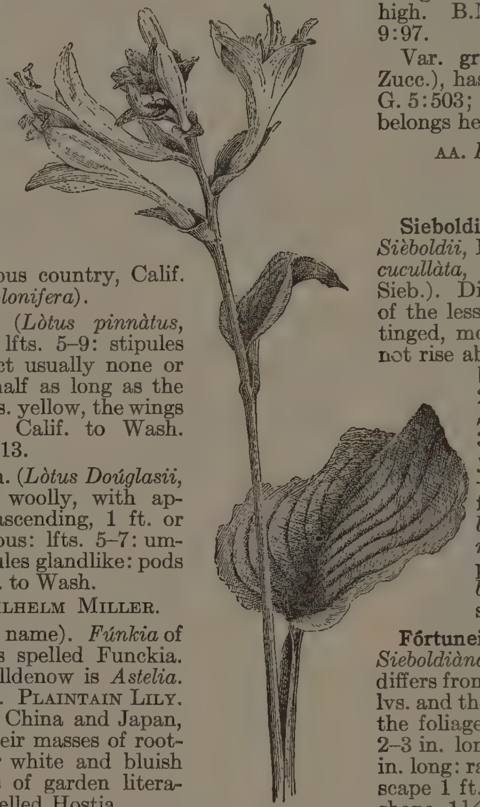
Woolverton, Charles Edward, pomologist, and nurseryman, was born in Grimsby, Ontario, August 22, 1820. He was the youngest son of Dennis Woolverton, of New Jersey, who settled on a farm of 400 acres on the south side of Lake Ontario, in the Niagara district in 1798. Here Charles became accustomed to every department of work both in farm and orchard. He was educated at Madison (now Colgate) University, and in 1846 settled upon a portion of the old homestead. In 1856, in company with A. M. Smith, he devoted a considerable portion of his farm to nursery and orchard, in which business he was quite successful, distributing fruits and fruit trees throughout a considerable portion of Ontario, Quebec and Nova Scotia. At Grimsby, he planted the first large commercial orchard of peach trees and proved the adaptability of the soil and climate of the Niagara district for the production of peaches and sweet cherries. In company with Messrs. Beadle, Smith, Arnold, Judge Logie and several others, Mr. Woolverton was instrumental in the formation of the Fruit-Growers' Association of Ontario, which afterward reached a membership of over 5,000, and was the chief agent in the encouragement and development of horticulture in southern Ontario. He died in August, 1900.

Linus Woolverton.

HOSÁCKIA (David Hosack, professor of botany and medicine in New York; author of "Hortus Elginensi," 1811; died 1835). *Leguminòsæ.* Herbaceous plants, three of which have been advertised by collectors of northwest American plants.

The genus contains about 40–50 species, all American and mostly confined to the Pacific slope: herbs or rarely subshrubs: lvs. pinnate, with 2 to many lfts.: stipules minute and gland-like, rarely scarious or leafy: fls. yellow or reddish, in axillary umbels which are peduncled or not.—The genus is closely related to Lotus, with which some authors unite it, but the calyx-teeth are shorter than the tube: keel obtuse: lvs. usually with numerous lfts., none of which is like stipules, while Lotus has calyx-lobes usually longer than the tube, a rostrate keel and 5 or 4 lfts., of which 2 or 1 are stipule-like. The two species first mentioned belong to a section in which the pods are shortly acute, linear, many-seeded, straight, glabrous: fls. and fr. not reflexed: peduncles long. The third species belongs to a section in which the pods are long-attenuate upward, incurved, pubescent: peduncles short or none: fls. and fr. reflexed. See *Lotus*.

crassifòlia, Benth. (*Lòtus crassifòlius*, Greene). Stout, 2–3 ft. high, nearly glabrous: lfts. 9–15, thickish: stipules scarious, small: bract below the umbel: calyx-teeth short: pod thick: fls. greenish yellow or purplish. Dry places in mountainous country, Calif. B.R. 1977 (as *H. stolonifera*).


1908. Hosta plantaginea. (×⅙)

bícolor, Douglas (*Lòtus pinnàtus*, Hook.). Glabrous: lfts. 5–9: stipules scarious, small: bract usually none or small: calyx-teeth half as long as the tube: pod slender: fls. yellow, the wings often white. Cent. Calif. to Wash. B.R. 1257. B.M. 2913.

decúmbens, Benth. (*Lòtus Doúglasii*, Greene). Silky or woolly, with appressed hairs: sts. ascending, 1 ft. or more long, herbaceous: lfts. 5–7: umbels less dense: stipules glandlike: pods pubescent. N. Calif. to Wash.

WILHELM MILLER.

HÒSTA (personal name). *Fúnkia* of Sprengel, sometimes spelled Funckia. The *Funckia* of Willdenow is *Astelia*. *Liliàceæ*. DAY LILY. PLAINTAIN LILY. Hardy perennials of China and Japan, much planted for their masses of root-leaves and for their white and bluish flowers; the funkias of garden literature. Sometimes spelled Hostia.

Herbs, forming stools or clumps: lvs. petiolate, ovate or lance-ovate, prominently several-ribbed, those on the flowering sts. smaller and becoming bract-like: fls. in terminal racemes or spikes, white or blue; perianth funnelform, 6-parted and more or less irregular, the lobes not widely spreading; stamens 6, the filaments filiform, the anthers long-oblong and versatile: pod oblong and angled, many-seeded, splitting into 3 valves; seeds flat and black, winged at the apex.—Species about 10. In cult., the synonymy seems to be much confused.

The hostas are hardy and of the easiest culture. Their dense stools or clumps of foliage are in place along walks or drives and in the angles against buildings. A continuous row along a walk gives a strong and pleasing character. Make the soil rich and deep. The clumps improve with age. The large-leaved kinds grow vigorously in moist, shady places. Of some varieties the leaves are strikingly variegated. They bloom in summer. Foliage is killed by frost. Propagation is by dividing the clumps; some species produce seeds freely, and seedlings can be grown readily if seed is sown as soon as ripe.

A. *Fls. white, ascending; fl.-bract very large, with a smaller one inside.*

plantagínea, Aschers. (*Hemerocállis plantagínea*, Lam. *H. álba*, Andr. *Fúnkia subcordàta*, Spreng. *F. álba*, Sweet. *F. liliiflòra*, Hort. *F. japónica*, Hort., at least of some. *F. cordàta*, Hort., not Sieb.). Fig. 1908. Lvs. large, broadly cordate-ovate, with a short, sharp point, green, many-ribbed: fls. large, 4–6 in. long, with an open bell-shaped perianth, waxy white, the base of the tube surrounded by a broad bract; spike short, the bracts very prominent.—The commonest species in old yards, and an excellent plant. The fls. have an orange-like odor. Clumps of foliage grow 12–20 in. high. B.M. 1433 (as *Hemerocallis japonica*). Gng. 9:97.

Var. **grandiflòra,** Hort. (*F. grandiflòra*, Sieb. & Zucc.), has very long and large fls. G.C. III. 4:153. G. 5:503; 23:591. *H. macrántha*, Hort., probably belongs here.

AA. *Fls. blue or lilac, more or less inclined or nodding; bract 1.*

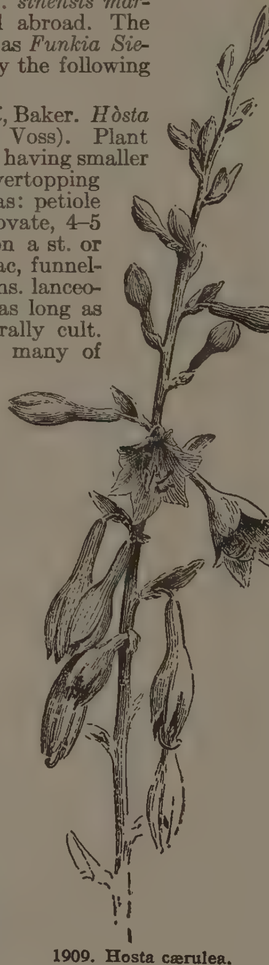
B. *Lvs. glaucous.*

Sieboldiàna, Engler (*Fúnkia Sieboldiàna*, Hook. *F. Sièboldii*, Lindl. *F. glaùca*, Hort. *F. sinénsis*, Sieb. *F. cucullàta*, Hort. *F. glaucéscens.* Hort. *F. cordàta*, Sieb.). Differs from the last in the metallic blue color of the less cordate lvs., in the inclined bluish or pale-tinged, more slender-tubed and smaller fls. (which do not rise above the foliage), and in having only 1 small bract at the base of the fl. B.M. 3663. B.R. 25:50. L.B.C. 19:1869 (as *Hemerocallis Sieboldtiana*). G. 10:387; 13:3. G.C. III. 38:94. There is a form with the body of the lf. yellowish white and the edge green. Lowe, 34.—Lf.-blade and petiole each 1 ft. long, the foliage therefore overtopping the fls. *F. Sieboldii elatior* and *F. sinensis marmorata*, are offered abroad. The plant usually cult. as *Funkia Sieboldiana* is probably the following species.

Fórtunei (*Fúnkia Fórtunei*, Baker. *Hòsta Sieboldiàna*, var. *Fórtunei*, Voss). Plant differs from *H. Siéboldiana* in having smaller lvs. and the racemes much overtopping the foliage, as in other hostas: petiole 2–3 in. long; blade cordate-ovate, 4–5 in. long: raceme ½ft. long on a st. or scape 1 ft. long; fls. pale lilac, funnel-shape, 1½ in. long, the segms. lanceolate and ascending and half as long as the tube.—Excellent. Generally cult. as *Funkia Sieboldiana*, and many of the pictures of that name, probably belong here, as, apparently, Gn. 38, p. 79; A.G. 11:157; A.F. 6:322. It is probable that the garden synonyms cited under *H. Sieboldiana* are usually applied to plants of *H. Fortunei*. A var. **gigantèa** is offered, with lvs. and fls. much larger than in the type. Vars. **robústa,** and **argénteo-variegàta,** are also listed abroad.

BB. *Lvs. green.*

cærùlea, Tratt. (*Fúnkia cærùlea*, Sweet. *F. ovàta*, Spreng. *F. lanceolàta*, Sieb.). Figs. 1909, 1910. Lvs. broad-ovate, 5–10 in. long and half as wide, usually tapering to the petiole, but sometimes subcordate: raceme long and lax; fl. with a short, slender tube and suddenly expanding into a bell-shape, 1½–2 in. long, nodding, deep blue. B.M. 894


1909. Hosta cærulea. (×⅙)

(as *Hemerocallis cærulea.*) Mn. 1, p. 73.—The commonest blue-fld. species. *Fúnkia marginàta,* Sieb., is a form with white-bordered lvs. There is also a yellow-variegated form.

lancifòlia, Tratt. (*Fúnkia lancifòlia,* Spreng. *F. japónica,* Hort., of some). Lvs. lanceolate to narrowly ovate-lanceolate, the blade 6 in. or less long and 2 in. or less wide: raceme lax, 6–10-fld., on a tall, slender st.; fls. 1½ in. or less long, the tube slender and gradually enlarging upward, pale lilac. Var. **álbo-marginàta,** Hort. (*Fúnkia álbo-marginàta,* Hook., B.M. 3657), has the lvs. edged white. Var. **tardiflòra** (*Fúnkia tardiflòra,* Hort.), blooms in late autumn: lvs. firmer and shorter petioled. Gn. 64, p. 297. Var. **undulàta** (*Fúnkia undulàta,* Otto & Dietr. *F. lancifòlia* var. *undulàta,* Bailey) is a form with undulate white-margined lvs. There is a form with 1-striped lvs., var. **univittàta,** Hort. Graceful. Fls. smaller than those of *H. cærulea.* **H. lóngipes** (*Fúnkia lóngipes,* Franch. & Sav.) is closely allied, but has broader lf.-blades decurrent on the petiole.

1910. Hosta cærulea.

H. Aòki, with "large glaucous-green lvs." is advertised. It has been offered in this country from European sources, and is said to be apparently identical with Hosta Sieboldiana, except in time of blooming.—*H. aùrea,* Hort., variegated forms of various species.—*H. elàta,* Hort., "bears tall scapes of pale blue fls."—*H. gigantèa,* Hort., has "long spikes of blue fls."—*H. variegàta,* Hort.=variegated forms of various species, usually of H. cærulea or H. lancifolia.—*H. víridis-marginàta,* Hort., is probably a form of H. cærulea.

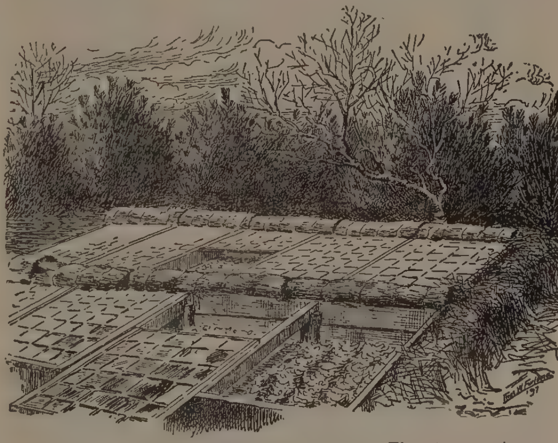
L. H. B.

HOTBEDS. Low glass structures in which plants are started or grown, usually heated by fermenting vegetable substances, such as stable-manure, although fire heat is occasionally applied, steam, hot water and flues being used. Their usual place is some spot sloping to the south, where they are protected by buildings, evergreen screens or board fences, from the north and west winds (Fig. 1911). The frames are made either of plank or boards and may be portable, or built in place, the former being taken down and packed away except when needed. A tight board fence 6 feet high, as a windbreak, is desirable, as it will also serve as a support for the shutters, mats and sash when they are removed from the bed, and it will answer best for this purpose if it inclines a foot or so to the north.

When movable frames (Fig. 1912) are used, they are generally constructed of 2-inch plank, the side pieces being from 9 to 12 feet and the ends 6 feet in length, to receive either three or four ordinary sash, which are 3 by 6 feet. The north side of the frame is made 15 inches wide, while the south side is but 9 or 10 inches, thus giving a slope to the south, which will permit the water to run off and favor the passage of the sun's rays through the glass. The end pieces are 6 feet in length, and in width taper from 15 inches at one end to 9 or 10 at the other, so as to fit the side boards. The plank for portable hotbed frames may be held in place by means of stakes, or iron rods or bolts may be fastened to the ends of the side pieces so that they can pass through the holes in the ends of the frame, which can then be secured by keys or nuts. As supports for the sash and to hold the sides of the frame in place, cross-strips of board 3 inches wide are sunk into the upper edge every 3 feet, and another strip with a width equal to the thickness of the sash is fastened on edge to the center of its side. Frames of this size require a slightly deeper mass of heating material than would be necessary for larger frames, and when they are to be used during the winter, it is well to excavate to the depth of 2½ feet and for a space 2 feet longer and wider than the frame, and after the hole has been filled with heating material, the material should be well tramped down. The frame is then put in place and manure is banked about it.

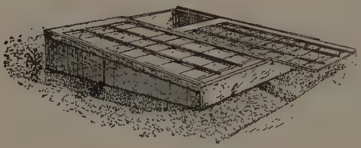
For permanent frames, rough 1-inch boards may be used, although 2-inch plank will be found far more durable. Stout stakes should be driven into the ground about 4 feet apart, where the north line of the bed is to be located. These should project above the surface from 12 to 15 inches, and should be boarded up from a point just below the level of the ground, so that the stakes will be on the north side of the frame. A second row of stakes should then be driven at a distance from the first row equal to the length of the sash, which is usually 6 feet, although other lengths are sometimes used. The south wall of the frame should then be boarded up so that it will be 5 or 6 inches lower than the north wall, after which the end should be closed and cross-pieces should be fitted, the same as for the portable sash. To prevent frost from working into the frame, soil should be taken from the inside and banked against the boards outside, so that it will reach two-thirds of the way to the top of the frame, and when the bed is ready for use, 3 or 4 inches of horse-manure should be spread over this. The frame should be placed about 3 feet from the fence, and if other rows are needed, there should be alleys about 7 feet wide between them.

Instead of boards or planks, concrete may be used for the walls of permanent frames. Forms should be set so that the lower part of the wall will be 4 inches thick but it may be only 2½ or 3 inches on the top. The excavation for the wall should extend about 1 foot below the surface and to prevent the settling of the concrete walls, when the excavation for the bed itself



1911. Hotbed sheltered by a hedge. The straw mats have been rolled off.

is made, concrete piers about 6 inches square should be built every 6 feet for the wall to rest upon. They should extend nearly 2 feet below the wall. The walls of the excavation will serve as a form for the piers and if care is taken in making the excavation for the wall itself, there will be no need of making a form for the outside of the walls below the surface, but plank should be set up for the inside of the walls, and for both sides of the wall above the surface. For making the grout, use four parts of gravel, two parts of sharp sand and one part of cement. Mix the sand and gravel and then after adding and thoroughly mixing the cement, pour on water enough to make a "wet mix." Pour the grout into the form, thoroughly packing it, and then allow the form to remain until it has set.


1912. Hotbed with movable frame.

Hotbed sash.

The size that has been found most satisfactory for hotbed sash is 3 by 6 feet, as when larger than this they are not readily handled by one man. While pine and other native lumber may be used, cypress is generally perferred, as it is much more durable and costs but little if any more than clear pine. The sides and upper ends of the sash are made from 3 by 1½-inch strips, grooved to receive the glass, while the lower end is about 1 by 5 inches. The center strips are 1 by 1½ inches. For glazing hotbed sash, single-strength 10 by 12 glass is commonly used, as three rows of this size will fill a sash 3 feet wide. While double-strength glass will be less easily broken, the increased weight is an objection to its use. The use of double-glazed sash is often advised, but aside from the extra cost, it will be found that the sash will be heavy to handle and, if used near where soft coal is burned, the bottom rows of glass will soon become nearly opaque and it will be necessary to reglaze the sash in order to wash the glass. Where there will be no trouble from soot and the sash is to be used for the covering of half-hardy plants in the winter, double-glazed sash may be used with satisfaction. The sash should receive two coats of paint, and after the glass, which may be either lapped or butted, has been set, it should be given a third coat.

Mats and shutters.

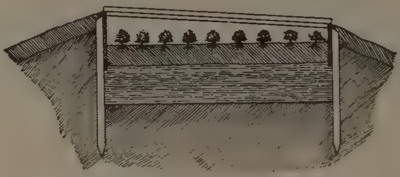
For covering the frames on cold nights during the winter and early spring months, straw mats are often used, although those made of burlap are generally preferred. The burlap may be either single or doubled, or it may be stuffed with straw, excelsior or other materials. Quilted mats filled with combination wool are very warm and quite durable. During the winter, wooden shutters are also desirable to place over the mats, as they assist in holding the heat, and by keeping the mats dry, aid in preserving them.

Heating material for hotbeds.

To provide heat for the beds decomposing horse-manure is generally used. While a large amount of straw is not desirable, the presence of urine-soaked bedding with the manure to the extent of one-third its bulk is not objectionable, as it will lengthen the heating period of the manure. Unless straw is mixed with the manure, it will be well to add forest leaves to the amount of one-third to one-half the amount of the manure. The heating material should be forked over and placed in a pile 5 to 6 feet wide, 3 to 4 feet high and of any desired length. If the manure and straw are dry, it will be well to moisten them with a fine spray. In case there is but a small amount of manure, it will be best to use warm water, though in all cases the soaking of the manure should be avoided. Within four or five days the giving off of steam will indicate that heating has commenced. The pile should then be forked over, working the outer portions into the center.

The amount of heating material that will be required for a hotbed will vary with the crop, as well as with the location and season. For zero weather, there should be at least 18 inches of heating material after it has been well packed down, and 24 inches will be desirable in midwinter in the northern states, while 6 to 8 inches may answer where only a few degrees of frost are expected. For 18 inches of manure, the excavation should be made to a depth of 28 inches below the level of the south side of the frame, and 31 inches below that of the north side. After the manure has warmed through for the second time it should be placed in the excavation, spreading it evenly and packing it down with the fork, but leaving it for a few days before tramping it. Care should be taken to have the corners well filled, that an even settling may be secured. After the manure has again warmed up, it should be thoroughly tramped.

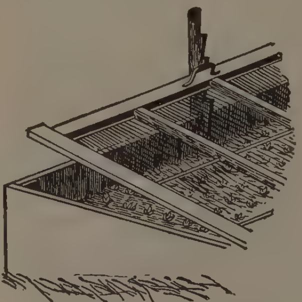
The bed is then ready for the soil, which should be quite rich and contain a large amount of sand and humus, a compost of decomposed pasture sods with one-third their bulk of rotten manure being excellent for the purpose. The thickness of the soil should vary from 5 to 7 inches, the greater depth being desirable for radishes and other root crops (Fig. 1913). When boxes of plants are to be placed in the beds, the depth of soil need not be more than 3 inches. For a few days the bed will be quite warm, but when the temperature of the soil has dropped below 90° the seeds may be sown or the plants set out.


1913. Hotbed in cross-section.

In severe weather the mats and shutters should be placed on the bed at night and should be removed in the morning. When the sun is shining, or if the bed is very hot, it should be ventilated by raising (Fig. 1914) or slipping down (Fig. 1912) the sash, the amount depending upon the season and the condition of the bed. By the middle of the afternoon the sash should be closed and the covering should be replaced before night. When used in the winter time, the hotbed should be either sunk in the ground or well banked up with soil or manure, so as to keep out the frost.

Fire-heated hotbeds.

Especially if the beds are to be used during the winter months, and where there is an abundance of wood for fuel, it is advisable to use artificial heat for hotbeds. The simplest and cheapest method of heating is by means of hot-air flues. These do not differ materially from greenhouse flues except that they run underground and 6-inch sewer-pipe is used for them. The best results are obtained when the beds are built on the slope of a hillside, as this improves the draft. A


1914. Ventilating the hotbed.

small furnace or firebox is constructed of brick or concrete at the lower end of the frames from which one or more lines of hotbeds may be heated. As a rule, it is not best to heat more than two rows of frames from a furnace.

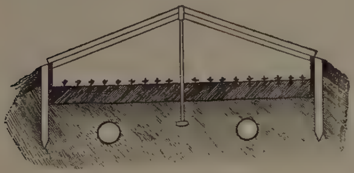
The flues are placed so that they will be 10 or 12 inches below the surface of the soil in the frames and they should rise gradually toward the farther end, where they should be connected with a pipe which will serve as a chimney. The height should vary from 6 to 10 feet, according to the length of the frames. For use in the winter, there should be two flues in a frame 12 feet wide.

When the hotbeds are located near a greenhouse heated by steam or hot water, it will be found satisfactory, particularly if the beds are higher than the heating plant, to put in either hot-water or steam pipes for heating them. While beds 6 feet in width may be heated in this way, it is better to make them about 12 feet wide, with a ridge in the center and a row of hotbed sash on each side. To heat such a frame with hot water, a 2½-inch flow-pipe should be run just under the ridge and there should be one or two 2-inch returns on each of the side walls. For use in the spring, one return on a side would answer, but in the winter months two will be necessary in sections where the mercury reaches zero, unless the beds are covered to prevent the escape of the heat. When steam is used, the feed-pipe should be 1½- or 2-inch and 1¼-inch pipe should be used for the returns.

In the northern states, it is seldom desirable to use hotbeds of any kind for the growing of winter crops, as not only can better results be secured in greenhouses, for which the cost will be but little more, but the work of handling the hotbeds in cold, stormy weather will be very disagreeable and unsatisfactory. In the South, however, hotbeds answer very well for winter use, both for growing plants for the truck-garden and for the forcing of various vegetable crops, although even there the simply constructed greenhouses would be more satisfactory.

Coldframes.

As an adjunct to the greenhouse when one is growing truck-crops, or bedding-plants, a coldframe will be found very helpful. These differ from hotbeds only in relying upon the sun for their heat. The surface of the soil should be from 6 to 12 inches below the glass. If plants are to be grown in the soil of a frame, care should be taken that it is adapted to the crop and that it is well stored with available plant-food. In many cases the frames are merely used for the hardening of plants which have been grown in the greenhouse, or for the carrying of half-hardy plants through the winter. For these purposes the soil in the frames should be of a sandy or porous nature.

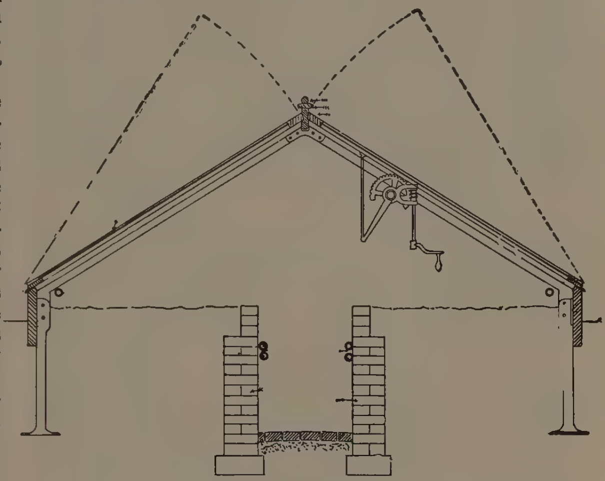


1915. Fire hotbed.

Glass sash should be used for covering the frames in the winter but, in the spring, canvas and other substitutes answer very well, particularly when the frames are to be used for the growing of seedlings. A long strip of canvas may be stretched lengthwise of the bed as a covering at night and upon cold days, and removed in whole or in part in pleasant weather. Oiled paper and water-proofed muslin are also used as substitutes for glass in hotbed sash.

Management of hotbeds.

If the weather is mild during the latter part of February, the manure can be procured and prepared for use so that the hotbed may be started about the first of March. If properly constructed they will provide heat for two months, and can then be used during May as coldframes, thus making it possible to take off two crops in the spring. Although it is not often practised, they may be used in the fall for growing a crop of lettuce or other vegetables, which can be matured before the first of December.



1916. Hotbed or forcing-house heated by hot water.

If a greenhouse is not available for starting the plants, seeds of lettuce, radishes, cabbages and other of the hardier plants may be sown in the hotbed in the spring as soon as it is ready, in rows 4 or 5 inches apart. When the first true leaf appears, the radishes should be thinned and the other plants transplanted to about 2 inches. Later on, the lettuce plants should be placed about 8 inches apart each way. If the weather is so cold that the bed should not be kept open, the seeds may be sown and the first transplanting may be in flats or boxes, which can then be placed in the beds. Aside from proper ventilation, covering and watering, the beds should occasionally be weeded and the soil stirred. About the first of April, tomatoes, cucumbers and similar plants may be started. As soon as one crop is taken off another should be placed in the beds, and by deepening the soil they may be used during the early summer for growing cauliflower, tomatoes and cucumbers.

L. R. Taft.

HOTÈIA: *Astilbe.*

HOTTÒNIA (Peter Hotton, 1648–1709, professor at Leyden). *Primulàceæ.* Featherfoil. Two species of water plants, perennial, not very ornamental, but suitable for small aquaria.

Plants rooting or floating, the sts. spongy and air-bearing, the peduncles hollow and erect: lvs. submersed and dissected, passing into entire narrow whorled bracts: fls. white or purplish, whorled and racemose, emersed; corolla salverform, with 5-parted limb; ovary free: fr. a globular more or less 5-valved many-seeded caps.—The European species is procurable from dealers in aquatics; the American can be gathered in shallow, stagnant ponds from Mass. to W. N. Y. and south to Fla. and La.

palústris, Linn., the European plant, is an herb with creeping rootstock, whorled leafy branches entirely submerged and alternate, pinnately dissected lvs., the divisions numerous and linear. From the center of the whorl of branches a single leafless fl.-st. rises out of the water in summer, bearing a raceme with several whorls of 3–5 or 6 handsome pale purple fls., apparently with

5 petals, but actually with a short corolla-tube below the lobes; stamens 5, inserted on the tube of the corolla: caps. subglobose, with 5 lateral valves; seeds numerous.—The plants root in the mud or float, and the fls. are about ¾in. diam.

inflâta, Ell., the American plant, has spongy sts. and clustered peduncles, which are partly above water, inflated, jointed, the lowest joint 2–4 in. long and sometimes 1 in. thick, the others 1–3 in number and successively shorter: fls. white in whorls of 2–10 at the joints. B.B. 2:586.—Neither species is advertised. Like all aquarium plants, they are interesting, but they have no horticultural value otherwise. Both plants are called featherfoil and water-violet; the American also water-feather and water-yarrow. The European species has dimorphic fls., after the manner of Primula. The earlier fls. in the American species are cleistogamous. L. H. B.

HOULLÈTIA (after Houllet, French gardener). *Orchidàceæ.* Epiphytic, pseudobulbous orchids, allied to Stanhopea, and blooming in summer.

Pseudobulbs conical, 1-lvd.: lvs. lanceolate, plicate: sepals and petals usually nearly equal; labellum continuous with the clavate, arcuate column; pollinia 2, on a long caudicle.—About 8 species from S. Amer.

odoratíssima, Lind. Sepals and petals reddish brown; labellum white, with 2 crimson appendages midway of its length. Colombia. G.C. II. 24:777. C.O. 1. Var. **antioquénsis,** André (*H. antioquénsis,* Hort.), has labellum white, tinged yellow. I.H. 17:12.

Brocklehurstiàna, Lindl. Fls. 5–8, about 3 in. across, brownish red, dotted with brown-purple; sepals oblong, obtuse, the lateral ones slightly united at base; petals narrower, obovate; labellum yellow, thickly dotted with brown-purple; from its lower half 2 linear appendages have their origin. Brazil. B.M. 4072. P.M. 9:49. R.H. 1885:492.

pícta, Lind. & Reichb. f. Fls. 6–10; sepals oblong, brownish, unspotted above, tessellated with yellow below; petals similarly colored; labellum yellow, spotted or dotted with brown-purple or red-purple, the end hastate; apex recurved, pale yellow veined with crimson. Colombia. B.M. 6305.

Wállisii, Lind. & Reichb. f. (*H. chrysántha,* Lind. & André). Fls. about 2 in. across; sepals and petals yellow, blotched inside with brown-purple; labellum yellow, dotted with crimson. Colombia. G.C. II. 18:437; III. 50:177. G.M. 54:661. J.H. III. 63:315. I.H. 18:71.

H. Sánderi, Rolfe. Raceme 2–3-fld.; fls. large, pale yellow; sepals about 1¼ in. long, the dorsal elliptic, the lateral broadly ovate; petals broader, nearly orbicular, about as long as sepals. Peru. B.M. 8346.

Oakes Ames.
George V. Nash.†

HOUSE PLANTS (Figs. 1917–1919) are those plants that can be grown in the ordinary rooms of dwelling-houses. They may be hardy or tender; only such as are suitable for this purpose will be considered here.

In the living-rooms of the modern well-built house, plants must contend against difficulties which did not exist in the less carefully equipped dwellings of fifty years ago or earlier. The present methods of heating and lighting, by gas or kerosene lamps, not electricity, produce a dry atmosphere which is inimical to vegetable growth. In houses lighted by electricity, and heated by any system which introduces fresh air in abundance, the hindrance is not so troublesome. Too much heat and dry air are harder for plants to endure than insufficient light, but it is also lack of light which makes it difficult to grow flowering plants in houses. Dust and insects do harm, but can be checked.

For the above reasons it is important to choose house plants which are adapted to resist a dry atmosphere, a high temperature and inadequate light. Such examples can be found among certain tropical plants with coriaceous leaves and small stomata, what the florists call foliage plants, e. g., rubber trees, palms, and the like. These make the best foundation upon which any successful system of growing plants in houses can be built. Flowering plants can also be used, but they should be introduced from time to time, each in its proper season, when about to bloom or in bloom, and not considered a part of the permanent arrangement. After flowering they should be removed: their function is not unlike the use of cut-flowers, but they last longer and are not more expensive, while they largely increase the attraction of the window-garden.

1917. Pot-plants in the window.

The best rooms for plants are those which get the most sun, and the best positions are those nearest the windows, where there is not only more light but more fresh air. A large palm, fern or rubber will grow in an entry or poorly lighted corner, but the best place is that which is best lighted. Plants do well in a kitchen, the moisture from the cooking helping them materially; it is by no means a bad hospital for unhealthy specimens.

A conservatory is desirable but not always obtainable on account of the expense; it should agree with the architecture of the house and have the proper aspect. The construction should be durable, the walls and roof low and, a point often neglected, great attention should be paid to ventilation. This should be given not only in the roof, the very apex when possible, but also on the sides at the bottom. The trouble comes in early autumn when the plants are first potted up and again when the sun begins to be hotter in February, March and April. Fresh air should be given all winter on bright days, but it is particularly needed at the times named above. Shade is also advisable on warm sunny days and a system of screens either inside or out can be devised. The florists' method of painting the glass is good but unsightly. When a regular conservatory is unobtainable, a plantroom can sometimes be made which is most satisfactory and at comparatively small cost. It is often possible to utilize a part of the basement for such purpose. A southeast or south exposure is best, but if it faces southwest or even west no trouble follows. Such a room should be well furnished with windows which open both at top and bottom. The floor should be of concrete or porous tile and the walls covered with material which is unharmed by water;

good drainage should be provided. Such a room is not only capable of keeping plants in good condition but can also be used for starting seedlings and cuttings. The temperature can be kept well above freezing and under 50° F. sometimes without extra fire heat when such a room opens into a heated cellar. It can be used not only for growing plants but also as a storeroom from which plants can be taken for decorating the living-rooms; there is no better place for all bulbous plants from the time they are taken out of the frame until they show flower-buds well developed.

In rooms in which plants are kept, any device by which the atmospheric moisture can be increased is desirable: oilcloth on the floor, or a floor of porous tiles; a zinc tray, in which the pots can be set and surrounded with moss; saucers under the pots, the pots being raised slightly to prevent the roots of the plants standing in the water which runs through. By these aids not only can plenty of water be given to the roots, but there will also be some opportunity to sprinkle the leaves, while the evaporation of surplus water will dampen the air. The Japanese porcelain pots are not only ornamental but useful; the glaze prevents undue evaporation from the sides, and the legs hold the pot well above the water which may collect in the saucer: they are in every way excellent. Wooden tubs are serviceable for large plants or for any which are likely to be exposed to frost, either before or after bringing into the house. Plants should never be overpotted, but the larger the bulk of earth the easier it can be kept uniformly moist; from the wider surface, too, there is more evaporation. For these reasons it is sometimes a good plan to have window-boxes in which several plants can be grown; or the boxes can be filled with moss in which the pots can be plunged. All pots, tubs or boxes for growing plants should have holes in the bottom through which water can pass freely.

Much trouble is likely to come from the use of unsuitable potting soil. Procure it from an experienced florist, or make it yourself of equal parts rotted sods, old leaf-mold, well-decayed cow-manure and clean, sharp sand: discard tea leaves, chip dirt, and the decomposed remains of dead stumps. The soil should always be moist when used, not too wet and never dry: it should be made firm, not hard, and a good space left between the surface and rim. Large pots should be drained with potsherds and moss. The best time for potting is just before the plant begins to grow; the next best is just before growth ceases, thus giving the plant opportunity to establish itself in its new quarters before it stops growing. It is not always easy to do this properly at home, and large and valuable plants should be sent to a florist. Plants growing in the open air should be lifted and potted two weeks or more before bringing into the house, not only before frost but before the nights are cool. Keep them at first in a shady place, gradually accustom them to the sunlight, and carefully avoid all drafts. Do not give too much water at the root: some wilting is unavoidable, and cannot be prevented by heavy watering. Give one good application when they are first potted, and sprinkle the foliage and surroundings in the middle of the day. After they are established, keep them out-of-doors, on the piazza or porch, until there is danger of frost, but try to bring them into the house before the furnace fires are lighted.

A period of rest is natural to all plants. Amateurs often make mistakes in trying to force plants to grow all winter in the house after a vigorous growth in the open ground all summer. Such plants should be rested, kept cool at first and water withheld, but never to such an extent as to shrivel the wood. No rules can be given for watering, the most important detail of plant-growing. Water must be given as it is required, a knowledge to be gained from experience only. This may be once a day or once a week, twice a day or once in two days. The smaller the pot and the more vigorous the growth, the oftener it will be required. In hot weather and in dry rooms more water is needed than in cool rooms and on damp, cloudy days. It should always be given in sufficient quantity to pass through the hole in the bottom of the pot: here it can remain an hour or more, and part of it will soak up, back into the pot, but the surplus should be taken away with a sponge, unless the pot has legs or it is a plant like calla, English ivy, or some ferns, which are uninjured by an over-supply. Water given to the foliage of house plants in the form of spray is always helpful.

Insects, dust and sometimes fungous pests are troublesome to house plants, due largely to insufficient watering and lack of ventilation. The best remedy is frequent washings with warm water and a sponge for plants with large leaves. All plants can be easily cleaned at the kitchen sink or in the bathtub, or advantage can be taken of a mild day, and the work done in the yard with the hose. The forcible application of water will remove most insects, but if scale appears it must be taken off with a stiff brush. Whale-oil and tobacco soap are too rank for house use; fir-tree oil and Gishurst's compound are less obnoxious. They can be used when the plants are washed with sponge or brush. The florists' preventive against greenfly is impracticable: enough tobacco smoke to harm them would not be tolerated in living-rooms. Tobacco stems may be burned, however, in the plantroom described above if a well-fitted door is provided and precautions are taken to make the ceiling air-tight. It is altogether too dangerous to use cyanide of potassium in any form of plant-growing in the house. The red-spider can be driven off by spraying with an atomizer, if discovered in time. Some plants are not attacked by insects, but are injured by dust, e.g., the rubber-tree. Dusting when dry is better than nothing, but washing is best. If fungous diseases appear, the plants should be isolated, giving a chance to recover, or be thrown away.

Ventilation is an important factor in keeping house plants in good condition. Open the windows on bright days: the fresh air is moist and therefore grateful, and will do no harm, even if the plants are near the glass, so long as the sun shines and discretion is exercised.

1918. A window-garden.

The night temperature need never exceed 50° F., and a drop of 5° or even 10° is not likely to do any harm. Precautions must be taken to exclude frost; the blinds must be shut and the curtains pulled down on cold nights. A layer of newspapers between the plants and the windows is a protection in extremely bad weather, or a large kerosene lamp can be allowed to burn all night near the plants.

A list of suitable foliage plants for the house: *Ficus elastica*, the rubber plant; *F. religiosa* (peepul tree) and most of the other strong-growing evergreen species. *Livistona sinensis*, *Corypha australis*, *Chamærops Fortunei* and *Rhapis japonica*, all good fan-palms (the first is the best); *Phœnix reclinata*, *P. rupicola* and *P. canariensis* are the best date-palms. *Seaforthia elegans*, *Howea Belmoreana*, *Kentia Forsteriana*, *Areca Baueri*, *A. rubra* and *Cocos Weddeliana* are all good palms, but require more care and heat than the fan- and date-palms. *Cycas revoluta* (sago-palm), *Curculigo recurvata*, *Aspidistra lurida*, *Pandanus utilis* (screw pine), *P. Veitchii*, *Phormium tenax* (New Zealand flax), *Cyperus alternifolius*, *Papyrus antiquorum*, Cordyline, Dracæna, *Agave americana* (century plant), Pittosporum, *Grevillea robusta*, English ivy, wandering jew and some species of cactus all do well in ordinary rooms. *Daphne odora*, laurestinus, *Olea fragrans* and orange trees are both flowering and foliage plants, but require a cooler room than any of the preceding varieties.

Good flowering plants are *Azalea indica* and *Camellia japonica*, both of which should be kept in a cool room when not in bloom. Calla and begonia both do well. Chrysanthemums, cinerarias, gloxinias, gladioli, cyclamens, Chinese and English primroses, freesia, oxalis, fuchsia, mahernia, euphorbia, heliotrope, pelargonium and lily-of-the-valley can be brought into the rooms when in flower, and last a reasonable time in good condition. Hyacinths, tulips, narcissi and crocus, if potted in October, kept covered up out-of-doors until cold weather, stored in a cool cellar until the middle of January and then brought into warm rooms, will give flowers: a succession can be maintained by bringing them into warmth at intervals. (See *Bulb.*)

1919. An attractive corner of pandanus, begonia, and wandering jew.

The following varieties of hyacinths and tulips are particularly recommended for growing in living-rooms under ordinary circumstances:

Hyacinths.—The single sorts are much better than the double and more easily handled. Single reds and pinks: Gen. Pelissier, Gigantea, King of the Belgians, La Victoire, Norma. Single white: La Grandesse, L'Innocence, Madame Van der Hoop, Mr. Plimsoll. Single blue: Czar Peter, Enchantress, Grand Lilas, King of the Blues, Lord Derby, Queen of the Blues. Double red: Grootvorst, Lord Wellington, Noble par Merite. Double white: Isabella, La Grandesse. Double blue: Bloksberg, Garrick, Van Speyk. Double yellow: Goethe.

Tulips, early single.—Albion (White Hawk), white. Belle Alliance (Waterloo), red. Couleur Cardinal, bronze-red. Cramoisi Brillant, bright scarlet. Goldfinch, yellow. Keizerkroon, red and yellow. La Reine, white turning pink. Mon Tresor, yellow. Pottebakker, scarlet. Primrose Queen, sulfur-yellow. Prince of Austria, orange-red. Proserpine, carmine. Rose Grisde Lin, pink. Rose Luisante, deep pink. Thomas Moore, orange. Vermilion Brilliant, scarlet. Yellow Prince, yellow.

Tulips, double.—Couronne d'Or, yellow flushed red. Imperator rubrorum, red. Murillo, best light pink. Salvator Rosa, deep pink. Tournesol, yellow.

All the Duc Van Thol tulips are excellent for early forcing, particularly the scarlet. The Darwin tulips are now sometimes forced, but they are not suitable for growing in houses. The Parrot Cottage tulips and the like are not grown in this way.

Roman hyacinths are easily forced and with the Paper White narcissus can be flowered between Thanksgiving and Christmas. Narcissus Campernelle var. rugulosus, the Chinese sacred narcissus, the double Roman, and most varieties of Polyanthus narcissus flower earlier than the other sorts.

B. M. Watson.

HOUSTÒNIA (Dr. Wm. Houston, who collected in the West Indies and Mexico, died 1733 in Jamaica). *Rubiàceæ.* About twenty-five North American small herbs or rarely sub-shrubs, with pretty white, blue or purple flowers, some of the species cultivated in wild gardens and rockeries.

Plants usually tufted or growing in colonies: lvs. small, opposite, on the slender sts: parts of the fls. in 4's, the corolla gamopetalous and funnelform or salverform; stamens and styles polymorphous; stigmas 2: caps. opening near the top, partly superior.—The species are native on the Atlantic side of the continent and in Mex. Some of the small herbaceous species are sometimes transferred to cult. grounds, although the kinds are little known as horticultural subjects. A moist, partly shaded place is to be recommended for most houstonias, because their flowering season is thereby prolonged and the plants retain their foliage much longer than in a drier and sunny position. Collected plants are not difficult to establish. Prop. by division. The following perennial species have been offered by American dealers:

A. *Plant tall (4–18 in.): peduncles many-fld.*

purpùrea, Linn. Tufted, 3–18 in. high, bearing offsets, glabrous or pubescent: radical lvs. round-ovate or oblong to lanceolate, short-stalked: fls. in late spring or summer, the corolla funnelform, purple; calyx-lobes exceeding the half-free caps. Md. and Iowa to Texas.

AA. *Plant lower (1–6 in.): peduncles 1-fld.*

cærùlea, Linn. BLUETS. INNOCENCE. QUAKER LADY. Fig. 1920. Little tufted perennials, 3–6 in. high, the sts. glabrous: radical lvs. spatulate to obovate, hairy, short-petioled, the st.-lvs. small: corolla salverform, the tube much exceeding the calyx-lobes, varying from blue to white, with a yellow eye. B.M. 370. Gn.W. 20:868.—Charming little plant in grassy places in the northeastern states and southward in the Alleghany region; early spring. Excellent for rockwork and grassy borders. In gardens, may be treated as annual or biennial.

serpyllifòlia, Michx. Prostrate and extensively creeping: radical lvs. orbicular to ovate-spatulate and abruptly petioled: corolla rather larger than that of *H. cærulea,* deep violet-blue (often white). Pa., southward. G.W. 12, p. 151.—Early spring. L. H. B.†

HOÙTTEA: *Vanhouttea.*

HOUTTUÝNIA (M. Houttuyn, of Amsterdam, writer on natural history in 1774–1783). *Saururàceæ.* One oriental species, the Californian species being now referred to Anemopsis (p. 287, Vol. I). *H. cordàta,* Thunb., is a perennial herb, growing ½–3 ft. high, from a creeping rootstock, from Himalaya to China and Japan: st. leafy, nearly simple, angular: lvs. alternate, simple, broadly ovate-cordate, 5-nerved: fls. very small, naked, in a short spike; stamens 3; short spike subtended by a corolla-like spathe in 4 ovate spreading white parts. B.M. 2731. G.W. 11, p. 385.—Grows in ditches along waysides, up to 5,000 ft. in India. Perhaps to be recommended for moist places in mild climates. L. H. B.

HÒVEA (probably A. P. Hove, Polish botanist). Syn. *Poirètia. Leguminòsæ.* Ornamental, unarmed or seldom thorny, greenhouse shrubs: lvs. alternate, simple, entire or prickly-toothed, glabrous above, often tomentose beneath; stipules setaceous, minute or none: fls. blue or purple, in axillary clusters or very short racemes or rarely solitary; upper lobes of calyx united into a broad, truncate upper lip, the 3 lower ones much smaller, lanceolate; petals clawed; standard nearly orbicular, emarginate: pod sessile or stipitate, the valves at length entirely spreading.—Eleven species, confined to Austral. Best prop. by seeds sown in spring in well-drained pots of sandy peat and placed over a gentle bottom heat. When 2–3 in. high, the points should be pinched out to induce a bushy habit. After they are established, grow in a cool greenhouse with plenty of air. **H. Célsii,** Bonpl. (*H. ellíptica,* DC.). A tall shrub, sometimes 8–10 ft. high: lvs. ovate-elliptical to narrow-lanceolate: fls. blue, in clusters or short racemes, the pedicels often as long as or longer than the calyx. B.R. 280. B.M. 2005. L.B.C. 15:1488. Gn. 59, p. 178, desc.; 75, p. 225. L. H. B.

HOVÈNIA (after David Hoven, Senator of Amsterdam). *Rhamnàceæ.* Ornamental shrub or small tree, grown chiefly for its handsome foliage.

Leaves deciduous, alternate, without stipules, long-petioled: fls. in axillary and terminal racemes; calyx-lobes, petals and stamens 5, style 3-parted: fr. 3-celled and 3-seeded, indehiscent.—One species in Japan, China and Himalayas.

Hovenia has greenish inconspicuous flowers in axillary peduncled cymes, and small globular fruits on reddish, fleshy and edible peduncles. It grows into a small round-headed tree, with handsome somewhat shining foliage. It thrives best in sandy loam and has proved fairly hardy in favorable positions at the Arnold Arboretum. Propagation is by seeds, also by root-cuttings and cuttings of ripened wood under glass.

dúlcis, Thunb. (*H. acérba,* Lindl. *H. inæquàlis,* DC.). JAPANESE RAISIN TREE. To 30 ft.: lvs. cordate-ovate or ovate-acuminate, serrate, sometimes nearly entire, almost glabrous or pubescent on the veins beneath, 4–6 in. long: cymes many-fld. Japan, China, Himalayas. S.Z. 73, 74. B.M. 2360. B.R. 501. S.I.F. 2:47. A.G. 12:80.

ALFRED REHDER.

1920. Houstonia cærulea.

HÓWEA (named for Lord Howe's Island, where these 2 species grow). Also written *Howeia. Palmàceæ,* tribe *Arèceæ.* Erect spineless palms known to the trade as kentias, and certainly ranking among the six most popular palms for house culture.

Caudex stout, ringed: lvs. terminal, numerous, dense, equally pinnatisect; segms. narrow, acuminate: spadices 2–3 ft. long, solitary or 3–5 from 1 spathe, thick, cylindrical, nodding or pendulous; peduncle long, compressed at the base; spathe solitary, as long as the spadix, cylindrical, 2-keeled toward the apex, longitudinally split: bracts bordering the channels; bractlets scaly: fls. sunk in the deep furrows of the spadix, the staminate nearly an inch long: fr. 1½ in. long, olive-shaped.

They have the habit of Kentia, but their flowers differ widely. Howea belongs to a subtribe in which the flowers in each spadix are attached to the stem between the bases of opposite leaves, while Kentia belongs to another subtribe in which the flowers are attached at a lower point. Also Howea has symmetrical staminate flowers with rotund sepals, while in Kentia the staminate flowers are not symmetrical, the sepals being small and acute. Howea's nearest cultivated ally is Linospadix, from which it is distinguished by the following characters: staminate flowers with very numerous stamens, the anthers erect and fastened at the base; pistillate flowers with no staminodes; ovule erect. *H. Belmoreana* is the more popular and as a house plant may be readily told from *H. Forsteriana* by the more ascending position of its leaf-segments, as in Fig. 1921; the leaves of *H. Forsteriana* are more flat or the sides pendent.

The two species of this genus are beyond a doubt the most popular and also the most satisfactory palms in the trade for decorative work in general, and in consequence of the great and growing demand are grown by tens of thousands in the large nurseries. There does not seem to be any record of either of these species having borne fruit in cultivation in this country, and the trade, therefore, depends on imported seeds, which are gathered in immense quantities on Lord Howe's Island, usually shipped from thence to Sydney, New South

Wales, and from the latter port to either London or New York. This long voyage is a severe test of the vitality of such seeds, and frequently results in faulty germination, the average of germination seldom exceeding 50 per cent, and is often much less. Two heavy shipments of Howea seeds are made each year, the first installment arriving in February or March, and the second in September or October. Many growers favor the autumn shipment of these seeds as giving the best results. The seeds should be sown at once on their arrival, the practice followed by large growers being that of broadcasting the seeds on a side-bench in a warm greenhouse on 2 to 3 inches of light soil, then covering them with 1 inch of the same compost, watering liberally and keeping up a bottom heat of about 80°. Under such treatment some of the seeds may germinate in two months, but others in the same lot may not start for eight or nine months, from which it will be seen that the operation extends over a considerable period of time. The seedlings should be potted into small pots when the first leaf is expanded, kept moist and given a night temperature of 65°, the greenhouse in which they are placed being moderately shaded. In three to four months the young plants should be ready for shifting into 3-inch pots if properly cared for; from this time forward they do not require a higher night temperature than 60°. The howeas are not very particular in regard to soil, a rich, light loam answering very well for them, but a very stiff soil may be improved by the addition of one-fourth part of peat, and in all cases a reasonable proportion of fertilizers may be used to advantage. Scale insects are the most troublesome the grower has to contend with, and should be removed as rapidly as possible, else the foliage will be permanently disfigured. Of the two species referred to, *H. Belmoreana* is perhaps the greater favorite, being more compact in growth and extremely graceful in foliage, a plant of this species of a given age usually carrying a greater number of leaves than one of *H. Forsteriana* of the same age, and the leaves having more leaflets than those of the latter species. The seeds of the two species are very similar in appearance, though those of *H. Belmoreana* frequently average a larger size, and while those of the last-named species require about three years to mature on the tree, the seeds of *H. Forsteriana* ripen in about twelve months. For house culture by amateurs, see *Palms*. (W. H. Taplin.)

1921. Howea Belmoreana, one of the most popular palms.

Belmoreàna, Becc. (*Kéntia Belmoreàna*, F. Muell. *Grisebáchia Belmoreàna*, H. Wendl. & Drude). Curly Palm. Fig. 1921. Described and distinguished above. B.M. 7018. R.H. 1897:256 and p. 257. G.C. III. 8:75. I.H. 21:191. A.G. 13:141; 16:345. Mn. 9:25. Gn.M. 6:288. Var. **variegàta,** Hort. Advertised 1895.

Forsteriàna, Becc. (*Kéntia Forsteriàna*, F. Muell. *Grisebáchia Forsteriàna*, H. Wendl. & Drude). Flat or Thatch-leaf Palm. G.C. III. 8:75, 533. S.H. 2:53. A.G. 16:346. A.F. 4:565; 14:701. G. 8:581. Gn. 73, p. 111. Gn. M. 6:289.

N. Taylor.†

HÓYA (Thomas Hoy was once gardener to the Duke of Northumberland). *Asclepiadàceæ*. Tropical climbing or trailing evergreen shrubs, bearing thick, opposite leaves and odd, often showy flowers in umbel-like clusters, grown under glass and one of them sometimes in window-gardens.

Corolla rotate, 5-lobed, thick and more or less waxy in appearance: crown rotate, of 5 thick and compressed fleshy appendages: pollen-masses short, fixed by their base in pairs to the 5 glands of the stigma: follicles acuminate, smooth: sts. twining, or climbing by means of roots.—Species perhaps 100, E. Asia to Austral.; difficult to determine in herbarium specimens.

Hoyas are summer-blooming plants, of comparatively easy culture. They need an intermediate or warm temperature. Let them rest or remain very slow in winter (50° in a dryish place), but start them into growth toward spring. In the summer they are sometimes plunged in the border, but better results are to be expected, as a rule, by keeping them in pots in the conservatory. In their growing and blooming season, give plenty of sun and air. They propagate by cuttings of the top-growth in spring, and also by layering. The latter method is particularly adaptable to *H. carnosa* and other species that climb by means of roots. The only species commonly known is *H. carnosa*.

A. *Plant distinctly climbing.*

carnòsa, R. Br. (*H. Motóskei*, Teijsm.). Wax-Plant. Twiner, and attaching itself to support by means of roots; ordinarily grown as a pot- or tub-plant, and reaching 5–8 ft. high, but growing twice and more this height when it has the opportunity: glabrous: lvs. succulent and shining, ovate-oblong, acute, short-stalked, entire: fls. white with pink center, fragrant, in axillary or inter-petiolar umbels, the crown-segms. very convex, and spreading into a horizontal star. S. China and Austral. B.M. 788 (as *Asclepias carnosa*). Gn. 69, p. 119. G. 25:123. A.G. 18:34.—The common species, and often seen in window-gardens. After the bloom is over (in summer) keep the plant in a cool place, that it may remain half-dormant. In late winter or spring, start it into growth. Do not cut off the spur which remains after the fls. pass, for this spur bears fls. again. The wax-plant is easy to manage, and it improves with age. Often trained as a permanent cover for a glasshouse wall. The chief drawback is the attacks of mealy-bug, but they may be kept off with a fine stream of water from the hose, and by handwork. In the South, it is nearly everblooming. There is a form (var. *variegàta*) with handsome variegated lvs. Lowe 44.

globulòsa, Hook. f. Hairy: lvs. elliptic-oblong or long-oblong, acuminate, rounded at the base, the midrib very stout, the petiole an inch or less long: fls. pale straw- or cream-color, the star-like crown-segms. white, with pink at the base, borne in dense, globular umbels: follicles a foot or more long. Sikkim. F.M. 1880:406.

G.C. II. 17:741.—A handsome species, requiring the general treatment given to *H. carnosa.*

austràlis, R. Br. Twiner, glabrous and succulent, apparently sometimes epiphytic: lvs. ovate, obovate to nearly orbicular, obtuse or short-acuminate, thick and fleshy: fls. white tinged pink, in simple umbels on peduncles that seldom surpass the petioles; corolla spreading, ½in. or less in diam., broadly 5-lobed; crown cup-shaped and expanding into horizontal concave prominently 2-keeled parts. Austral.

multiflòra, Blume (*H. coriàcea,* Lindl., not Blume. *Cyrtocèras multiflòrum,* Heynh. *C. floribúndum,* Maund. *Centrostémma multiflòrum,* Decne. *C. Lindleyànum,* Decne.). Stout and glabrous, climbing: lvs. linear-oblong, acute at both ends, the petiole short: fls. straw-yellow (corolla white tipped with buff), in many-fld. terminal and axillary umbels on peduncles 1–2 in. long; corolla-lobes ¾in. or less long; corolla-tube bearded at base; segms. of crown entire on inner angles. Malacca, etc. B.R. 25:18. B.M. 5173.

imperiàlis, Lindl. Lofty climber, with puberulent sts. and foliage: lvs. elliptic or linear-oblong, obtuse but with a short point: fls. immense (2–3 in. across), leathery, dull purple, somewhat pubescent near the white crown, the segms. triangular-acute: umbels drooping on long peduncles: follicles 9 in. long. E. Indies. B.M. 4397. F.S. 4:393, 394. R.H. 1900:576. J.H. III. 55:443. G. 7:607.—A noble hoya, requiring very rich soil and a rather high temperature. Although naturally a very tall climber, it can be made to flower in pots when 3 or 4 ft. high.

AA. *Plant trailing or nearly erect.*

bélla, Hook. (*H. Páxtoni,* Hort.). Slender, bushy, 1–2 ft. high, pubescent: lvs. an inch long, ovate-acute, very short-stalked, somewhat recurved: fls. ¾in. across, pure white, with very short and half-acute lobes, the crown-segms. boat-shaped and violet: umbels few-fld. and short-stalked. India. B.M. 4402. F.S. 4:399. J.H. III. 35:5. Gn.W. 4:793; 22. suppl. July 1.—Handsome little species; scarcely climbing.

H. campanulàta, Blume=Physostelma.—*H. fratérna,* Blume. Climbing, rooting near insertion of petioles: lvs. 6–12 in. long, very thick, elliptic, glossy above and pale beneath: fls. brownish red, in dense umbels; corolla rotate, pale buff with 5 red-brown blotches; lobes of crown round-ovate, concave with blood-red spot at base. Java. B.M. 4684. J.F. 4:385.—*H. fúsco-marginàta,* N. E. Br. Lvs. fleshy, ovate-lanceolate, 7–9 in. long, tawny on margins: fls. ochre-yellow to yellowish green, in many-fld. umbels on peduncles 2 in. or less long. Country unknown.—*H. ovalifòlia,* Wight & Arn. Slender, glabrous: lvs. more or less clustered, variable, being elliptic to ovate or lanceolate: fls. bright yellow with red corona, in large umbels. India. J.F. 1:64.—*H. pállida,* Lindl.=*H. parasítica,* Wall. (H. pallida, Lindl.). Tall climber: lvs. fleshy, variable, ovate-elliptic to lanceolate: fls. pale yellow or straw-color, the corona pinkish. India. B.R. 951. J.F. 1, p. 64.—*H. purpùreo-fúsca,* Hook. Twining, glabrous: lvs. ovate and acute: fls. purplish brown, in dense umbels; corolla rotate, pubescent above; crown-lobes ovate, nearly plane above. B.M. 4520. J.F. 1:30.

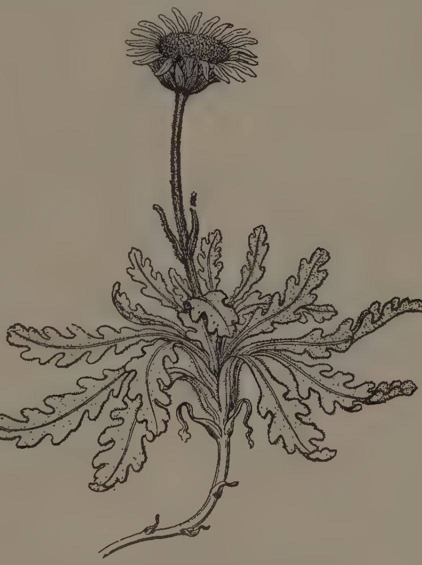
L. H. B.

HUCKLEBERRY: *Vaccinium* and *Blueberry;* also *Gaylussacia.*

HUDSÒNIA (for William Hudson, 1730–1793, an English botanist). *Cistàceæ.* Beach Heather. Three little heath-like shrubs of eastern North America, suitable for colonizing in dry places and along the seashore: low and diffusely branched, with narrow or scale-like or awl-like often closely pressed lvs.: fls. many and small, yellow, crowded on the upper parts of the branches; petals 5, obovate-oblong, exceeding the calyx; stamens many: fr. a 3-valved caps, included in the calyx. Allied to Helianthemum, but differing chiefly in the 2-ovuled cells of the ovary and in the scale-like or subulate imbricate lvs. *H. tomentòsa,* Nutt., on shores and dunes, and in pine-lands, New Bruns. to N. C. and far westward: lvs. oval to narrow-oblong, closely imbricated: fls. nearly or quite sessile: densely tufted, hoary, 4–8 in. high. May–July. *H. ericoìdes,* Linn., in sands and pine-lands near the coast, Newfoundland to N. C.: greenish, although downy: lvs. subulate and spreading: fls. on slender pedicels; at least 1 sepal with tooth near apex: 4 to 8 in. L.B.C. 2:192. *H. montàna,* Nutt., in mountains of N. C.: bushy and somewhat villous: lvs. narrow-subulate, somewhat spreading with age: fls. on slender pedicels; at least 1 sepal with linear-subulate lobe: tufted, the branches 4–6 in. long. They are hardy N. and handsome when covered with their bright yellow numerous fls., but very rarely cult., as they are difficult to grow and short-lived. The first species is a seashore plant and demands very sandy moderately moist soil; the second grows in dry sandy soil. Prop. by seeds and probably by cuttings.

Alfred Rehder.
L. H. B.

HUÉRNIA (Justus Huernius, or Heurnius, collector of Cape plants). Also spelled *Heurnia. Asclepiadàceæ.* Succulent dwarf perennials resembling Stapelia, but differing in having the angles between the corolla-lobes produced into teeth, the corolla campanulate, the corona toothed or lobed and adnate to base of corolla. They are greenhouse subjects, mostly from the Cape, but some from Trop. Afr. and one from Arabia. They appear not to be in the trade, but some of the 30 or more species may be found in collections of succulents.



1922. Hulsea nana. (×⅓)

HUERNIÓPSIS (*Huernia-like*). Also spelled *Heurniopsis. Asclepiadàceæ.* One species, *H. decípiens,* N. E. Br., in S. W. Trop. Afr., differing from Huernia in having no outer corona and in other characters. It is a small succulent with decumbent more or less clavate obtusely 4-angled toothed sts. 1–3 in. long: fls. 2–3 together at the middle or toward the top of the st., 1 in. diam. when expanded, outside pale yellow-green spotted and streaked purple, inside brown-red spotted yellow, fetid at night.

HÚLSEA (Dr. G. W. Hulse, of Louisiana, who collected in California). *Compósitæ.* Perennial, biennial or annual herbs native of California, Nevada and north.

Glandular pubescent or woolly herbs: lvs. pinnately lobed or toothed: fls. large, solitary, yellow or purple; involucral bracts free, narrow; style-branches obtuse; pappus of 4 hyaline, lacerated, chaffy scales.—Eleven species. This includes one of many woolly herbs offered by Californian collectors. It grows a few inches high and bears fls. with yellow rays. Treated best as a partial alpine.

nàna, Gray. Fig. 1922 (adapted from Pacific R. R Report). Sts. depressed, leafy at summit, sticky-hairy: lvs. pinnatifid or incised; petiole long-margined: peduncle 1–2 in. long; involucral scales in 2 series; rays 20–30. Calif., north. N. Taylor.†

HUMÀTA (Latin, *of the earth;* referring to the creeping habit of the rhizomes). *Polypodiàceæ.* Ferns of small stature related to Davallia and sometimes included with that genus, with small, thick, deltoid lvs., with the indusium tough, suborbicular or reniform, attached by a broad base and free at the apex and sides.—Some 20 species are known, mostly from the E. Indies. For cult., see *Davallia.*

Tỳermannii, Moore (*Davállia Tỳermannii,* Baker). Bear's-foot Fern. Rootstock wide-creeping, densely covered with linear white scales: lvs. 4–6 in. long, deltoid, 3–4-pinnatifid; lower pinnæ largest, the lowest pinnules cuneate-oblong or deltoid; sori at the base of the ultimate lobes less than a line broad. Cent. China. G.C. 1871:871.

H. heterophýlla, Smith. (Davallia angustata, Wallich.). A small creeping plant with long slender rhizomes and simple entire or slightly lobed lvs. 3–6 in. long, 1 in. broad; fertile lf. narrower, with deep sinuate clefts along the sides. Malaya and Polynesia. —*H. rèpens,* Diels (Davallia alpina, Blume). Small plant: lvs. dimorphic, the sterile 1-pinnate, the pinnæ divided into many small segms.; fertile lvs. reduced nearly to the rachis and midveins of the pinnæ; sori borne on spine-like branches of the latter. E. Asia. L. M. Underwood.

HÙMEA (after Lady Hume). *Compósitæ.* Herbs or shrubs, one of the most popular of which is a half-hardy biennial Australian plant, growing 5 or 6 feet high, cultivated for the grass-like beauty of its large, loose, much-branched, drooping panicles.

Flowers exclusively tubular and hermaphrodite, 1–4 in a small head; involucre narrow, with scarious or petaloid, non-radiating bracts. Three, at any rate, of the 4 other species are shrubs, with fls. in dense corymbs and involucral bracts rigid or petal-like, while in *H. elegans* the bracts are thin and scarious. The genus has no near allies of garden value. It belongs to a group of 6 Australian genera which have no pappus. Humea has nothing of the typical beauty of the common garden composites, since it has no rays, but the common species is a striking plant.

Sow seed from July 1 to September 1. Keep young plants during winter in very cool house in preference to frames, in northern latitudes, on account of losing so much foliage through damping. In spring, or when signs of growth are taking place, repot into larger pots, using a good, rich loam, which has had plenty of manure. They are gross feeders and growers, requiring plenty of water and good feeding. Good plants in 10-inch pots are very ornamental for conservatory or piazza work. The young plants need plenty of light and air, and should be kept nearly dry during the winter. In spring they should be started into growth gradually, and successively repotted until an 8-inch pot is needed. They should not be syringed except when growing rapidly in warm weather. In June the plants can be placed in a subtropical bed that is shielded from high winds, and staked. The foliage has a peculiar and agreeable scent. (A. P. Meredith.)

élegans, Smith. Lower lvs. ovate-lanceolate or oblong, acuminate: st. clasping or decurrent, 6–10 in. long, wrinkled: fls. variously described as brownish red, pink, ruby-red and rose, very numerous, in long loose, gracefully pendulous panicles, much overtopping the rest of the plant. R.H. 1862, pp. 9, 10; 1895, p. 459. S.H. 1, p. 154. *H. álbida,* Hort., is presumably a whitish-fld. form of this species, and should therefore be called var. **álbida.** Var. **gigantèa,** Hort. Much taller than type, reaching 20 ft. in height, having larger lvs. and panicles. The species itself is said by Bentham to attain 5 or 6 ft. or more in Austral. N. Taylor.†

HÙMULUS (Latin name, of doubtful origin). *Moràceæ.* Hop. Two twining vines, with rough, opposite, palmately lobed or divided leaves, grown for ornament and one also for "hops."

Diœcious, the fls. in axillary clusters; staminate fls. with 5 erect stamens and 5-parted calyx, in little drooping tassel-like racemes; pistillate fls. with an entire calyx or perianth closely investing the ovary, which bears 2 long stigmas, the fls. in pairs under large overlapping bracts, the whole making a cone-like catkin which, when becoming very large, is a "hop."—One species in N. Amer. and Eurasia, and one in Japan and Manchuria.

A. *Plant bearing hops,—the pistillate catkin greatly enlarging in fr.*

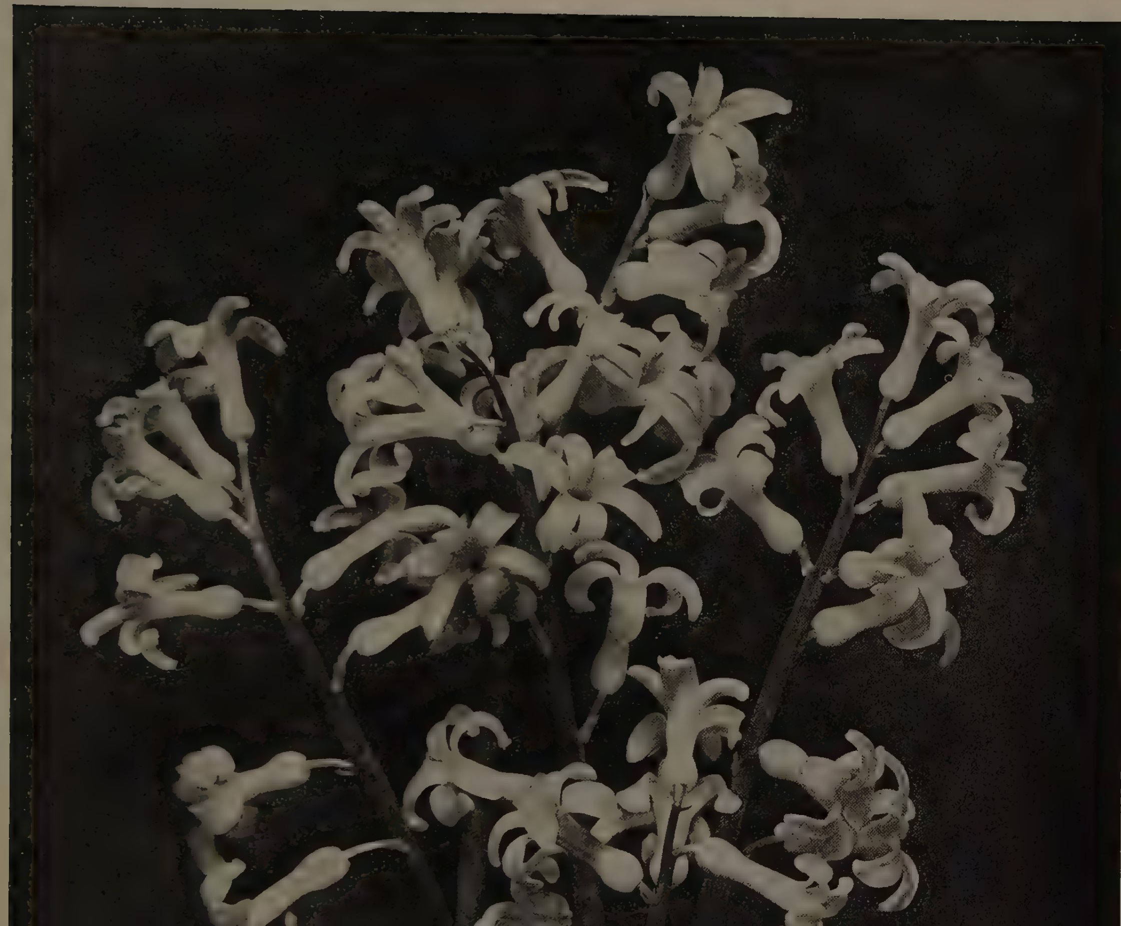
Lùpulus, Linn. Common Hop. Perennial herb: shoots often grow 25–30 ft. long in the season: rough-hairy: lvs. ovate or orbicular-ovate in general outline, deeply 3-lobed (sometimes 5–7-lobed), or the upper ones not lobed, margins strongly and uniformly dentate, petioles long: staminate fls. in panicles 2–6 in. long: hops (mature pistillate catkins) oblong or ovoid, loose and papery, straw-yellow, often 2 in. or more long, glandular and odoriferous.—Native along rivers and in thickets in the northern states and Canada, and southward in the Alleghanies and Rockies; occurs as far south as Fla. and Ariz. Much cult. for "hops," used in brewing, and extensively run wild from cult. plants. The hop makes an excellent arbor or screen plant. Var. **aùreus** has yellow foliage. G.W. 10, p. 501. The hop grows readily from cuttings of the shoots, which spring from the crown; also by seeds, but the latter do not reproduce the particular varieties or strains. As a field crop, the hop is not a horticultural subject, and is not discussed here. See Cyclo. Amer. Agric., Vol. II, p. 380. The Rocky Mt. form, common in Colo. and New Mex., has been separated as var. **nèo-mexicànus,** Nels. & Ckll., and it is in the trade: it has more deeply divided lvs. and more sharply acuminate bracts than the ordinary hop; lf.-segms. from broad-lanceolate to nearly linear, acuminate, with resin particles on the lower surface.

AA. *Plant not bearing hops,—the pistillate catkin not greatly enlarging in fr.*

japónicus, Sieb. & Zucc. Annual (or at least treated as such): foliage very like the last, but usually more deeply cut and not less than 5-lobed: catkins not glandular. Japan, China (perhaps intro.) Manchuria; somewhat run wild from cult. in this country. G.C. II. 24:716.—Intro. to general cult. in 1886, and now one of the most popular climbing herbs. It is a very quick grower, plants 10–20 ft. long coming from seed sown in early May. It is very easy of cult. and usually seeds itself. Var. **variegàtus,** Hort., is the most popular form. Gng. 1:241. A.F. 8:489. The foliage is variously streaked and splashed with white. Seeds of this variety will give a large percentage of variegated forms, and the plants usually show interesting variations. *H. japonicus* is more popular as an ornamental vine than *H. Lupulus,* because it grows so quickly from seeds, and also because it has such interesting variegated forms; but *H. Lupulus* has a distinct charm in its great hanging hops, and the heavy odor is enjoyed by some persons. L. H. B.

HUNNEMÁNNIA (John Hunneman, English friend of botany, died 1839). *Papaveràceæ.* Mexican Tulip Poppy. One yellow-flowered herb closely allied to the California poppy (Eschscholtzia) and of similar garden value, where hardy.

The genus agrees with Eschscholtzia in having much-cut foliage and spreading lobes of the stigma, but differs in having separate sepals instead of the peculiar hood-like calyx of Eschscholtzia, which covers the young fl. like a candle extinguisher: torus scarcely dilated; sepals



LVI. Roman hyacinth.—Hyacinthus orientalis variety.

2, caducous; petals 4, spreading, yellow; stamens many, orange-colored; ovary oblong, attenuated into a short style: caps. 1-celled and 2-valved, prominently 10-nerved; seeds many.—Mex. in the xerophytic regions.

fumariæfòlia, Sweet. Perennial, persisting for several years when planted in Calif., but mostly treated as an annual: lvs. triternately divided: peduncles solitary, terminal; fls. 2–3 in. across; sepals ovate, concave, glabrous, longitudinally striate; petals concave, wavy, broadly obovate or nearly orbicular. B.M. 3061. R.H. 1902:112. Gn. 77, p. 288. Gn.W. 15:443. A.F. 27:579.—Sold as giant yellow tulip poppy. Seed sown early in May in the East give bloom in July, and plants are covered with large yellow fls. until hard frost. The plants have bushy habit and beautiful, feathery, glaucous foliage; 2 ft. The fls. at times stand up like tulips; excellent for cutting. L. H. B.†

1923. Hura crepitans. (× about ½)

HÚNTLEYA (personal name). *Orchidàceæ.* Epiphytal orchids without pseudobulbs, like Zygopetalum.

Leaves several: fls. solitary on long peduncles in the lf.-axils; sepals and petals similar, spreading, the lateral sepals forming a slight chin; lip articulated to the foot of the column, the upper part ovate, concave, narrowed into a broad claw below with a fringed callus; column broadly winged at apex; pollinia 4, upon an ovate stalk.—Species 2, in Trop. Amer.

meleàgris, Lindl. (*Batemánnia meleàgris,* Reichb. *Zygopétalum meleàgris,* Benth.). Lvs. up to 1 ft. long, exceeding the peduncles: fls. about 3 in. across; sepals and petals ovate-lanceolate, acuminate, the base white, the middle portion yellow, the upper part red-brown, yellow-spotted; lip white with a red-brown apex. Brazil. B.R. 25:14. H.U. 1, p. 6.

Búrtii, Pfitz. (*Batemánnia Búrtii,* Reichb. *Zygopétalum Búrtii,* Benth.). Lvs. up to 15 in. long, much exceeding the peduncles: fls. 3–4 in. across; sepals and petals ovate, acute, the base white, followed by a yellow zone, the apex red-brown, yellow-spotted; lip white below, red-brown at apex, the teeth on the disk purple. Costa Rica. B.M. 6003. F.M. 1874:101.

George V. Nash.

HÙRA (South American name). *Euphorbiàceæ.* Trees, cultivated in the tropics and sometimes in greenhouses as curious or ornamental plants.

Leaves simple, alternate, broad, petioled, hairy: fls. monœcious, apetalous; staminate calyx cupulate, truncate or denticulate; stamens generally numerous, in 2–3 whorls; style long, with flat, radiate stigma; ovules 1 to each of the 5–20 cells: fr. large, flat.—Two species of Trop. Amer.

The sandbox tree, *H. crepitans,* is noted for its explosive capsules which, when ripe, throw the seed many feet with a loud noise. The large poplar-like leaves on long petioles give it quite an ornamental aspect, and it is often planted in the tropics of both hemispheres. It may be grown in Florida and California. The abundant milky juice is poisonous. The tree is suited to light loam soil and is propagated by cuttings in sand with heat, under glass.

crépitans, Linn. Sandbox Tree. Monkey Dinner-bell. Fig. 1923. A tree up to 100 ft. high: lvs. broad-ovate, cordate, acuminate, distantly repand-dentate: fls. small, reddish: caps. 3 in. wide, 1½ in. thick, deeply many-ribbed. Trop. Amer. Lyon Horticole, 1907:125.

J. B. S. Norton.

HUSK TOMATO: *Physalis.*

HUTCHÍNSIA (named for Miss Hutchins, of Ireland, who was skilled in cryptogamic botany). Syn. *Hymenólobus. Cruciferæ.* Low, annual or perennial herbs with entire or pinnate lvs.: fls. white, small, sub-corymbose; pedicels elongated: fr. long-oval or lance-shaped; seeds many or only 2.—Eight species in the Medit. region and the colder parts of the Old World, one species being very widely spread. According to some authorities, Hutchinsia is limited to one species. **H. alpìna,** Ait., is a good subject for the alpine garden and is also occasionally used as a border plant. It grows from 1–4 in. high: lvs. pinnate, shining: fls. snow-white, in clusters, blooming from May to June and often through the summer. Cult. in moist half-shady places and prop. by seeds or cuttings. Gn. 72, pp. 31, 278.

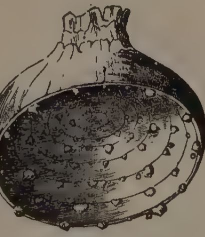
HYACINTH: *Hyacinthus.* **Hyacinth Bean:** *Dolichos.* **Hyacinth, Grape:** *Muscari.* **Hyacinth, Water:** *Eichhornia.*

HYACÍNTHUS (name from Greek mythology). *Liliàceæ.* Hyacinth. Popular hardy spring-flowering bulbs, producing flowers in shades of blue and red, also white; also grown under glass for winter bloom.

Bulbs tunicated: stemless, the lvs. all radical, linear or strap-shaped, the scape simple: fls. in a simple terminal raceme or spike, erect or spreading or pendulous; perianth funnel-shaped to campanulate, nearly or quite equally 6-lobed; stamens 6, attached at the throat or in the tube: caps. nearly globular, 3-grooved or 3-lobed, dehiscent loculicidally; seeds rather few.—Of hyacinths there are something over 30 species, the greater part S. African. Others inhabit the Medit. region, and from this source come the common garden kinds. From related genera, Hyacinthus is distinguished by the funnel-shaped or bell-shaped fl., the throat not constricted, the lobes shorter than or at most not much exceeding the tube, the 6 stamens attached to the tube or throat and the filaments thread-like or dilated at the base. For the general cultural requirements, see *Bulbs.*

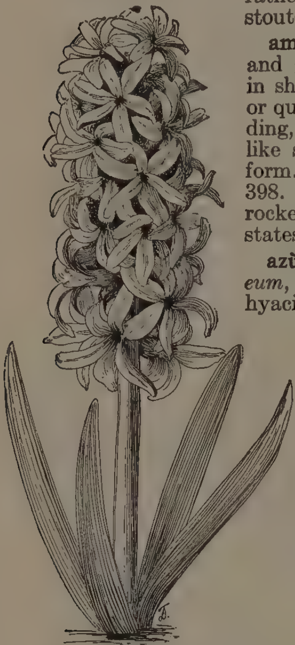
orientàlis, Linn. Common Hyacinth. Fig. 1926. Lvs. 8–12 in. long, ½–1½ in. wide, thick and green: scape 8–18 in. tall, stout, bearing an elongated and dense raceme: perianth about 1 in. long, the tube usually ventricose or swollen, the lobes oblong-spatulate, as long as the tube, in many colors, often double in cult. B.M. 937. B.R. 995. F.S. 23:2399–2400.—The hyacinth has been cult. for some centuries, and it shared some of the early popularity of the tulip in the Netherlands. It is wild in Syria, Asia Minor, Greece and Dalmatia. It is extensively grown in Holland for export to this and other countries, and consequently is commonly known as the Dutch hyacinth. The Roman hyacinth

1924. Cut hyacinth bulb. (×½)



1925. Hollowed hyacinth bulb. (×½)

(Figs. 1927, 1928) belongs to the group represented by var. **álbulus,** Baker (*H. álbulus,* Jord.) and var. **prǽcox,** Voss (*H. prǽcox.* Jord.). These are slender plants with narrow erect lvs., fls. fewer and earlier, white to blush to blue, the tube more slender. Var. *præcox* differs from var. *albulus* in its yellow anthers, rather more ventricose tube and stouter growth.



1926. Common or Dutch hyacinth.

amethýstinus, Linn. Slender and graceful, with light blue fls. in short racemes, standing nearly or quite 6 in. high: fls. small, nodding, bell-shaped, with short teeth-like segms. There is a white-fld. form. Spain. B.M. 2425. B.R. 398. Gn. 47, p. 147.—Good for rockeries. Hardy in the middle states.

azûreus, Baker (*Muscàri azùreum,* Fenzl). Looks like a grape hyacinth (or *Muscari*): 4–8 in. tall, with strongly canaliculate, glaucous lvs.: fls. blue, fragrant, in a dense spike 1 in. long, tubular, with small teeth: distinguished from the genus Muscari by the perianth-segms. being flaring instead of incurved. Medit. region. B.M. 6822. G.C. III. 24:191 (var. *giganteus*). Gn. 75, p. 176.—Hardy in middle states. This species is probably to be called *H. ciliàtus,* Cyrill., or a form of it.

lineàtus, Steud. Low, 2–4 in. high: lvs. 2 or 3, oblong-lanceolate, falcate, about equaling the scape: fls. small (⅙in. or less long), 6–12 in a raceme 1 in. long, blue, campanulate, ascending. Asia Minor. Gt. 1887, p. 446. G.C. III. 29:103; 39:210. Gn. 76, p. 169. J.H. III. 65:203 (as *H. azureus* var. *lineatus*).

fastigiàtus, Bertol. (*H. Pouzòlzii,* Gay). A delicate species, with very narrow lvs., scape 3–5 in. high and shorter than the lvs.: fls. few, in a loose cluster, ¼–⅓in. long and light blue (a white form), with oblong-lanceolate segms. longer than the tube. Corsica. B.M. 6663.—Hardy in S. New England. Has the look of *Scilla verna.*

H. cándicans, Baker=Galtonia. Gn. 75, p. 80. G. 2:546.—*H. romànus,* of Linnæus, is not the H. romanus of horticulturists (which is the Roman hyacinth, a form of H. orientalis). Linnæus' species is a blue-white, scilla-like plant (see B.M. 939, as Scilla romana).

L. H. B.

Culture of the hyacinth.—The perfection of the hyacinth flower depends largely on the strength of the roots, and as the plants make all their root-growth in autumn, the bulbs should be planted early,—say from the beginning to the middle of October. Any good garden soil suits, provided it is well drained. The ground should be carefully prepared by spading to a depth of 20 inches, so that the roots may pass straight through it to their full development of 12 or 16 inches. If the soil is naturally stiff, it may be lightened by the addition of sand, and if the beds have been occupied by other plants during the summer, some clean old cow-manure, well worked in, is recommended. Horse-manure should not be used.

The bulbs should be planted 6 inches deep (to the bottom of the bulbs) and very uniformly, to insure simultaneous flowering. The ground having been prepared as above, perhaps the best way is to remove 3 or 4 inches of the earth, level the bed carefully with the rake and set the bulbs in it 5 or 6 inches apart each way, pressing them in firmly, and then covering them evenly with the earth that has been taken out. When winter sets in, the beds should be covered with 2 inches of dry litter or coarse manure. As soon as the shoots appear above ground in the spring, 1 inch of this covering should be removed and the remainder when danger from late frosts is past.

For large beds and borders, second-size named hyacinths are used to a great advantage. The flower-spikes are not so large as from the first-size bulbs, but the latter when in bloom in the open usually become top-heavy and are often blown down by wind, while the flowers of the second-size bulbs stand more erect and last longer.

Forcing in pots.

For growing indoors in pots, large, solid bulbs should be chosen, and potted singly in 5-inch pots in a rich compost of loam, leaf-mold and sharp sand. A few pieces of broken pot being placed in the bottom for drainage, the pots should be filled lightly, and the bulbs pressed into the loose soil till only the apex remains above the surface. The pots are then buried to a depth of 8 or 10 inches in the open ground or in a frame for seven or eight weeks, till the roots are developed fully and the sprout is about 1½ inches above the bulb. When taken inside, they should be kept in subdued light, at a temperature of about 50°, until the sprout has assumed a vigorous green color. Florists who force large numbers for winter decorations set them under the greenhouse benches for about two weeks, and then force them in a temperature of 70°. A greater heat than this attenuates the growth and weakens the color. Syringing with water twice a day is recommended, and as the flower-spike develops, weak manure-water is helpful. The slower hyacinths are forced, the finer and more lasting will be the bloom. Bulbs wanted in flower for Christmas should be potted in September, and for a succession later, at intervals as desired. Single hyacinths are handsomer and force better than the double, although a few of the latter may be recommended. The following are among the best adapted for forcing and are largely grown by American florists:

Single blue.—Grand Maitre, deep lavender-blue. Czar Peter, light blue. King of the Blues, dark blue. Leonidas, clear blue. Queen of the Blues, light blue. Regulus, porcelain-blue. Schotel, pale blue.

Double blue.—Bloksberg, porcelain-blue. Van Speyk, lilac-blue.

Single white.—Angenis Chistina, pure white. Baroness van Thuyll, pure white. Grandeur a Merveille, blush-white. La Grandesse, pure white. L'Innocence, pure white. Madame Van der Hoop, pure white. Mimi, blush-white. Paix dé l'Europe, pure white.

Double white.—La Tour d'Auvergne, pure white. Isabella, blush-white.

Single red.—De Wet, light rose. Gertrude, bright pink. Gigantea, bright rose. Lady Derby, lovely pink. La Victoire, brilliant scarlet-red. Moreno, waxy pink. Norma, delicate waxy pink. Robert Steiger, crimson.

1927. Roman hyacinth.

Double red.—Bouquet Tendre, crimson. Noble par Merite, deep rose.

Single lilac.—Sir William Mansfield, lilac-mauve.

Single yellow.—King of the Yellows, deep yellow. Yellow Hammer.

Double yellow.—Goethe. Bright yellow.

Miniature hyacinths, or "Dutch Romans," are small-sized bulbs of the ordinary Dutch hyacinths. They are excellent for growing in groups in bowls, pans or flats, planted close together and treated the same as the large hyacinths when grown in pots.

Culture in glasses.

Some of the single hyacinths may be grown very satisfactorily in water. Special glasses for the purpose can be bought from the seedsmen. They should be filled with pure water and the bulb so placed that its base barely touches the water. The glasses must then be placed in a dark closet or cellar till sufficiently long roots have developed and the main flower shoot is about 3 inches tall. This usually requires eight to ten weeks. Thereafter they may gradually be brought into the light. An airy, sunny situation and a temperature of about 60° regularly maintained will insure the best results. The glasses should be kept filled by adding water occasionally as required. A small piece of wood charcoal placed in the glass tends to keep the water pure and sweet.

1928. Roman hyacinth.

The following varieties are especially suited for glasses: Lady Derby, pink. Lord Macaulay, deep rose. Mina, pure white. L'Innocence, pure white. La Victoire, brilliant red. Grand Maitre, blue. Grand Lilas, light blue. King of the Blues, dark blue. Schotel, finest light blue. Mimi, blush-white. MacMahon, pure yellow. Moreno, deep rose. Lord Balfour, lilac tinged violet.

Roman hyacinths.

Instead of one large truss from each bulb, the Roman hyacinth produces three or four smaller but more graceful flower-spikes. The bulbs arrive in America in August, and by successive pottings they may be had in flower from November till May. They require the same forcing treatment as the larger hyacinths, but three or four bulbs may be planted in a pot. The florists use wooden flats instead of pots, setting the bulbs close together, forty or fifty in a flat. By reason of its beauty and exquisite fragrance, its earliness and easy culture, the white Roman hyacinth is the most popular of winter-blooming plants. Several millions of these bulbs are grown annually by the florists of the large cities for winter cut-flowers.

Within the last few years, large quantities of Dutch hyacinths have been planted and grown for one year in the south of France, where they ripen off several weeks earlier than in Holland. Consequently, these hyacinths can be forced in bloom two to three weeks earlier than the ordinary Holland-grown stock of the Romans.

The propagation of hyacinths.

With the exception of the Roman hyacinths (which come from the south of France), the world's supply of hyacinth bulbs is produced in Holland. The soil and climate of that country seem to be peculiarly suitable for bulb-growing, which has been one of the leading industries there for 200 years. The bulbs intended for next year's market are planted in October in carefully prepared, richly manured land, and protected over winter by a thick covering of reed or litter. The flowers are cut when in full bloom in the spring. By July the bulbs are fully ripened, and are taken out of the ground by hand, dried, cleaned and assorted into three grades of quality, according to size. Early in August they are ready for shipping. Overgrown or unshapely bulbs are reserved for propagating. As soon as these are taken out of the ground, three deep cross cuts are made with a sharp knife in the bottom of each bulb. They are then set out, bottom upward, and covered with loose soil for two or three weeks, during which time the cuts open out and the wounds are healed. They are then taken up and kept spread out on tables in storehouses till October, when they are planted out. When lifted next June, nothing of the parent bulb remains but dry skins, on the edges of which twenty to thirty offsets are fastened. These bulblets are picked off by hand and planted out in autumn, just like large bulbs. This process of planting in autumn and taking up in summer for a two months' rest is repeated for four or five years, till the bulbs have attained to marketable size. Another method of propagating is to hollow out the bottom of the bulb smoothly to a point in the center. More offsets are secured in this way, but they are smaller and take a year or two longer to reach maturity. These methods are illustrated in Figs. 1924, 1925.

New varieties are obtained from seed, but as the present leading varieties have attained a very high degree of perfection in form and in color, few seedlings show marked improvements on existing sorts. New varieties are also produced by "sporting," that is, one plant spontaneously assumes a new and different character from the remainder of the stock and from this one plant new stocks are grown. In this way the beautiful light rose variety DeWet sported from single blue Grand Maitre, while single purple Lord Balfour first appeared in a stock of the deep rose Moreno, and so on.

The tendency to produce new varieties should be restricted to distinctive forms and colors. Many of so-called new varieties recently introduced are merely slight alterations in form or color of the parent bulb, not sufficient in appearance to justify calling them new sorts, merely increasing the list of named sorts for advertising or selling purposes. J. M. Thorburn & Co.

HYÆNÁNCHE (Greek, referring to its native African use as a hyena poison). *Euphorbiàceæ.* Small tree, sometimes grown in greenhouses. Lvs. whorled or sometimes opposite, simple, entire: fls. diœcious, apetalous, in axillary clusters; sepals in staminate fls. 5–12, stamens numerous: ovules 2 in each of the 3–4 cells. The single species is **H. capénsis,** Pers. (*Toxicodéndron capénse,* Thunb. *H. globòsa,* Lamb.). HYENA POISON. A much-branched tree, 5–6 ft. high: lvs. linear to oblong, base cuneate, apex rounded, glabrous: caps. subglobose. S. Afr. It is adapted to well-drained light soil, and is prop. by cuttings in sand under glass. During its rest-period water should be given sparingly. J. B. S. NORTON.

HYBÁNTHUS (from Greek meaning *hump-backed flower*). *Violàceæ.* Species about 50, in Old and New World, mostly in tropical and subtropical parts. One species native to the E. U. S., is sometimes listed: it is an herbaceous perennial 1–2 ft. high, with mostly oblong, narrowly acuminate lvs. 3–5 in. long, and small nodding greenish fls. solitary or in pairs in many of the lf.-axils: sepals linear and equal; petals mostly nearly equal in length, connivent nearly their entire length, the lower one much larger, saccate at the base, emarginate at the broad apex; stamens with broad connectives wholly connate into an ovoid sac open only between the free tips, a rounded or 2-lobed scale-like gland adnate to the base anteriorly.

cóncolor, Spreng. (*Ionídium cóncolor,* Benth. & Hook. *Sòlea cóncolor,* Ging. *Cubèlium cóncolor,* Raf.). May, June. Moist woods and ravines, Ont. to Ga. and West. F. W. BARCLAY.

HYBRIDS are the products of crossing between species. Of late, the word hybrid has been used by most writers to comprise all crosses, whether between species or varieties. The justification of this usage is the fact that there are no hard and fast lines between varieties and species, and therefore that hybridism in the old sense is incapable of exact delimitation. The opponents to this usage, however, contend that so long as it is customary to speak of species and varieties as different classificatory categories, it is equally allowable and useful to speak of hybrids as between species and of cross-breeds as between varieties; moreover, historical custom favors this usage. Common-language terms rarely if ever express absolute or ideal truth: they grow up by custom. Whenever new ideas and discoveries render them inexact, it may be quite as well to invent new terms as to give new and technical meanings to old terms which are thoroughly established in literature. The word hybrid has always been a specific term, and it were a pity now to make it a generic one, particularly since there is a well established generic term. The generic word, both substantive and verb, is *cross.* Specific kinds of crosses are hybrids, between species; cross-breeds, between plants of the same species; half-hybrid, between a species and a variety of another species; bigener, between plants of different genera. There are technical terms to designate the various kinds and degrees of crossing. The word hybrid has now become so flexible, however, and other standards of measurement are so much in vogue, that these special terms are little used.

It was formerly held that inability to make fertile hybrids is proof that the forms are distinct species; and contrarywise, that plants which make fertile crosses are of one species. Hybridization has also been made a test of genera. These notions are now given up, for crossing and classification belong to two unlike categories of facts. Species and genera are not entities in themselves, but are mere artificial groups made by men for their convenience when writing and speaking of living things. Crossing is a biological phenomenon.

Hybrids are unusual facts in nature; that is, they are rare compared with the whole number of plants. On the other hand, cross-breeds are usual. Most flowers are so constructed as to favor cross-pollination. Cross-breeding is one of the prime means of inducing slight variations and of invigorating a type. Upon the variations which arise from crossing and other means, natural selection operates in the production of new forms. But it is significant that these new forms usually come about slowly and gradually. It is the desire of the cultivator to produce new forms quickly and of pronounced distinctness. He therefore employs crossing between unlike types, or species, hoping thereby to secure wider departures. In nature, the cross-breed is the beginning of a process of breeding: it starts off the variation. Man is often tempted to look upon the hybrid as the end. If the products of a given cross are not to his liking, he throws them away and tries again. The most expert plant-breeders, however, now hybridize to get a "break," and thenceforth depend chiefly on selection to realize their clear-cut ideals, particularly in seed-propagated plants.

To man hybrids are of no value unless they can be propagated. By seeds they usually vary immensely: it is difficult to "fix" them so that they will come true. By cuttings or layers or division, however, the character of the parent may be propagated with practical certainty: the original plant is divided, and the parts are put on the market. Nearly all commercial hybrids are of plants which are thus propagated by asexual parts: Kieffer pear, hybrid grapes, Wilson blackberry, Wild Goose plum, cannas, roses, begonias, anthuriums, fuchsias, pelargoniums, rhododendrons. Since the hybrid is variable when propagated by seeds, continued selection, or plant-breeding, must be employed to fix and establish a desirable type.

It is thus seen that hybridization rarely gives rise to dominant horticultural seed-races, but rather to an individual plant which may be disseminated by some divisional means of propagation. The seeds of hybrids—as of the modern cannas—may give rise to good varieties, and they may not; but these new varieties are, in their turn, usually propagated by means of asexual parts if they are to be kept true.

Practically there is no certainty in hybridization. Rarely can a man picture to himself an ideal variety, and then by means of hybridization produce it. He hybridizes plants which possess some of the characteristics of the desired or ideal variety, and then takes his chances. True plant-breeding sets an ideal, and then reaches it by working along certain definite lines. It seeks first to secure a variation in the desired direction: this may be secured by means of crossing, change of soil, modification of food-supply, and other changed conditions. It seeks, then, to preserve or augment the form by means of definite selection.

We are not yet able to formulate positive laws of hybridization. Every hybrid is a law unto itself. By the study of many examples of hybridization, one is able to construct an average of probabilities as to what will or what will not occur in a given case: but the given case may contradict all the probabilities without apparent cause. Hybridization is an empirical subject.

One cannot tell what species will or will not hybridize except by trying. Hundreds of species have been tried, and for them the knowledge is more or less exact. Plants hybridize most freely which are the subjects of much care and coddling: the orchids are the best examples. In these groups, hybrids are chiefly fanciers' plants, valuable often only because they are hybrids or are rare and curious. One cannot tell beforehand whether the products of any hybridization will be exact intermediates, or in what way or degree they will carry over or blend the parental characters. As a rule, the more closely akin the species, the more perfect will be the blending or amalgamation of the two. See *Breeding of Plants,* Vol. I.

The literature of hybridization is extensive but scattered. The possibilities of hybridization as a factor in plant-breeding are presented in many aspects in the "Hybrid Conference Report" of the Royal Horticultural Society, London, 1900. There are special books devoted to orchid hybrids (see *Orchids*). See an excellent paper by Swingle and Webber, "Yearbook of the United States Department of Agriculture," 1897; papers in "American Gardening," 1899, pp. 397, 413, 431; Bailey & Gilbert's "Plant-Breeding;" De Vries' "Plant-Breeding."

L. H. B.

HYDRÁNGEA (Greek, *hydor*, water, and *aggeion*, vessel; alluding to the cup-shaped fruit). *Saxifragàceæ.* Ornamental woody plants, grown chiefly for their showy white, pink or blue flowers.

Deciduous shrubs: lvs. opposite, without stipules, petioled, serrate, sometimes entire, rarely lobed: fls. perfect, in terminal panicles or corymbs, often with sterile marginal fls.; calyx-lobes and petals 4–5; stamens usually 10; ovary inferior or half-inferior; styles 2–5, short: caps. 2–5-celled, dehiscent at the base of the styles, with many minute seeds.—About 35 species in N. and S. Amer., Himalayas and Cent. and E. Asia, of which more than 20 occur in China; for a key to the Chinese species, see Rehder, Synopsis of the Chinese Hydrangeas (in Sargent, Plantæ Wilsonianæ 1:34–41).

The hydrangeas are highly ornamental mostly low shrubs, rarely vines climbing by rootlets, with medium-sized or rather large leaves and small white, bluish or pinkish flowers in corymbs or panicles, bearing usually marginal sterile flowers, with enlarged showy sepals, or in some varieties all the flowers are sterile and enlarged. *H. paniculata* is the hardiest of all, but *H. arborescens*, *H. radiata*, *H. xanthoneura* and *H. Bretschneideri* are also almost hardy North, while *H. quercifolia* and *H. petiolaris* are hardy as far north as Massachusetts, and *H. involucrata*, *H. opuloides*, *H. Sargentiana*, *H. heteromalla* and *H. Davidii*, are still more tender, and cannot be grown outdoors North.

They grow best in a rich, porous and somewhat moist soil and thrive well in partly shaded positions, but flower more freely in full sun if they only have sufficient moisture. All hydrangeas are well adapted for borders of shrubberies, and *H. paniculata* and *H. opuloides*, especially the varieties with sterile flowers, are very showy as single specimens on the lawn. In warmer climates the latter is sometimes used for ornamental hedges (see G.C. III. 24:337, 456); but it is not hardy in the North. These and also most of the other species should be pruned in fall or early spring, and the branches of the previous year cut back to one to three pairs of buds, according to the growth of the branches and the desired size of the panicles; if only slightly pruned, the panicles will be many but small. Sometimes they are cut back every year almost to the ground and produce then enormous panicles, which, however, usually need artificial support and lack the gracefulness of less severely pruned plants. *H. paniculata* var. *grandiflora* can be grown into a small standard tree; for this purpose vigorous young plants should be selected and planted in rich soil, and cut down to the base. The strongest shoot of each plant will attain by fall the height of 4 to 6 feet, if freely manured and watered during the summer; in autumn, all the weaker branches are cut off, and in colder climates the plants should be lifted and stored in a frost-proof pit or cellar, since the wood is usually not sufficiently ripened to withstand severe frost. In the following year the top of the stem is allowed to branch. The weaker basal shoots may be pegged down to make new plants. Strong-growing varieties of *H. opuloides* may be treated in the same way if standard plants are desired.

The method of winter protection of hardy hydrangeas adopted around Newport, Rhode Island (and possibly other places) may be worthy of mention. In the case of individual specimens, after the leaves have dropped in the fall, the branches are tied together and the plant covered with a box having open ends. The box is then filled with earth. When the plants are growing together in a bed or border, they may be treated in a similar way by placing boards along the side of the bed, to assist in retaining the earth that is used as a covering material. If, after the branches are tied, they are bent over somewhat, a saving of labor is effected by reason of a smaller quantity of earth being sufficient to cover them. (Montague Free.)

H. opuloides, which cannot withstand much more than 10° of frost, is in the North much grown as a pot-plant, especially the more showy varieties with large heads of sterile flowers, and is extensively used for outdoor decoration during the summer. Late in fall, when the leaves have fallen after frost, the plants are moved to a frost-proof cellar and kept rather dry until spring, when they are repotted in new soil and the growth of last year cut back to one or two pairs of buds. As a suitable soil may be recommended a mixture of loam, leaf-mold and sand, with ground bone, dried cow-manure or some other kind of manure added. During the summer a liberal supply of water should be given, also occasionally applications of liquid manure, until the flowers have developed. They may also be planted in the open ground during the summer, lifted late in fall with a large ball of earth, stored over winter in a coldframe or pit and planted out again in spring; this will not injure in any way the profusion of flowers. In certain kinds of soil the pink hortensias show a tendency to turn blue, and perhaps this can be caused by adding iron filings or alum to the soil. *H. opuloides* is also a valuable plant for forcing, and is much grown for Easter, especially the var. *otaksa*, on account of its dwarfer habit. Handsome pot-plants can be grown in one year from cuttings. In February or March cuttings are inserted in the propagating-house with slight bottom heat, and planted in small pots as soon as they are rooted. During the summer they may be easily grown in pots and plunged outdoors in coal-ashes or in any kind of porous soil, transplanted several times, and freely watered and occasionally manured; or they may be planted out in rich soil, exposed to the full sun, where water should be liberally given and now and then an application of liquid manure. Last of September they should be repotted in 8-inch pots, kept shady some days until established, and afterward exposed to the sun. After the first frosts they may be brought into a cool greenhouse. If intended to have them in flower for Easter, they should be transferred not later than the fore part of January into a warmer house, with a temperature gradually rising from 50° to 60°; the plants should be freely watered, and about once a week an application of liquid manure given until the flower-buds are developed. The flowers should be almost fully developed some time before they are desired, that they may be hardened off in a cooler house, since overforced plants are likely to collapse if exposed to sudden changes of temperature. After

1929. Summer cutting of Hydrangea paniculata.

flowering, the plants are pruned and repotted or planted out and treated as above described for cuttings, or they may be thrown away and another set of plants raised from cuttings.

H. petiolaris is a handsome climbing plant for covering walls and trunks of trees, and grows well in the shade, but flowers freely only in the full sun.

The hydrangeas are readily propagated by cuttings of half-ripened or nearly ripe wood under glass in summer (Fig. 1929); also by hardwood cuttings, layers, suckers or division of older plants. *H. quercifolia* is best propagated by suckers or by layers of growing wood put down in summer. Rarely increased by seeds, which are very small, and should be sown in fall in pans or boxes and only slightly covered with soil.

INDEX.

acuminata, 7 (1).
albo-variegata, 7.
altissima, 16.
anomala, 16.
arborescens, 8.
aspera, 13.
Azisai, 7 (1).
Belzonii, 7 (1).
Bretschneideri, 4, 5.
Buergeri, 7 (1).
cinerea, 9.
cordata, 8.
cyanea, 7 (1).
cyanoclada 7 (2).
Davidii, 6.
fimbriata, 7 (3).
floribunda, 2.
glabrescens, 4.
grandiflora, 2, 8.
heteromalla, 3.
Hortensia, 7 (2).
hortensis, 2, 7, 14.
involucrata, 14.
japonica, 7 (1).
Lindleyana, 7 (1).
macrophylla, 13.
macrosepala, 7 (1).
mandshurica, 7 (2).
Mariesi, 7 (1).
monstrosa, 7 (2).
nigra, 7 (2).
nivalis, 7.
nivea, 10.
opuloides, 7.
otaksa, 7 (2).
paniculata, 2.
pekinensis, 4.
petiolaris, 15.
plena, 7 (2).
præcox, 2.
prolifera, 7 (3).
pubescens, 3.
quercifolia, 1.
radiata, 10.
ramulis, 7 (2).
rosalba, 7 (1).
rosea, 7 (2).
roseo-marginata, 7.
Rosthornii, 12.
rubro-plena, 7 (3).
Sargentiana, 11.
scandens, 15.
serrata, 4, 7 (1).
setchuenensis, 5.
stellata, 7 (3).
sterilis, 8, 9.
strigosa, 13.
tardiva, 2.
Thunbergii, 7 (1).
tricolor, 7.
urticifolia, 8.
variegata, 7.
Veitchii, 7 (1).
vestita, 3, 4,
volubilis, 15.
Wilsonii, 5.
xanthoneura, 5.

A. *Shrubs erect or spreading: stamens 10: petals expanding.*

B. *Infl. pyramidal.*

1. **quercifòlia,** Bartram. Shrub, with spreading branches, to 6 ft.: young branches densely ferrugineously tomentose: lvs. long-petioled, roundish or broadly ovate, pinnately lobed with serrate lobes, glabrous above at length, whitish tomentose beneath, 4–8 in. long: panicle 4–7 in. long; fls. pinkish white, the sterile ones turning purple; styles 2: caps. with the calyx-teeth at the apex. June. Ky. to Ala. and Fla. B.M. 975. Gng. 2:305. Gn.M. 2:66. G.C. II. 22:369. Gn. 27, p. 199. G. 27:389. G.W. 5, p. 109. M.D.G. 1913:517.

2. **paniculàta,** Sieb. Shrub or small tree, to 30 ft., with dense globose head: lvs. elliptic or ovate, acuminate, serrate, sparingly pubescent above, more densely on the veins beneath, 2–5 in.: panicle 6–12 in. long; fls. whitish, the sterile ones changing later to purplish; styles 3: caps. with the margin of the calyx about at the middle. Aug., Sept. Japan, China. S.Z. 61. F.E. 15:501; 34:387. F.R. 21:9. G.W. 2, p. 114; 12, p. 366. G.C. III. 9:553. Gn. 59, p. 181; 75, p. 548; 76, p. 5. Mn. 9:75. The following varieties are cult.: Var. **floribúnda,** Regel. Panicles large, with more and larger sterile fls. Gt. 16:530. Var. **grandiflòra,** Sieb. (var. *horténsis*, Maxim.). Fig. 1930. Almost all fls. sterile; panicles very large and showy. F.S. 16:1665, 1666. Gn. 10:37; 38, p. 569; 54, p. 376; 64, p. 407; 72, p. 560. R.H. 1873:50; 1899, pp. 130, 131. Mn. 8:119. A.G. 18:313. Gng. 3:357; 5:3. F.E. 8:214. S.H. 1:174. G.M. 39:728; 46:794. Gn.M. 2:67. A.F. 17:194, 517. C.L.A. 7:43. G.W. 8, p. 210; 15, p. 454. G.Z. 10:80. Var. **prǽcox,** Rehd. Fig. 1931. Almost like the type, but flowering about 6 weeks earlier, in the middle of July; sepals usually elliptic. G.F. 10:363 (adapted in Fig. 1931). The late-flowering typical form is sometimes called var. **tardìva,** Hort.—*H. paniculata* var. *grandiflora* is the common hydrangea of lawns. It is seen to best effect when planted close in front of heavy shrubbery. Cut back rather heavily in early spring.

1930. Hydrangea paniculata var. grandiflora.

BB. *Infl. corymbose, flat or globular.*

C. *Ovary partly superior; hence caps. ovoid, with the margin of the calyx about the middle; styles usually 3: sterile fls. present.*

D. *Fertile fls. white.*

E. *Lvs. white-tomentose below.*

3. **heteromálla,** Don (*H. vestìta*, Wall. *H. pubéscens*, Decne.). Shrub, to 10 ft.: petiole deeply grooved and margined, red; lvs. ovate, acuminate, densely setosely dentate, almost glabrous above, densely whitish-tomentose beneath, 4–8 in. long: cyme 5–8 in. broad, with bracts; sepals of sterile fls. elliptic or obovate, acute or mucronulate: caps. with the calyx above the middle. June, July. Himalayas. F.S. 4:378—79. G.C. II. 22:617. G.M. 50:859.

EE. *Lvs. villous or nearly glabrous below.*

4. **Brétschneideri,** Dipp. (*H. vestìta* var. *pubéscens*, Maxim. *H. pekinénsis*, Hort.). Fig. 1932. Shrub, to 8 ft.: last year's branchlets with chestnut-brown bark peeling off in thin flakes: petioles not margined; lvs. ovate or elliptic-ovate to oblong-ovate, acute or acuminate, serrate with short callous teeth, more or less pubescent beneath, 3–5 in. long: cymes similar to the former but smaller and denser; sepals roundish, obtuse: caps. with the calyx near the middle. July. N. China. G.F. 3:17 (adapted in Fig. 1932); 6:396. G. 27:387. Gng. 16:305. G.W. 9, p. 541. Var. **glabréscens,** Rehd. (*H. serràta*, Koehne, not DC.). Lvs. smaller, elliptic, more coarsely serrate and only sparingly pubescent.

5. **xanthoneùra,** Diels. Shrub, to 15 ft.: last year's branchlets with close chestnut-brown bark marked with conspicuous lenticels: lvs. elliptic to elliptic-oblong, abruptly acuminate, serrate, glabrous and bright green above, marked with more or less conspicuous yellow veins, light green below and glabrous or slightly pubescent on the veins, 4–7 in. long; petioles ½–1¼ in. long: corymbs rather loose, convex, 5–10 in. across; sterile fls. 1¼–2 in. across, with oval obtuse sepals. July. W. China. Var. **Wílsonii,** Rehd. Last year's branchlets grayish or pale brown: lvs. somewhat narrower, glossy above. W. China. M.D.G. 1912:26. The handsomest form of the species. Var **setchuenénsis,** Rehd. (*H. Brétschneideri* var. *setchuenénsis*, Rehd.). Last year's branchlets light brown: lvs. to 8 in. long and to 4 in. broad, villous below. W. China.—This species and its varieties have proved hardy at the Arnold Arboretum. It is very similar to the preceding species, but easily distinguished by the close bark.

DD. *Fertile fls. bluish or pink: lvs. glabrous or pubescent only on the veins below.*

6. **Dàvidii,** Franch. Shrub, to 6 ft.: young branchlets finely appressed pubescent, older light brown: lvs. elliptic-lanceolate or ovate-lanceolate, long-acuminate, cuneate at the base, sinuately serrate, yellowish green and nearly glabrous above, pubescent on the veins below, 3½–6 in. long: corymbs loose, convex, sometimes nearly paniculate, 6–8 in. across; sepals and petals lanceolate; sterile fls. about 1½ in. across, with 3 or 4 sepals: caps. with the margin of the calyx about or slightly below the middle. W. China.—Handsome species with its large loose corymbs of blue fls.; tender.

7. **opuloìdes,** Koch (*H. horténsis,* Smith. *H. Horténsia,* DC. *H. japónica,* Sieb.). Shrub, to 8 ft., almost glabrous: lvs. ovate or ovate-elliptic, acuminate or acute, coarsely serrate, 5–8 in. long: fls. in large cymes without bracts, white, bluish or pink, few or all of them sterile.—The greenhouse hydrangea. June, July, but blooming in winter under glass. A large number of varieties have been intro. from Japan and China, where this species has been extensively cult. for many centuries, and where it is native. The following are some of the best known. They may be divided into 3 groups:

(1) *Japonica group: cymes flat, with sterile and fertile fls.*

Var. **acuminàta,** Dipp. (*H. acuminàta,* Sieb. & Zucc. *H. Buérgeri,* Sieb. & Zucc.). Lvs. ovate-lanceolate, acuminate, sparingly appressed-pubescent: sterile fls. with elliptic entire sepals, usually blue. S.Z. 56, 57. Var. **Azísai,** Dipp. (*H. Azísai,* Sieb.). Lvs. elliptic-ovate, glabrous: sterile fls. with obovate sepals, long-pedicelled, overtopping the fertile ones. S.Z. 51. Var **Belzònii,** Schneid. (*H. Belzònii,* Sieb. & Zucc. *H. japónica* var. *cærùlea,* Hook. *H. japónica* var. *cæruléscens,* Regel). Of dwarfer and stouter habit: lvs. ovate or obovate, short-acuminate, glabrous, somewhat thick: sterile fls. whitish, pinkish, or bluish, with rhombic, usually entire sepals. S.Z. 55. B.M. 4253. Here belongs also var. *Imperatrice Eugenie* with pink fls. R.H. 1868:471. Var. **japónica,** Schneid. (*H. japónica,* Sieb.). Lvs. ovate to elliptic, acuminate, glabrous: sepals broadly ovate, toothed, pink. S.Z. 53. B.R. 30:61. R.H. 1874:90 (as *H. acuminata*). Var. **macrosépala,** Dipp. Differs from the former only by its larger sepals. Gt. 15:520. Var. **Màriesi,** Hort., seems also not much different, but has somewhat broader lvs., and the pink sterile fls. are very large. Gn. 54: 390. G.C. III. 23, suppl. May 28. G. 26:409. G.M. 41:347; 46:577, 578. G.W. 6, p. 557; 9, pp. 413, 414. Var. **Veìtchii,** Hort. Similar to the preceding variety, but sterile fls. pure white, 3–3½ in. across. G. 26:175. Var. **Lindleyàna,** Rehd. (*H. rosálba,* Van Houtte. *H. horténsis* var. *Lindleyàna,* Nichols.). Lvs. ovate or elliptic-ovate, acuminate, sparingly hairy: sepals dentate, ovate or broadly ovate, white and pink, or white changing to pink. F.S. 16:1649, 1650. R.H. 1866:430. Gn. 46:466. Var. **serràta,** Rehd. (*H. serràta,* DC. *H. Thúnbergii,* Sieb. & Zucc. *H. cyànea,* Hort.). Lvs. elliptic or ovate, narrowed at both ends, serrate, sparingly appressed-hairy, 1½–3 in. long: cymes small, 3–4 in. broad; fls. pinkish or bluish; sepals roundish, obtuse or emarginate. S.Z. 58. G.C. 1870:1699.

(2) *Hortensia group: cymes globose, with almost all fls. sterile.*

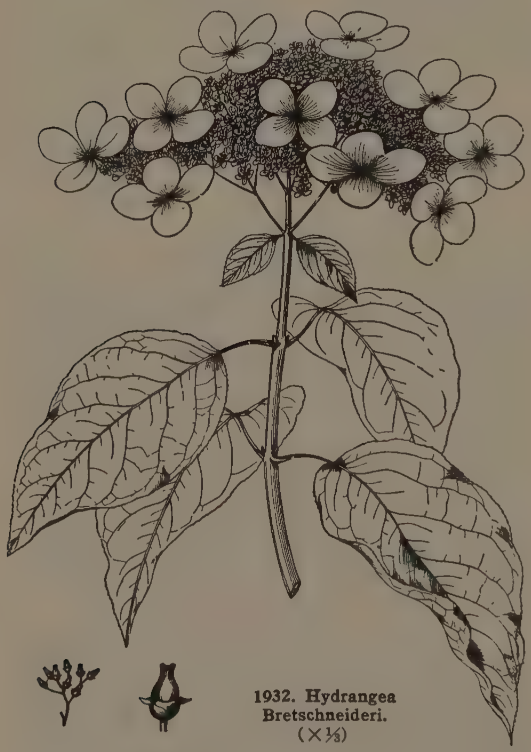
Var. **cyanóclada,** Dipp. (*H. mandshúrica,* Koehne. *H. Horténsia* var. *nìgra,* Arb. Kew. *H. nìgra,* Carr. *H. rámulis coccíneis* and *H. rámulis píctis,* Hort.). Branches dark purple or violet, often almost black: lvs. ovate-elliptic, acute: cymes large, with purple peduncles; sepals pink or bluish, obovate. A.F. 5:361. Var. **Horténsia,** Dipp. Lvs. large, elliptic, glabrous: sepals broadly ovate, entire, usually pink. This is the form which first came into cult. outside of Japan and China, and is said to have been intro. from China to England in 1790, by Joseph Banks. B.M. 438. G.C. III. 24:45; 52:251. Gn. 45, p. 12; 50, pp. 123, 256, 367; 52, p. 281. F.E. 18:277. A.G. 1900:695. Gn.M. 2:66. G. 4:223; 15:139; 20:441. Var. **plèna,** Regel. Similar to the preceding, but sepals toothed. Var. **otáksa,** Dipp. (*H. otáksa,* Sieb. & Zucc.). Fig. 1933. Dwarfer, but of vigorous growth: lvs. obovate, short-acuminate, rather thick, glabrous: sepals obovate, entire, pink or blue. S.Z. 52. F.S. 17:1732, 1733. Gn. 50: 122. R.H. 1868:450. Mn. 5, p. 105. A.G. 11:415; 19: suppl. Feb. 12; 44:415. A.F. 10:1015. F.E. 9:52, 401. Gng. 5:161; 6:7. Here belong also the following 4 forms: Var. *otáksa monstròsa,* Lambert, with very large heads. S.H. 2:517. G.W. 13, p. 43. Var. *otáksa monstròsa nàna,* Brunnemann. A very dwarf form of the preceding. M.D.G. 1909:235. Var. *ròsea,* Veitch. Lvs. smaller, more finely serrate: fls. deep rose-color or bright blue. Gt. 53:1533 (rose). R.H. 1904:544 (blue). Gn. 50:122. G.W. 7:582. Gn.W. 22:493. Var. *Thomas Hogg,* Hort. Lvs. elliptic, or ovate: heads pure white, large. One of the best as a pot-plant. It is also to be recommended for outdoor cult., as it is one of the hardiest.—Some beautiful forms mostly of hybrid origin of the Hortensia group have recently appeared in the trade, of these may be mentioned here: *Madame E. Mouillère,* white fls. with crenate close sepals. R.H. 1912, p. 62. M.D.G. 1911:41. G.C. III. 49:204. Gn. 75, p. 180. *Beauté Vendomoise,* fls. very large, with clawed and crenate sepals, fls. therefore open in the center. R.H. 1912, p. 63. *Professor D. Bois,* fls. deep rose, large, sometimes 5 in. across. R.H. 1912, p. 325. *Eclaireur,* fls. large, rose-carmine, said to be the most deeply colored form. *Mademoiselle Renée Gaillard,* fls. white with dentate sepals. M.D.G. 1911: 38, 39. *Avalanche,* fls. pure white. *Genérale Vicomtesse de Vibraye,* with very large pink fls., with entire sepals. R.B. 37:377. *Président Viger,* very floriferous, clusters large, fls. very large, with dentate sepals, bright pink. *Saarbrücken,* dwarf, with very large heads of pink fls.; sepals denticulate. M.D.G. 1910:601. G.W. 15, p. 76. For other varieties see: M.D.G. 1911:38–41, 265–273; 1912:210, 211.

1931. Hydrangea paniculata var. præcox. (×⅙)

(3) Stellata group: fls. with many narrow sepals.

Var. **stellàta,** Dipp. (*H. stellàta,* Sieb. & Zucc.). Lvs. ovate or ovate-oblong, sparingly pubescent: cymes with larger sterile and smaller fertile fls., both with many narrow-elliptic sepals. S.Z. 59. Var. **fimbriàta,** Dipp. Cymes rather dense, with almost all the fls. sterile; sepals fimbriate, white, pink toward the base. G.C. III. 23, suppl. May 28. Var. **prolífera,** Hort. (*H. stellàta* var. *prolifera,* Regel). The fertile fls. bearing 1 or few smaller ones in the center. Var. **rùbro-plèna,** Dipp. Cymes rather dense, with almost all fls. sterile, changing from pink or pale lilac to dark red.

There are also some varieties with variegated lvs., as var. **variegàta,** Hort. (*H. japónica variegàta,* Hort.), a form of var. *japonica* with the lvs. edged white (H.F. 1861:108); var. **álbo-variegàta,** Hort. (*H. japónica fol. álbo-variegàtis,* Hort.), a form of var. *Belzonii,* with the lvs. edged white (F.S. 7:696. G. 27:517); var. **trícolor,** Hort., with the lvs. variegated with white and edged yellow; var. **ròseo-marginàta,** Hort., with the lvs. spotted white and edged pink; var. **nivàlis,** Hort. (*H. Horténsia nivàlis,* Bull & Sons). Lvs. with a deep green margin and an irregular patch of creamy white in the center. G.C. III. 32:455. G.M. 47:639.



1932. Hydrangea Bretschneideri. (×⅓)

cc. *Ovary inferior, hence caps. truncate, with the calyx-teeth at the apex; styles usually 2.*

d. *Cymes without involucre at the base.*

e. *Branchlets and lvs. glabrous or lvs. villous or tomentose below: seeds not winged.*

f. *Lvs. glabrous below.*

8. **arboréscens,** Linn. (*H. urticifòlia,* Hort.). Erect shrub, 4–10 ft.: lvs. long-petioled, ovate, acute or acuminate, rounded or cordate at the base, serrate, green and glabrous on both sides or somewhat pubescent or glaucous beneath, 3–6 in. long: cymes 2–5 in. broad, with none or few sterile fls. June, July. N. J. to Iowa, south to Fla. and Mo. B.M. 437. G.W. 15, p. 612. Var. **cordàta,** Torr. & Gray, has the lvs. broadly ovate and cordate. Var. **stérilis,** Torr. & Gray. A form with all the fls. sterile; sepals broadly oval, rounded or mucronate at the apex: lvs. oval to oblong-ovate, rounded or abruptly contracted at the base. It is doubtful whether this form is still in cult. Var. **grandiflòra,** Rehd. A form of var. *cordata* with all the fls. sterile: heads 5–7 in. across; fls. ¾–1 in. across with ovate acute sepals: lvs. ovate to ovate-elliptic, cordate or rounded at the base. M.D.G. 1907:380; 1909:4; 1912:472. Gn. 75, p. 435. G.W. 13, p. 617. R.B. 33:375; 34:259. G. 31:671. F.E. 22:70; 28:359; 31:606. G.M. 50:357.—A striking plant with its showy large heads of white fls.; quite hardy.

ff. *Lvs. tomentose or densely grayish pubescent below.*

9. **cinèrea,** Small. Shrub, to 6 ft.: lvs. membranous, oval or broadly ovate to ovate-oblong, rounded or cordate at the base, serrate, densely grayish pubescent below, 2½–6 in. long: corymbs 2–5 in. across, usually with sterile fls. June, July. B.B. 2:185 (as *H. radiata*); (ed. 2) 2:231. N. C. to Tenn. and Ala. Var. **stérilis,** Rehd. All fls. sterile, in dense heads 5–7 in. across; fls. about ½in. across with oval obtuse sepals. F.E. 28:359; 30:911.

10. **radiàta,** Walt. (*H. nívea,* Michx.). Similar to the former, but lvs. leathery, densely whitish tomentose and reticulate beneath and cymes always with sterile fls. June, July. N. C. and S. C. F.E. 32:11.

ee. *Branchlets strigose or bristly and lvs. strigose or densely clothed with rough hairs: seed winged.*

f. *Base of lvs. rounded or subcordate.*

11. **Sargentiàna,** Rehd. Shrub, to 6 ft. with stout upright branches clothed with harsh hairs and stiff bristles: young growth more or less purple: lvs. ovate to ovate-oblong, shortly acuminate, crenate-serrate, dull green and hairy above, densely rough-villous below, 6–12 in. long; petioles 1½–3½ in. long: cymes nearly flat, dense, 5–6½ in. across; fertile fls. pale violet, the sterile fls. white; style 2–3. July, Aug. Cent. China. B.M. 8447. Gn. 77, p. 264. G.M. 55: suppl. p. 5, June 1.—A strikingly handsome plant with its large lvs., the dense pubescence purplish on the young growth and with its large cymes bluish violet in the center and surrounded by conspicuous white sterile fls. It is rather tender and can be grown outdoors in the S. only and demands a shady position.

12. **Rósthornii,** Diels. Shrub, to 12 ft.: branchlets strigose: lvs. roundish-ovate or ovate, occasionally ovate-oblong, acuminate, cordate at the base, unequally or doubly fimbriate-dentate, sparingly strigose above, densely grayish strigose and reticulate below, 4–9 in. long and 3–7 in. broad; petiole 1½–4 in. long: cymes 4–7 in. across; sterile fls. 1–1½ in. across, white or purplish; sepals suborbicular or oval, entire or serrate; styles 2. July. W. China.

ff. *Base of lvs. cuneate.*

13. **strigòsa,** Rehd. (*H. áspera,* Hemsl., not Don). Shrub, to 8 ft.: branchlets strigose: lvs. oblong-ovate to elliptic-lanceolate or lanceolate, acuminate, serrulate or serrate, sparingly strigose or nearly glabrous above, densely strigose below, 3–7 in. long; petiole about 1 in. long: cymes 4–6 in. across; sterile fls. white or sometimes purple, 1–1½ in. across, with broadly oval, entire or serrate sepals; styles 2. Aug. Cent. China. Var. **macrophýlla,** Rehd. (*H. áspera* var. *macrophýlla,* Hemsl.). Lvs. 8–12 in. long: cymes to 8 in. across with the sterile fls. about 2 in. broad.

dd. *Cyme inclosed before expanding by 6–8 large, deciduous bracts.*

14. **involucràta,** Sieb. Low shrub, to 5 ft.: lvs. oblong, acuminate, densely and sharply serrate, appressed-pubescent on both sides, rough to the touch,

4–8 in. long: bracts at the base of the cyme large, orbicular; smaller bracts none: fertile fls. blue or pinkish, sterile ones whitish: caps. with the calyx at the apex; styles usually 2. Aug. Japan. S.Z. 63. J.H. III. 32:102. *H. Sapphire*, intro. 1890, seems to belong here. Var. **horténsis**, Maxim. Fls. double, usually pink and often proliferous. S.Z. 64. F.S. 3:187.

AA. *Shrubs climbing by aërial rootlets: petals cap-like, cohering, falling off as a whole.*

15. **petiolàris**, Sieb. & Zucc. (*H. scándens*, Maxim., not DC. *H. volùbilis*, Hort.). Climbing to 80 ft. in Japan: lvs. long-petioled, broadly ovate-cordate to elliptic, acute or acuminate, serrate, almost glabrous, 2–4 in. long: cymes rather loose, 8–10 in. across, with rather few sterile fls.; stamens 15; styles usually 2: caps. with the calyx at the apex. July. Japan, Saghalin. B.M. 6788. S.Z. 54, 59, 2, 92. M.D.G. 1897:236, 237. S.H. 2:191, 193. Gn. 62, p. 248; 64, p. 219. G. 35:461. —A very variable species, figured and described by Sieb. & Zucc. under 3 different names. In gardens it is often met with under the name of *Schizophragma hydrangeoides*, another Japanese climber of similar habit, which, however, is easily distinguished by its sinuately dentate lvs. and its sterile fls. having only 1 large cordate sepal.

16. **anómala**, Don (*H. altíssima*, Wall.). High-climbing, glabrous: lvs. ovate to elliptic-ovate or ovate-oblong, broadly cuneate at the base, denticulate-serrate, 2–4 in. long; petioles ¾–2 in. long: cymes loose, puberulous, 4–6 in. across; stamens 10; sterile fls. few or sometimes wanting, about 1 in. across, with suborbicular sepals. July. W. China, Himalayas. Wallich, Tent. Flor. Nepal. 50.

H. áspera, Don. Shrub, to 20 ft., similar to H. strigosa: lvs. oblong-lanceolate, fimbriate-denticulate, densely villous beneath: sepals usually toothed: styles usually 3. Himalayas. Tender.—*H. canéscens*, Koch (H. arborescens × H. radiata). Very similar to H. cinerea, but the hairs smooth or nearly smooth under the microscope, in H. cinerea tuberculate. Garden origin.—*H. hírta*, Sieb. & Zucc. Shrub, to 4 ft.: lvs. broad-elliptic, coarsely incised-serrate: cymes without sterile fls. Japan. S. Z. 62. Not very decorative.—*H. lóngipes*, Franch. Allied to H. Rosthornii. Lvs. thinner, smaller, more coarsely serrate, sparingly strigose or glabrescent below; petioles 2–7 in. long. Cent. and W. China.—*H. robústa*, Hook. f. & Thoms. (H. cyanema, Nutt.). Closely related to H. Rosthornii. Spreading shrub, to 15 ft., with large ovate lvs., pubescent on both sides: sterile fls. with toothed sepals. Himalayas. B. M. 5038. Handsome in bloom, but tender.—*H. ròseo-paniculàta*, Foucard. Supposed to be a hybrid of H. paniculata and H. opuloides. Fls. rose-carmine. R. H. 1912, p. 324.—*H. villòsa*, Rehd. Allied to H. strigosa. Branchlets, petioles and cymes clothed with spreading villous hairs: lvs. strigose above, with a rough woolly tomentum below, 4–7 in. long. W. China. Var. *strigòsior*, Rehd. Branchlets and petioles with shorter and fewer or without spreading hairs: lvs. smaller.—*H. virens*, Sieb. Slender shrub, to 6 ft.: lvs. elliptic or lanceolate, coarsely serrate, 1–2½ in.: cymes rather few-fld., sterile fls. with 3 or 4 large, unequal sepals, white. Japan. S. Z. 60. A desirable shrub, with graceful and delicate fls. and with the lvs. often handsomely variegated along the veins, but tender.

ALFRED REHDER.

HYDRÁSTIS (name of doubtful meaning). *Ranunculàceæ.* Hardy herbaceous perennials, grown in a few gardens for their showy leaves and beautiful red fruit. The roots are ground when dry and used for medicine.

Stem erect, pubescent: lvs. palmately 5–7-lobed, serrate: fls. greenish white, small, solitary; sepals 3, petal-like, falling early; petals none; stamens many: carpels 2-ovuled, in fr. becoming aggregated berries. —Two species, 1 from Japan and 1 from N. Amer., the former (*H. jezoensis*, Sieb.) apparently not in cult.

Moist situations in good, rich loam with plenty of leaf-mold are required. Seeds may be sown in moist, shaded soil of a sandy nature. This is done in fall or early spring. The seeds should be covered very slightly but a mulch or covering is helpful. Plants which have grown in one place for a number of years are easily propagated by division of the roots in late fall or early spring. The commercial cultivation of goldenseal for medicinal purposes is explained in Farmers' Bulletin No. 613 (United States Department of Agriculture) by Walter Van Fleet.

canadénsis, Linn. ORANGE ROOT. GOLDENSEAL. St. 4–10 in. long, from a thick, yellow rootstock: basal lvs. 5–8 in. broad; st.-lvs. 2, lower one petioled, upper sessile and near the small fl.: fr. in ovoid raspberry-like head, the 8–12 fleshy carpels tipped with a short, curved beak. April. E. U. S., as far south as Mo. and Ga., in rich woods. B.M. 3019 (in flower); 3232 (in fruit).

K. C. DAVIS.

HYDRIASTÈLE (Greek, *water* and *column;* the tall trunks growing near springs). *Palmàceæ*, tribe *Arèceæ.* A monotypic genus containing a tropical Australian palm advertised sometimes as *Kentia Wendlandiana.* This may belong to Exorrhiza, which see. If it is a true Hydriastele, however, it is told from the kentias in foliage by the leaf-segments split at the apex instead of acuminate and not split.

1933. Hydrangea hortensis var. otaksa.

More fundamentally, Hydriastele differs in having the ovule on the side of the cell instead of at the bottom, as in Kentia. In this respect it agrees with the group of genera mentioned under Hedyscepe, but it differs from that group in having the fls. borne in 4 ranks instead of spirally. Hydriastele is a spineless palm with erect winged caudex: lvs. terminal, pinnatisect; segms. alternate, linear, split at the apex; midveins covered below with caducous scales; margins thin; rachis laterally compressed, dorsally convex; face of the petiole concave; sheath rather short: spadices with short, wide peduncles, branched from the base, the branches obtusely quadrate, long, slender, pendulous: spathes 2, complete, compressed, deciduous, the lower one ancipital: bracts and bractlets connate: fr. small, ellipsoidal, smooth or ribbed.

This distinct and excellent palm has hitherto been rare, but now that the seeds are being produced in tropical nurseries it is fast becoming popular. The seeds are round, fairly hard, and resemble those of *Archontophœnix Alexandræ.* The characteristic leaves are pinnatifid, the segments being irregular and somewhat jagged at the apex, after the fashion of a fish-tail palm or caryota. It stands the temperature of an ordinary living-room better than many other palms. For rapid growth it needs more heat than *Howea Belmoreana* and *H. Forsteriana.* In the greenhouse a temperature of 60° to 70° is most congenial. A lower temperature will not hurt it, but gives a slower and more compact growth. It loves plenty of moisture, and frequent syringing is beneficial. For potting soil, it likes rich loam, with plenty of sharp sand and good drainage. The seeds and seedlings should be treated more like the commercial areca, i.e., *Chrysalidocarpus lutescens*. It forms a single stem when only 3 feet high, and grows to a height of 20 feet or more in cultivation. It is at its best when 10 to 15 feet high. When well established and pot-bound it loves high feeding, as does *Chrysalidocarpus lutescens*. (H. A. Siebrecht.)

Wendlandiàna, H. Wendl. & Drude (*Kéntia Wendlandiàna*, F. Muell.). A tall palm in nature with the lvs. many feet long; segms. numerous, unequal, the longest 1½ ft., the upper ones confluent at the base, all denticulate at the apex. Queensland.

N. Taylor.†

1934. Hydrocleis nymphoides. (×⅔)

HYDRÍLLA (*water* plant with *whorled* lvs.). *Hydrocharitàceæ*. One aquatic plant of Cent. Eu., Asia and Austral., offered abroad as a water or aquarium subject. **H. verticillàta,** Casp. Forming large masses, leafy, submerged, diœcious: lvs. linear or oblong, serrulate or entire, 4–8 in a whorl, very short (¼–⅓in. long): sterile or male fls. solitary and short-pedicelled in a sessile spathe; sepals, petals and stamens 3: fertile or female fls. 1–2 and sessile in the spathe; sepals and petals 3; ovary extending beyond the spathe into a beak; stigmas 3: fls. very small; the male fls. detach and float.

L. H. B.

HYDRÓCHARIS (Greek, *graceful water plant*). *Hydrocharitàceæ*. Frogbit. A monotypic genus, an aquatic plant, grown in a few aquaria. It is found in ditches and ponds in Eu. and Temp. Asia. **H. Mórsus-rànæ,** Linn., has floating sts. resembling runners, and tufts of radical lvs. and submerged roots: lvs. stalked, roundish, with a heart-shaped base, rather thick, about 2 in. across: peduncles of the staminate plant bearing 2–3 fls. on long pedicels, which spring from a spathe of 2 thin bracts; petals 3, white, stamens 3–12; spathe of the pistillate fls. sessile among the lvs.; styles 6, with 2-cleft stigmas. For American frogbit, see *Limnobium*. Hydrocharis dies in the fall, but winter-buds (see similar buds of Elodea, Fig. 1391) break off and sink when the old plants die. In spring, or in the greenhouse or aquarium under genial conditions, they start early into growth, the scales bursting and a young lf. developing and then the whole rises to the surface. It is a very interesting plant. Its fine, silky roots are beautiful and attractive in the aquarium, as well as the soft, tender lvs. and delicate fls.

Wm. Tricker.

HYDRÓCLEIS (*water key*). *Butomàceæ*. Sometimes spelled *Hydrocleys*. Water plants, one of which is very useful for summer ponds and for aquaria.

Floating: lvs. broad, ovate to strap-shaped: fls. perfect, mostly large; sepals 3, coriaceous and persistent; petals 3, thin and fugacious; stamens many or numerous, the external sterile: carpels 3, rarely 4 or 6 or even 8, lance-linear, connate at base, gradually attenuate into the style.—The latest monograph (Buchenau, Engler's Pflanzenreich, hft. 16, 1903) recognizes 3 species, from Brazil. The genus is sometimes united with Limnocharis, from which it differs in having definite rather than many carpels, and the papillose introrse stigmas.

nymphoìdes, Buchen. (*H. Cómmersonii*, Rich. *H. Húmboldtii*, Endl. *Limnócharis Húmboldtii*, Rich. *L. Cómmersonii*, Spreng. *L. nymphoìdes*, Mich. *Stratiòtes nymphoìdes*, Willd. *Vespúccia Húmboldtii*, Parl.). Water-Poppy. Fig. 1934. Perennial: st. prostrate and rooting: lvs. broad-cordate-oval, thick, mostly floating: fls. and lvs. arising from bracted nodes, both long-stalked: fls. 2–2½ in. across, with 3 obovate-rounded light yellow petals: carpels 5–7, not united. Brazil, to Buenos Ayres. B.M. 3248. B.R. 1640.—A handsome plant with the yellow fls. (lasting 1 day) standing well above the water. In habit, remarkably like *Limnanthemum nymphoides*. Grows well in an aquarium or in shallow water. Continuous bloomer; not hardy to frost. The cult. of *Hydrocleis nymphoides* is of the simplest. When grown in tubs, fill them in two-thirds full of moderately rich soil, covering with sand and fill up with water. Two or 3 plants planted in the center in a short time will furnish the tub with its bright glossy green lvs. and numbers of its bright cheery yellow fls., which continue late in the season. In natural ponds, planted on the edge, the plants grow very rapidly, and spread over a large surface of water. In artificial ponds, plant in tubs or boxes and place in shallow water or stand the tub or box on some stand, allowing 6–9 in. depth of water.

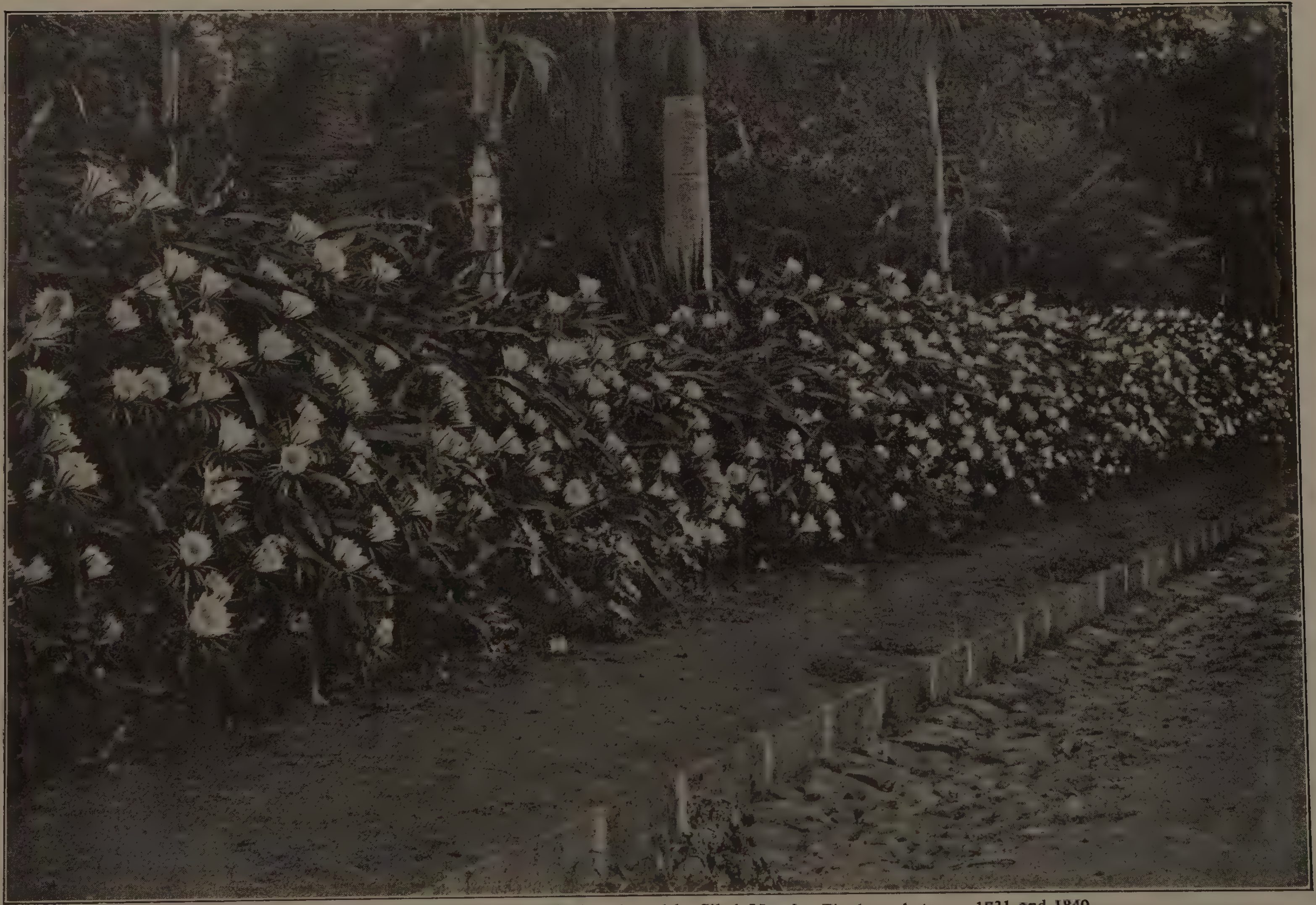
William Tricker.
L. H. B.

HYDROCÓTYLE (Greek, *water* and *cup;* the plants thrive in moist places, and the roundish leaves have a cup-like depression in the middle). *Umbelliferæ*. Water Pennywort. Slender creeping perennials of wet places, one of which is somewhat used in carpet-bedding.

Herbs, with round or reniform often peltate lvs., and scale-like stipules at the base of the petioles: fls. very small, white, in umbels or umbel-like clusters opposite the lvs., sometimes 1 umbel appearing above another; calyx-teeth minute; petals entire, concave: fr. strongly compressed.—Species about 75, widely distributed around the world, several being native in the U. S. and Canada.

1935. Hydrocotyle rotundifolia. (×⅓)

rotundifòlia, Roxbg. (*H. sibthorpioìdes*, Lem. *Sibthórpia europæa*, Hort., not Linn.). Fig. 1935. Lvs.



LVII. Hylocereus tricostatus in Hawaii. Hedge planted by Sibyl Moseley Bingham, between 1831 and 1840.

shining, ¼–1 in. across, orbicular, cordate, subentire or 7–9-lobed to the middle or lower, doubly crenate: umbel 6–8-fld.: fr. 2-ribbed. Trop. Asia and Afr.—Numerous synonyms are accounted for by the variable length of the petiole. Prostrate, rooting at the nodes.

vulgàris, Linn., offered abroad: creeping or floating, rooting at the nodes: lvs. orbicular, 1 in. or less across, crenate or slightly lobed, centrally attached, the petioles surpassing the peduncles: fls. minute, white, in 2 or 3 whorls or in a single umbel: marshes and bogs, and edges of ponds. Eu. L. H. B.†

HYDRÒLEA (probably from *water*, because of the habitat). *Hydrophyllàceæ.* Annual or perennial herbs or subshrubs, scarcely cult., of warm countries and a few in the U. S.; species perhaps a dozen: now often included with Nama (which see): branching plants, sometimes spiny: lvs. ovate or lanceolate, entire, pinnate-veined: fls. blue or white, in clusters or solitary; corolla broadly campanulate or nearly rotate, 5-cleft; stamens 5, about the length of the corolla, with filaments dilated below: fr. a globular caps. with minute seeds. Four species occur in the U. S.: *H. corymbòsa,* Ell. (*Nàma corymbòsum,* Kuntze), with clustered blue yellow-nerved fls. ⅔in. across, and oblong to oblanceolate lvs.: S. C. to Fla. *H. quadriválvis,* Walt. (*H. caroliniàna,* Michx. *Nama quadriválvis,* Kuntze), with solitary or few-clustered blue or lilac fls., and linear-elliptic lvs.: Va., south. *H. ovàta,* Nutt. (*Nama ovàtum,* Brit.), with purplish or white fls. in leafy-bracted panicles, and ovate or elliptic lvs. Swamps, Mo. to La. and Texas. *H. affinis,* Gray (*Nama affine,* Kuntze), with violet fls. in few-fld. leafy clusters, and linear-elliptic lvs. Ind. and Ill. to Miss. and Texas. L. H. B.

HYDROPHÝLLUM (Greek, *water-leaf; application* obscure). *Hydrophyllàceæ.* WATER-LEAF. A half-dozen or more American hardy herbaceous plants, mostly perennial, suitable for wild gardens and for colonizing in shady rich places.

Plants with pinnate or palmately cut foliage and cymose clusters of numerous small white, lilac, light blue, purplish or violet fls. in early summer: floral parts in 5's; calyx appendaged or not; corolla bell-shaped, the tube within bearing a linear longitudinal appendage opposite each lobe, with infolded edges, forming a nectar-bearing groove; stamens and 2 styles usually exserted: caps. 2-valved, with 1–4 nearly globular seeds.—Mostly in moist woods and copses. The perennial species are useful for planting about remote borders of shrubbery, where they take care of themselves.

A. *Calyx appendaged with a reflexed lobe at each sinus: biennial.*

appendiculàtum, Michx. Loosely branching, 1–2 ft., hirsute with long spreading hairs: root-lvs. pinnately 5–7-parted; st.-lvs. palmately 5–7-angulated-lobed: fls. violet or purple, the stamens little exserted. Vt., south and west.

AA. *Calyx not prominently appendaged (often minutely appendaged in H. canadense): perennial.*

B. *Lvs. pinnately cut.*

capitàtum, Douglas. Tufted, about 9 in. high, with fascicled fleshy roots: lvs. softly hirsute or pubescent, ovate or roundish, 5–7-parted, the divisions lobed and cleft: fls. in close clusters, on peduncle shorter than petiole, blue. Colo., west.

occidentàle, Gray. Pubescent, hirsute or sparingly hispid, 1–2 ft.: divisions of the lf. 7–15: fls. violet-purple, varying to white; peduncle longer than the petioles. Calif., Ore.

virginiànum, Linn. Glabrous or nearly so, 1–2½ ft.: lvs. pinnately divided, the 5–7 divisions ovate-lanceolate or oblong: fls. white or violet-purple, the peduncles longer than the petioles. Quebec, west and south.

BB. *Lvs. palmately cut.*

canadénse, Linn. Nearly smooth, 1–2½ ft.: lvs. 5–7-lobed, rounded: fls. mostly greenish white, sometimes purplish the peduncles usually shorter than petioles. B.R. 242. L. H. B.

HYDRÓSME (name probably refers to the wet or aquatic habitat). *Aràceæ.* By some held to be the proper genus for *Amorphophallus Rivieri* (*H. Rivieri,* Engl.); but in the latest monograph (Engler, Pflanzenreich, hft. 48, 1911) it is included in Amorphophallus, as is also Corynophallus, constituting a section of the genus. When kept distinct from Amorphophallus, the separation is largely on technical characters of the seeds.

The section Corynophallus of the genus Amorphophallus, as accepted by Engler, comprises only *Amorphophallus leonensis,* Lem. (*Corynophallus Afzelii,* Hort. *C. leonensis,* Engl. *Hydrosme leonensis,* Engl.), which is sometimes cult. in two or three forms (Vol. I, p. 276): peduncle very stout, 3–8 in. high, from an oblate tuber, bearing a pyriform erect spathe 6 in. high; tube of spathe 1¾ in. diam, white; limb concave, 3½ in. broad at about the middle, rounded at top; mouth of spathe dark purple streaked with dirty white and bearing a few roundish spots; lips of spathe black-purple, incurved: spadix expanding toward the top so that it nearly fills the spathe, brown and mottled: lf. 1, appearing after the fls., on an erect petiole 2–3 ft. high, the blade about 12 in. across and trisect; primary segms. 1- or 2-pinnatifid, the ultimate segms. narrow-linear. Sierra Leone, and adjacent regions. B.M. 7768. F.S. 2:161. G.C. 1872:1619. Var. *spectábilis,* N.E. Br. (*Corynophállus Afzèlii* var. *spectábilis,* Mast.), petiole bearing obscure linear-oblong spots. Var. *élegans,* N. E. Br. (*C. Afzèlii* var. *élegans,* Mast.), petiole green, segms. 2-pinnatisect, the ultimate segms. very narrow. Var. *latifòlia,* N. E. Br. (*C. Afzèlii* var. *latifòlia,* Mast.), petiole green, segms. pinnatisect, the ultimate segms. broader and confluent.—This variable species may be found only rarely in choice collections. L. H. B.

HYDROTÆNIA (Greek, *water* and *band;* referring to a triangular glandular bar which secretes nectar). *Iridàceæ.* Four species of tender bulbs from Mexico and Peru, more curious than beautiful, allied to Tigridia.

From Tigridia (with which the genus is sometimes united), it is distinguished by the perianth-segms. lacking a spreading blade, the perianth being campanulate; tube none; filaments united in a cylindrical column as long as the anthers; ovary clavate, 3-celled: sts. 1–3 ft., simple, or slightly branched above, bearing 1 or more lvs.: cormous.

Van Hoùttei, Baker. St. 2–3 ft. long, bearing 2–3 fls.: lvs. lanceolate, plaited, the lower 1 ft. long: spathes inflated, 2 in. long: outer segms. oblong, over 1 in. long, greenish outside, inside dark brown, much veined, yellowish at tip, very obtuse: inner segms. suborbicular, half as long, pale lilac, somewhat veined. Mex. F.S. 21:2174 (as *Tigridia Van Houttei*).—Corm said to be eaten in its native region. L. H. B.

HYLOCÈREUS (*wood* and *Cereus*). *Cactàceæ.* A high-climbing cactus, with stems three-angled or -winged, adhering to walls and trees by numerous aërial roots.

Spines small, usually inconspicuous: fls. nocturnal, usually very large, with red or greenish sepals, white or pinkish petals: fr. large, spineless, covered with numerous lf.-like bracts.—Some 16 species of this genus are known, but only 1, and that under a wrong name, is grown to any extent in this country. The species are easily grown in hothouses, especially if given a wall to climb upon. A very curious small-fld. species, *H.*

minutiflorus, has recently been described by Britton & Rose. It flowers freely in Washington and New York, but as yet has not been very widely distributed.

tricostàtus, Brit. & Rose (*Cèreus tricostàtus*, Gosselin. *C. triangulàris* of most writers, not of Haw.). Plate LVII. Vines often 20–40 ft. long, green: ribs 3, thin, crenate, with a corneous margin: spines 2–4 from each areole, short: fls. about 1 ft. long, white: fr. large, red without, white within, edible. Mex. B.M. 1884.

H. exténsus, Brit. & Rose (Cereus extensus, Salm-Dyck). Sts. creeping, perhaps also sometimes climbing, bearing aërial roots, green, rather slender, 3-sided, with obtuse angles: fls. large and handsome; sepals tipped and margined with red; petals rose-colored; style thick, longer than the stamens. This species was described by De Candolle in 1828, but it is unknown in cult. and in a wild state. A species under this name was figured in B. M. for 1844, but this may or may not be the plant described by De Candolle.—*H. napoleònis*, Brit. & Rose (Cereus napoleonis, Graham). Sts. much branched, with 3 acute angles; spines 4–5, rigid, 4–5 lines long: fls. 8 in. long; sepals yellow; petals pure white. This species is not in cult. and is not known in the wild state. It was described and figured from a plant which flowered in Edinburgh about 1836. It is occasionally reported in cult.; but all such material seems to be wrongly identified.

J. N. Rose.

HYMENÆA (Greek, *nuptial;* in allusion to the paired lfts.). *Leguminòsæ.* Ten species of evergreen unarmed trees in Trop. Amer.: lvs. alternate, with 1 pair of coriaceous lfts.: fls. in short corymbose panicles; sepals 4; petals 5, generally oblong, scarcely longer than sepals; stamens 10, distinct; ovary short-stalked with few seeds: pod oblong to obovate, thick, often nearly cylindric, woody, indehiscent. The following species is the most important of the genus and occasionally cult. in tropical collections and in greenhouses of botanic gardens for its economic interest. Prop. is by cuttings in summer under glass with bottom heat or by seeds. It yields a fragrant amber-like resin known as courbaril, or American or West Indian copal; the heavy, close-grained and hard wood is used for wheelwork, tree-nails, beams and in various machinery; the sweetish acid pulp of the pods is eaten by the Indians.

Courbaríl, Linn. Tree, to 60 ft.: lfts. 2, nearly sessile, oblong, very oblique at the base, acuminate, glabrous, about 3 in. long; petiole ½in. long: fls. short-pedicellate; petals about ¾in. long, yellow, striped purplish: pod few-seeded, 3–4 in. long. W. Indies to Brazil.

Alfred Rehder.

HYMENÁNTHERA (from the Greek for *membrane* and *anther*, in allusion to the anthers being terminated by a membrane). Syn. *Solenántha. Violàceæ.* Stiff shrubs or small trees: lvs. alternate or sometimes fascicled, entire or toothed, with small fugacious stipules: fls. small, axillary or on the naked branches below the lvs., regular, hermaphrodite or unisexual: fr. a small subglobose berry; seeds 2, rarely 3–4.—About half a dozen species from New Zeal., Austral., Tasmania and Norfolk Isls. *H. crassifòlia*, Hook. f., is offered abroad. A low, rigid, much-branched shrub 2–4 ft. high: bark white, furrowed: lvs. very thick and coriaceous, linear-spathulate, entire, sinuate or toothed: fls. small, solitary or few together, axillary: berry white or purplish, ⅙–¼in. diam. New Zeal. Gn. 75, p. 568.—A variable species. Should be grown in a warm, sunny place as a rock-garden plant. Prop. by seeds, cuttings or layers in summer. Good for amateurs on account of the early fls., March to April, and particularly the ornamental berries, which retain their characters a long time. In cold climates needs winter protecton; hardy in south of England.

L. H. B.

HYMENOCÁLLIS (*beautiful membrane*, alluding to the webbed filaments). Including *Ismène. Amaryllidàceæ.* Spider-Lily. Sea-Daffodil. Bulbous plants of the warm parts of the New World (one in Africa), cultivated for the fragrant white (in one species yellow) umbellate flowers.

Perianth salverform, with a cylindrical tube, equal linear or lanceolate segms.; stamens 6, the filaments free above but webbed and united into a cup below, the anthers narrow and versatile; ovary 3-loculed, with 2 collateral ovules in each, bearing a long slender style and very small capitate stigma: scape solid and compressed, arising from a tunicated bulb: lvs. oblong or strap-shape.—Species about 40, from N. C. and Mo. to S. Amer., 1 from W. Afr. The genus is represented in the Old World by Pancratium, which differs chiefly in having many superposed ovules in each locule.

Some of the species of Hymenocallis are winter bloomers: these should be treated essentially like crinums, being rested or kept slow in the summer. They require a warm temperature. Of such are *H. macrostephana*, *H. speciosa*, *H. caribæa.* Other species require an intermediate or conservatory temperature, and bloom in spring or summer, resting in winter. Of such are *H. calathina*, *H. Harrisiana*, *H. Macleana*, *H. rotata*, *H. littoralis.* Some of these latter or intermediate-house species are hardy in the southern states, there blooming in spring, as *H. lacera*, *H. galvestonensis*, and others. The species of hymenocallis require no special treatment (see *Bulb*), except that the same bulbs may be flowered year after year if they receive good care. Use turfy or peaty soil that will not become "sour" or soggy. Propagation is by offsets from the bulbs. See *Amaryllis*, for the general handling of this class of bulbs.

INDEX.

angustifolia, 3.
calathina, 12.
caribæa, 7.
declinatum, 7.
galvestonensis, 8.
Harrisiana, 6.
lacera, 9.
littoralis, 4.
Macleana, 11.
macrostephana, 10.
rotata, 9.
senegambica, 5.
speciosa, 3.
tubiflora, 1.
undulata, 2.

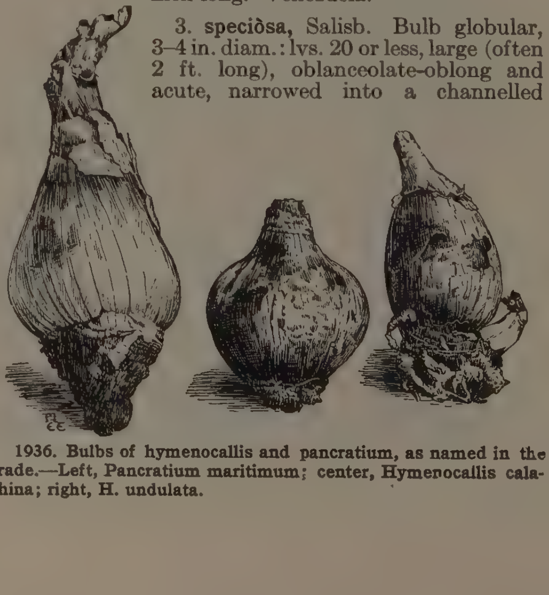
A. *Filaments long and slender beyond the small cup.*

B *Lvs. distinctly petioled.*

1. **tubiflòra**, Salisb. Bulb ovoid, about 4 in. diam., short-necked: lf.-blade about a foot long and one-third to one-half as broad at the middle, the petiole 6–12 in. long: scape 1 ft. tall; fls. many in the umbel and sessile, the valves or bracts broad and cuspidate; tube of perianth greenish, 6–8 in. long, the linear white reflexing segms. 4 in. long; cup 1 in. long, not toothed, less than half or a third the length of the free part of the filament. N. E. S. Amer. B.R. 265 (as *Pancratium guianense*, Ker).

2. **undulàta**, Herb. Fig. 1936. Bulb ovoid, 3–4 in. diam.: lvs. with an oblong blade 1 ft. long and half as wide, cross-veined: scape 2 ft. long, compressed; fls. about 10, sessile, the tube 6–7 in. long, and the segms. 3–4 in. long and linear, white, with tinged red cup an inch long. Venezuela.

3. **speciòsa**, Salisb. Bulb globular, 3–4 in. diam.: lvs. 20 or less, large (often 2 ft. long), oblanceolate-oblong and acute, narrowed into a channelled



1936. Bulbs of hymenocallis and pancratium, as named in the trade.—Left, Pancratium maritimum; center, Hymenocallis calathina; right, H. undulata.

petiole: scape mostly shorter than the foliage, glaucous; fls. 10–15, on very short pedicels, the bracts or spathe-valves 3–4 in. long; tube of perianth greenish, 3–4 in. long, the segms. often twice longer (entire fl. often 9 in. long); cup about 1½ in. long, toothed, the free parts of the filaments little longer than the cup. W. Indies. B.M. 1453. Gn. 47, p. 294. F. 1883, p. 71.—One of the best. The bulb improves with age if care is taken in growing and repotting. The lvs. are evergreen and handsome. Fls. very fragrant, and retaining their scent even when dried. Blooms in winter. This and *H. macrostephana* are the most showy species. Var. **angustifòlia,** Worsley, is a very stiff narrow-lvd. form of recent date.

BB. *Lvs. not petioled, strap-shaped.*

C. *Perianth-tube mostly above 3 in. long.*

4. **littoràlis,** Salisb. Bulb 3–4 in. diam.: lvs. about 12, 2–3 ft. long, 1½ in. broad, acute: scape 2-edged, 2 ft. or less tall; fls. 4–8 in a sessile umbel, the tube 6–7 in. long and green-tinged, the segms. linear and recurved, 4 in. long, joined to the base of the cup; the cup funnel-shape, broader and longer, toothed, the free part of the filaments about 2–3 in. long; style about equaling the stamens. Trop. Amer., widely distributed. Gn. 53, p. 57.—Long known in cult., but less showy than other species.

5. **senegámbica,** Kunth & Bouché. Lvs. somewhat curved, acute, 2 ft. long, 2 in. broad at the widest place: scape about as long as the lvs.; fls. 6–8 in a sessile umbel, the tube 5–6 in. long, segms. very narrow and 4 in. long; cup funnel-shaped, 1 in. long and somewhat broader, the free parts of the filaments 2 in. long. W. Afr.

6. **Harrisiàna,** Herb. Bulb globular, small (less than 2 in. diam.): lvs. only 3–6, a foot long and 2 in. broad, much narrowed below: scape less than 1 ft. tall, slender, glaucous; fls. 2–3 in a sessile umbel, the tube slender and 3–4 in. long, the segms. linear and 3 in. or less long; cup funnel-shaped, ¾in. long, plicate, small-toothed, the free filaments 1½ in. long and often exceeding the style. Mex. B.M. 6562.—Flowers in early summer. Hardy S.

CC. *Perianth-tube mostly under 3 in. long.*

7. **caribæ̀a,** Herb. (*Pancràtium caribæ̀um,* Linn. *P. declinàtum,* Jacq.). Bulb globular, 3–4 in. diam.: lvs. thin, 12 or more, not 2-ranked, shining, 2–3 ft. long, 2–3 in. broad at the widest place: scape sharp-angled, nearly or quite as long as the lvs.; umbel sessile, 6–12-fld.; tube 2–3 in. long, the segms. linear and somewhat exceeding it; cup 1 in. long, toothed, the free part of the filaments 1½–2 in. long. W. Indies. B.M. 826. L. B.C. 6:558.

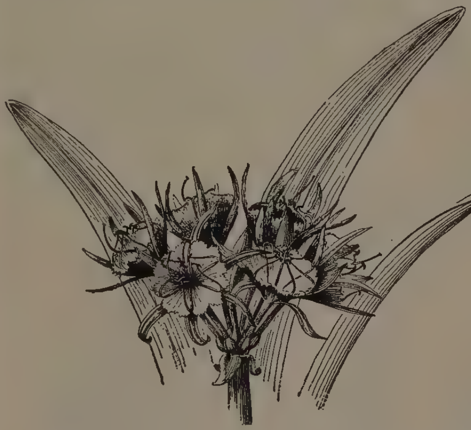
8. **galvestonénsis,** Baker. Scape 1–2 ft. long, rather shorter than the linear lvs.: umbel sessile, 4–6; perianth-tube 2–3 in. long (sometimes shorter), mostly a little shorter than the linear segms.; cup 1¼ in. or less long, funnel-shape, the edge erect, the free part of the filaments little more than ½in. long. Texas.—Intro. to cult. with the statement that it "may be planted out in gardens all over the N. like a peony and prove hardy." Spring or early summer.

9. **rotàta,** Herb. (*H. lácera,* Salisb. *Pancràtium rotàtum,* Ker). Bulb ovoid, 2 in. or less diam., with a long neck and producing stolons or runners: lvs. 6–8, linear, 1½ ft. or less long, flat above but concave toward the base: scape 2-edged, glaucous, about as long as the lvs.; umbel sessile, with 2–6 fls.; tube green, 3–4 in. long, exceeded by the linear, often recurved lobes; cup saucer-shaped or rotate, irregularly toothed, the free part of the filaments 1½ in. long. N. C. to Fla. in low places and in sandy soil. B.M. 827. L.B.C. 1:19.—Variable, particularly in the dimensions of the fl. Spring or early summer.

10. **macrostéphana,** Baker. Fig. 1937. Closely allied to *H. speciosa* and conjectured by Baker to be a hybrid of that species and *H. calathina.* Bulb with a long neck: lvs. 8–9, oblanceolate and bright green, 2–3 ft. long: fls. 6–10, large and striking because of the great cup (whence the specific name), which is 2 in. across and as much long, wavy-toothed; tube greenish, 3 in. long; segms. linear-lanceolate, a little longer than the tube. B.M. 6436.—Blooms in Feb. and March. One of the best of the spider-lilies, perhaps the best for warmhouse cult.

AA. *Filaments short and incurved (usually less than 1 in. long) beyond the large cup. (Ismene.)*

11. **Macleàna,** Nichols. (*Ismène Macleàna,* Herb.). Bulb ovoid, 2 in. diam: lvs. a foot or more long and nearly 2 in. broad, narrowing toward the base: scape 2-edged, about the length of the lvs.; fls. 2–8, with a straight tube 2 in. or less long, and linear, erect or somewhat spreading segms. as long as the tube; cup corolla-like, 1½ in. long and green-striped, fringed, the free filaments ½in. long, strongly inflexed and angled or kneed at the cup. Peru. B.M. 3675.—One of the plants known to the Peruvians as Amancæs, the subject of festivals. This and the next are intermediate house species, flowering in spring and summer.



1937. Hymenocallis macrostephana. (×⅛)

12. **calathìna,** Nichols. (*Ismène calathìna,* Herb. *Pancràtium calathìnum,* Ker). Fig. 1936. BASKET-FLOWER. Bulb long-necked: lvs. 6–8, somewhat 2-ranked, star-shaped, 2 ft. or less long: scape 2-edged, 1½ to 2 ft. tall, bearing 2–5 fls. in a sessile umbel; tube green, 3–4 in. long, much enlarging above; segms. as long as the tube, ½in. wide, lanceolate; cup corolla-like and green-striped, usually larger than in the last, with rounded fringed lobes; filaments, free for ½in., incurved but not angled. Peru, Bolivia. B.M. 2685.—One of the paler kinds.

The following names may be expected in the trade: *H. adnàta,* Herb.=H. littoralis.—*H. Amáncæs,* Nichols., is one of the Ismene group, and the only species with yellow fls. B.M. 1224. B.R. 600. Gn. 48, p. 168.—*H. amæ̀na,* Herb.=H. ovata (below).—*H. Andreàna,* Nichols. An Ismene: fl. only 1, the cup nearly or quite as long as the segms. R.H. 1884, pp. 129, 468.—*H. crassifòlia,* Herb. =H. occidentalis.—*H. Érnstii,* Worsley. Garden hybrid, H. Moritziana being one of the parents.—*H. fràgrans,* Salisb.=H. ovata (below).—*H. Moritziàna,* Kunth. Evergreen, with lvs. like eucharis: fls. white, fragrant, with greenish tubes, very slender and twice as long as the segms., the cup very short and toothed. Venezuela. G.C. III. 27: 89.—*H. occidentàlis,* Kunth. Bulbs large: lvs. evergreen, thick, strap-shaped: fls. white, 3–6, the tube 3–4 in. long; cup much narrowed below. S. C. to Mo. and south.—*H. ovàta,* Roem. Lvs. broad and petioled: fls. 6–10, the tube about 2 in. long, the linear segms. little longer; cup 1 in. long. W. Indies. B.R. 43. B.M. 1467.—*H. schizostéphana,* Worsley. Cup laciniate: fls white, 12–20 in an erect, crowded umbel, the filaments very short and winged at base. Probably Brazil.

L. H. B.

HYMENÒDIUM: *Elaphoglossum.*

HYMENOPHÝLLUM (Greek, *membrane-leaf*). *Hymenophyllàceæ.* Like all members of the family, the species are small and with lvs. of very delicate texture; the sporangia are borne in marginal sori protected by 2-lipped cup-like indusium; otherwise the species are like those of Trichomanes, the other large genus of the family.—A genus of about 240 species, nearly all of which are tropical. Culture p. 1214.

A. *Lvs. glabrous; rachis slightly winged above.*

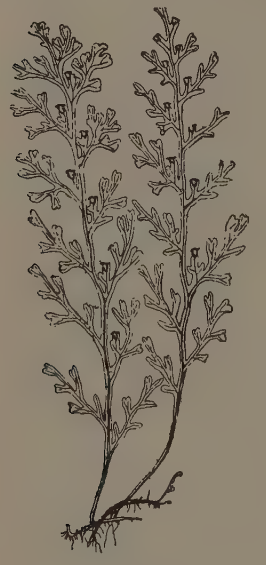
polyánthos, Swartz. Lvs. 2–8 in. long, 1–3 in. wide, tripinnatifid; sori 2–12 to a pinna: involucre small. Tropics of both hemispheres.

demíssum, Swartz. Lvs. 4–12 in. long, 3–4 in. wide, 3–4-pinnatifid; sori very numerous, 20–30 to a pinna: involucre with ovate entire valves. E. Indies to New Zeal.

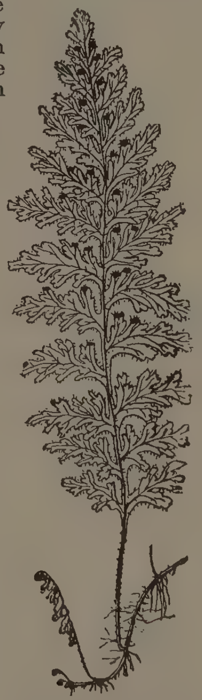
AA. *Lvs. pubescent or ciliate.*

ciliàtum, Swartz. Fig. 1938. Lf.-stalks ciliated and winged above; lf.-blades 2–6 in. long, 1–2 in. wide, tripinnatifid. the segms. ciliated: involucre roundish, the valves divided half way down and ciliated. Tropics of both hemispheres.

æruginòsum, Carm. Fig. 1939. Lf.-stalks tomentose; lf.-blades 2–3 in. long, 1 in. or less wide, tripinnatifid, the pinnæ often imbricate, the surface and margins densely pubescent: involucres small with valves divided nearly to the base, densely ciliate. Tristan d'Acunha.



1938 Hymenophyllum ciliatum. (×½)



1939. Hymenophyllum æruginosum. (Nat. size)

H. dicranótrichum, Sadeb. (H. chiloense, Hook.). A S. American species with triangular lvs. 2–4 in. long, 1 in. broad, bipinnatifid with rounded segms.; the margins and under surfaces hairy. Gn. 74, p. 228.—*H. fucoìdes,* Swartz. A common Trop. American species with oblong lvs., 6–10 in. long, 1½–2 in. broad, tripinnatifid, the rachis and mid-veins of the pinnæ winged, the ultimate segms. linear, spinulose. Gn. 74, p. 228.

L. M. Underwood.
R. C. Benedict.†

HYMENÓSPORUM (Greek, *membrane* and *seed;* referring to the winged seeds). *Pittosporàceæ.* An ornamental evergreen shrub or tree from Australia, cultivated in California for its handsome foliage and profusely produced fragrant yellow flowers. On account of its symmetrical pyramidal habit and its fast growth, it is well adapted for street planting.

Leaves large, alternate, entire, crowded toward the end of the branches: infl. a terminal loose panicle; sepals free; petals 5, with obovate blades and the long straight claws approximated into a tube; stamens 5; ovary incompletely 2-celled, cylindric, silky, with a short style: fr. a stipitate, compressed caps. with many compressed winged seeds. This monotypic genus is closely related to Pittosporum which differs chiefly in its thick, not winged seeds surrounded by a sticky substance wanting in Hymenosporum. Propagation is like that of Pittosporum by seeds or cuttings of half-ripened wood.

flàvum, F. Muell. (*Pittósporum flàvum,* Hook. f.). Shrub or tree, to 50 ft.: lvs. obovate, entire, to 9 in. long: fls. yellow, marked with red at the throat, fragrant, over 1 in. across: caps. compressed, 1 in. long and nearly as broad. B.M. 4799. R.H. 1913, p. 327.

Alfred Rehder.

HYMENÓXYS CALIFÓRNICA: *Actinolepis coronaria.*

HYOPHÓRBE (Greek, *food for swine,* referring to the fruits). *Palmàceæ,* tribe *Chamædòreæ.* Showy ornamental palms from Mauritius, often in trade collections, and well worthy wider cultivation.

Trunks unarmed, stout, either cylindric or in some species with a swelling beneath the lf.-cluster: lvs. terminal, equal, pinnatisect, the lfts. almost always opposite, and usually linear-lanceolate; margins recurved toward the base of the lft. and thickened throughout; petiole somewhat 3-angled and channelled: spadix short-stalked, many-branched, the branchlets spreading: fls. diœcious or in the different spadices sometimes monœcious, spirally arranged, pale yellow or greenish; sepals and petals 3, the latter small and broadly ovate; stamens 6: fr. somewhat inverted pear-shaped or olive-shaped.—There are only 3 or 4 species, and the genus is most closely related to Chamædorea, of horticultural palms, from which it differs in its usually diœcious fls. and in having the spadix below the lf.-cluster. I.H. 13:462, 463.

The two species in cultivation are ornamental palms, rather slow-growing and requiring much heat and moisture, and a night temperature of 65°. *H. Verschaffeltii* is much the better of the two species described below from a horticultural standpoint. Propagation is by seeds, which should be sown in a light compost or in pure peat with a bottom heat of 80°. The young seedlings are delicate and need protection from chills and over-watering.

amaricaùlis, Mart. (*Arèca speciòsa,* Hort.?). St. 60 ft. in nature, scarcely so tall in cult., with a bottle-shaped swelling near the base, usually abruptly narrowed near the lf.-cluster: petiole about a foot long, grooved and angled; lfts. 40–60 pairs, about 12–16 in. long and 2 in. broad: spadix about 12 in. long: seed elliptic, about ½in. long. Mauritius.

Verschafféltii, Wendl. (*Arèca Verschafféltii,* Hort.). Trunk 25–30 ft., about 6 in. diam., bulging about half way up: petiole about 3 in. long, slightly grooved on the upper surface and with a yellow band extending from the upper part of the lf.-sheath to the extremity of the blade, which is one of the chief horticultural attractions of the species; lfts. 30–50 pairs, about 2 ft. long and an inch wide: spadix as in the preceding, but the fls. orange: seed nearly cylindric, about ⅞in. long. Mauritius. G.W. 12, p. 207.

H. Commersoniàna, Mart. and *H. índica,* Gaertn. are both Chrysalidocarpus lutescens.

N. Taylor.†

HYOSCỲAMUS (Greek, *hog bean*). *Solanàceæ.* Henbane. A coarse, clammy, ill-smelling, wayside weed cultivated for medicinal purposes. An extract is commonly sold in drugstores.

Annual, biennial or perennial, mostly clammy pubescent: lvs. alternate, coarsely toothed, or pinnatifid, rarely entire: corolla pallid or lurid and netted-veined, funnel-shaped, with 5 unequal lobes; stamens mostly exserted, declined: caps. 2-celled, circumscissile above the middle. Henbane grows wild in Eu., W. Asia and Himalayas and is naturalized in Amer. It is found in sandy and waste places. The genus contains about 15 species, of the Old World.

nìger, Linn. Annual or biennial, 1–2½ ft. high: lvs. 3–7 in. long, the upper ones st.-clasping, irregularly lobed or pinnatifid: fls. greenish yellow, with purple veins, short-pedicelled or sessile, in leafy 1-sided spikes: caps. inclosed in the enlarging calyx.—The plant is said to be poisonous to domestic fowls but not to swine, although it is supposed the generic name has reference to harmful qualities to the latter animals. The lvs. and flowering tops are medicinal. The plant has no horticultural value. June–Sept. L. H. B.

HYOSÈRIS (*swine salad;* i.e., disagreeable or offensive). *Compósitæ.* Four species of nearly stemless herbs of S. Eu. and the Medit. region, one of which is sometimes grown as an alpine: allied to Krigia. Plant glabrous or glandular-pubescent: lvs. radical, pinnatifid: scape 1-headed, leafless, the heads yellow and homogamous; involucre cylindrical-campanulate, the inner bracts 1-rowed and equal, the outer ones few and short; receptacle plane and naked; corollas ligulate: achene glabrous. **H. fœ́tida,** Linn. (*Aposèris fœ́tida,* Less.), the species to be expected in the lists is by some authors retained in the genus Aposeris, distinguished by characters of the achene: perennial, much like Taraxacum, glabrous or somewhat pilose on veins on under side of foliage: lvs. runcinate-pinnatifid, the lobes about 10–12 pairs and somewhat triangular and sinuate-dentate: small plants in mountains of Eu. L. H. B.

HYÓSPATHE (*hog spathe:* i.e., hog palm, a vernacular name). *Palmàceæ.* Three S. American palms, little grown, with pinnatisect lvs. and unarmed reed-like sts.: fls. green, minute, the pistillate smaller than the staminate; stamens 6, and staminodia 6 in pistillate fls.: fr. small, ellipsoid or obovoid, purple. *H. élegans,* Mart., of the Amazon, one of the thatch palms, has sts. 1 in. diam. and 6 ft. high: lvs. 3–4 ft. long, at first nearly entire but becoming irregularly pinnate: fls. of both sexes borne in spikes beneath the terminal lvs. Other species sometimes referred to this genus belong to Prestoea and Pigafetta. L. H. B.

HYPÉCOUM (an old Greek name). *Papaveràceæ.* Annual herbs, sometimes grown in the flower-garden. Scapes erect, ascending or prostrate: lvs. radical and more or less rosulate, pinnately parted, the segms. pinnatifid or pinnately lobed, the floral lvs. less divided: fls. rather small, yellow or white; sepals 2, small, deciduous; petals 4, in 2 series, the outer ones often lobed, the 2 inner ones deeply 3-parted; stamens 4, opposite the petals: caps. narrow and silique-like, constricted between the seeds.—Species 15, according to the latest monograph (Fedde, in Engler's Pflanzenreich, hft. 40, 1909), in the Medit. region and east to China. They are of simple cult. under usual garden conditions. *H. procúmbens,* Linn. One foot: sts. or scapes ascending or becoming decumbent in fr.: lvs. glaucous-green, the basal ones 2-pinnatifid and the lobes very narrow and entire: fls. bright yellow, about ½in. across; outer petals somewhat 3-lobed but the side lobes very short. Medit. region to India. Variable. *H. grandiflòrum,* Benth. Six to 12 in., forking: lvs. with narrow linear segms. which are often lobed at top: fls. orange, about ½in. across, the outer petals with prominent side lobes. Medit. region to Asia Minor. L. H. B.

HYPÉRICUM (*Hypereikon,* ancient Greek name of a plant, of obscure meaning, possibly derived from *ereike,* heather, with the prefix *hypo,* beneath). *Hypericàceæ,* often united with *Guttiferæ.* St. John's-Wort. Ornamental shrubby or herbaceous plants chiefly grown for their bright yellow flowers; planted in the open; often with interesting foliage and habits.

Deciduous, or sometimes evergreen, usually low shrubs, or herbaceous perennials, rarely annual: lvs. opposite, short-petioled or sessile, entire, dotted with pellucid or opaque glands, without stipules: fls. usually in terminal cymes, less often solitary, sometimes axillary, yellow, rarely pink or purplish; sepals 5, imbricate or valvate, often unequal; petals 5, oblique, convolute in bud; stamens usually numerous, free, or connate at the base into 5 or 3 bundles, rarely as few as 3; ovary superior, with 3–5 parietal placentæ, 1–5-celled; styles 3–5, distinct or united: fr. a septicidal caps., rarely a berry; seeds usually cylindric, many, rarely few.—About 200 species in the temperate and subtropical regions of the northern hemisphere, few in the southern hemisphere.

The St. John's-worts are exceedingly variable in habit; most species in cultivation are low shrubs, either upright with ascending or spreading branches, or tufted or procumbent; the herbaceous species have often stiff upright wand-like stems or are diffuse or procumbent: the leaves are usually narrow and rather small; the yellow, rarely pink or purplish flowers appear usually in profusion during the summer in terminal clusters, less often solitary, sometimes axillary and forming leafy racemes or panicles; they vary from ⅕ inch to 3 inches in diameter; the capsular fruits are inconspicuous or even unsightly when ripe, only the fruits of the one berry-bearing species are ornamental. Most of the species are tender in the North. *H. aureum, H. prolificum, H. lobocarpum,* and other American species, also *H. calycinum* and *H. patulum* var. *Henryi,* with some protection, have proved hardy as far north as Massachusetts, and *H. Kalmianum* and *H. Ascyron* are still hardy in Canada. Others like *H. patulum, H. Hookerianum, H. Moserianum, H. chinense* can be relied upon only south of New York. *H. floribundum* is doing well in California and so will probably the other Mediterranean species.

They thrive in any good loamy soil, and also in sandy soil, if sufficiently moist; most of them prefer partly shaded situations and bloom longer if not exposed to the full sun. They are, as a rule, short-lived plants and ought to be renewed when they show signs of exhaustion. The larger kinds are well adapted for borders of shrubberies and form round rather dense bushes when standing alone, while those like *H. calycinum, H. Buckleii* and *H. adpressum* are suited for low borders or as a ground-cover, particularly *H. calycinum* which spreads rapidly by suckers. Many of the low tufted or prostrate species enumerated in the supplementary list are handsome plants for rockeries where the more tender species can be so planted as to be easily protected during the winter. Propagation is by seeds, which germinate readily, the shrubby species also by greenwood cuttings under glass in summer; the creeping kinds as *H. calycinum* and some herbaceous species also by division and suckers.

INDEX.

adpressum, 17.
Androsæmum, 23.
Ascyron, 1.
aureum, 14.
axillare, 12.
Buckleii, 16.
calycinum, 2.
cernuum, 3.
chinense, 4.
cistifolium, 18.
densiflorum, 11.
elatum, 22.
fastigiatum, 17.
floribundum, 20.
foliosum, 13.
galioides, 12.
glomeratum, 10.
grandifolium, 22.
Henryi, 6.
hircinum, 21.
Hookerianum, 5.
Kalmianum, 9.
Leschenaultii, 5.
lobocarpum, 8.
minor, 21.
monogynum, 4.
Moserianum, 7.
multiflorum, 22.
nepalense, 6.
nudiflorum, 15.
oblongifolium, 3, 5, 6.
patulum, 6.
perforatum, 19.
prolificum, 11, 13, 14.
pumilum, 21.
pyramidatum, 1.
sphærocarpum, 18.
tricolor, 7.
triflorum, 5.
uralum, 6.
Vilmorinii, 1.
virginicum, 24.
Webbianum, 22.

KEY TO THE SPECIES.

A. *Fls. yellow.*
  B. *Number of styles 5.*
    C. *Plants herbaceous, 2–6 ft.* .... 1. **Ascyron**
    CC. *Plants shrubby.*

D. *Lvs. ovate to ovate-lanceolate: fls. 1–3 in. across; stamens in 5 fascicles.*
E. *Height 1 ft. or less, suffruticose, stoloniferous: fls. solitary* . . . . 2. **calycinum**
EE. *Height 1–6 ft., shrubby.*
F. *Styles twice as long as ovary: branchlets terete.*
G. *Sepals unequal; styles distinct* . . . . 3. **cernuum**
GG. *Sepals nearly equal; styles connate nearly to the apex* . . . . 4. **chinense**
FF. *Styles as long or shorter than ovary.*
G. *Branches terete* . . . . 5. **Hookerianum**
GG. *Branches 2-edged.*
H. *Calyx with suborbicular nearly equal sepals* . . . . 6. **patulum**
HH. *Calyx with oval to oblong, unequal sepals* . . . . 7. **Moserianum**
DD. *Lvs. linear-oblong to lanceolate: fls. ⅓–1 in. across; stamens all distinct.*
E. *Cymes many-fld.; fls. ⅓–½ in. across* . . . . 8. **lobocarpum**
EE. *Cymes few-fld.; fls. ½–1 in. across* . . . . 9. **Kalmianum**
BB. *Number of styles 3.*
C. *Fr. a caps.*
D. *Stamens and styles shorter than petals; styles more or less united; stamens all distinct.*
E. *Growth shrubby.*
F. *Lf.-blades narrowly oblong to linear.*
G. *Cymes forming a terminal corymb.*
H. *Lvs. sessile: caps. incompletely 3-celled*. . 10. **glomeratum**
HH. *Lvs. short-petioled: caps. completely 3-celled* . . . . 11. **densiflorum**
GG. *Cymes axillary, forming a narrow elongated panicle.*
H. *Fls. ½in. across: lvs. narrowly linear* . . . . 12. **galioides**
HH. *Fls. ½–1 in. across: lvs. narrowly oblong* . . . . 13. **prolificum**
FF. *Lf.-blades ovate to oblong.*
G. *Caps. incompletely 3-celled: height 1–4 ft.*
H. *Size of fls. 1–2 in.: lvs. short-petioled* . . . 14. [redacted]
HH. *Size of fls. ½–¾in.: lvs. sessile* . . . . 15. **nudiflorum**
GG. *Caps. completely 3-celled: height 1 ft. or less* . . . . 16. **Buckleii**
EE. *Growth herbaceous or suffruticose.*
F. *Sts. 2-edged: caps. ovoid, incompletely 3-celled* . . . . 17. **adpressum**
FF. *Sts. 4-angled: caps. subglobose, 1-celled* . . . . 18. **cistifolium**
DD. *Stamens about as long as petals; styles distinct; stamens in 3–5 fascicles.*
E. *Plant herbaceous: fls. ½–1 in. across* . . . . 19. **perforatum**
EE. *Plant shrubby: fls. 1–2 in. across.*
F. *Branches terete* . . . . 20. **floribundum**
FF. *Branches 2-edged.*
G. *Fls. solitary or 3: odor of plant goat-like* . . . . . 21. **hircinum**
GG. *Fls. in 3–7-fld. cymes* . . . . 22. **elatum**
CC. *Fr. a black berry: styles distinct, short* . . . . 23. **Androsæmum**
AA. *Fls. pink or purplish; stamens mostly 9, in 3 fascicles* . . . . 24. **virginicum**

Section Roscyna.

1. **Áscyron,** Linn. (*H. pyramidàtum,* Dry.). Upright perennial, 2–6 ft. high, with tetragonal sts.: lvs. clasping, ovate-oblong or ovate-lanceolate, acutish, 2–5 in. long: cymes terminal, 3–12-fld., appearing in July; fls. 1–2½ in. diam.; sepals ovate to ovate-oblong, unequal; petals thin, narrowly obovate or oblanceolate, curiously shaped and twisted, persistent until withered; stamens in 5 clusters; styles somewhat spreading; stigmas capitate: caps. ovoid, ¾in. long. N. E. N. Amer., Cent. and E. Asia. B.B. (ed. 2) 2:529.—A somewhat coarse plant and toward fall apt to be unsightly through the lower lvs. dying and remaining. Var. **Vilmorínii,** Rehd. Fls. 3–4 in. across. Recently raised by M. L. de Vilmorin from seeds obtained from Korea. B.M. 8557.

Section Eremanthe.

2. **calycìnum,** Linn. Rose of Sharon. Aaron's Beard. Fig. 1940. A subshrub, 1 ft. or less high, with many procumbent or ascending 4-angled sts. occurring in thick tufts: lvs. ovate-oblong or oblong, obtuse, evergreen, subcoriaceous, dark green, glaucous below, 2–4 in. long: fls. large, solitary, or 2–3 together, 3 in. diam.; sepals large, obovate, spreading; stamens long and showy, in 5 clusters, with red anthers; styles shorter than the stamens, divergent: caps. ovate, 4 in. long. July–Sept. B.M. 146. G. 25:333. G.W. 1, p. 197.—A rapidly spreading plant, creeping by woody rootstalks completely covering the soil. Used as a ground-cover abroad. Not very hardy in New England, the annual killing back preventing its covering wide stretches, but not destroying its bloom each year, nor its usefulness in the herbaceous border, or in the margin of a shrubbery. May be protected, and its dark, persistent foliage preserved. Thrives in sun and moderate shade.

1940. **Hypericum calycinum.** (×¼)

3. **cérnuum,** Roxbg. (*H. oblongifòlium,* Choisy). Shrub, to 5 ft., with terete branches: lvs. sessile, narrowly elliptic to ovate-lanceolate, acutish, narrowed at the base, glaucous beneath, 1–3 in. long: fls. pale yellow, nearly white when opening, 2 in. across, long-stalked, nodding, solitary or in cymes of 3–5; sepals acute; petals obovate; stamens little shorter than petals. Himalayas.—Cult. in Calif.

Section Norysca.

4. **chinénse,** Linn. (*H. monógynum,* Willd.). Half-evergreen shrub to 2 ft., with terete branchlets: lvs. sessile, oblong, obtuse, 1½–3 in. long: fls. about 2 in. across; sepals ovate-oblong, obtuse; petals broadly obovate; stamens little shorter than petals; style slender, about ¾in. long, 5-parted at the apex. China. B.M. 334. G.C. III. 1:705.—Tender.

5. **Hookeriànum,** Wight & Arn. (*H. oblongifòlium,* Hook., not Choisy). A rather compact shrub, to 6 ft., with terete bright reddish brown branches: lvs. among the largest of the genus, 1–4 in. long, evergreen, ovate or oblong, sessile, dark blue-green above, pale and glaucous below: corymbs several-fld., of large golden yellow

fls. in profusion, 2–2½ in. diam.; sepals large, obovate; petals very large, firm, broadly obovate; stamens scarcely half as long as petals; styles recurved, longer than the stamens: caps. broad-ovate, longitudinally furrowed, ¾in. long. Aug. Himalayas. B.M. 4949. Gn. 54, p. 490. G. 3:463. This is one of the most showy species. Var. **Leschenaúltii,** Dyer (*H. triflòrum,* Blume). Of slenderer and more graceful habit: fls. 2½ in. across; sepals acute. Himalayas, Java. Gn. 23:158.

6. **pátulum,** Thunb. An evergreen spreading shrub, 1½–3 ft. high, with many smooth, purplish, arching 2-edged branches: lvs. ovate-lanceolate or ovate-oblong, acutish, 1½–2 in. long: fls. many, solitary or in cymes, large, 1½–2 in. diam., of good substance; sepals suborbicular, longer than half the petals; styles upright: caps. ovate, more or less longitudinally furrowed, ½in. long. July–Sept. Japan. B.M. 5693. J.H. III. 43:405. Gn.W. 21:95. R.H. 1875:170. Gt. 15:513. Var. **oblongifòlium,** Koehne (*H. oblongifòlium,* Wall.). Lvs. 2–4 in. long, bluish gray beneath, acutish: fls. 1¾in. across; sepals shorter than half the petals. Himalayas. Var. **urâlum,** Koehne (*H. urâlum,* Don. *H. nepalénse,* Hort.). Lvs. about 1 in. long, acute or acutish: fls. ¾–1 in. across; sepals shorter than half the petals. Himalayas. B.M. 2375. Gn. 17, p. 53. The name has no connection with the Ural Mts., but is an adaptation of the native name "urala swa." Var. **Hénryi,** Veitch. Lvs. ovate or ovate-oblong, obtuse, 2–3 in. long: fls. 2–2½ in. across; sepals ovate, acute. China. This variety is hardier than the other forms of this species and of more vigorous growth.

7. **Moseriânum,** André. Gold Flower. Hybrid raised by Moser, of France, from *H. patulum* and *H. calycinum,* generally resembling the latter but lacking its coarseness, and surpassing both parents in good qualities. A glabrous subshrub 2 ft. high, erect, with the tips of the branches pendulous: lvs. similar to those of *H. calycinum,* ovate, obtuse and mucronulate, opaque, 2 in. long, dark green above, pale below: infl. with 1–3 fls. to the stalk, which are golden yellow, 2–2¾ in. diam., blooming for some time; sepals foliaceous, unequal, oval to oblong; corolla of broad rounded petals, their color heightened by the many tufted yellow stamens with reddish anthers: caps. top-shaped. July, Aug. R.H. 1889, p. 464. Gn. 54:490. R.B. 16:97. G.C. III. 10:333.—Not hardy in New England, but successful farther south. Not good individually, but good in masses, better adapted to the herbaceous border than the shrubbery. May be used as a pot-plant. Var. **trícolor.** Variegated form of white and green edged with red. Habit like *H. patulum,* but more horizontal, the lvs. smaller and narrower: fls. one-fourth the size of those of *H. Moserianum* but similar. Less hardy. J. 8, p. 186.

Section Myriandra.

8. **lobocárpum,** Gattinger. Upright shrub, to 6 ft.: lvs. oblong-lanceolate or linear-lanceolate, obtuse or barely acute, 1½–2½ in. long: fls. profuse, ⅓–½ in. across, in many-fld., naked cymes, forming a corymbose or elongated panicle; sepals oblong, obtusish; stamens numerous; styles connivent: caps. oblong, 5-angled, furrowed, ¼in. long. Aug. Tenn., where it frequents marshes. G.F. 10:453.

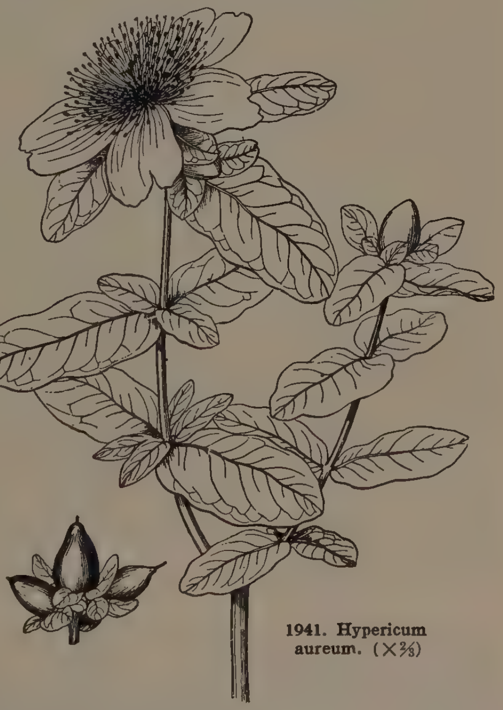
9. **Kalmiânum,** Linn. A shrub, 2–3 ft. high, with rather contorted sts.: lvs. oblong-linear, or oblanceolate, 1–2½ in. long, bluish, more or less glaucous below, crowded: fls. small, ½–1 in. diam., in 3- to several-fld. cymes; sepals foliaceous, oblong, acute; styles united below to form a beak: caps. ovoid, longitudinally furrowed. Aug. Ont. and W. N. Y. to Ill. and Wis. B.M. 8491. G.F. 3:113. Mn. 6:141.—Easily adapted to the garden, succeeding in the shade and enduring considerable dryness. Not so showy in fl. as some other species, but good because of its bright, narrow lvs. and hardiness.

10. **glomerâtum,** Small. Shrub, to 3 ft.: lvs. sessile, narrowly oblong to narrowly linear, apiculate, paler beneath, ¾–1½ in. long: fls. bright yellow, ¾–1 in. across, in dense cymes at the end of the branchlets; sepals rather foliaceous, narrowly oblong, acutish: petals cuneate-spatulate: caps. slightly lobed. Aug. N. C.

11. **densiflòrum,** Pursh (*H. prolíficum* var. *densiflòrum,* Gray). Shrub, to 6 ft.: lvs. short-petioled, linear-oblong to linear, revolute, acute, ½–2 in. long: fls. bright yellow, about ½in. across, in broad and dense, many-fld. corymbs; sepals unequal, oblong to elliptic-oblong: caps. ovoid, slightly 3-lobed. July–Sept. N. J. to Fla., Mo. and Texas. B.B. (ed. 2) 2:530. Mn. 4:97. G.F. 3:527. R.H. 1899, pp. 517, 518.

12. **galioìdes,** Lam. (*H. axillàre,* Lam., not Michx.). Shrub with slender sts. to 3 ft.: lvs. sessile, ¼–¾in. long, linear, acute, dark green, crowded: fls. yellow, ¼–½in. across, axillary, solitary or in small cymes, forming narrow leafy panicles; sepals linear or linear-spatulate; petals cuneate at the base: caps. conic, acute, furrowed, incompletely 3-celled. July–Sept. Del. to Fla., Mo. and Texas. G.F. 10:433. G.C. III. 24:301.—Forms usually a low round bush with handsome dark green foliage.

13. **prolíficum,** Linn. (*H. foliòsum,* Jacq. *Myriándra prolífica,* Spach). A stout, dense shrub, to 5 ft. high, with exfoliating light brown bark, the twigs 2-angled: lvs. narrowly oblong or oblanceolate, obtuse, 1–3 in. long, glossy, dark green, pellucid-punctate: fls. in profusion, ½–1 in. wide, in several- to many-fld. axillary cymes; sepals obovate; stamens numerous, distinct; styles united at the base: caps. large, oblong, ½in. long, not furrowed. July–Sept. Found in sandy or rocky soil, N. J. to Iowa and Ga.; one of the most commonly cult. G.F. 3:526. W.D. B. 2:88.—A strong, hardy shrub. Grows rapidly in ordinary garden soil, flowering regularly and profusely. Varies greatly in size.


1941. Hypericum aureum. (×⅔)

14. **aùreum,** Bartram (*H. prolíficum* var. *aùreum,* Koehne). Fig. 1941. Showy shrub 3 ft. high, more

woody than most species, of stiff, dense habit, top often globular like a miniature tree, with thin, exfoliating red bark, the branchlets 2-edged: lvs. ovate-oblong to oblong, mucronate, bluish, pale below, leathery, 1–3 in. long: fls. sessile, solitary in the native state, in cymes of several in cult., 1–2 in. diam., bright yellow, heightened by the golden filaments at the center; sepals lf.-like, obovate, very unequal, shorter than the thick, broad petals, which persist until withered; stamens distinct, very numerous; styles connate: caps. ovate, acuminate, red, not furrowed, nearly ½in. long. July–Aug. Affects rocky situations when wild, generally shady, where moisture is longest retained, from S. C. to Tenn., Ga. and Texas, but perfectly hardy in Mass. B.M. 8498. Gn. W. 20:934. G.F. 2:185 (adapted in Fig. 1941).—Prop. by seeds and cuttings, young plants from seed blooming the second year.

15. **nudiflòrum,** Michx. Shrub or subshrub, 1–3 ft.: branchlet 4-angled: lvs. sessile, elliptic-oblong to elliptic-lanceolate, obtuse, flat, thin, pale above and below, 1–2½ in. long: fls. light yellow, ½–¾in. across, in naked, peduncled, loose corymbs 2–5 in. broad; sepals elliptic-oblong to elliptic-oblanceolate; styles united: caps. conic-ovate, ¼in. long. July–Aug. N. C. to Fla. and Ala.

16. **Búckleii,** Curtis. Later written *Buckleyi*. Dense shrub, with slender, 4-angled sts. forming neat, rounded tufts not more than 1 ft. high: lvs. bluish, obovate to elliptic, ¼–1 in. long, rounded at the apex, gradually narrowed at the base, pale below, becoming scarlet in autumn: fls. solitary or in cymes of 3, 1 in. diam.; sepals obovate, obtuse; petals striated and strap-shaped; styles connate: caps. conic-ovoid, about ⅓in. long. June, July. Found only in the highest mountains of the Carolinas and Ga. G.F. 4:581.—Adapted to rockeries and margins of small shrubberies.

17. **adpréssum,** Bart. (*H. fastigiàtum*, Ell.). Practically a herbaceous perennial, erect from a creeping or decumbent base, growing in dense masses, ½–2 ft. tall: lvs. oblong or lanceolate, 1–2 in. long, acute, thin: fl. yellow, ½in. across in several-fld. terminal cymes; sepals lanceolate or ovate-lanceolate: caps. ovoid, slender-beaked. July, Aug. Moist places, Nantucket, Mass. to Ga. and La. B.B. (ed. 2) 2:531.—Spreads rapidly by underground stolons, suggesting occasional use as a ground-cover. Not very hardy in New England.

18. **cistifòlium,** Lam. (*H. sphærocárpum*, Michx.). Upright perennial or subshrub, with 4-angled sts., 1–3 ft. high: lvs. sessile, often slightly clasping, oblong or linear-oblong, obtuse, revolute, 1–3 in. long: fls. yellow, ½in. across, nearly sessile, in terminal, loose corymbs; sepals ovate to lanceolate: caps. globose to globose-ovoid, 1-celled. July–Sept. Ohio to Ill., Ala., and Ark. B.B. (ed. 2) 2:532.—Satisfactory in light, sandy soil. Spreads rapidly by stoloniferous roots, covering the soil and preventing washing. Not very ornamental. Half-hardy N.

Section EUHYPERICUM.

19. **perforàtum,** Linn. Herbaceous perennial, 1–2 ft., with upright, 2-edged sts.: lvs. sessile, oblong to linear, obtuse, black-dotted, ½–1 in. long: fls. bright yellow, ½–1 in. across, in terminal cymes; sepals acute; stamens in 3 fascicles: caps. ovoid, glandular. June–Sept. Eu., now commonly naturalized in fields and waste places. B.B. (ed. 2) 2:533. R.F.G. 6:343 (5177).

Section WEBBIA.

20. **floribúndum,** Dry. A subshrub, with round, glabrous sts.: lvs. lanceolate-elliptic, rounded at the base; light green; without dots, 1–1½ in. long: fls. in terminal, many-fld. panicles, 1½–2 in. diam., with dilated peduncles; sepals ovate-lanceolate, somewhat acute; stamens numerous, in 3 fascicles, petals and stamens persistent; ovary oval; styles long, divergent, with capitate stigmas. From the Canary and Madeira Isls.—Not hardy N., but in cult. in S. Calif. Grows very rapidly to the height of about 12 ft. or more, but it is usually kept lower by topping it after blooming and thus making it bloom again in about two months. Generally prop. from seeds, which are produced freely.

Section ANDROSÆMUM.

21. **hircìnum,** Linn. Glabrous subshrub of round, compact habit, 2–3 ft. high, the branches winged toward the tips: lvs. sessile, ovate-lanceolate, acute, glandular, 1–2½ in. long, deep green: fls. 1–1½ in. wide, solitary or 3-clustered; sepals lanceolate, deciduous, one-third to one-fourth the length of the lance-oblong petals, which are of a deeper yellow than in the other species; stamens very long, in 5 fascicles; styles spreading, longer than the stamens: caps. ovoid, pointed. July, Aug. W.D.B. 2:86.—Species characterized by the strong, goat-like odor of the lvs. (hence the name). Of easy cult., but requiring a dry position and winter protection. Medit. region. Var. **pùmilum,** Wats. (var. *mìnor*, Lav.). Dwarfer, with smaller lvs. and fls.; as pretty and free-blooming as the type, and, in the rock-garden, preferable. W.D.B. 2:87.

22. **elàtum,** Dry. (*H. grandifòlium*, Choisy. *H. multiflòrum*, Hort., not HBK. *Andrósæmum Webbiànum*, Spach). Shrub or subshrub, 3–4 ft. high, with slightly 2-edged branchlets: lvs. ovate-oblong, acute or obtusish, often subcordate at the base, 1½–3 in. long: fls. 1–1½ in. across, in several- to many-fld. terminal panicles; sepals ovate or ovate-lanceolate, obtuse or sometimes acutish, about ¼in. long; stamens in 5 fascicles; styles longer than ovary: caps. ovate-oblong. July. Canary Isls., Madeira. R.F.G. 6:352. W.&.B. 2:85.—*H. multiflòrum*, Hort., has been considered a hybrid between *H. elatum* and *H. Androsæmum*, but the plant cult. at the Arnold Arboretum does not show any influence of the latter species and is apparently only a form of *H. elatum* with more numerous and somewhat smaller fls.

23. **Andrósæmum,** Linn. (*Andrósæmum officinàle*, All.). SWEET AMBER. COMMON TUTSAN. A dense undershrub with erect, 2-edged sts.: lvs. ovate to ovate-oblong, 2–4 in. long, subcordate, minutely dotted, dark green, whitish below: fls. solitary or in cymes of 3–9, large, light yellow, 1 in. across; sepals ovate, ⅓–½in. long; stamens in 5 clusters, longer than the petals; ovary subglobular or oval, incompletely 3-celled; styles divergent, persistent, shorter than ovary: fr. berry-like, blackish violet, the size of a pea. June–Sept. Lives in shady, wet places, W. and S. Eu. to Persia.—Not yet proved hardy at the N. Fls. not particularly attractive, but good in fr. and foliage. All parts very aromatic.

Section ELODEA (Triadenum).

24. **virgínicum,** Linn. (*Triadènum virgínicum*, Raf. *Elodèa campanulàta*, Pursh. *Elodèa virgínica*, Nutt.). MARSH ST. JOHN'S-WORT. Smooth perennial, 1–1½ ft. high, nearly simple: lvs. numerous, oblong or oval, cordate, clasping, rounded, 1–2½ in. long: fls. ½in. diam., pink- or flesh-colored, in small, close cymes; sepals equal; petals oblong; stamens at least 9 in 3 sets; styles distinct: caps. oblong. July, Aug. In swamps, Labrador to Fla. west to Man., Neb. and La. B.B. (ed. 2) 2:537.—Useful plant for an artificial bog, and thrives well also in any fine, loamy soil in the shade or sun.

H. ægyptiacum, Linn. Dwarf shrub: lvs. crowded, elliptic, acute, ¼–⅓in. long: fls. solitary, axillary ⅓–½in. across, forming leafy racemes; styles 3. Medit. region. B.M. 6481. G.C. II. 14:503. B.R. 196.—*H. Arnoldiànum*, Rehd. (H. galioides × H. lobocarpum). Similar to H. galioides, but with a many-fld. terminal infl. and several-fld. lateral infl.: caps. 3–5-celled. Originated at the Arnold Arboretum.—*H. baleàricum*, Linn. Low upright shrub with the lvs. beneath and the twigs warty: lvs. oval, obtuse, about ⅓in. long: fls. 1½ in. across, solitary, terminal; styles 5. Medit. region.

B.M. 137.—*H. canariénse*, Linn. Allied to H. floribundum. Shrub, to 15 ft.: lvs. oblong-lanceolate, narrowed at the base, 2–3 in.: fls. 1–1⅓ in. across, in panicles; sepals ovate, acute, ciliate. L.B.C. 10:953.—*H. còris*, Linn. Procumbent subshrub, 6–8 in. high: lvs narrowly linear, revolute on the margin, about 1 in. long, in whorls of 4–6: fls. ¾in. across, in few-fld. loose cymes; styles 3. Cent. and S. Eu. B.M. 6563.—*H. cuneàtum*, Poir. Low diffuse subshrub, ½–1 ft. high: lvs. obovate, ¼–⅓in. long: fls. ¾in. across, axillary, slender-stalked, forming leafy racemes. Asia Minor. —*H. Dawsoniànum*, Rehd. (H. lobocarpum × H. prolificum). Differs from H. prolificum in the more numerous fls. and the 3–5-celled, furrowed caps. Originated at the Arnold Arboretum.—*H. dolabrifórme*, Vent. Procumbent perennial, with ascending sts. 6–20 in. high: lvs. linear-lanceolate, ½–1½ in. long: fls. 1 in. across, in terminal leafy corymbs. Ky. and Tenn. B.B. (ed. 2) 2:532.—*H. èlegans*, Steph. Upright perennial, ½–1 ft. high.: lvs. ovate-lanceolate, ¾–1 in. long: fls. ¾–1 in. across, in terminal panicles; sepals ovate-lanceolate, glandular-ciliate. Cent. Eu. to Altai Mts. R.F.G. 6:350 (5190).—*H. elòdes*, Huds.=H. helodes, Linn.—*H. empetrifòlium*, Willd. Upright shrub, to 1 ft.: lvs. linear, revolute on the margin, ½–¾in. long, in whorls of 3: fls. ½–¾in. across, in 3–5-fld. cymes forming panicles; sepals broadly oblong. S. E. Eu., Asia Minor. B.M. 6764. Gn. 30, p. 221.—*H fasciculàtum*, Lam. Allied to G. galioides. Shrub, to 6 ft.: lvs. linear, thick, ½–¾ in. long: fls. ⅓–½ in. across, in narrow panicles. N. C. to Fla. and Texas.—*H. fràgile*, Heldr. & Sart. Dwarf subshrub: lvs. ovate, imbricate, ⅙in. long, glaucescent-fls. large, in 3- to many-fld. cymes; sepals linear-lanceolate. Greece.—*H. helòdes*, Linn. Procumbent perennial, with orbicular-ovate, villous lvs. ⅓–¾in. long: fls. pale yellow, about ⅓in. across; in few-fld. terminal cymes. Eu. R.F.G. 6:342 (5182). Suitable for boggy places.—*H. inodòrum*, Willd. (H. ramosissimum, Ledeb.). Allied to H. hircinum, but without the goat-like odor. Arching shrub, with strongly 2-edged branchlets: lvs. ovate to ovate-oblong, 1½–2 in. long: fls. 1 in. across, in few-fld. dense corymbs. Caucasus.—*H. japónicum*, Thunb. Decumbent perennial, with ovate or oval 3-nerved lvs. and 4-angled sts.: fls. ¼in. across, with petals equaling the lanceolate sepals, in terminal cymes. E. Asia to Austral. Scarcely ornamental.—*H. lysimachioìdes*, Wall. Slender shrub, with slightly angular arching branchlets: lvs. ovate to ovate-oblong, acute, 1–1½ in. long: fls. 1 in. across in loose leafy cymes; sepals linear-lanceolate; styles 5. Himalayas. V.F. 25.—*H. montànum*, Linn. Perennial: lower lvs. larger, ovate, glabrous: fls. in close compact cymes, often reduced to a head. Cent. and S. Eu.—*H. napauléns*e, Choisy (H. nepalensis, Hort.). Trailing subshrub with ovate to ovate-lanceolate lvs. ½–¾in. long: fls. ⅓in. across in few-fld. loose cymes. Himalayas.—For H. nepalense, Hort., see also No. 6.—*H. nóthum*, Rehd. (H. densiflorum × H. Kalmianum). Similar to H. densiflorum, but fls. less numerous, lvs. narrower and caps. 3–5-celled, slightly furrowed. Originated at the Arnold Arboretum.—*H. nummulàrium*, Linn. Diffuse ascending subshrub: lvs. roundish, ⅓–½in. long: fls. ¾in. across, in terminal cymes; sepals glandular-ciliate. Pyrenees. R.F.G. 6:346 (5184).—*H. olýmpicum*, Linn. Upright or ascending subshrub, 1 ft.: lvs. oblong-lanceolate, grayish green, ½–1½ in. long: fls. golden yellow, 1½–2½ in. across, in terminal few-fld. corymbs; sepals large, pointed; petals oblong-obovate. S. E. Eu., Asia Minor. B.M. 1867. Gn. 31:302.—*H. opàcum*, Torr. & Gray. Allied to H. sphærocarpum. Subshrub, 1–3 ft.: lvs. oblong-lanceolate, ½–1 in. long: fls. ⅓in. across, in open corymbs; sepals obtuse: caps. ovoid. S. C. to Fla. and Miss. G.F. 5:305.—*H. orientàle*, Linn. Upright perennial, ½–1 ft.: lvs. obovate-oblong to linear-oblong, obtuse, glandular-ciliate, ½–1 in. long: fls. 1 in. across, in small terminal cymes. Asia Minor.—*H. polyphýllum*, Boiss. Perennial with ascending sts.: lvs. elliptic-linear, glaucous, ⅕–⅓ in. long: fls. 1½–2 in. across, in dense terminal cymes. Cilicia.—*H. púlchrum*, Linn. Allied to H. perforatum. Sts. terete: lvs. ovate, clasping, ⅓–½in. long: fls. ½–¾in. across, in terminal panicles; sepals glandular-ciliate. Cent. Eu. R.F.G. 6:347 (5185).—*H. ramosíssimum*, Ledeb.=H. inodorum.—*H. rèpens*, Linn. Perennial, with prostrate sts.: lvs. oblong or linear-oblong, ¼–⅓in. long: fls. golden yellow, 1 in. across in few-fld. terminal cymes. S. E. Eu., Asia Minor. S.F.G. 8:775.—*H. rèptans*, Hook. f. & Thoms. Prostrate shrub, with rooting sts.: lvs. elliptic-oblong, ¼–½in. long: fls. cup-shaped, solitary, terminal, 1¾in. across; petals broadly obovate; styles 5. Himalayas. Gn. 24, p. 267; 30, p. 221. —*H. salicifòlium*, Sieb. & Zucc. Allied to H. chinense, but distinguished by the narrower acute lvs., many-fld. corymbs and acute sepals. Japan.—*H. spléndens*, Small. Allied to H. aureum. Shrub, to 5 ft.: lvs. oblong, ¾–1 in. long: fls. pedicelled, 1½ in. across, in several- to many-fld. cymes; stamens orange-colored: caps. with 3 narrow wings Ga. Seems not yet in cult.; very desirable.—*H. tomentòsum*, Linn. Perennial with ascending sts.: lvs. ovate, woolly, ⅓–¾in. long: fls. ½–¾in. across, in many-fld. corymbs; sepals ciliate, acute. Eu. R.F.G. 6:346 (5183).—*H. túrgidum*, Small. Allied to H. sphærocarpum. Shrub, 1–2 ft.: lvs. linear-oblanceolate, ½–1 in. long: fls. 1 in. across in several-fld. cymes; sepals ovate to elliptic: caps. subglobose, broadest at the top. Ala.

ALFRED REHDER.†

HYPHÆNE (Greek, *to entwine;* referring to the fibers of the fruit). *Palmàceæ*, tribe *Borásseæ*. Fan-leaved unarmed palms of moderate or tall stature from tropical Africa and Madagascar.

Caudex robust, cylindrical, ventricose or pear-shaped, simple or forkingly branched: lvs. terminal, orbicular, palmate-flabelliform, plicate-multifid; segms. ensiform, acute or 2-fid, margins induplicate with fibers interposed; rachis short; petiole strongly biconvex or a trifle flatter above; margins minutely spiny; ligule short, rotund; sheath short, open: fls. diœcious, in relatively deep pits, on the infl., which is partly hidden by the lvs.—About 10 species from Trop. Afr. The Borassus tribe of palms consists of Borassus, Lodoicea, Latania and Hyphæne. In the first two the staminate fls. in the pits of the spadix are numerous; in the last two they are solitary. In the first and fourth there are few stamens; in the second and third the stamens are numerous.

crinìta, Gaertn. (*H. natalénsis*, Kunze). Young fronds 1 to 1½ ft. long, lanceolate, bi- or trifid at the apex, bright green, clothed on both sides with a white bloom which soon vanishes, plicate, scabrous on the margins and nerves above; petiole sheathed for 1 or 2 in., deeply channelled above, rough on the margins: frs. obovate, 2½ in. long, smooth. S. Afr.—Cult. outdoors in S. Fla. Does not look at all like Latania. It has long, thick seed-lvs., and, it is said, has withstood the cold in Fla. better than any other palm. It is extremely slow of growth, and cannot be desirable as a house plant. It is probably cult. more in northern conservatories than in the S.

H. thebàica, Mart. A showy palm with striking yellow-orange frs. is probably a Corypha. It is little cult. in N. Amer. F.S. 21:2152–3.—*H. ventricòsa*, Kirk, is a showy blue-green palm with an immense cluster of lvs. and a bulging trunk. Congo. Not in cult. in Amer. G. C. II. 21:649.

N. TAYLOR.†

HYPOCHÈRIS (old name, of doubtful origin). *Compósitæ*. Sometimes written with the digraph *æ*. Perhaps 50 herbs, of the Medit. region, N. Asia and the southern part of S. Amer., allied to Leontodon, scarcely cult. They are annual or perennial, more or less branched, yellow-fld.: lvs mostly radical: involucre campanulate, the scales marginless; receptacle with narrow bracts: achenes 10-ribbed, some or all tapering into a beak; pappus of many fine plumose bristles; heads homogamous, the florets ligulate. **H. uniflòra,** Vill. (*Achyróphorus helvéticus*, Scop. & Less.), has been offered in N. Amer.: perennial: radical lvs. oblong-lanceolate, dentate, hirsute; cauline lvs. 1–2: st. simple, 1-headed or sometimes 2–3-headed under cult.: involucre very hairy: achenes beaked. Mountains of Eu., and useful in alpine- and rock-gardening.

L. H. B.

HYPOCÝRTA (name refers to the gibbous or *curved beneath* corolla-tube). *Gesneriàceæ*. Shrubby, erect, creeping or climbing, natives of tropical America of perhaps ten species. They are little known in cultivation; require the handling of Gesneria and similar plants. *H. grácilis*, Mast.=*Codonanthe gracilis.*

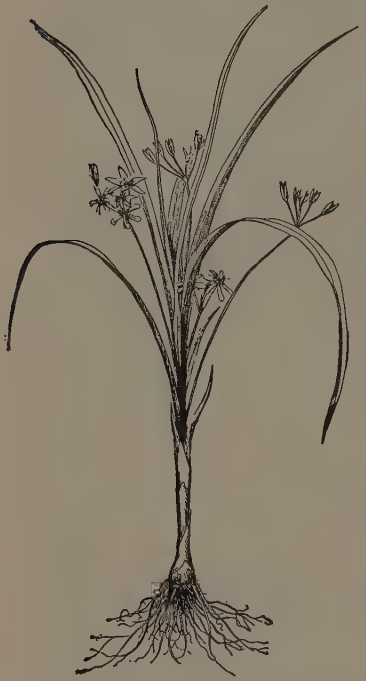
HYPÓLEPIS (Greek, *a scale underneath*). *Polypodiàceæ*. Tropical glasshouse ferns of both hemispheres rarely cult. Allied to Cheilanthes: rhizomes long and creeping, the fronds herbaceous: distinguished particularly by the marginal sori, placed in the sinuses of the lf., and covered with the membranous lf.-margin.—Ten or more species are known. (See p. 1215.)

rèpens, Presl. Lf.-stalks straw-colored, more or less prickly; lf.-blades 3–4 ft. long, quadripinnatifid; lower pinnæ 1–2 ft. long, 6–12 in. wide, ovate-acuminate; sori 2–6 to a segm. W. Indies to Brazil.—A rather coarse fern, of easy cult., with the general appearance of a cyathea. Like all strong-growing ferns, it requires a large percentage of loam. It likes shade and moisture at all times, and is readily prop. by spores, which it produces in great quantity, being often self-sown. It requires a stove or intermediate temperature.

H. califórnica, Hook. See Cheilanthes californica.—*H. meifòlia*, Baker. See Cheilanthes meifolia.

L. M. UNDERWOOD.

HYPOLÝTRUM (from the Greek for *beneath* and a *sheath;* in reference to the 2 or 3 scales found under the true scale). *Cyperàceæ*. Perennial herbs with leafy sts., often very strong and coarse: spikelets numerous and small in compound panicles that have long leafy involucral bracts; glumes imbricate around the rachis; stamens 3 or less: fr. a hard 3-angled nutlet.—Species 25 or 30, in tropical and subtropical regions of both hemispheres. Only one species seems to be in the trade. **H. Schraderiànum,** Nees, is listed abroad, apparently as a greenhouse plant, the lvs., "crowded in bold triangular tufts, green with purplish red margins, traversed on the upper surface by 2 ribs running equidistant from base to apex," giving it a striking and ornamental effect: panicle much decompound; spikelets obovate-elliptic: lvs. linear-lanceolate, 3-nerved, the margin and midnerve more or less serrulate-scabrous toward the apex, 2 ft. long and 1½ in. or less wide: culms 5–6 ft. In woods and swamps, Brazil. L. H. B.


1942. Hypoxis hirsuta.

HYPÓXIS (old Greek name, of no application to these plants). *Amaryllidàceæ.* Star-Grass. About 50 species of little herbs of temperate and tropical regions, with linear lvs., hard rootstocks or corms, perianth adnate to the ovary, and anthers not versatile: stemless: fls. few, on slender scapes. They are scarcely known in cult., although the common species of the northern states, **H. hirsùta,** Coville (*H. erécta,* Linn.), Fig. 1942, is offered by dealers in native plants. The lvs. are radical, hairy, grass-like: fls. 1–6, small, star-like, bright yellow, on scapes 4–10 in. tall. Give a half-shady place in the rockery or border. Prop. by division. Blooms in spring. Not showy, but interesting. **H. stellàta,** Linn. f., from S. Afr., is a pretty greenhouse bulb, blooming in Dec.: lvs. 4–12, glabrous, a foot or less long: peduncles sometimes forked, 1–4, bearing fls. white inside, and the outer segms. green-striped on the back: corm globose: plant variable. L. H. B.

HÝSSOPUS (ancient name; but precisely what plant was the sacred Hyssop of the Jews is uncertain). *Labiàtæ.* Hyssop. A familiar plant, cultivated for medicine and also for ornament in hardy borders.

It is considered a genus of only 1 species, the numerous synonyms being referred mostly to *H. officinalis* or to the genus Lophanthus, 2 species of which are cult. Hyssopus has entire lvs.: Lophanthus has serrate lvs. Important generic characters of Hyssopus are the 15-nerved tubular calyx, divergent stamens, upper lip of corolla 2-lobed, lower 3-lobed, stamens 4, didynamous, nutlets ovoid and smooth and somewhat 3-sided.

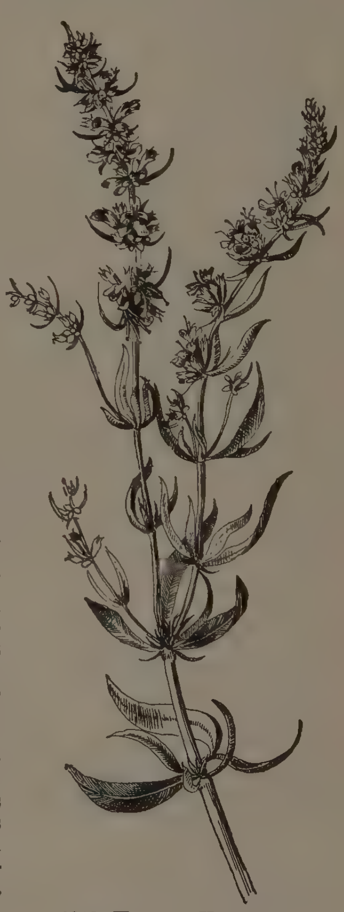
officinàlis, Linn. Fig. 1943. Sts. herbaceous from a woody base, slender, branched or not: lvs. linear to oblong, sessile or nearly so, acute at both ends or the lower ones obtuse at the apex, 1½–2 in. long. Eu. and Temp. Asia; also run wild in this country. B.M. 2299 (as *H. orientalis*). Var. **álba,** with white fls., is cult. Var. **grandiflòrus,** Hort., from Lake Baikal, has large open fls., a diffuse habit and a lax arrangement of the whorls of fls.

Hyssop is a hardy perennial subshrub, 18 inches tall. The whole plant has a strong odor and pungent, bitter taste. The green parts are used in connection with wormwood and other plants in the manufacture of absinthe, occasionally as a pot-herb, and as a flavoring for cold-salad plants. The powdered, dried flowers are similarly employed in soups. The flower-spikes are cut just as the blossoms begin to open, and are dried for use in domestic medicine as a stimulant and expectorant in the treatment of asthma, coughs and other pulmonary troubles. Hyssop is not now so highly esteemed as formerly by the medical profession.

This plant is readily propagated by seeds, cuttings and plant-division. The seed, generally employed in cold climates, is sown in early spring, either in drills 15 to 18 inches apart where the plants are to remain, or broadcast in nursery beds for transplanting, 12 inches apart in June or July. Propagation by cuttings and by divisions may be done in the autumn, but better in the spring, when the plants first start to grow. Greenwood cuttings may be started in the shade in the early summer. They need to be well watered. The soil should be a light, mellow, calcareous or sandy loam, with a warm aspect. Culture and harvesting are the same as for sage, mint and other herbs. The beds should be renewed every three or four years. M. G. Kains.

HÝSTRIX (Greek, from *hustrix,* a porcupine). *Gramíneæ.* Perennials with simple culms, flat blades and loosely fld. spikes: spikelets 2–4-fld., nearly sessile, 1–3 together at each joint of a zigzag rachis as in Elymus, widely divergent at maturity; glumes 1 or 2 short awns; lemmas rigid, tapering into a long awn.—Species 4, N. Amer. and Eurasia. *H. pátula,* Moench (*Asprélla Hýstrix,* Willd.), Bottle-brush Grass is found in E. U. S. and is sometimes used for lawn decoration and for borders. Dept. Agric., Div. Agrost. 20:168.

A. S. Hitchcock.


1943. Hyssop.—Hyssopus officinalis. (×½)

I

IBÈRIS (from *Iberia*, the ancient name of Spain, where many species occur). *Cruciferæ.* Candytuft. Small flower-garden and border plants.

Annual, biennial or perennial, sometimes half-shrubby, usually glabrous but sometimes ciliate or even hairy: lvs. alternate, entire or pinnatifid, sometimes fleshy: fls. racemose or corymbose, white or purplish, the outer ones in the dense cluster more or less radiate; sepals 4, deciduous; petals 4, the 2 outer much larger than the others; stamens 4, free, not appendaged: fr. a scale-shaped roundish or ovate pod which is margined or winged and often notched at the top, plano-compressed; seeds single in each locule, ovate, not margined.—Species 30–40, native to S. Eu., W. Asia and N. Afr., all low-growing plants. Comparatively few species are cult. The annuals are the common candytuft of gardens. The biennials are not cult. The subshrubs are flat, dwarf, compact, commonly evergreen plants, with dark green lvs., completely covered with broad, flat or elongated clusters of irregular cruciferous fls. in spring. The common white-fld. annual candytuft is *I. amara.* The common annual kinds with colored fls. are *I. umbellata.* The common perennial kind is *I. sempervirens.* The clusters of some kinds remain rather flat-topped when they run to seed, while the clusters of other kinds lengthen after flowering; these differences are made division points in the arrangement of species, following.

1944. Iberis gibraltarica. (×½)

The annuals are showy branching plants, 6 to 18 inches high, much grown in masses in beds or for edging. Florists grow them also, especially the white varieties, for cut-flowers. They are of easy cultivation, and succeed in any rich garden soil, in a place exposed to light and air. They are propagated by seeds, which may be sown at any season, in the house or open ground, but particularly in the fall when the climate permits, or as early as possible in spring, in rows 6 to 8 inches apart where the plants are to grow, the plants being thinned later to 4 inches apart in the row. The finest display is attained from autumn-sown plants, which flower from May to July. If seed is sown in autumn, the plants should be slightly protected from the sun during winter. Seeds sown early in the spring bloom from July to September. Continuous bloom may be obtained by sowing every two weeks. Good results are attained by sowing under glass and transplanting into open ground when the soil is warm. To secure the best bloom, the plants should be given much room, and never crowded. The name candytuft was given because the flowers appear in tufts and because the first introduced species, *I. umbellata,* was brought from Candia.—The subshrubby species are adapted to the front of shrubberies, where they connect taller plants with the surrounding lawn. They may appear in separate clumps, in broad masses, or may mingle with other genera in the herbaceous border. They are suited to rockeries, and hang well over walls and ledges. They are to be treated much like herbaceous perennials. They are plants of refinement, and are pleasing when close to the observer. They are useful and popular for cut-flowers, are easily forced into bloom in winter, and are adapted to pot and pan culture. They are easily propagated. The perennial iberis succeed best when let alone. Once planted and not disturbed, they soon form a dense foliage. They are the best spreading, dwarf plants with white flowers. (A. Phelps Wyman.)

INDEX.

affinis, 2.
alba, 9.
amara, 1.
carminea, 9.
carnea, 9.
corifolia, 6.
coronaria, 1.
Dunnettii, 9.
foliis variegatis, 5, 12.
Garrexiana, 7.
gibraltarica, 8.
hybrida, 8, 9.
lilacina, 9.
nana, 9.
odorata, 3.
pectinata, 2.
petræa, 10.
pinnata, 4.
plena, 5, 12.
Pruitii, 11.
pumila, 9.
pupurea, 9.
rosea, 5, 9.
saxatilis, 6.
semperflorens, 12.
sempervirens, 5.
superba, 5.
Tenoreana, 10.
umbellata, 9.

A. *Infl. racemose in fr.*

B. *Annuals or biennials: sts. not woody at the base.*

C. *Lobes of the pod erect.*

1. **amàra,** Linn. Common Annual Candytuft. Plant erect, stiffish, 6–12 in., very bitter: lvs. lanceolate, toothed toward apex: fls. white, the clusters at first short but afterward elongating: pod nearly orbicular. Common weed of cult. ground in Great Britain and Cent. and S. Eu. The best form is var. **coronària,** Voss (*I. coronària,* Hort., not D. Don). Rocket Candytuft. This has larger and fuller clusters and larger fls. The taller varieties, Empress, Spiral White, and Giant Snowflake, grow 18 in. high, with solid pyramidal trusses 5–8 in. long. Dwarf forms are Tom Thumb and Little Prince. All are good bedders, and Empress is excellent for cutting. Seed may be sown at any time, but the best results with Empress are secured by sowing under glass and transplanting to the open, where plants will bloom in May and June.

2. **pectinàta,** Boiss. (*I. affinis,* Hort., not Jord.). Lvs. pectinate (i.e., divisions deeper, narrower, and farther apart): fls. white. Spain.—Advertised only as *A. affinis.* Likely to be confused with *I. odorata,* but the petals are 4 times as long as the calyx and the pods have short hairs, while in *I. odorata* the petals are 1½ times as long as the calyx and the pods glabrous.

CC. *Lobes of the pod spreading.*

3. **odoràta,** Linn. Sweet-scented or Fragrant Candytuft. Annual, 6–12 in.: lvs. linear, wider toward the top, toothed, ciliate toward base: fls. white, fragrant. Greece, Syria.—Frequently confused with *I. pinnata.* Said to be better and more fragrant in poor soil.

4. **pinnàta,** Linn. Annual or biennial, with oblong-linear pinnatifid or pinnatisect lvs., the segms. being very narrow: 12 in. or less: fls. white, fragrant; infl. only slightly elongated in fr. and therefore sometimes described as corymbose. Spain, S. France, Italy.—Said to be often sold as *I. odorata.*

BB. *Perennials: sts. woody at the base.*

C. *While in flower, racemose.*

5. **sempérvirens,** Linn. Perennial, to 1 ft., branching, somewhat shrubby: lvs. oblong, obtuse, narrowed at base, glabrous: fls. white, in elongating racemes. S. Eu. Gng. 2:145 (fine habit sketch). F.R. 1:75 (poor). G.W. 8, p. 373. Var. **plèna,** a double form, is cult., but is less desirable. Var. **ròsea** and var. **fòliis variegàtis,** are sold abroad. Var. **supérba,** or Perfection, is said to be one of the best forms.—This is the commonest, hardiest and most permanent of the perennial kinds. When the rarer and tenderer kinds are winter-killed, *I. sempervirens* is likely to spread out and surround the labels of other kinds. This probably explains why some of the most reliable dealers have sold this plant under other names, particularly *I. gibraltarica.*

CC. *While in flower, corymbose.*

D. *Margin of lvs. entire.*

6. **saxátilis,** Linn. Perennial, dwarf, evergreen, 6 in. or less, with ascending sts.: lvs. linear, entire and somewhat fleshy, mostly ciliate: fls. white, corymbose. S. Eu. Var. **corifòlia,** Sims (*I. corifòlia,* Sweet). Lvs. glabrous: fls. white. B.M. 1642, although this picture was doubtfully referred by Baker to *I. Garrexiana.* G.M. 46:289.

1945. Iberis Tenoreana var. petræa.

7. **Garrexiàna,** All., not Scop. Lvs. oblong, narrow at the base, glabrous: fls. rather small, white, the racemes much elongating. Piedmont, Pyrenees. Referred by some to *I. sempervirens.* Intermediate between *I. sempervirens* and *I. saxatilis,* having the habit of the latter. It is sometimes described as *I. sempervirens* var. *Garrexiana.* Gn. 62, p. 393. G.M. 48:211.

DD. *Margin of lvs. toothed toward apex.*

8. **gibraltárica,** Linn. Fig. 1944. Perennial, evergreen, diffuse, 12–20 in.: lvs. wedge-shaped, obtuse, subciliate: outer fls. pink, inner ones white. Spain, Morocco. B.M. 124. G.C. III. 46:158. Gn. 10:288; 76, p. 69. G. 27:446. R.H. 1870:330. Gn. 24, p. 549, same as R. H. 1885, p. 446.—This is considered by some as the most striking and showy of the perennial kinds. It grows higher and more erect, with larger clusters and larger fls., but is less hardy than the others. This is much sought after, and the stock in the nurseries is often not true to name. Var. **hýbrida,** is advertised, the fls. white shading to lilac.

AA. *Infl. corymbose in fr.*

B. *Annuals: sts. not woody at the base.*

9. **umbellàta,** Linn. COMMON ANNUAL CANDYTUFT. Upright, 6–15 in.: lvs. lanceolate, acuminate, lower ones serrate, upper ones entire: fls. in the wild typically purplish, rarely white, in umbels terminating all the main sts.: pods acutely 2-lobed. Italy, Crete, Spain. B.M. 106.—This is the common hardy annual candytuft with colored fls., the colors being more numerous and better fixed than in any other species. Trade names are vars. **carmínea, cárnea, lilácina** and **Dúnnettii** (*I. Dúnnettii,* Hort.), the last being dark purple. Vars. **ròsea, purpùrea** and **álba** are advertised abroad, also vars. **nàna, pùmila** and **hýbrida.** Tall and dwarf forms of all the colors are procurable.

BB. *Perennials: sts. woody at the base.*

C. *Lvs. ciliate, crenate.*

10. **Tenoreàna,** DC. Perennial, somewhat shrubby at base, ascending, about 6 in. high: lower lvs. obovate, narrowed at base; upper lvs. oblong-linear: fls. purplish or whitish, the clusters flattish and not elongating: pods notched at apex. Naples. B.M. 2783. L.B.C. 18:1721. G. 34:119.—According to Baker (G.C. 1868: 711), this is the only perennial kind that is decidedly hairy. DeCandolle says the lvs. are puberulous. Var. **petræa,** Nichols. (*I. petræa,* Jord.). Fig. 1945. A good rock-garden form, with fls. white tinged red in center.

CC. *Lvs. not ciliate, entire or subdentate.*

11. **Prùitii,** Tineo. Perennial, 6 in., woody at base: lvs. glabrous, obovate-spatulate, entire or subdentate: fls. white, in compact clusters: pods merely notched at apex; seed not margined, the radicle descending; septum of pod simple. Sicily.

12. **semperflòrens,** Linn. Perennial, evergreen, 1–2 ft.: lvs. wedge-shaped or spatulate, obtuse, entire, glabrous, somewhat fleshy: fls. large, pure white, fragrant: pods scarcely notched at apex; seed somewhat margined, the radicle horizontal; septum of pod nearly double. Sicily and perhaps Persia. Var. **plèna,** a double variety. Var. **fòliis variegàtis** said to be cult. abroad.

I. cordifòlia is an error for I. corifolia.—*I. correæfòlia,* Hort., is a common trade name abroad, which is usually spelled, I. corræfolia in American catalogues. There is no genus Corra, and Correa is an Australian plant of the Rutaceæ. Specimens should therefore be compared with I. saxatilis var. corifolia. Mottet's description, however, would place this plant directly after I. Garrexiana in the key, being distinguished from I. Garrexiana by the fls. becoming purplish instead of always remaining white. Mottet says that I. correæfolia, Hort., is a hybrid, with spatulate, entire, obtuse lvs.—*I hyacinthiflòra,* Hort., is an annual candytuft with milk-white fls. in elongated panicles. It is said to be a first-quality cut-fl. for summer bloom.—*I. jucúnda,* Schott & Kotschy=Æthionema coridifolium.—*I. Lagascàna,* DC. Annual, 1 ft.: lvs. oblong-spatulate, toothed at apex: fls. pure white, in close corymbs: pods 2-lobed. Spain.—*I. lilácina* of trade catalogues is presumably a lilac-fld. variety of I. umbellata.—*I. nàna hýbrida,* Hort., is not I. nana, All., a distinct botanical species, but a trade name of mixed dwarf varieties of some common annual kind, presumably I. umbellata.

WILHELM MILLER.
L. H. B.†

IBÍDIUM (named from the fancied resemblance of the anther to the beak of an ibis). *Orchidàceæ.* By some authors used to supplant the generic name Spiranthes (which see), but the latter name is retained by the "nomina conservanda" of the Vienna code. Under Ibidium, the nomenclature becomes:

I. coloratum, House (*Spiranthes colorata,* N.E. Br.);

I. cernuum, House (*Spiranthes cernua,* Rich.);

I. Romanzoffianum, House (*Spiranthes Romanzoffiana,* Cham.);

I. plantagineum, House (*Neottia plantaginea,* Raf. *Neottia lucida,* H. H. Eaton. *Spiranthes latifolia,* Torr. *S. lucida,* Ames);

I. præcox, House (*Spiranthes præcox,* Wats.);

I. Beckii, House (*Spiranthes Beckii,* Lindl. *S. simplex,* Gray. *S. Grayi,* Ames);

I. gracile, House (*Neottia gracilis,* Bigel. *Spiranthes gracilis,* Beck);

I. vernale, House (*Spiranthes vernalis,* Engelm. & Gray). Lvs. oblong-lanceolate to linear-lanceolate, tapering to both ends, ¼in. wide or less, mostly basal, the lower ones usually withering before flowering time: scape densely pubescent above; floral-bracts longer than the ovaries, with hyaline margins; raceme slender, 1-ranked, 1–3 in. long; fls. ⅓in. long, yellowish, lip ovate to ovate-oblong, pubescent beneath. Mass. to Fla., Ill. and Kans.

H. D. HOUSE.

ICACÒREA: *Ardisia.*

IDÈSIA (Yobrants Ides, Dutch traveler in China). *Flacourtiàceæ.* Ornamental tree grown for its handsome large foliage and also for the attractive orange-red berries.

Deciduous: lvs. alternate, long-petioled, 3–5-nerved at the base, crenate-serrate; stipules small, caducous: fls. diœcious, in large terminal panicles; sepals 5 (3–6); petals wanting; stamens, numerous, with villous filaments; ovary 1-celled, with 3–6 spreading styles: fr. a many-seeded berry.—One species in S. Japan and Cent. and W. China.

This is a handsome tree with close grayish white bark and spreading branches forming a low broad head; the rather large lustrous leaves are borne on long reddish stalks; the flowers are not showy, but the orange-red berries, borne in pendulous racemes sometimes 10 inches long, are very conspicuous, particularly after the leaves have fallen. The plants raised from seeds recently introduced from Central China have proved hardy at the Arnold Arboretum, at least in favorable positions, while the Japanese plant introduced about fifty years ago is not hardy north of Philadelphia; otherwise there is no difference between the Japanese and the Chinese plant. The tree grows quite rapidly while young and does not seem particular as to the soil. Propagation is by seeds, which germinate readily, and by greenwood and root-cuttings.

polycárpa, Maxim. (*Polycárpa Maximowiczii,* Hort.). Tree, to 50 ft.: lvs. usually cordate-ovate, rarely oblong-ovate, acuminate, remotely crenate-serrate, deep green above, glaucous below, glabrous, 5–10 in. long; petiole 4–6 in. long: fls. greenish yellow, fragrant, in pendulous panicles 4–10 in. long; staminate fls. over ½in. across, pistillate ⅓in. June; fr. in Sept.–Nov. B.M. 6794. Gn. 12, p. 532; 13, p. 99. R.H. 1872, pp. 174, 175; 1888, pp. 463–5. F. 1874, pp. 64, 65. F.S.R. 2, p. 189. J.H.S. 27:410. L.I. 11. S.I.F. 1:76. Gt. 39, p. 40 (habit). F.E. 24:853. G.C. III. 39:13. Var. **vestita,** Diels. Lvs. densely pubescent or tomentose below. W. China. Tender. Var. **críspa,** Carr. Lvs. irregularly incised and curled. R.H. 1878, p. 254; 1888, p. 463. Gn. 15, p. 471. Var. **fòliis variegàtis,** Hort. Lvs. variegated with sulfur-yellow and gray.

Alfred Rehder.

ÌLEX (the ancient Latin name of *Quercus Ilex*). Including *Prìnos* and *Othèra. Aquifoliàceæ* (or *Ilicìneæ*). Holly. Ornamental woody plants, grown for their handsome foliage and the attractive mostly red berries.

Evergreen or deciduous trees or shrubs: lvs. alternate, petioled, with small, caducous stipules, sometimes spiny: fls. diœcious, usually in rather few-fld. axillary cymes; calyx-lobes, petals and stamens usually 4, sometimes more; ovary superior; style very short: fr. a berry-like drupe, with 2–8 bony 1-seeded stones.—About 275 species in N. and S. Amer., Trop. and Temp. Asia, and few in Afr., Austral. and Eu. Monograph by Loesener in Nov. Act. Leop.-Carol. Acad. 71, pt. 1 (1901). For a horticultural monograph, see Dallimore, Holly, Yew and Box, pp. 1–149 (1909), with many illustrations.

The hollies have medium-sized, simple leaves, small, inconspicuous, whitish flowers in axillary clusters or solitary, and black, red or sometimes yellow berries, remaining on the branches often until the following spring. Of the evergreen species, only *I. glabra* and *I. opaca* are hardy North, and also *I. crenata* in somewhat sheltered positions. *I. Aquifolium, I. Pernyi,* and *I. cornuta* are more tender, but stand many degrees of frost if sheltered, while most of the others can be grown only in the South. Of the deciduous species, *I. decidua, I. monticola, I. lævigata* and *I. verticillata* are hardy North; also *I. serrata* and some other Japanese species are hardy or nearly so. The hollies, especially those with scarlet or red berries, are highly ornamental, and the berried branches of *I. opaca* and *I. Aquifolium* are in great demand for Christmas decoration. Also *I. lævigata* and *I. verticillata,* the prettiest in fruit of the deciduous kinds, are sometimes sold for this purpose. The deciduous species are mostly shrubs, while many of the evergreen species grow into small or medium-sized trees, and *I. opaca* is the tallest of the broad-leaved evergreens which are hardy North and thrives even on extremely poor soil, and has good color also; the evergreens *I. crenata,* and *I. glabra* always remain shrubby. *I. Aquifolium* is a favorite evergreen in English gardens, and numerous varieties are there in cultivation; it also grows well on the Pacific coast from British Columbia to California. It stands severe pruning well, and can be clipped and trained into almost every shape; it also makes fine hedges, but its slow growth is a disadvantage. As the chief value of the deciduous species is in the ornamental fruits, and the hollies are diœcious, care should be taken to choose in planting mostly pistillate plants and a few staminate ones and to give the former the most prominent place. The light, close-grained and tough wood of some of the arborescent species is much valued for turnery-work, engraving and cabinent-making. The leaves of some tropical species, as *I. paraguariensis* and *I. conocarpa,* yield a kind of tea known as Yerba de Maté, or Paraguay tea, which is much used in South America.

The hollies grow best in rich, well-drained soil, and the evergreen ones in partly shaded situations, but *I. lævigata, I. verticillata* and also *I. serrata* prefer moist places, and grow even in swamps. Most of the species grow slowly, and are not easily transplanted when older. The best time for moving the evergreen species is the early fall, when the young wood has almost ripened, or in the spring just before the plants start into new growth. The leaves should be stripped on *I. opaca* and *I. Aquifolium* when transplanted, particularly if at all exposed—or at least nearly all. This is absolutely necessary to insure success. Wild hollies may be handled this way with success, particularly if cut back as well. Propagation is by seeds, which do not germinate until the second year, and are therefore stratified and treated like those of the slow-growing hawthorns. The young seedlings should be transplanted after the second year. The evergreen species may be increased by cuttings of ripened wood under glass, especially the shrubby ones; they are also sometimes grafted or budded on seedlings of *I. Aquifolium* or *I. opaca.*

INDEX.

albo-marginata, 21.
albo-picta, 22.
alteclarensis, 2.
Amelanchier, 50.
angustifolia, 44.
Aquifolium, 1.
argentea, 21.
argenteo-marginata, 21.
argenteo-medio-picta, 22.
argutidens, 53.
aureo-maculata, 23.
aureo-marginata, 24.
aureo-regina, 24.
aureo-picta latifolia, 25.
aureo-variegata, 46.
bronxensis, 52.
camelliæfolia, 20.
caroliniana, 45.
Cassine, 44, 45.
chinensis, 8.
chrysocarpa, 52.
conspicua, 7.
cornuta, 36.
crenata, 46.
crispa, 19.
Dahoon, 44.
decidua, 48.
dipyrena, 38.
dubia, 49.
echinata, 14.
Fargesii, 42.
fastigiata, 52.
ferox, 14.
ferox argentea, 26.
ferox aurea, 27.
Fortunei, 46.
fructu aurantiaco, 32.
fructu luteo, 31.
glabra, 47.
handsworthensis, 9.
hastata, 10.
Herveyi, 51.
heterophylla, 15.
heterophylla aureo-picta, 28.
Hodginsonii, 3.
integra, 40.
lævigata, 51.
latifolia, 4, 41.
latifolia marginata, 24.
laurifolia, 16.
laurifolia longifolia, 20.
lineata, 11.
longifolia, 46.
luteo-variegata, 46.
macropoda, 49.
maderensis, 35.
magnifica, 20.
marginata, 17.
megalophylla, 42.
microphylla, 11, 46.
mollis, 49.
monticola, 49.
Mundyi, 7.
myrtifolia, 12, 44.
nobilis, 7.
opaca, 39.
Othera, 40.
paraguariensis, 43.
paraguensis, 43.
paucispinosa, 38.
pendula, 33.
perado, 35.
Pernyi, 37.
platyphylla, 35.
platyphyllos, 5.
princeps, 6.
pyramidalis, 34.
quercifolia, 39.
recurva, 19.
scotica, 18.
scotica aurea, 29.
serrata, 53.
serratifolia, 13.
Shepherdii, 7.
Sieboldii, 53.
tenuifolia, 52.
tortuosa, 19.
variegata, 35.
Veitchii, 37.
verticillata, 52.
vomitoria, 45.
Wateriana, 30.
Wilsonii, 7.
xanthocarpa, 38, 53.

A. *Foliage evergreen (Nos. 1–47).*

B. *Lvs. with coarse, spiny teeth, rarely entire.*

C. *Fls. in axillary clusters on branches of the previous year.*

D. *Frs. and fls. stalked.*

E. *Shape of lvs. oval or ovate to lanceolate.*

1. **Aquifòlium,** Linn. English Holly. Fig. 1946. Tree, to 40 ft., with short, spreading branches, forming an oblong or pyramidal head, in cult. often shrubby, glabrous: lvs. short-petioled, usually ovate or oblong-ovate, waved and with strong, spiny teeth, shining, 1½–3 in. long: fr. scarlet, globular, shining. May, June. S. and Cent. Eu., W. Asia, China. Gng. 4:83. H.W. 3, p. 51.—A very variable species. A full account of the numerous varieties cult. in England is given by T. Moore in G.C. II. 2, pp. 432, 519, 687, 750, 812; 4, pp. 687, 741; 5, pp. 43, 365, 437, 624; 6, pp. 232, 389, 616, where 153 varieties are described and many of them figured. Some of the most important and most distinct are described below. *Osmanthus Aquifolium,* Sieb. & Zucc., an oleaceous shrub, which may readily be known by its opposite lvs., is occasionally supplied by dealers as a variety of *Ilex Aquifolium.*

1946. Ilex Aquifolium. (×⅓)

(a) *Varieties with foliage green.*

(b) *Lvs. spiny-toothed.*

(c) *Size of lvs. large, about 2–4 in. long.*

2. Var. **alteclarénsis,** Loud. Lvs. oval, large, thin and rather plain, with numerous teeth. G.C. III. 34:322. G.M. 54:321. 3. Var. **Hódginsonii,** Waterer. Lvs. roundish ovate, dark green, 2¾–3¾ in. long, with distant and nearly equal spines. G.C. III. 34:322. 4. Var. **latifòlia,** Loud. Lvs. oval, to 3½ in. long, with rather few, divaricate teeth. G.C. II. 2:433. 5. Var. **platyphýllos,** Goepp. Lvs. broadly ovate, to 3½ in. long, with divaricate spines, thick, deep green. 6. Var. **prínceps,** Moore. Lvs. broadly ovate, to 4½ in. long, with strong, regular spines, dark green, with prominent veins below. G.C. II. 13:45. 7. Var. **Wílsonii,** Hort. Lvs. oval, with numerous well-developed spines in the same plane, dark green, with distinct veins, up to 5 in. long: fr. large. G.C. III. 30:117. Gn. 69:205. In this group belong also, var. *conspícua,* Moore (G.C. II. 13:45); var. *Múndyi,* Hort. (Gn. 65, p. 394); var. *nóbilis,* Lawson (G.C. II. 2:432. Gn. 63, p. 423); var. *Shépherdii,* Waterer (Gn. 65, p. 394).—The varieties of this group are probably mostly hybrids between *I. Aquifolium* and *I. perado.* A geographical variety is 8, var. **chinénsis,** Loes. Lvs. ovate-oblong to oblong-lanceolate, spiny-dentate: fls. smaller. Cent. China.

(cc) *Size of lvs. small, 1–2 in. long.*

9. Var. **handsworthénsis,** Fisher. Lvs. ovate-lanceolate, with numerous, moderately divaricate spines, projected toward the apex, glossy green. G.C. II. 2:519; III. 30:118, 131. 10. Var. **hastàta,** Smith. Lvs. ovate-lanceolate, halbert-shaped; spines large, usually only 2–4 on each side at the base, the upper half usually entire. G.C. II. 2:687. 11. Var. **microphýlla,** Fisher. Lvs. ovate-lanceolate, about 1 in. long, shining green, with small, equal plane spines. G.C. II. 2:751. A very small-lvd. form, but var. **lineàta,** Waterer, is still smaller, and has the smallest lvs. of all. 12. Var. **myrtifòlia,** Waterer. Lvs. ovate-lanceolate, 1–1½ in. long, moderately spiny, rarely entire. G.C. II. 2:687. G.M. 31:652. 13. Var. **serratifòlia,** Loud. Lvs. ovate-lanceolate, stiff, with numerous small spiny teeth. G.C. II. 2:687. 14. Var. **fèrox,** Ait. (*I. echinàta,* Mill.). Lvs. of medium size, with strong teeth and numerous small spines on the upper convex surface. A very distinct variety, known as hedgehog holly.

(bb) *Lvs. all or most of them without spines.*

15. Var. **heterophýlla,** Ait. Lvs. oval or elliptic-ovate, about 2½ in. long, sometimes twisted near the apex, entire or with few spiny teeth. G.C. II. 2:519. 16. Var. **laurifòlia,** Loud. Lvs. ovate to elliptic-lanceolate, 2–3 in. long, usually quite entire. G.C. III. 34:314. Gn. 63, pp. 378, 423, 424. 17. Var. **marginàta,** Loud. Lvs. broadly ovate, sometimes twisted near the apex, with thickened entire margin. G.C. II. 2:813. 18. Var. **scótica,** Hort. Lvs. oval-obovate, blunt and rounded at the apex, rarely pointed, 1½–2 in. long, with thickened, wavy entire margin. G.C. II. 2:813. 19. Var. **recúrva,** Loud. (var. *críspa,* Lawson; var. *tortuòsa,* Waterer). Lvs. oval and spirally twisted, with revolute margin, entire or with few spines, about 2 in. long: of dense habit. G.M. 31:654; 36:764. G.C. II. 2:813. 20. Var. **camelliæfòlia,** Fisher (var. *magnífica,* Hort.; var. *laurifòlia longifòlia,* Hort.). Lvs. elliptic or oblong, acuminate, dark olive-green, very glossy, entire or with a few spines near the apex. G.C. II. 2:813. Gn. 65, p. 220. G.M. 31:783. Gt. 55:1551, 4.

(aa) *Varieties with foliage variegated.*

(b) *Lvs. spiny-toothed.*

21. Var. **álbo-marginàta,** Loud. (var. *argénteo-marginàta,* Hort.; var. *argéntea,* Hort.). Lvs. broadly ovate, to 2½ in. long, with numerous irregular spines, dark green, the disk mottled with grayish green, with rather narrow silvery margin. Gn. 64, p. 301. G.M. 48:84. 22. Var. **álbo-pícta,** Loud. (var. *argénteo-mèdio-pícta,* Hort.). Lvs. ovate, with divaricate spines, dark green, with a whitish center and a narrow, irregular, silvery margin. G.C. II. 4:687. 23. Var. **aùreo-maculàta,** Hort. Lvs. oblong-oval, 2½ in. long, with distant triangular, somewhat divaricate spines, with a large creamy-white blotch in the center, outer part of the margin dark green, inner part mottled pale gray. G.M. 31:654. 24. Var. **aùreo-regìna,** Hort. (var. *aùrea-marginàta* and var. *latifòlia marginàta,* Hort.). Lvs. broadly ovate, to 3 in. long, with strongly divaricate spines, mottled with gray and green, with a broad, continuous golden yellow margin. G.C. II. 5:44. G.M. 54:322. 25. Var. **aùreo-pícta latifòlia,** Hort. Lvs. ovate or broadly ovate, 2 in. or more long, with a large, branching, deep yellow blotch in the middle, and with an irregular, deep glossy green margin. G.C. II. 5:624. 26. Var. **fèrox argéntea,** Loud. Like var. *ferox,* but the margin and the surface spines creamy white. G.C. II. 5:44. 27. Var. **fèrox aùrea,** Loud., is like the former, but with yellow spines and margin. G. C. II. 6:616.

(bb) *Lvs. spineless or mostly so.*

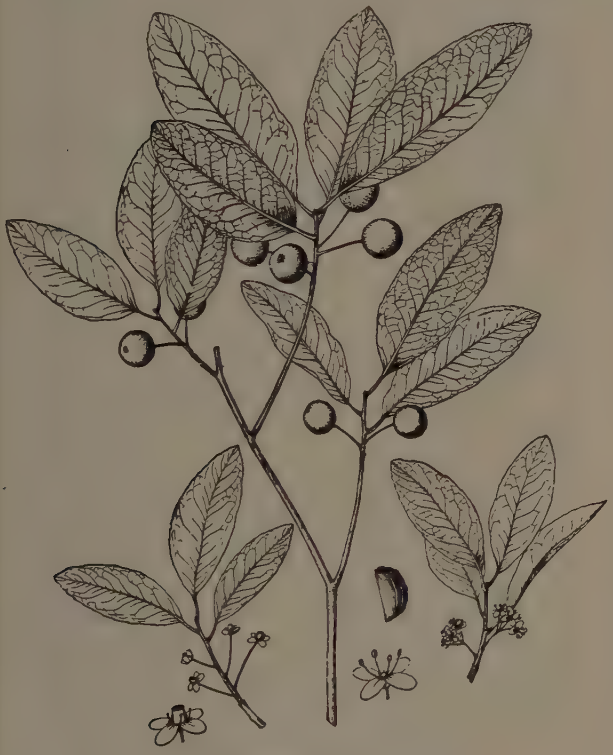
28. Var. **heterophýlla aùreo-pícta,** Hort. Lvs. ovate, flat, sometimes with few spines, about 2½ in. long, marked in the middle with a broad feathery blotch of bright yellow. G.C. II. 6:389. 29. Var. **scótica aùrea,** Hort. Lvs. obovate, blunt, slightly wavy, about 1½in. long, dark, mottled green, with a broad golden margin: of dwarf habit. 30. Var. **Wateriàna,** Hort. Lvs. oblong or ovate, with a few spines, or entire and plain and obtuse, about 2 in. long, mottled with gray and yellowish green and edged with a broad, irregular golden band. G.C. II. 6:233.

1947. Ilex opaca. (×⅓)

There are also some other varieties in cultivation, as 31, var. **frùctu lùteo,** Lawson, with yellow, and 32, var. **frùctu aurantìaco,** Paul, with orange berries; 33, var. **péndula,** Waterer, with pendulous branches (Gn.

62, p. 129. G.M. 48:81); and 34, var. **pyramidàlis,** Hort., with ascending branches, forming a narrow, oblong head.

35. **peràdo,** Ait. (*I. maderénsis,* Lam.). Shrub or tree, to 20 ft.: lvs. ovate, obovate or oval to oblong-lanceolate, spiny-dentate, or dentate-serrate with short spines, sometimes entire, spiny-pointed, or sometimes obtuse or even emarginate, glossy above, reticulate below, 2–4 or sometimes to 6 in. long, the blade decurrent into the margined petiole deeply channelled above: fr. dark red or nearly black, ½in. across. Madera, Canary Isls., and Azores. L.B.C. 6:549. B.M. 4079. G.C. III. 34:317. Gn. 69:205. G.M. 48:150. Var. **platyphýlla,** Loes. (*I. platyphýlla,* Webb. & Berth.). Lvs. ovate, rarely oblong, 4–8 in. long, in the staminate plant smaller, entire or spiny dentate-serrate with irregular short teeth. Var. **variegàta,** Hort. (*I. maderénsis variegàta,* Hort.). Lvs. 2½–3 in. long, with rather evenly arranged spiny teeth, with a golden blotch mixed with pale green in the center.



1948. Ilex Amelanchier (×½). No. 50.

EE. *Shape of lvs. quadrangular-oblong, 3-pointed at the apex.*

36. **cornùta,** Lindl. Shrubby, with short spreading branches, glabrous: lvs. quadrangular-oblong, with 3 strong spines of nearly equal size at the dilated apex, and with 1–2 strong spines on each side of the truncate base, but rounded and spineless at the base on older plants, dark glossy green above, 1½–3 in. long: fr. scarlet, clustered, short-pedicelled. June, July. N. China. G.C. 1850:311. F.S. 7, p. 216; 9:895. B.M. 5059. I.H. 1:10.

DD. *Frs. and fls. sessile or nearly so.*

37. **Pérnyi,** Franch. Shrub, to 10 ft.: branchlets densely and minutely pubescent: lvs. crowded, short-petioled, rhombic- or quadrangular-ovate, with 1–3 rigid spines on each side, the upper pair the largest, but shorter than the terminal spiny point, dark green and lustrous above, ¾–1 in. long: fls. in dense sessile clusters: fr. bright red, about ⅓in. across. May; fr. in Aug. Cent. China. H.I. 16:1539. G.C. III. 45:75. J.H.S. 34:220 (fig. 110). G.M. 51:714. R.B. 35:24. M.D.G. 1909:145.—A handsome evergreen of very compact habit. Var. **Veìtchii,** Rehd. (*I. Veìtchii,* Veitch). Lvs. truncate at the base, larger, 1½–2 in. long, with 4–5 rigid spines on each side.

38. **dipyrèna,** Wall. Tree, to 40 ft.: branchlets glabrous: lvs. short-petioled, elliptic-ovate to ovate-oblong, broadly cuneate or nearly rounded at the base, short and spiny-acuminate, remotely spiny-serrate with flat, not wavy margin, rarely entire, dark green and lustrous above, pale below, 2–4 in. long; petiole about ⅙in. long: fls. in axillary dense clusters, nearly sessile: fr. ovoid, red, lustrous, nearly ⅓in. long, with usually 2 stones. Himalayas. G.M. 54:339. Var. **paucispinòsa,** Loes. Lvs. oval to ovate-oblong, with 3–5 spreading strong spines on each side. Cent. China.

CC. *Fls. in 1- to few-fld. axillary, solitary cymes, on this year's growth.*

39. **opàca,** Ait. (*I. quercifòlia,* Meerb.). American Holly. Fig. 1947. Tree, with spreading short branches, sometimes to 50 ft., forming a narrow, pyramidal head, glabrous: lvs. oval or elliptic-lanceolate, with large remote spiny teeth, rarely entire, dull green above, yellowish green beneath, 2–4 in. long: fr. dull scarlet, usually solitary, globose. June. Mass. to Fla., west to Mo. and Texas. Em. 385. S.S. 1:45. Gng. 4:276, 277. F.E. 16:444, pl. 63; 20:402, pl. 14. Gn.M. 2:19; 4:237. V. 3:86; 12:79, 80.—Hardier than *I. Aquifolium,* but less handsome. Var. **xanthocárpa,** Rehd. Frs. yellow.

BB. *Lvs. serrate, crenate or entire.*

C. *Fr. red or yellow; nutlet ribbed on the back. Tender.*

D. *Margin of lvs. entire.*

40. **ìntegra,** Thunb. (*Othèra japónica,* Thunb. *Ilex Othèra,* Spreng.). Evergreen shrub or tree, to 40 ft., glabrous: lvs. slender-petioled, oval to elliptic-oblong or oblong-obovate, rarely oblanceolate, narrowed at the base, at the apex contracted into a short obtuse point, entire, very rarely with a few teeth, indistinctly veined, 2–3½ in. long; petiole ⅓–¾in. long: fls. on stalks ⅕–⅓in. long, in axillary fascicles on branches of the previous year: fr. red, globose or ovoid, ⅓–½in. long. Feb.–April; fr. in Aug.–Oct. Japan. S.I.F. 1:60. —Variable in the size and shape of the lvs. and in the length of the pedicels; one of the forms is cult. in the S. as *Othera japonica.*

DD. *Margin of lvs. crenate or serrate.*

E. *Lvs. longer than 3 in.*

F. *Apex of lvs. acuminate or acute.*

41. **latifòlia,** Thunb. Tree, sometimes to 60 ft., glabrous: lvs. oval to oblong-lanceolate or obovate-oblong, acuminate, serrate, glossy green above, 3–7 in. long; petiole about ½in. long: fr. red, ⅓in. across, short-stalked, in dense clusters. June. Japan. B.M. 5597. S.I.F. 1:62.—One of the most beautiful hollies.

42. **Fárgesii,** Franch. Shrub, to 15 ft., glabrous: lvs. oblong-lanceolate to oblanceolate, narrowly cuneate at the base, long-acuminate, denticulate-serrate usually only above the middle, dull green above, 3–5 in. long; petiole slender, about ½in. long: fls. short-stalked in dense axillary clusters on branchlets of the previous year: berries red, ¼–⅓in. across, on stalks about ¼in. long. May, June: fr. in Sept. Cent. China. Var. **megalophýlla,** Loes. Lvs. to 6 in. long and 1½ in. broad.

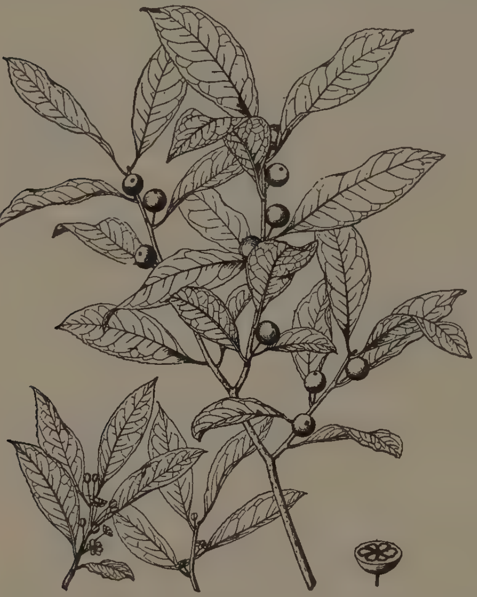
FF. *Apex of lvs. obtuse.*

43. **paraguariénsis,** St. Hil. (*I. paraguénsis,* Don). Shrub or small tree, to 20 ft.: branchlets glabrous or puberulous: lvs. obovate to obovate-oblong

or elliptic-oblong, narrowed at the base, obtuse or short and obtusely acuminate, crenate-serrate, glabrous or pubescent below, 3–5, rarely to 10 in. long: fls. axillary, fascicled or in stalked cymes: fr. globose or ovoid, ⅕–¼in. across, red or reddish brown. Brazil. B.M. 3992. J.F. 3, p. 69.

EE. *Lvs. shorter than 3 in.*

44. **Cassìne,** Linn. (*I. Dahoòn,* Walt.). DAHOON. Shrub or small tree, to 30 ft.: lvs. obovate to oblong-linear, acute or obtuse and mucronulate, entire or sharply serrate above the middle, usually pubescent beneath when young, 2–3 in. long: fr. globose, small, dull red, rarely yellow, on this year's growth. April, May. N. C. to Fla., west to La. S.S. 1:46. Var. **angustifòlia,** Ait. Lvs. linear-oblong to linear, 2–3 in. long. Var. **myrtifòlia,** Chapm. Lvs. linear-oblong, 1–2 in. long: fr. usually solitary. S.S. 1:45.—Cassine or cassena is the name in the language of the Timucua Indians for an exhilarating beverage prepared from the lvs. of the following plant which had been confused with this species; the name seems to have been borrowed from the Muscogee word *ássi,* leaves, modified by a prefix.



1949. Ilex lævigata (×½). No. 51.

45. **vomitòria,** Ait. (*I. Cassìne,* Walt., not Linn. *I. caroliniàna,* Loes.). CASSENA. YAUPON. Shrub, rarely tree, to 25 ft., with spreading branches: lvs. oval or oblong, obtuse, crenate, glabrous, ½–1, rarely to 2 in. long: fls. clustered on branches of the previous year: fr. scarlet, globose, small. April. Va. to Fla., west to Ark. and Texas. S.S. 1:48. C.L.A. 13:498.

CC. *Fr. black; nutlets smooth: pistillate fls. usually solitary, on this year's growth.*

46. **crenàta,** Thunb. (*I. Fórtunei,* Hort.). Much-branched shrub, rarely small tree to 20 ft.: lvs. oval, obovate or oblong-lanceolate, crenately serrate, glabrous, ½–1½ in. long: fls. 4-merous: fr. ¼in. across, solitary, short-stalked. May, June; fr. in Oct. Japan. Gng. 6:165. F.E. 30:1161. G.M. 46:208. Gn. 64, p. 413. Gn.M. 4:237. Var. **microphýlla,** Maxim. Lvs. ⅓–½in. long, elliptic or elliptic-oblong. This variety is somewhat hardier than the type. Var. **longifòlia,** Hort. Lvs. elliptic-oblong to lanceolate. Var. **lùteo-variegàta,** Regel (var. *aùreo-variegàta,* Hort.). Lvs. spotted yellow, obovate. M.D.G. 1913:53.

47. **glàbra,** Gray (*Prìnos glàber,* Linn.). INKBERRY. WINTERBERRY. Much-branched upright shrub, to 8 ft.: lvs. obovate to oblanceolate, obtuse, with few obtuse teeth toward the apex, glabrous, 1–2 in. long: fls. 5–8-merous. June. Mass. to Fla., west to Miss. L.B.C. 5:450.

AA. *Foliage deciduous: fr. red.* (*Prinos.*)

B. *Frs. mostly and lvs. partly fascicled on short spurs: nutlets ribbed on the back.*

48. **decídua,** Walt. (*Prìnos decíduus,* DC.). Shrub or small tree, to 30 ft., with light gray, spreading branches: lvs. cuneate-oblong or obovate, usually obtuse, crenately serrate, dark green, and with impressed veins above, pale and pubescent beneath, 1½–3 in. long: fr. globose, orange or orange-scarlet, ⅓in. across. May. Va. to Fla., west to Texas. S.S. 1:49. G.C. II. 14:689.

49. **montícola,** Gray (*I. dùbia,* Brit. Stern. & Pogg.). Tree, to 40 ft., with slender branches, forming a narrow pyramidal head or spreading shrub: lvs. oval or oval-lanceolate, acute or acuminate, sharply serrate, pubescent only along the veins beneath, 2–6 in. long: fr. red, globular-ovoid, over ⅓ in. across. May. N. Y. to S. C., west to Ala. S.S. 1:50. Var. **móllis,** Brit. (*I. móllis,* Gray). Lvs. broadly ovate, soft-pubescent when young, glabrous above at length. Var. **macrópoda,** Rehd. (*I. dùbia* var. *macrópoda,* Loes. *I. macrópoda,* Miq.). Lvs. ovate or oval, pubescent below. Japan, Cent. China. S.I.F. 1:59.

BB. *Frs. and lvs. not fascicled: frs. axillary.*

C. *Stalks of fr. ⅓in. long, nutlets ribbed on back.*

50. **Amelánchier,** Curtis. Fig. 1948. Deciduous shrub to 6 ft.: lvs. oblong, subacute, serrate, pubescent, 1½–3 in. long: staminate fls. several on a common peduncle: fr. dull red, large; nutlets strongly 3-ribbed on back. Va. to La. G.F. 2:41 (adapted in Fig. 1948).—Hardy.

CC. *Stalks of fr. ¼in. or shorter; nutlets smooth.*

D. *Fls. 6–9-merous.*

51. **lævigàta,** Gray (*Prìnos lævigàtus,* Pursh). WINTERBERRY. Fig. 1949. Low shrub, of upright habit: lvs. lanceolate, acute, finely or crenately serrate, rather thick, glabrous or nearly so, 1½–2½ in. long, turning clear yellow in fall: staminate fls. on long and slender stalks: fr. depressed-globose, bright orange-red, over ¼in. across. May, June; fr. in Sept. Maine to Pa. and Va. G.F. 4:221 (adapted in Fig. 1949). Gt. 55:1551, 3. Var. **Hérveyi,** Rob. Frs. bright yellow.

52. **verticillàta,** Gray (*Prìnos verticillàtus,* Linn.). BLACK ALDER. WINTERBERRY. Fig. 1950. Shrub, with spreading branches: lvs. obovate to oblanceolate or lanceolate, acuminate or acute, serrate or doubly serrate, usually pubescent beneath, 1½–3 in. long, turning black after frost: all fls. short-stalked: fr. bright red, about ¼in. across. June, July: fr. in Oct. Canada to Fla., west to Wis. and Mo. Em. 388. F.E. 24:779. Var. **tenuifòlia,** Torr. (*I. bronxénsis,* Brit.). Lvs. obovate, glabrous or pubescent, thin: fls. and frs. larger. B.B. (ed. 2) 3:489. Var. **chrysocàrpa,** Rob. Frs. bright yellow. Also *I. fastigiàta,* Bicknell, from Nantucket, differing in its fastigiate habit and in the narrower lanceolate or oblong-lanceolate lvs., is probably only a variety of this species.—Very variable in shape and texture of lvs. One of the best hardy shrubs with ornamental frs. remaining on the branches until midwinter, and are rarely eaten by birds.

DD. *Fls. 4–5-merous.*

53. **serràta,** Thunb. (*I. Siebóldii,* Miq.). Slender shrub, to 15 ft., similar to the former but smaller in every part: lvs. elliptic or ovate, acute or acuminate, finely serrate, pubescent beneath, 1–2 in. long: fls. 4–5-merous: fr. bright red, small ⅙–⅕in. across. June;

fr. in Oct. Japan. S.T.S. 1:15. S.I.F. 1:61. Var. **argùtidens,** Rehd. (*I. argùtidens*, Miq.). Lvs. glabrous beneath, short-petioled, teeth more remote and less fine: fls. usually 4-merous. Var. **xanthocárpa,** Hort. Frs. yellow.

I. ambígua, Chapm. Deciduous large shrub, allied to I. monticola. Lvs. usually almost glabrous, remotely serrate, 1–2 in. long. N. C. to Fla., west to Ark. and Texas.—*I. Brandegeeàna*, Loes. Evergreen tree to 40 ft.: branchlets pubescent: lvs. elliptic-lanceolate, remotely serrate or almost entire, pubescent, 2–3½ in. long: fls. 5-merous. Low. Calif. G.F. 7:416 (by error named I. californica.)—*I. califórnica*, Brandegee. Evergreen large shrub, to 12 ft., glabrous: lvs. elliptic to oblong-elliptic, obtuse, remotely and crenately serrulate, 2–5 in. long: fr. black, small. Low. Calif. G.F. 7:415 (by error named I. triflora).—*I. canariénsis*, Poir. Evergreen tree, to 20 ft., glabrous: lvs. ovate to ovate-oblong, obtuse, entire, 2–4 in. long: fr. usually solitary, on this year's growth. Canaries.—*I. conocárpa*, Reiss. Evergreen shrub, to 6 ft.: lvs. oblong-lanceolate, acuminate, serrulate, glabrous, 3–5 in. long: fls. in short, dense spikes: fr. ovoid-conic. Brazil. B.M. 7310.—*I. corállina*, Franch. Evergreen shrub: lvs. ovate-oblong, acuminate, spiny-serrate or nearly crenate-serrate, 2–3 in. long: frs. small, red, nearly sessile, in dense clusters. W. China.—*I. coriàcea*, Chapm. (I. lucida, Torr. & Gray). Allied to I. glabra, but taller: lvs. broader and longer, to 3 in., acute or acuminate. N. C. to Fla., west to La.—*I. Franchetiàna*, Loes. Evergreen shrub, to 12 ft., glabrous: lvs. elliptic-obovate to lanceolate-oblong or oblanceolate, acuminate, denticulate, 2½–4 in. long: fr. bright red on short stalks, in dense clusters. W. China. — *I. geniculàta*, Maxim. Deciduous shrub, glabrous: lvs. ovate to elliptic-ovate, acuminate, sharply serrate, 1½–2 in. long: fr. scarlet, solitary, drooping on filiform peduncles ¾–1½ in. long. Japan. Very graceful shrub; has proved hardy at the Arnold Arboretum.—*I. gongónha*, Mart.=Villaresia mucronata. — *I. insígnis*, Hook. f. Evergreen small tree: lvs. elliptic-lanceolate, 6–9 in. long, spiny-toothed, often almost entire on older plants: fr. large, globose. Himalayas. G. C. II. 14:297. G. M. 31:475.—*I. lóngipes*, Chapm. Deciduous shrub, allied to I. decidua: lvs. elliptic-lanceolate, crenately serrate, almost glabrous: fr. globose, slender-pedicelled. N. C. to Ga., west to La. G. F. 3:345.—*I. macrocárpa*, Oliver. Deciduous tree, to 30 ft., glabrous: lvs. elliptic or elliptic-ovate to oblong-lanceolate, finely serrate, 3–4½ in. long: frs. black, solitary, ½–¾in. across, on peduncles ½–1¼ in. long. Cent. China. H. I. 18:1787.—*I. microcárpa*, Lindl.=I. rotunda, Thunb.—*I. Óldhamii*, Miq.=I. purpurea, Thunb.—*I. pedunculòsa*, Miq. Evergreen small tree, glabrous: lvs. slender-petioled, elliptic-ovate to ovate-oblong, abruptly short-acuminate, entire or sparingly serrulate, 1½–3 in. long: fr. red, usually solitary on slender pedicels 1½–2 in. long. Japan. S. I. F. 1:61. Var. *continentàlis*, Loes. Lvs. generally larger, thicker: sepals ciliate. Cent. China.—*I. purpùrea*, Thunb. (I. Oldhamii, Miq.). Evergreen tree, glabrous: lvs. elliptic-ovate to oblong-lanceolate, crenate-serrulate, 2–3 in. long.: fr. red, ⅓in. across, pedicelled, usually 2–5 on a common peduncle about ⅓in. long. Japan, Cent. China. S. I. F. 1:62.—*I. rotúnda*, Thunb. (I. microcarpa, Lindl.). Evergreen shrub or tree, to 40 ft.: lvs. oblong or elliptic, acute, pointed, quite entire: fr. small, red, in peduncled clusters. Japan. G. C. 1850:311. F.S. 7, p. 216. S. I. F. 1:60.—*I. rugòsa*, F. Schmidt. Evergreen low spreading shrub, sometimes prostrate, glabrous: lvs. oblong-lanceolate to lanceolate, remotely crenate-serrate, rugose above, ¾–2 in. long: fr. usually solitary, scarlet. Japan, Saghalin. — *I. szechwanénsis*, Loes. Evergreen shrub, to 12 ft., glabrous: lvs. short-petioled, ovate- to elliptic-oblong, serrulate, 1–2½ in. long.: fr. black, solitary, on stalks about ¼in. long. Cent. China.—*I. triflòra*, Brandegee=I. Brandegeeana. —*I. yunnanénsis*, Franch. Evergreen shrub, to 10 ft.: branchlets villous: lvs. short-stalked, ovate to ovate-oblong, crenate-serrate or serrulate, pubescent below, at least on the midrib, ¾–1½ in. long: fr. red, solitary, stalked. W. China.

ALFRED REHDER.

ILLÍCIUM (Latin for *allurement;* probably in reference to the agreeable odor). *Magnoliàceæ.* Small trees or shrubs, one of which is sometimes planted far South.

Aromatic glabrous plants, with thick short-petioled entire evergreen lvs.: fls. perfect, small, solitary or in 3's in the axils of lvs. or bud-scales, nodding or inclined, yellow or purplish; sepals 3–6; petals many, imbricated in 3 or more rows or series; stamens 10 to many, with thick filaments: carpels usually many, forming a ring of almost woody pods.—Species about a score, mostly oriental (India, China, Philippines), and 2 in the S. U. S.

One of the illiciums furnishes the star or Chinese anise, which is the small star-shaped cluster of fruits. The odor and flavor strongly resemble anise. It is much used in oriental countries in cookery, and is exported to some extent and is said to be used in flavoring certain French wines. This product comes from China. It has been supposed to be the product of *I. anisatum* of Linnæus, but that plant is a Japanese tree and it contains a poison. In the American trade are the names *I. anisatum* and *I. religiosum.* It now transpires that these names belong to the same plant, and that the star anise is produced by another species. This other species, or the true star anise, was first accurately described and figured (as *I. verum*, Hook. f.) in B.M. 7005 (1888), where the confusion of two or three centuries is elucidated. There is probably only one east Asian illicium in the trade in North America, as follows:

anisàtum, Linn. (*I. religiòsum*, Sieb. & Zucc.). Small tree: lvs. alternate, elliptic, short-petioled, somewhat acuminate: fls. mostly solitary, sessile or nearly so, yellowish, not fragrant, with many very narrow petals, and 20–30 stamens. Japan. B.M. 3965.—Grown far S. About as hardy as camellia. There is a form with variegated lvs.

1950. Ilex verticillata (×½). No. 52.

Two native illiciums growing in the S. are: *I. floridànum*, Ellis. Shrub, 6–10 ft.: lvs. oblong-lanceolate, 4-in. or more long: petals 20–30, very narrow, dark crimson or purple. Fla. to La. B.M. 439. Gn. 36, p. 151. J.H. III. 30:365; 52:168. H.U. 5, p. 136.—*I. parviflòrum*, Michx. Lvs. elliptic or lanceolate, mostly under 4 in. long: petals very small (¼in. long), 6–12, yellowish: less tall. Ga. and Fla.—A species appearing in European horticultural literature in recent years is *I. laurifòlium*, Hort. It is described as a handsome evergreen shrub: lvs. short-stalked, oval, acute: fls. yellowish white, in many-fld. terminal cymes. Of uncertain origin. R.H. 1901, p. 17.—*I. vèrum*, Hook, f. The true star anise: 9 ft.: lvs. elliptic to oblanceolate: fls. red, globose, the petals about 10. China.

L. H. B.

IMANTOPHÝLLUM: *Clivia.*

IMBRICÀRIA: *Mimusops.*

IMMORTELLES: *Everlastings.*

IMPÀTIENS (from the Latin; having reference to the pods, which, when ripe, on slight pressure burst open, scattering the seed). *Balsaminàceæ.* TOUCH-ME-NOT. Flower-garden and greenhouse subjects, grown for the odd and ornamental blossoms.

Tender, succulent annual or perennial herbs, often with very fleshy sts. and simple lvs. usually alternate (sometimes opposite) and the upper ones often in whorls: peduncles axillary, with 1–6 or more very irregular fls. of various colors; sepals 3 (seldom 5), the posterior one taking on a spur-like shape, the 2 lateral ones short, green; petals 2 or 3, the one at the back commonly very broad and erect, sometimes keeled or winged, the lateral ones more or less 2-lobed or auricled; stamens 5, the filaments appendaged and the scales connivent over the stigma: fr. a 5-valved pod, which, when ripe, bursts when pinched, scattering the seeds.—Species probably 500, widely distributed about the world, largely in mountainous regions in warm-temperate and tropical countries. The genus has been greatly enlarged in recent years, with explorations in Afr. and other regions. It abounds in species that will probably have horticultural value, although relatively few are now in cult. outside botanical collections. The garden balsam (*I. Balsamina*) is a general favorite in the annual flower-garden. *I. Sultani* is common in greenhouses, and latterly *I. Holstii*, *I. Oliveri*, and a few others are sometimes seen. This beautiful genus has not been much developed horticulturally. Great numbers of species, hybrids and interesting forms may be expected to appear in cult. in the future. The genus has immense possibilities for productive horticultural work. The common touch-me-not of Great Britain and other parts of Eu. is *I. Noli-tangere* (sometimes written *I. Noli-me-tangere*), an erect smooth branching annual, 2 ft. or less high, with large showy yellow fls. spotted with orange, on slender axillary peduncles. It has been reported as an escape in N. Amer. The N. American *I. biflora* is naturalized in England.

The cultivation of impatiens is mostly simple and easy. The seeds are large and germinate readily (see *Balsam*). The indoor species grow well and readily from either cuttings or seeds. Some of them also do well when grown as tender annuals in the open ground, although likely to suffer in dry weather and to bleach in bright sun. The remarks under *I. Oliveri*, *I. Sultani*, *I. Holstii*, *I. Hawkeri*, *I. platypetala*, *I. flaccida*, and *I. Hookeriana* indicate the treatment for the greenhouse kinds.

1951. Impatiens pallida.—One of the native jewel-weeds. (×½)

INDEX.

alba, 12, 13.
arcuata, 3.
aurea, 2.
Balfourii, 15.
Balsamina, 3.
biflora, 1.
biglandulosa, 13.
candida, 14.
coccinea, 3.
Episcopi, 7.
flaccida, 12.
fulva, 1.
glanduligera, 14.
grandiflora, 5.
Hawkeri, 10.
Holstii, 8.
Hookeriana, 13.
hortensis, 3.
latifolia, 12.
Liegnitzia, 8.
macrantha, 3.
macrochila, 14.
micrantha, 3.
moschata, 14.
Nortonii, 1.
Oliveri, 6.
oppositifolia, 4.
pallida, 2.
Petersiana, 9.
platypetala, 11.
pulcherrima, 11.
rosea, 3.
Roylei, 14.
Sultani, 7.
vulgaris, 3.

A. *Species of the U. S. and Canada, seldom grown in wild gardens, and frequently found about the borders of damp cult. grounds.*

1. **biflòra**, Walt. (*I. fúlva*, Nutt.). SPOTTED TOUCH-ME-NOT. JEWEL-WEED. Annual, with orange-colored fls. much spotted with reddish brown. spur strongly inflexed, about half as long as posterior sepal: lvs. ovate or oval, petioled and coarsely toothed: usually 2–3 ft. Moist, shady places. July–Oct. Nova Scotia to Alaska, Ore., Mo. and Fla.—Has been offered by dealers in native plants. **I. Nórtonii**, Rydb., of W. Mo. and Kans., differs from *I. biflora* in having larger and relatively longer and narrower saccate sepal which tapers gradually into a shorter spur.

2. **pállida**, Nutt. (*I. aùrea*, S. Wats.). PALE TOUCH-ME-NOT. JEWEL-WEED. Fig. 1951. With *I. biflora* the representatives of the family in the indigenous flora of the U. S. Larger than *I. biflora;* otherwise similar to it, with pale yellow fls. sparingly dotted with brownish red; spur short, notched, and less than one-third the length of the posterior sepal. Moist, shady places. July–Sept. Que. to Ore., Kans. and Ga.—Annual. Perhaps procurable from dealers in native plants.

AA. *Species of familiar flower-gardens: annuals.*

3. **Balsámina**, Linn. GARDEN BALSAM. Figs. 450–453, Vol. I. Annual, erect and branching, pubescent or nearly glabrous: lvs. either narrowly or broadly lanceolate and acuminate, deeply serrate, the petiole glandular: fls. large, rose-colored; standard orbicular and retuse; wings or side petals very broad, with the lateral lobe rounded and the terminal sessile and large; lip small and cone-like; spur variable, incurved: caps. large, tomentose. Trop. and Subtrop. India, Malaya, China.—Very variable in its wide range. Hooker recognizes 6 wild botanical varieties: Var. *vulgàris*, Hook. f. (*Balsámina horténsis*, DC.). Tall: lvs. broadly lanceolate: fls. large, with short spur. Var. *coccínea*, Hook. f. (*Balsámina coccínea*, DC.). Lvs. narrow-lanceolate: fls. of medium size, the spur long and slender. B.M. 1256. Var. *arcuàta*, Hook. f. Diffusely branched: lvs. small and narrow: fls. small, the spur long, slender and arcuate. Var. *macrántha*, Hook. f. Four inches high: lvs. ovate-lanceolate: fls. large, with short spur. Var. *micrántha*, Hook. f. Small, simple: lvs. small, ovate-lanceolate: fls. small, with long and slender spur. Var. *ròsea*, Hook. f. (*I. ròsea*, Lindl.). Tall: lvs. linear-lanceolate: fls. rather small, with lip saccate and spur short and incurved. B.R. 27:27.—*I. Balsamina* now runs into many forms, through long cult. and breeding. See *Balsam.*

AAA. *Species of many countries, mostly of indoor cult., but sometimes grown in the open.*

B. *Lvs. linear: annual.*

4. **oppositifòlia**, Linn. Annual of free-branching habit, very floriferous, erect: lvs. long-narrow-linear, mostly nearly sessile, remotely serrate: fls. about 1 in. diam., rosy red, purplish or pink, on glabrous pedicels; sepals linear, acuminate; wings with broad-obovate terminal lobe and small lateral lobe; lip conical, produced into a short and stout incurved spur. India. G.C. III. 42:102. G.M. 51:321.

BB. *Lvs. ovate to lanceolate: probably all perennial.*

C. *Peduncles axillary, 1-fld. or sometimes 2-fld.*

D. *Spur of fl. much enlarged or swollen at base.*

5. **grandiflòra,** Hemsl. Stout, branching, glabrous: lvs. alternate, stalked, 3–6 in. long, ovate-lanceolate and sinuate-crenate, puckered or blistered above between the nerves, glandular on lower part of blade and on petiole: fls. solitary, to 3 in. across, bright rose-red with crimson stripes on the wing-lobes; sepals 2, green, orbicular-ovate; standard orbicular, erect, short-spurred below the tip; lip 1¾ in. long, swollen, white netted with purple, abruptly narrowed into an incurved spur 1 in. or more long; wings very large, the terminal lobe obovate and the basal orbicular. Madagascar. B.M. 7826. G.C. III. 29:111.

1952. Impatiens Sultani. (×½)

6. **Óliveri,** Wright. Glabrous, reaching 4–8 ft., erect, the sts. pale green: lvs. 4–8 at a node, oblanceolate, acute or acuminate, to 8 in. long, dentate-ciliate: fls. 2¼ in. across, pale lilac or rose-colored, almost white beneath, on 1-fld. peduncles about 2½ in. long; lateral sepals ovate and acuminate, much shorter than the petals; lip ovate, funnel-shaped, with abrupt reflexed mucro; spur 1¾ in. long, curved, slender; standard nearly orbicular, recurved and apiculate at apex; wings deeply 2-lobed, the terminal lobe obovate and the lateral obcordate: fr. oblong. Trop. E. Afr., 6,000–8,000 ft. altitude. B.M. 7960. G.C. III. 40:292. Gn. 66, p. 266. G. 27:288, 405. G.W. 11, p. 1. R.H. 1908:180. A.F. 29:155. Gng. 16:3.—An excellent greenhouse subject and also useful in the open border. It makes a very showy plant when given cool greenhouse treatment, producing a bush 10 ft. through. Prop. readily either by seeds or cuttings, the former being produced freely.

DD. *Spur very slender throughout.*

7. **Sultáni,** Hook. f. Fig. 1952. From 12–24 in. high, with stout st. and branches, rather succulent and green, glabrous: lvs. elliptical or lanceolate and narrowed into a petiole about 1 in. long; lower lvs. alternate, upper ones almost whorled: peduncles axillary; fls. rich scarlet in the original form; petals flat; standard obovate-orbicular and retuse; lip less than half length of petals, suddenly narrowed into a slender upwardly curved long spur. Hybrids and sports have given shades from pink to almost purple, and a white variety also exists. spur is very long and thin. Zanzibar. B.M. 6643. Gn. 23, p. 331. G. 14:283. V. 7:325, 326. S.H. 2:280. I.H. 30:488; 42, p. 140. R.H. 1884:12.—Increased by seeds; also by cuttings, which root readily. A greenhouse plant; it also does well as a house plant, blooming almost continuously. Var. **Epíscopi,** Hort. A perpetual flowering variety with purple-carmine fls. marked brilliant rose.—*I. Sultani* was named by Hooker "in honor of that distinguished potentate, the Sultan of Zanzibar, to whose enlightened and philanthropic rule eastern Africa owes so much." See No. 13.

8. **Hòlstii,** Engler & Warb. Very like *I. Sultani.* Fleshy herb or subshrub, nearly glabrous, 2–3 ft.: the branches striped red: lvs. alternate, long-petioled, oval or ovate to lanceolate, acute, crenate and with a bristle between the teeth: fls. 1 or sometimes 2 on the peduncle, pure scarlet, 1¾ in. across, flat; sepals 3, the lateral small and scale-like; spur slender, 1½ in. long; standard broadly obcordate; lateral petals deeply divided into 2 obovate-spatulate lobes. E. Trop. Afr., 2,500–5,000 ft. B.M. 8029. G.C. III. 38:14. Gn. 72, p. 337; 74, p. 17. G.M. 48:413; 56:46. J.H. III. 51:65. R.H. 1906:136. G.W. 15, p. 356 (as var. *nana amabilis*).—Of better constitution under cult. than *I. Sultani,* having quicker and more vigorous growth, and larger and brighter fls. It is useful either as a pot-plant indoors or for growing in the open; for the latter purpose, seeds may be started early in spring and plants will bloom from early summer till frost. Var. **Liegnítzia,** Grign., is a compact condensed form, with color more clear and brilliant than the type, blooming freely throughout the year; excellent for pot cult. R.H. 1909, p. 279.

9. **Petersiàna,** Rehd. Very like *I. Holstii,* but all the parts red or bronzy rather than green, sts. pubescent, petioles longer: lvs. longer and elliptic rather than oval, peduncles and pedicels longer, fls. carmine-red rather than scarlet and the petals entire, caps. small and purple. W. Trop. Afr. M.D.G. 1905:390 (descr.) R.H. 1910:452.

1953. Impatiens flaccida. (×¼)

10. **Háwkeri,** Bull. A bushy, soft-wooded plant, 2 ft. or less high, with well-branched sts. of a dull red color; lvs. opposite or in whorls of 3, ovate, acuminate, serrate, dark green, pale beneath: peduncles axillary, long and slender; fls. rounded in outline, about 3 in. diam., deep carmine, with a white eye; standard round-obovate, retuse; spur to nearly 3 in. long, slender and slightly curved. South Sea Isls. Intro. about 1886. B.M. 8247. G.C. II. 25:761. I.H. 34:2. Gn.W. 5:213. G.W. 14, p. 126. G.Z. 31, p. 122.—A greenhouse plant, needing an intermediate temperature. Plants from early spring cuttings bloom all summer and into autumn.

11. **platypétala,** Lindl. (*I. pulchérrima,* Dalzell). Sts. strong, succulent, branched and usually reddish purple: lvs. whorled, lanceolate or oval, serrate, hairy beneath: peduncles axillary, shorter than the lvs.; fls. large, rose-colored; spur sickle-shaped, rather thin and petals transversely obcordate. Summer. Java. R.H. 1847:221. B.R. 32:68.—Needs a moderate to warm temperature and may be used as a house-plant or in protected and warm situations outdoors. Prop. by cuttings, and during growth should be treated like gloxinias. Var. Lucie or Lucy belongs here.

12. **fláccida,** Arn. (*I. latifòlia,* Hook., not Linn.). Fig. 1953. Slender but erect, somewhat branched, glabrous, 6–18 in.: lvs. stalked, ovate or lanceolate, crenate, 2–5 in. long, the petiole with or without glands: fls. rose-purple, 1½ in. or less in diam., mostly solitary; sepals ovate; standard broad, 2-lobed, spurred; wings broad, 2-lobed, variable; lip boat-shaped, with a long slender curved spur about 1½ in. long and sometimes parted to the middle: caps. glabrous, ½in. long. India. B.M. 5276, 5625.—Thrives under the treatment given *I. Sultani.* There is a white-fld. form (var. *álba*).

cc. *Peduncles with 3–6 or more fls., often more or less clustered or terminal.*

13. **Hookeriàna,** Arn. (*I. biglandulòsa,* Moon. *I. Sultáni álba,* Hort.). A very succulent much-branched plant, growing to a height of 3 ft.: lvs. long-petioled, ovate-lanceolate, toothed: peduncles axillary in the upper lvs.; fls. large, white, spotted with purple on the large lower petals; spur bent horn-shaped, and longer than the fls. Blooms in fall. Ceylon. B.M. 4704. J.F. 14:391.—It is a perennial, requires a moderate temperature and does not bloom until well developed. Prop. by cuttings. One of the best species in cult.

14. **Róylei,** Walp. (*I. glandulígera,* Royle). Fig. 1954. A rather coarse garden annual, with strong st., succulent and much-branched: lower lvs. opposite; upper lvs. usually in 3's and whorled, all ovate or ovate-lanceolate, naked, 4 in. long, sharply serrate; basal serrations and the petiole glandular: peduncles axillary, with 3 or more fls. and very numerous toward top of plant; fls. large, dark purple; spur very short. Aug., Sept. India, in the Temp. W. Himalaya region, 6,000–8,000 ft. altitude. B.M. 4020. B.R. 26:22. J.F. 4:427.—Grown from seed, needing but little care, and useful in groups. In its native country it grows 4–10 ft. high. Variable. Var. *moschàta,* Hook. (*I. moschàta,* Edgew.), has lvs. alternate and whorled, coarsely serrate and less glandular. Var. *cándida,* Hook. (*I. cándida,* Lindl.), has uppermost lvs. opposite or whorled, and fls. white spotted crimson. J.F. 4:416. Var. *macrochìla,* Hook. (*I. macrochìla,* Lindl.), has upper lvs. alternate; terminal lobes of the wings half-oval (as if one side wanting) and falcate. B.R. 26:8.

15. **Bálfourii,** Hook. f. Glabrous, slenderly branching, 2–3 ft.: lvs. 3–5 in. long, short-stalked, ovate-lanceolate and very long-acuminate, with many minute recurved teeth, glandless: fls. loosely racemose at the top of the st. on very slender pedicels, large, rose and yellow; sepals 2, nearly orbicular, small; standard orbicular, reflexed, white suffused rose; the keel red; wings 1¼ in. long, pale yellow on basal lobe and bright rose on the hatchet-shaped terminal lobe; lip to 1¼ in. long, gradually narrowed into a horn-like somewhat incurved obtuse spur: caps. erect, narrow, to 1½ in. long, red on the angles. W. Himalayas. B.M. 7878.

I. auricoma, Baill. Perennial, 6–24 in.: lvs. alternate, lanceolate, acuminate, crenate and with bristles: fls. golden yellow streaked red within; lateral petals connate; spur short, curved, 2-parted: sts. and midrib reddish. Comoro Isls., Mozambique. B.M. 7381.—*I. chrysántha,* Hook. f. Annual, glabrous: lvs. alternate, lance-ovate, serrate: fls. several on a peduncle, golden-yellow; spur short and incurved. India. B.M. 7786.—*I. comorénsis,* Baker. Lvs. elliptic-lanceolate, acute and crenate: fls. large, bright carmine with 2-parted white spur. Comoro Isls.—*I. comoricoma,* Hort. (I. comorensis × I. auricoma).—*I. cuspidàta,* Wight & Arn. Shrubby, glabrous, farinaceous: lvs. alternate or uppermost opposite, lanceolate or oblong-lanceolate, serrulate: fls. solitary, 1 in. across, very pale red; spur slender. India. Var. *arthrética,* Hook. f., has the lower nodes much thickened. B.M. 7844.—*I. fálcifer,* Hook. f. Annual, more or less decumbent: lvs. alternate, sessile or stalked, ovate to ovate-lanceolate, serrate: fls. solitary and short-pedicelled, ringent, golden yellow spotted blood-red; spur slender, to 1½ in. long. India. B.M. 7923.—*I. Hérzogii,* Schum. Stout branching herb the branches 4-angled: lvs. opposite and whorled, ovate to ovate-lanceolate: fls. solitary or clustered, about 2 in. across, cinnabar; spur to nearly 3 in. long, very slender, incurved. New Guinea. B.M. 8396. R.H. 1913:12.—*I. Hólstani,* Hort. (I. Holstii × I. Sultani).—*I. kewénsis,* Hort. (I. platypetala × I. Herzogii) —*I. Mariánæ,* Reichb. Annual: lvs. cuneate-oblong and acute, serrate with lighter areas between veins: fls. light purple, cymose; standard with a projection below the tip; lip with slender hooked spur. India. G.W. 14, p. 127.—*I. psittacina,* Hook. f. Annual, leafy and much branched: lvs. alternate, ovate, acuminate, serrate: fls. solitary, oddly colored, 2 sepals green, standard pale rose, wings suffused and streaked red, lip white with irregular dash of carmine; spur short and hooked. Burma. B.M. 7809.—*I. Thómsonii,* Hook. f. Annual, erect, 8–12 in.: lvs. alternate, ovate-lanceolate, serrate: fls. several on a peduncle, ¾in. long, pale rose; spur slender, incurved. India. B.M. 7795.

L. H. B.†

1954. Impatiens Roylei. (×⅓)

IMPERÀTA SACCHARIFLÒRA: *Miscanthus.*

IMPERATÒRIA: *Peucedanum.*

INCARVÍLLEA (after Incarville, the French Jesuit missionary to China, correspondent of Jussieu in 1743). *Bignoniàceæ.* Showy herbs, annual, biennial, or perennial, planted in the open.

Closely allied to Amphicome, and the fls. of both have the same general appearance, but in Incarvillea the calyx-lobes are awl-shaped, while in Amphicome the calyx is truncate or shortly dentate; also the seeds of Incarvillea have an entire hyaline wing, while in Amphicome the seeds have a wing that is cut into long thin strips or hairs. The two genera form a small but remarkable group, characterized by their caps. opening by the ventral suture only. Calyx campanulate, 5-lobed; corolla-tube elongated, enlarging; limb somewhat 2-lipped, the lobes 5, spreading and broad; stamens 4, included, didynamous; disk annular or ring-like; ovary 2-loculed: fr. a narrow more or less curved caps. with many seeds: plant erect, branching or simple: lvs. alternate, 2–3-pinnate or simple, with narrow segms.: fls. large, in terminal clusters, red to yellow.—Species about a dozen, Turkestan, Thibet, China. The general experience seems to be that these plants need rather more winter protection than most hardy herbaceous perennials. A light, sandy loam, well enriched and deeply worked, suits them well, and they like a sheltered position in a rather warm, sunny place. Prop. by division or seed.

A. *Lf.-segms. toothed or crenate.*

Delavàyi, Bur. & Franch. Fig. 1955. Lvs. few, radical; lfts. 4–5 in. long, not quite opposite: stamens included. B.M. 7462. Gn. 54:430; 60, p. 229; 72, p. 421. G. 23:157. Gn.W. 15:713. G.W. 15, p. 409. R.H. 1893:544. J.H. III. 30:449. Gt. 43:1398. Mn. 3, p. 26. G.C. III. 26:123. G.M. 38:306.—*I. Delavayi* is a hardy plant with handsome pinnate foliage, each lf. being 1 ft. long, with as many as 15–20 dentate segms.: scape 1–2 ft. high, bearing 2–12 large trumpet-shaped rosy purple fls., each 2–3 in. long and as much wide. These fls. are probably equal in decorative value to many of the bignonias cherished in greenhouses. In size and beauty they rank with those of catalpa, bignonia and tecoma, of the same family. The tube is yellow inside and out, and the 2 upper lobes are smaller than the 3 lower ones.

lùtea, Bur. & Franch. Two to 4 ft.: lvs. mostly radical, 8–15 in. long, pinnate, long-petioled; lfts. broad-lanceolate, crenate: scapes stout and stiff, bearing a few bracts and 6–20 yellow, somewhat pendulous fls., with limb 2 in. across and paler yellow than the tube. S. W. China, 10,000–12,000 ft. altitude. G.C. III. 50, suppl. Aug. 19 (1911).

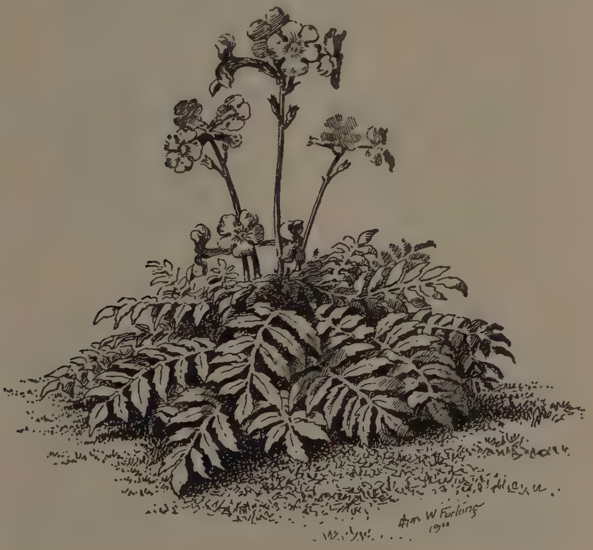
AA. *Lf.-segms. parted or dissected.*

variábilis, Batalin. Subshrub: lvs. 2- or 3-pinnate; segms. parted or dissected, their lobes entire or slightly lobed: fls. as many as 10, pale rose. Gt. 47, p. 222.—A strong-growing, bushy plant covered with fls. each 1 in. or more across, from May to Oct.: seedlings bloom the first year.

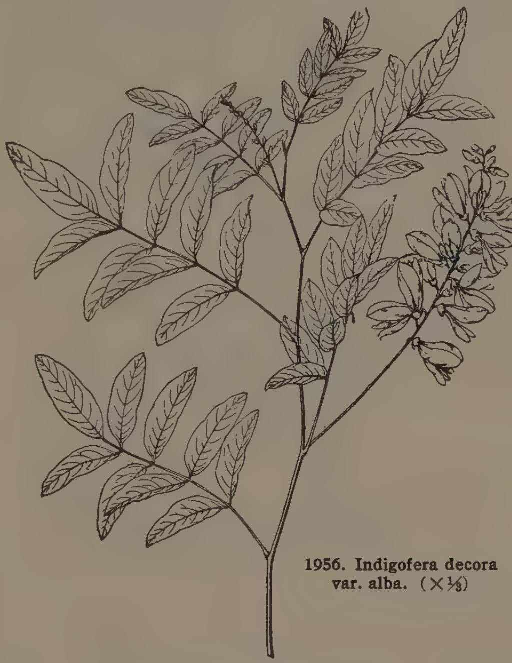
AAA. *Lf.-segms. often entire or nearly so.*

Ólgæ, Regel (*I. Koòpmannii,* W. Lauche). Subshrub, 2–3 ft. high: lvs. 2–4 in. long; segms. linear-oblong or lanceolate, narrower than in *I. Delavayi,* especially at the base, entire or with a few distant teeth toward the tip: fls. pale pink, veiny; tube 1½ in. long; limb about 1 in. across, the 5 lobes nearly equal. B.M. 6593 (throat not yellow). G.C. II. 19:89. Gn. 28, p. 653.—The hardiest species.

grandiflòra, Bur. & Franch. Differs from *I. Delavayi* in its shorter lvs., more rounded lfts., segms. ovate or broader, short scapes bearing only 1 or 2 fls. as large as those of *I. Delavayi,* but with narrower calyx-lobes and longer corolla-lobes, the color deep rose-red. Dried specimens show about a dozen scapes on a plant. China. Gn. 56:22. J.H. III. 46:357. G. 27:349; 35:145. G.M. 46:219. Var. **brévipes,** Sprague (*I. Bonvalòtii,* Hort., not Bur. & Franch.), is offered abroad: "large brilliant crimson fls., habit of *I. Delavayi:*" pedicels much shorter than the peduncle. Yunnan, China.



1955. Incarvillea Delavayi.



1956. Indigofera decora var. alba. (×⅓)

compácta, Maxim. Handsome hardy perennial, glabrous or somewhat pubescent: st. short, becoming 1 ft. or more high: lvs. fleshy or thick, mostly radical, pinnatisect; segms. subcordate-ovate, all more or less decurrent, entire or nearly so: fls. at first congested near the crown, but becoming elevated, purple, the corolla 2–2½ in. long and the limb 1½ in. across; corolla-tube dilated, the limb broad and with roundish lobes; calyx-teeth deltoid, acuminate. N. W. China. Gt. 49:1479.

L. H. B.†

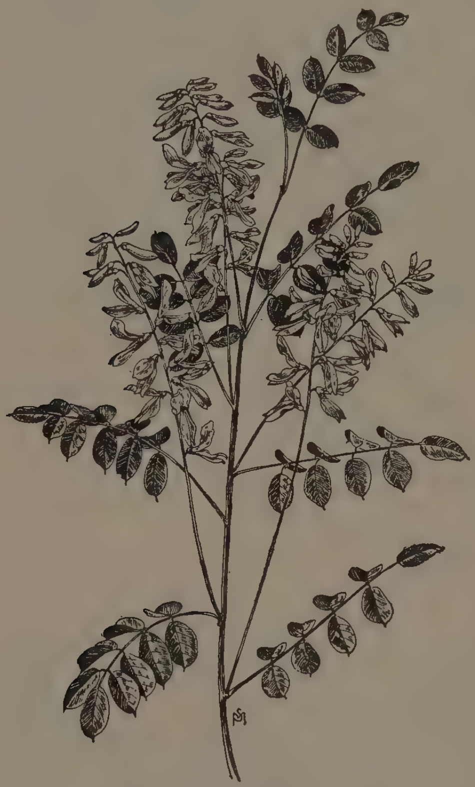
INDIAN BEAN: *Catalpa.* **I. Cherry:** *Rhamnus caroliniana.* **I. Corn:** *Zea Mays.* **I. Cress:** *Tropæolum.* **I. Cucumber-root:** *Medeola virginica.* **I. Currant:** *Symphoricarpos vulgaris.* **I. Fig:** *Opuntia vulgaris.* **I. Hemp:** *Apocynum cannabinum.* **I. Mallow:** *Abutilon.* **I. Physic:** *Gillenia.* **I. Pipe:** *Monotropa.* **I. Rice:** *Zizania aquatica.* **I. Shot:** *Canna.* **I. Tobacco:** *Lobelia inflata.* **I. Turnip:** *Arisæma triphylla.* **I. Wheat:** *Fagopyrum tataricum.*

INDIGO: *Indigofera.* **False Indigo:** *Baptisia* and *Amorpha.*

INDIGÓFERA (*indigo-bearing*). *Leguminòsæ.* INDIGO. Shrubs and perennial herbs sometimes grown for ornament, and some species cultivated in various parts of the world for indigo.

Plants of differing habit, more or less silky-hairy: lvs. odd-pinnate (rarely digitate), or sometimes simple (1-foliolate): fls. usually small, in axillary racemes or spikes, in color ranging from purple to rose and white, papilionaceous; standard mostly roundish, often persisting for some time; keel with a spur or swelling on either side; stamens 10, monadelphous, or 9 and 1: pod various, usually with thin partitions between the seeds.—The species are probably 300, in tropical regions of the world, and extending to the Cape region of S. Afr. Several species are native to the U. S.

Indigo is mostly the product of *I. tinctoria,* of Asia, but it is also made from the West Indian species, *I. Anil*. These species were early introduced into the southern states for indigo-making, and the product was once manufactured to a considerable extent. The plant was introduced into South Carolina in 1742 from the West Indies. When it was found that commercial indigo could be produced, the British Government offered a bounty. In 1775, the production was more than one million pounds of indigo. The war for independence checked the industry, and thereafter the rising importance of the cotton crop, amongst other things, drove it to the wall. But as late as the middle of the last century, indigo continued to be made in remote places. Plants still persist in some places as escapes from cultivation. *I. tinctoria* is perennial, but is grown from seeds, which give from two to four cuttings of herbage the first year. The indigo is not contained in the plant, but the dye is a product of manufacture from a glucoside indican which is contained in the herbage, and which is obtained as an extract. Indigo seed is offered by seedsmen. Other species, even of other genera, also yield indigo. Very much of the indigo of commerce is now manufactured synthetically from coal-tar.



1957. Indigofera Kirilowii. (×⅜)

In North America, several species of Indigofera are occasionally grown as ornamental subjects. In the North, they are mostly greenhouse subjects. Propagated by seeds or cuttings, chiefly the latter. Recent introductions are *I. amblyantha* and *I. Kirilowii*, excellent species and hardy at the Arnold Arboretum.

A. *Raceme longer than the lf.*

decòra, Lindl. Weak-growing or even half-climbing shrub, the branches slender and red-tinged: lfts. in 6–8 pairs, broad-lanceolate, usually drooping, sharp-pointed: racemes long, with showy rose-pink fls. about 1 in. long; standard oblong, nearly or quite obtuse, with a heart-like mark near the base; wings linear-lanceolate or spatulate, ciliate. China. B.R. 32:22. B.M. 5063. G.M. 31:591. P.M. 16:290.—Regarded as a greenhouse plant and cult. in the open far S. Var. **álba** (Fig. 1956), with white fls., is a hardy herbaceous or half-shrubby plant at the Arnold Arboretum, Boston. G.F. 7, pp. 266, 376; fig. 61, p. 375 (adapted in Fig. 1956).

macróstachys, Vent. Shrubby, the sts. terete and appressed-pubescent: lfts. 8–10 pairs, oval-oblong, obtuse but mucronate, pubescent: racemes longer than the lvs., many-fld.; fls. rose. China. V.F. 53.

caroliniàna, Walt. Tall and branching, 6–7 ft.: lfts. 4–8 pairs, oblong, oval or oblanceolate, mucronate, with slender petiolules: fls. small, many, yellowish brown and with short-acute calyx-teeth: legume oblong, 2-seeded, less than ½in. long.—Perennial, in the pine-barrens from N. C. south.

Kirilòwii, Maxim. Fig. 1957. A beautiful species of recent intro., with fls. as large as those of *Robinia Pseudacacia*, bright rose-color: lvs. petioled: subshrub, 3–4 ft., soon glabrous, the branches slightly angular and bark soon striate: lf.-blade to 5 in. long, the stalk to 1⅛ in.; lfts. about 7–9, usually opposite, elliptic or rounded-elliptic, obtuse and mucronate, to 1¼ in. long and 1 in. wide, both surfaces bearing white hairs attached by their centers: racemes axillary, longer than the lvs., the peduncle about twice as long as the petiole; corolla glabrous nearly throughout when in bud; standard oblong-elliptic, ⅔in. long and half as wide, ciliate; keel acuminate, ciliate, as long as standard; anthers prominently apiculate. N. China, Korea. B.M. 8580. M.D.G. 1912:271.—Prop. by division, suckers and cuttings; appears not to seed in cult.

AA. *Raceme mostly shorter than, or not exceeding, the lf.*

amblyántha, Craib. Upright shrub, 3–6 ft.: young branchlets angled, whitish from appressed hairs: lvs. petioled, 4–6 in. long; lfts. usually opposite, oval to elliptic-oblong, broadly cuneate at the base, rounded and mucronate at the apex, bright green above, glaucescent beneath, appressed-pubescent on both sides, ½–1½ in. long: fls. in axillary slender racemes with the peduncle 2½–4 in. long, very numerous, pink, small, ¼in. long; petals narrow, of nearly equal length; standard spatulate-obovate, upright, incurved at the apex; calyx appressed-pubescent; ovary densely whitish pubescent: pod linear, with both sutures thickened, pubescent, 1½–2 in. long. July–Oct. Cent. China.—A handsome shrub with its numerous dense racemes of small pink flowers blooming all summer and autumn. Hardy at Arnold Arboretum. Prop. by cuttings, and by seeds which are freely produced.

austràlis, Willd. (*I. angulàta*, Lindl. *I. sylvática*, Sieb.). A very variable species, known by its glabrous aspect, short or nearly obsolete teeth of the calyx and the pod glabrous when young. Erect shrub: lfts. 9–17, varying from oblong to almost orbicular, ¾in. or less long, obtuse or retuse: fls. red and mostly showy, the racemes sometimes fully as long as the lvs.; standard truncate at the base with a very short claw: pod nearly or quite straight, terete. Austral. B.M. 3000. B.R. 386; 991. L.B.C. 2:149.

tinctòria, Linn. INDIGO. Fig. 1958. Shrub, 4–6 ft., with silvery branches: lfts. 7–15, thin, rather large, obovate-oblong, pubescent beneath: fls. small, reddish yellow, in short racemes, the pedicels finally recurved; calyx pubescent, the lobes subulate: pod nearly straight, somewhat knotty, 8–12-seeded, about ¾ or 1 in. long. S. Asia.—Long cult. and widely distributed. Runs wild S. Indigo was known to the Egyptians.

Ánil, Linn. WEST INDIAN INDIGO. Fig. 1958. Much like the last, but fls. smaller, and pods curved and not knotty, and about ½in. long. W. Indies, but now runs wild in the southern states. B.M. 6506.

Gerardiàna, Wall. (*I. Dosùa,* Hort., not Hamilt.). Low much-branched shrub with silvery canescent branchlets: lvs. 1–2 in. long, with thickish opposite pale white bristly lfts. to ½ in. long and oblanceolate-oblong and 9–17 in number: fls. pale red, canescent outside, the peduncled racemes 12–20-fld.: pod to 2 in. long, nearly cylindrical. India. B.R. 28:57.

I. caudàta, Dunn. Shrubby, 3–8 ft., with a coppery pubescence on young growths: fls. white, about ⅓in. long, in very long tail-like racemes that droop at the end. China.—*I. hebepétala,* Benth. Branching shrub, lightly pubescent when young: lvs. 4–7 in. long; lfts. 4–8 pairs, oblong, about 2 in. long: fls. small, reddish, in short axillary racemes. Himalayas. B.M. 8208.—*I. reticulàta,* Franch. Similar to I. Kirilowii, but dwarfer: lvs. dark shining green: fls. clear white. China, Korea. The plant in cult. may be I. reticulata, Koehne.

L. H. B.

ÍNGA (a West Indian name). *Leguminòsæ.* Tropical trees and shrubs, with acacia-like foliage and clusters of showy red stamens.

Spineless: lvs. abruptly pinnate, usually with glands between the large lfts.: fls. not papilionaceous, in heads, spikes, racemes or umbels, mostly 5-merous; stamens ∞, monadelphous, exserted beyond the small tubular or campanulate corolla: pod narrow, often thickened at the sutures, completely or partially indehiscent.—Species upward of 150, in W. Indies and S. Amer.

A. *Lfts. hairy beneath.*

affinis, DC. Lvs. simply pinnate; lfts. in 4 pairs, ovate, acuminate, pubescent above, somewhat shining and villous below, one side smaller than the other, 3 in. long, 1½ in. wide; petioles, branches, peduncles and fls. velvety tomentose, a gland between each pair of lvs.: spikes solitary or in pairs; corollas villous. Trop Amer.

1958. Indigofera Anil. (Nearly natural size.) The single pod is I. tinctora. (×½)

AA. *Lfts. not hairy.*

Feuillei, DC. Foliage handsome; lvs. simply pinnate; lfts. in 3–4 pairs, oval-oblong, acute at both ends, glabrous: pods 1–2 ft. long, linear, flat, glabrous, white inside. Peru.—The sweet, edible pulp of the pods is much prized by the Peruvians, who call it pacay. It has ripened its pods in Calif.

I. anómala, Hort.=Dichrostachys nutans.—*I. dúlcis,* Willd.=Pithecolobium.—*I. guadalupénsis,* Desv.=Pithecolobium.

Wilhelm Miller.
L. H. B.†

INGENHOÙZIA (Dr. John Ingenhousz, 1730–1799, famous vegetable physiologist). *Malvàceæ.* A sub-shrubby plant of S. Ariz. and Mex., intro. recently in S. Calif. for ornament. Allied to Gossypium: involucel of 3 triangular-lanceolate entire bracts; calyx saucer-shaped; stigma obscurely 3-lobed: fr. a globular leathery 3-celled and 3-valved caps.; seeds 5–8 in each cell or locule, puberulent. **I. tríloba,** DC. Perennial, 4–10 ft., glabrous: lvs. 3-parted or 5-parted, or the uppermost entire and lanceolate, the lvs. and branches black-dotted: fls. on axillary peduncles, or somewhat corymbose above; petals 1 in. long, pure white turning to rose, dark-dotted. Generic name variously spelled.

INOBÚLBON (in reference to fibrillose bulbs). *Orchidàceæ.* Pseudobulbs short, few-jointed, annulate, fibrillose, few-lvd.: fls. in racemes or panicles; sepals and petals equal, the lateral sepals not forming a mentum; lip 3-lobed, the lateral lobes small, the middle lobe large, with a thick fleshy callus 3-parted disk; column short, footless.—Species 2, New Caledonia.

muníficum, Kränzl. (*Dendròbium muricàtum* var. *muníficum,* Finet). Pseudobulbs about 3 in. long, 1½ in. thick, 2-lvd.: lvs. up to 8 in. long: panicle of few branches, somewhat nodding; sepals and petals greenish, brown-spotted; lip marked with reddish purple and yellow. B.M. 8371.

George V. Nash.

INÒDES: *Sabal.*

INOPHÝLLUM: *Tahitian chestnut.*

INSECTICIDES, INSECTS: *Diseases and Insects,* p. 1042.

INSPECTION OF HORTICULTURAL MERCHANDISE.—To guard against the introduction of insect pests and plant diseases, governments have instituted inspection service at ports of entry and for interstate commerce. The regulations may be federal, or state or provincial.

The plant-quarantine act.

A federal plant-quarantine act was enacted by Congress August 20, 1912. This act authorizes the Secretary of Agriculture to regulate the importation of nursery stock and other plants and plant-products, and to establish and maintain quarantine districts for plant-diseases and insect pests within the United States, and also to exclude by quarantine diseased plants or plant-products from foreign countries or to provide such regulations governing the entry of such materials as will insure safety.

The first general attempt to secure national legislation of this nature resulted from the introduction of the San José scale into the eastern United States and its threatened general distribution on nursery stock. To meet this emergency, a convention was called in Washington in 1897, composed of the delegates from horticultural societies, nurserymen's associations, state agricultural boards, agricultural colleges and experiment stations—a large and representative body of men. After full discussion a bill was drafted, the primary object of which was the control of domestic nursery stock, but which provided also for the inspection of foreign nursery stock. While this measure received the endorsement of the convention, and was submitted to Congress, the different interests were not fully agreed as to the desirability of all its features, and it was not heartily pushed and was ultimately dropped with the idea of replacing it by a more suitable bill.

During succeeding years, a number of bills covering the same general subject were introduced at the different sessions of Congress, and some of these were reported favorably from the Committee on Agriculture, but the opposition of importing nurserymen prevented any of these measures ever reaching a very advanced stage. In the meantime, various conferences were held between the entomologists of the different states and horticultural inspectors and the principal nurserymen's associations, without, however, coming to any agreement as to suitable legislation. Finally, in 1908, the promoters of this legislation having become thoroughly discouraged, the project was definitely abandoned,—the San José scale in the meantime having been carried on nursery stock into practically every state in the Union.

The effort which eventually resulted in the enactment of the present law was due to the discovery, in 1909, of the introduction of enormous quantities of brown-tail moth nests full of hibernating larvæ on seedling fruit stock, chiefly from northern France and Belgium. With these were occasional egg-masses of the gipsy-moth. During the years 1909 and 1910, stock infested with thousands of larval nests was sent to no less than twenty-two different states, covering the country from the Atlantic seaboard to the Rocky Mountains. So far as possible, this stock was followed up by state and federal inspectors and the infesting insects destroyed.

This new danger led the writer in 1909 to draft a national quarantine and inspection bill relating particularly to imported nursery stock, and other plants and plant-products offered for entry from foreign countries, but providing also means for quarantining new pests locally established within the United States. This bill promptly passed the House, but was objected to by nurserymen, and was withdrawn with the idea of revising it so as to meet in a satisfactory way these objections. There followed many attempts to draft a measure which would give reasonable protection and be at the same time satisfactory to the nursery interests, and many different bills were introduced in Congress from time to time, all based on the original bill just referred to. Securing desirable legislation of this kind—against a small but organized opposition—is a slow process, and the effort instituted in January, 1909, did not reach fruition until August, 1912. The passage of the act was finally much aided by the hearty coöperation of Californian interests, due to the discovery that the Mediterranean fruit-fly had become thoroughly established in Hawaii and was likely at any time to be carried by Hawaiian fruits to California, and thus jeopardize the vast fruit development of that state.

The bill as passed is a compromise measure, and divides responsibility between the federal government and the state authorities. It, furthermore, gives no control over the interstate movement of domestic nursery stock, except as to areas and plants specifically quarantined.

The scope of this act has been given in an opening paragraph. The system of control of imported nursery stock and a description of the several foreign and domestic plant quarantines and restrictive orders follow.

Control of nursery stock importations.

For the purposes of this act, nursery stock offered for entry into the United States falls into two classes, namely:

1. That coming from countries having an official inspection and certification system, and
2. From countries which have no system of inspection or certification.

Nursery stock from the first class of countries, arrives with some assurance of freedom, or at least the responsibility for its condition fixed on some known foreign official.

Nursery stock from the second class of countries arrives with no information as to its probable freedom from infestation by insects or diseases.

Commercial importations are permitted only from the countries belonging to the first category, and from countries belonging to the second category importations are limited by regulation and permitted only for experimental or scientific purposes. Mail importations are not permitted except of field, vegetable, and flower seeds.

The following countries have provided for inspection and certification of export plants and plant-products in conformity with the regulations under the plant-quarantine act: Australia, Barbados, Belgium, Bermuda, British Guiana, Canada, Cuba, Denmark, England, France, Germany, Guatemala, Holland, Ireland, Japan, Leeward Islands, Antigua, St. Christopher-Nevis, Dominica, Montserrat, Virgin Islands, Grand Duchy of Luxemburg, New Zealand, Scotland, Union of South Africa, Straits Settlements, Switzerland, Trinidad, Wales, Windward Islands, Granada, St. Lucia, and St. Vincent; and these include most of the countries which have hitherto maintained any considerable commerical trade in nursery stock with the United States. Any other country may obtain the benefits of commercial exportation by providing for the proper inspection and certification of exported stock. The Italian government has indicated that the Province of Padua will certify export nursery stock, and a national law has been passed with the object of ultimately meeting for the country as a whole the requirements of the plant-quarantine act.

The federal act has very greatly stimulated those foreign countries which have considerable commercial trade in plants with the United States to do better work of inspection and to provide suitable legislation and officers to meet the requirements of the act.

The United States is no longer a dumping-ground for any sort of infested and diseased stock. Brown-tail moth and gipsy-moth infestation has practically ceased, insect infestation by any important pest is rare, and the general condition of the stock has been very much improved.

In general explanation of the federal powers in relation to the importation of nursery stock, it may be said that these powers relate (1) to the issuance of permits for the importation of nursery stock, (2) the provision for foreign inspection and certification as a condition of entry, and (3) the distribution to the several state inspectors of exact information in regard to the origin, arrival, and destination of the imported stock.

To the several states is left the entire responsibility for the inspection at destination of commercial importations of nursery stock, and, if this inspection is not done by state inspectors, there is nothing in the federal law to make good this neglect. Most of the states have made fairly adequate provision for such inspection, and this inspection, as shown by the pests intercepted and destroyed, has been of tremendous value.

Foreign plant quarantines.

Under the provisions of Section 7 of the plant-quarantine act, the following foreign plant-quarantines have been established:

White pine blister-rust.—This is Quarantine No. 1, promulgated September 16, 1912, and amended and superseded by Quarantine No. 7, promulgated May 21, 1913. This quarantine was drawn to prevent the introduction into the United States of the white pine blister-rust, and forbids the importation into the United States from each and every country of Europe and Asia of all five-leafed pines.

Potato wart.—This is Quarantine No. 3, promulgated September 20, 1912, to prevent the introduction into the United States of the disease known as "potato wart," "potato canker," "black scab," and the like, and forbids the importation into the United States from the countries of Newfoundland, the islands of St. Pierre and Miquelon, Great Britain and Ireland, Germany, and Austria-Hungary, of the common or Irish potato (*Solanum tuberosum*).

Mexican fruit-fly.—This is Quarantine No. 5, and was promulgated January 15, 1913, to prevent the introduction into the United States from Mexico of the insect known as the Mexican fruit-fly (*Trypeta ludens*), and forbids the importation into the United States from the Republic of Mexico of the following fruits: oranges, sweet limes, mangoes, *Achras Sapota*, peaches, guavas, and plums. It was amended February 8, 1913, to include, in addition to the above fruits, the grapefruit and its horticultural varieties.

Pink boll-worm of cotton.—This is Quarantine No. 8, promulgated May 28, 1913, to prevent the introduction into the United Sates of the pink boll-worm of cotton, and forbids the importation into the United States of cotton-seed of all species and varieties and cotton-seed hulls from any foreign locality and country, excepting only the locality of the Imperial Valley in the state of Lower California in Mexico. The importation from the region specified in Mexico is governed by regulations. By later amendments this quarantine was lifted and cotton-seed and seed-cotton were permitted to be entered, under regulations, from the Mexican states of Neuvo Leon, Tamaulipas, Coahuila, Durango, and Chihuahua.

Potato quarantine.—This is Quarantine No. 11, promulgated December 22, 1913, to prevent the introduction into the United States of the disease known as powdery scab (*Spongospora subterranea*), and forbids the importation into the United States from the Dominion of Canada, Newfoundland, the islands of St. Pierre and Miquelon, Great Britain, Ireland and Continental Europe, of the common or Irish potato (*Solanum tuberosum*), until such time as it shall have been ascertained to the satisfaction of the Secretary of Agriculture that the country or locality from which potatoes are offered for import is free from powdery scab and other injurious potato diseases. Amendments 1 and 2, February 20; 3, March 12; and 5, November 30, 1914, eliminate Belgium, Denmark, and the Netherlands, and the Dominion of Canada, from the provisions of this quarantine and make it possible to import potatoes under regulation from these countries. The importation under regulation is also now permitted from Bermuda, Santo Domingo, and the states of Chihuahua and Sonora, Mexico. Amendment 4 to this quarantine, promulgated June 25, 1914, eliminates the territory of Porto Rico from its provisions.

Avocado seed quarantine.—This is Quarantine No. 12, promulgated February 27, 1914, to prevent the introduction into the United States of the avocado weevil (*Heilipus lauri*), and forbids the importation into the United States of the seeds of the avocado or alligator pear from Mexico and the countries of Central America.

Sugar-cane quarantine.—This is Quarantine No. 15, promulgated June 6, 1914, to prevent the introduction into the United States of injurious insects and fungous diseases of the sugar-cane, and forbids the importation into the United States, from all foreign countries of living canes of sugar-cane, or cuttings or parts thereof. This quarantine does not apply to Hawaii and Porto Rico.

These foreign quarantine orders are absolute prohibitions of the entry of the goods covered, and are enforced through the active coöperation of the customs service of the Treasury Department.

Domestic plant quarantines.

Under the provisions of section 8 of the plant-quarantine act the following domestic plant-quarantines have been established:

Mediterranean fruit-fly.—This is Quarantine No. 2, promulgated September 18, 1912, to protect the United States from the entry of the Mediterranean fruit-fly, now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits and vegetables specified in the notice of quarantine into or through any other state, territory, or district of the United States.

Gipsy-moth and brown-tail moth.—This is Quarantine No. 4, promulgated November 5, 1912, and revised and amended as Quarantine No. 10, June 24, 1913, and as Quarantine No. 17, July 3, 1914. This quarantine describes and quarantines the districts in New England infested by the two moths named, and makes regulations governing the movement in interstate commerce of plants and plant-products which may be infested from the areas quarantined.

Date-palm scale insects.—This is Quarantine No. 6, promulgated March 1, 1913, to prevent the further distribution in the United States of two important date-palm scale insects. It quarantines certain counties in California, Arizona and Texas, and makes regulations governing the interstate movement of date palms originating within the areas quarantined.

Pink boll-worm of cotton.—This is Quarantine No. 9, promulgated June 24, 1913, and applies to the territory of Hawaii. It has the same object as the foreign quarantine on the same subject, described above. It prevents the movement from the territory of Hawaii into or through any other state, territory or district of the United States of all cotton-seed and cotton-seed hulls.

Mediterranean fruit-fly and melon-fly.—This is Quarantine No. 2, promulgated September 18, 1913, and revised and amended as Quarantine No. 13, promulgated March 23, 1914, to protect the United States from the entry of the Mediterranean fruit-fly (*Ceratitis capitata*) and the melon-fly (*Dacus cucurbitæ*), now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits, nuts and vegetables specified in the notice of quarantine into or through any other state, territory or district of the United States, in accordance with the regulations prescribed under this quarantine. This quarantine became effective May 1, 1914.

Powdery scab of potatoes.—This is Quarantine No. 14, promulgated April 25, 1914, to prevent the further distribution in the United States of the dangerous potato disease known as powdery scab (*Spongospora subterranea*), which exists in certain parts of the state of Maine. This quarantine became effective August 1, 1914.

Sugar-cane quarantine.—This is Quarantine No. 16, promulgated June 6, 1914, to prevent the further distribution in the United States of certain injurious insects and fungous diseases of the sugar-cane existing in the territories of Hawaii and Porto Rico, and forbids the movement from the territories named into or through any other state, territory or district of the United States of living canes of sugar-cane, or cuttings or parts thereof.

Most of the domestic quarantines provide for the movement of the quarantined articles under a system of inspection and certification. The very considerable work of inspection and certification necessitated, particularly in the case of the moth quarantine in New England and the Mediterranean fruit-fly quarantine in Hawaii, is done under federal authority, in coöperation with state and insular officers, who are made for that purpose collaborators of the Department of Agriculture.

Regulatory orders.

Under the authority given by section 5 of the plant-quarantine act, orders placing restrictions on the importation of potatoes and avocados have been promulgated.

The order restricting the admission of all foreign potatoes not under quarantine was issued December 22, 1913, and regulations governing the entry of potatoes under this order into the United States were issued December 30, 1913. This order specifies that potatoes may be imported only from countries which are free from injurious potato diseases and insect pests and under permit and prior foreign inspection and certification. All such imported potatoes are subject to a second inspection by a federal inspector on their arrival in this country.

The order governing the admission of the avocado or alligator pear under restriction was issued February 27, 1914. These two orders are supplemental to the quarantine orders described above in relation to the potato and to avocada seed.

The federal horticultural board.

The act provides (section 12) that for the purpose of carrying out its provisions there shall be appointed by the Secretary of Agriculture from existing bureaus and offices in the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service, a Federal Horticultural Board consisting of five members, of whom not more than two shall be appointed from any one bureau or office, and who shall serve without additional compensation.

State legislation.

The state of California for the last twenty years has enforced a quarantine at the port of San Francisco, and has had quarantine and other control legislation which has furnished protection to the state of untold value, and to a less degree to the remainder of the United States. A few other states have had minor plant-legislation, but the San José scale outbreak in the East in the early nineties, already referred to, was the inciting cause of plant-legislation in nearly every state of the Union. This legislation, chiefly in relation to domestic nursery stock, lacks uniformity, and thus entails unnecessary difficulty to dealers in nursery and other plant stock. An effort has been under way for several years to devise, for general adoption, a uniform nursery and plant act, and it seems now possible that uniform legislation may eventually be secured. A bill has been drafted by J. G. Sanders, State Entomologist of Wisconsin, as Chairman of a Committee on Uniform State Legislation of the American Association of Horticultural Inspectors, and this bill has been approved by this association, representing the different states and by the National Nurserymen's Association. It will probably be many years, however, before it is generally substituted for present state legislation on this subject.

Space at disposal does not permit of a full analysis of the plant legislation of the different states. This legislation has been well summarized in Circular No. 103 of the Department of Agriculture of the state of New York. Shippers of nursery stock should first inquire as to legislation, which may vary from year to year, of any state to which goods are to be sent. Many of the states also require the taking out of licenses, and in some states imported nursery stock must be reëxamined by local state inspectors before it can be liberated.

Plant legislation in Canada.

The Canadian legislation to control the entry of injurious insect pests and plant-diseases has much the same history as the similar legislation in the United States and the same inciting causes. The San José scale excitement in the United States led in 1898 to the passage by Canada of the San José Scale Act which prohibited the importation of nursery stock from all countries in which this scale insect occurred. Later (1901) this prohibition was removed and nursery stock from countries in which the scale occurred was allowed to enter, subject to fumigation with hydrocyanic-acid gas,—the ports of entry and the time of the year when such entry could be made being limited. In 1909 brown-tail moth nests were found on shipments of nursery stock to Canada and this led to the enactment of the "Destructive Insect and Pest Act" of May, 1910. This act provides either for the prohibition of entry, fumigation on entry, or inspection subsequent to entry, of nursery stock, and gives other conditions governing the introduction of living plants. The act has been amended by additional regulations from time to time, particularly in relation to the chestnut-bark disease, the Mediterranean fruit-fly, potato diseases, and forest products from New England.

Canadian provincial legislation.

In addition to the legislation of the Dominion of Canada against insect pests and plant-diseases, several of the provincial governments have enacted similar laws. With the exception, however, of the provinces of British Columbia and Nova Scotia, the provincial governments restrict their attention to the control of pests within their territories. The provinces of British Columbia and Nova Scotia, however, inspect and fumigate, if necessary, nursery stock and fruit imported into these provinces. Nova Scotia fumigates and inspects stock coming from other parts of Canada only. As in the case of the United States, there is coöperation between the inspection service of the Dominion and provincial governments. The full text of the Canadian Dominion and provincial laws in relation to this subject may be obtained from the Dominion Department of Agriculture, Ottawa.

C. L. MARLATT.

Quarantine laws.

State quarantine laws are now in a transition stage. For two or three years there has been active propaganda for uniform state legislation looking to the control of destructive insects and plant diseases. The statutory requirements in the different states are so unlike as to cause much annoyance, and state departments of agriculture or other bodies issue circulars explaining these different requirements for the guidance of nurserymen and others. The bill drafted by the Sanders Committee, already mentioned, has been practically completed, and now awaits enactment. At the request of the Federal Horticultural Board, the Solicitor of the United States Department of Agriculture has drawn a bill for enactment by the different states, to constitute a general plant act rather than a nursery-stock act. Several states are now proposing to enact this draft.

Even in view of the tentative character of much of the legislation, it seems to be well to reprint here a few of the standard or most important statutes. The Canadian law is the simplest and most direct. It embodies in a few words the power to control the entry of plants from foreign countries and also to control the plants within the Dominion. Under the federal and state constitutions in the United States, such a brief and simple law seems to be impossible. There are here printed, the Canadian law; the United States law; and the laws of New York and California.

The ideal law is probably one that confers broad powers, and then leaves the details to regulation so that necessary minor changes may be made as circumstances arise. There must naturally be considerable discretion conferred on competent officers or authorities in dealing with such subjects as quarantine of insects and plant diseases.

Under the federal quarantine act of the United States, some twenty quarantines have now been laid and several of these have required rather elaborate regulations, and modifying orders and amendments have been issued; these matters cannot, of course, be entered here.

Some of the leading sections in the Sanders' bill, now proposed for legislation in the different states, are reprinted on pages 1653 and 1654. This bill is likely to become of much importance in inspection legislation.

The Destructive Insect and Pest Act of Canada (May 4, 1910).

1. This Act may be cited as *The Destructive Insect and Pest Act.*

2. In this Act, unless the context otherwise requires, 'the Minister' means 'the Minister of Agriculture.'

3. The Governor in Council may make such regulations as are deemed expedient to prevent the introduction or admission into Canada, or the spreading therein, of any insect, pest or disease destructive to vegetation.

4. Such regulations may provide,—

(*a*) for the prohibition generally, or from any particular country or place, of the introduction or admission into Canada of any vegetable or other matter likely to introduce any such insect, pest or disease;

(*b*) the terms or conditions upon, and the places at which any such vegetable or other matter may be introduced or admitted into Canada;

(*c*) for the treatment and manner of treatment to be given to any vegetation, vegetable matter or premises in order to prevent the spreading of any such insect, pest or disease, and may prescribe whether such treatment shall be given by the owner or by a person appointed for such purpose;

(*d*) for the destruction of any crop, tree, bush or other vegetation or vegetable matter or containers thereof infested or suspected to be infested with any such insect, pest or disease;

(*e*) for the granting of compensation for any such crop, tree, bush or other vegetation or containers thereof so destroyed, such compensation not to exceed two-thirds of the value of the matter destroyed and to be granted only by the Governor in Council upon the recommendation of the Minister;

(*f*) for the prohibition of the sale of any vegetable matter infected with any such insect, pest or disease;

(*g*) that the occupier of the premises on which is discovered any such insect, pest or disease shall forthwith notify the Minister and shall also send specimens of such insect, pest or disease;

(*h*) for the confiscation of any vegetable matter and the container thereof, if any, in respect of which a breach of this Act, or any regulation made thereunder, is committed, and generally for any other purpose which may be deemed expedient for carrying out this Act, whether such other regulations are of the kind enumerated in this section or not.

5. The Minister may appoint inspectors and other officers for carrying out this Act and the regulations made thereunder.

(2) Such appointments, if not confirmed by the Governor in Council within thirty days of the date thereof, shall lapse and cease to be valid.

6. Any inspector or other officer so appointed may enter any place or premises in which he has reason to believe there exists any such insect, pest or disease, and may take specimens thereof and also of any vegetable matter infested or suspected of being infested therewith.

7. The Minister, upon the report of any inspector setting forth a reasonable belief of the existence of any such insect, pest or disease in any area defined in such report, may prohibit the removal from such area or the movement therein of any vegetation, vegetable or other matter which, in his opinion, is likely to result in the spread of such insect, pest or disease.

8. Every person who contravenes any provision of this Act, or any regulation made thereunder, shall be liable, upon summary conviction, to a fine not exceeding one hundred dollars, or to imprisonment for a term not exceeding six months, or to both fine and imprisonment. Any vegetable or other matter imported or brought into Canada contrary to this Act, or to any regulation made thereunder, shall be forfeited to the Crown.

9. Every order in council and regulation made under this Act shall be published in "The Canada Gazette," and shall be laid, by the Minister, before Parliament within fifteen days after the commencement of the then next session.

The United States Plant Quarantine.

AN ACT To regulate the importation of nursery stock and other plants and plant products; to enable the Secretary of Agriculture to establish and maintain quarantine districts for plant diseases and insect pests; to permit and regulate the movement of fruits, plants, and vegetables therefrom, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any person to import or offer for entry into the United States any nursery stock unless and until a permit shall have been issued therefor by the Secretary of Agriculture, under such conditions and regulations as the said Secretary of Agriculture may prescribe, and unless such nursery stock shall be accompanied by a certificate of inspection, in manner and form as required by the Secretary of Agriculture, of the proper official of the country from which the importation is made, to the effect that the stock has been thoroughly inspected and is believed to be free from injurious plant diseases and insect pests: *Provided,* That the Secretary of Agriculture shall issue the permit for any particular importation of nursery stock when the conditions and regulations as prescribed in this act shall have been complied with: *Provided further,* That nursery stock may be imported for experimental or scientific purposes by the Department of Agriculture upon such conditions and under such regulations as the said Secretary of Agriculture may prescribe: *And provided further,* That nursery stock imported from countries where no official system of inspection for such stock is maintained may be admitted upon such conditions and under such regulations as the Secretary of Agriculture may prescribe.

Sec. 2. That it shall be the duty of the Secretary of the Treasury promptly to notify the Secretary of Agriculture of the arrival of any nursery stock at port of entry; that the person receiving such stock at port of entry shall, immediately upon entry and before such stock is delivered for shipment or removed from the port of entry, advise the Secretary of Agriculture or, at his direction, the proper State, Territorial, or District official of the State or Territory or the District to which such nursery stock is destined, or both, as the Secretary of Agriculture may elect, of the name and address of the consignee, the nature and quantity of the stock it is proposed to ship, and the country and locality where the same was grown. That no person shall ship or offer for shipment from one State or Territory or District of the United States into any other State or Territory or District, any nursery stock imported into the United States without notifying the Secretary of Agriculture or, at his direction, the proper State, Territorial, or District official of the State or Territory or District to which such nursery stock is destined, or both, as the Secretary of Agriculture may elect, immediately upon the delivery of the said stock for shipment, of the name and address of the consignee, of the nature and quantity of stock it is proposed to ship, and the country and locality where the same was grown, unless and until such imported stock has been inspected by the proper official of a State, Territory, or District of the United States.

Sec. 3. That no person shall import or offer for entry into the United States any nursery stock unless the case, box, package, crate, bale, or bundle thereof shall be plainly and correctly marked to show the general nature and quantity of the contents, the country and locality where the same was grown, the name and address of the shipper, owner, or person shipping or forwarding the same, and the name and address of the consignee.

Sec. 4. That no person shall ship or deliver for shipment from one State or Territory or District of the United States into any other State or Territory or District any such imported nursery stock the case, box, package, crate, bale, or bundle whereof is not plainly marked so as to show the general nature and quantity of the contents, the name and address of the consignee, and the country and locality where such stock was grown, unless and until such imported stock has been inspected by the proper official of a State, Territory, or District of the United States.

Sec. 5. That whenever the Secretary of Agriculture shall determine that the unrestricted importation of any plants, fruits, vegetables, roots, bulbs, seeds, or other plant products not included by the term "nursery stock" as defined in section six of this act may result in the entry into the United States or any of its Territories or Districts of injurious plant diseases or insect pests, he shall promulgate his determination, specifying the class of plants and plant products the importation of which shall be restricted and the country and locality, where they are grown, and thereafter, and until such promulgation is withdrawn, such plants and plant products imported or offered for import into the United States or any of its Territories or Districts shall be subject to all the provisions of the foregoing sections of this act: *Provided,* That before the Secretary of Agriculture shall promulgate his determination that the unrestricted importation of any plants, fruits, vegetables, roots, bulbs, seeds or other plant products not included by the term "nursery stock" as defined in section six of this act may result in the entry into the United States or any of its Territories or Districts of injurious plant diseases or insect pests he shall, after due notice, give a public hearing, under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney.

Sec. 6. That for the purpose of this act the term "nursery stock" shall include all field-grown florists' stock, trees, shrubs, vines, cuttings, grafts, scions, buds, fruit pits and other seeds of fruit and ornamental trees or shrubs and other plants and plant products for propagation, except field, vegetable, and flower seeds, bedding plants, and other herbaceous plants, bulbs, and roots.

Sec. 7. That whenever, in order to prevent the introduction into the United States of any tree, plant, or fruit disease or of any injurious insect, new to or not theretofore widely prevalent or distributed within and throughout the United States, the Secretary of Agriculture shall determine that it is necessary to forbid the importation into the United States of any class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products from a country or locality where such disease or insect infestation exists, he shall promulgate such determination, specifying the country and locality and the class of nursery stock or other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products which, in his opinion, should be excluded. Following the promulgation of such determination by the Secretary of Agriculture, and until the withdrawal of the said promulgation by him, the importation of the class of nursery stock or of other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the said promulgation from the country and locality therein named, regardless of the use for which the same is intended, is hereby prohibited; and until the withdrawal of the said promulgation by the Secretary of Agriculture, and notwithstanding that such class of nursery stock, or other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products be accompanied by a certificate of inspection from the country of importation, no person shall import or offer for entry into the United States from any country or locality specified in such promulgation, any of the class of nursery stock or of other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products named therein, regardless of the use for which the same is intended: *Provided,* That before the Secretary of Agriculture shall promulgate his determination that it is necessary to forbid the importation into the United States of the articles named in this section he shall, after due notice to interested parties, give a public hearing, under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney: *Provided further*, That the quarantine provisions of this section, as applying to the white-pine blister rust, potato wart, and the Mediterranean fruit fly, shall become and be effective upon the passage of this act: *Provided further*, That hereafter any class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products of which the importation may be forbidden from any country or locality under the provisions of section seven of the Plant Quarantine Act approved August twentieth, nineteen hundred and twelve (Thirty-seventh Statutes, page three hundred and fifteen), may be imported for experimental or scientific purposes by the Department of Agriculture upon such conditions and under such regulations as the said Secretary of Agriculture may prescribe.

SEC. 8. That the Secretary of Agriculture is authorized and directed to quarantine any State, Territory, or District of the United States, or any portion thereof, when he shall determine the fact that a dangerous plant disease or insect infestation, new to or not theretofore widely prevalent or distributed within and throughout the United States, exists in such State or Territory or District; and the Secretary of Agriculture is directed to give notice of the establishment of such quarantine to common carriers doing business in or through such quarantined area, and shall publish in such newspapers in the quarantined area as he shall select notice of the establishment of quarantine. That no person shall ship or offer for shipment to any common carrier, nor shall any common carrier receive for transportation or transport, nor shall any person carry or transport from any quarantined State or Territory or District of the United States, or from any quarantined portion thereof, into or through any other State or Territory or District, any class of nursery stock or any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine except as hereinafter provided. That it shall be unlawful to move or allow to be moved any class of nursery stock or any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine hereinbefore provided, and regardless of the use for which the same is intended, from any quarantined State or Territory or District of the United States, or quarantined portion thereof, into or through any other State of Territory or District, in manner or method or under conditions other than those prescribed by the Secretary of Agriculture. That it shall be the duty of the Secretary of Agriculture to make and promulgate rules and regulations which shall permit and govern the inspection, disinfection, certification, and method and manner of delivery and shipment of the class of nursery stock or of any other class of plants, fruits, vegetables, roots, bulbs, seeds, or other plant products specified in the notice of quarantine hereinbefore provided, and regardless of the use for which the same is intended, from a quarantined State or Territory or District of the United States, or quarantined portion thereof, into or through any other State or Territory or District; and the Secretary of Agriculture shall give notice of such rules and regulations as hereinbefore provided in this section for the notice of the establishment of quarantine: *Provided*, That before the Secretary of Agriculture shall promulgate his determination that it is necessary to quarantine any State, Territory, or District of the United States, or portion thereof, under the authority given in this section, he shall, after due notice to interested parties, give a public hearing under such rules and regulations as he shall prescribe, at which hearing any interested party may appear and be heard, either in person or by attorney.

SEC. 9. That the Secretary of Agriculture shall make and promulgate such rules and regulations as may be necessary for carrying out the purposes of this act.

SEC. 10. That any person who shall violate any of the provisions of this act, or who shall forge, counterfeit, alter, deface, or destroy any certificate provided for in this act or in the regulations of the Secretary of Agriculture, shall be deemed guilty of a misdemeanor and shall, upon conviction thereof, be punished by a fine not exceeding $500 or by imprisonment not exceeding one year, or both such fine and imprisonment, in the discretion of the court: *Provided*, That no common carrier shall be deemed to have violated the provisions of any of the foregoing sections of this act on proof that such carrier did not knowingly receive for transportation or transport nursery stock or other plants or plant products as such from one State, Territory, or District of the United States into or through any other State, Territory, or District; and it shall be the duty of the United States attorneys diligently to prosecute any violations of this act which are brought to their attention by the Secretary of Agriculture or which come to their notice by other means.

SEC. 11. That the word "person" as used in this act shall be construed to import both the plural and the singular, as the case demands, and shall include corporations, companies, societies, and associations. When construing and enforcing the provisions of this act, the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

SEC. 12. That for the purpose of carrying out the provisions of this act there shall be appointed by the Secretary of Agriculture from existing bureaus and offices in the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service, a Federal Horticultural Board consisting of five members, of whom not more than two shall be appointed from any one bureau or office, and who shall serve without additional compensation.

SEC. 13. That there is hereby appropriated, out of the moneys in the Treasury not otherwise appropriated, to be expended as the Secretary of Agriculture may direct, for the purposes and objects of this act, the sum of $25,000.

SEC. 14. That this act shall become and be effective from and after the first day of October, nineteen hundred and twelve, except as herein otherwise provided.

THE NEW YORK LAW TO REGULATE THE SALE OF FRUIT-BEARING TREES (April 15, 1914).

Section 1. The title of article eleven of chapter nine of the laws of nineteen hundred and nine, entitled "An act in relation to agriculture, constituting chapter one of the consolidated laws," is hereby amended to read as follows:

Apples; pears; peaches; quinces; fruit-bearing trees.

§ 2. Such chapter is hereby amended by adding at the end of article eleven three new sections to be sections two hundred and sixty-three, two hundred and sixty-four and two hundred and sixty-five, to read, respectively, as follows:

§ 263. *Sale of fruit-bearing trees.* Every person, firm or corporation selling fruit-bearing trees shipped from any point in the state of New York must have attached to each car, box, bale or package a copy of a certificate of inspection issued by the state department of agriculture and signed by the commissioner of agriculture, valid to the first day of September next following the date of issuance thereof. There shall also be attached to each bundle or package of such fruit-bearing trees a label specifying the name of variety of trees contained therein. In case such bundle or package shall contain trees of different kinds or varieties there must be attached to each tree therein a like label.

§ 264. *Damages accruing from sale of trees.* Nothing contained in section two hundred and sixty-three or any other section of this chapter shall be construed to deprive a purchaser of any fruit-bearing tree of his remedy at law in a civil action to recover damages sustained by reason of such trees proving untrue to name as specified on the label. Such damages may be recovered in a civil action by the purchaser of such fruit-bearing trees or by his personal representative or assignee at any time prior to the third bearing year, provided the purchaser notifies the seller as soon as he has reason to believe that such trees are not true to name. In any action to recover damages suffered by the purchaser by reason of any fruit tree or trees not being of the name or variety under which they were tagged and sold, the seller shall have the burden of proof in establishing that any contract not in writing or any provision of any such contract exempting the seller from liability or limiting his liability was fully understood and agreed to by the purchaser. In every case of a sale of fruit-bearing trees in lots of twenty-five or more, when by written contract, the seller must at once furnish the purchaser a copy of such contract upon the face of which shall be plainly printed the following: "In any action to recover damages suffered by the purchaser by reason of any fruit tree or trees not being of the name or variety under which they were tagged and sold, the seller shall have the burden of proof in establishing that any contract not in writing or any provision of any such contract exempting the seller from liability or limiting his liability was fully understood and agreed to by the purchaser." The seller must also accompany the shipment of such trees with an itemized list of the same, which lists shall also give the name of the county and state where the trees covered by it were grown, the age of the trees, and the name and address of the person for whom the trees were grown, if requested by letter or in writing on the contract by the purchaser at the time of purchase. Within five days after the receipt by the purchaser of the trees and the list thereof the purchaser shall compare and notify the seller of any discrepancy between the list and the labels on such trees.

§ 265. *Agent to carry certificate of authority.* Any person, firm or corporation acting as agent for another in the sale of fruit-bearing trees in this state shall carry with him, at all times when engaged in selling trees, a certificate in writing signed by his principal and properly acknowledged, showing his authority to act as such agent and upon request shall exhibit the same to the purchaser and shall leave with the purchaser a copy of the contract bearing on its face the clause referred to in section two hundred and sixty-four.

§ 3. This act shall take effect September first, nineteen hundred and fourteen.

THE HORTICULTURAL QUARANTINE LAW OF CALIFORNIA.

AN ACT to provide for the protection of horticulture and to prevent the introduction into this state of insects or diseases, or animals, injurious to fruit or fruit trees, vines, bushes or vegetables, providing for a quarantine for the enforcement of this act, making a violation of the terms of the act a misdemeanor, and providing the penalty therefor; providing that said act shall be an urgency measure and go into effect immediately, and repealing that certain act entitled "An act for the protection of horticulture and to prevent the introduction into this state of insects, or diseases, or animals, injurious to fruit or fruit trees, vines, bushes or vegetables, and to provide for a quarantine for the enforcement of this act," approved March 11, 1899.

The people of the State of California do enact as follows:

SECTION 1. Any person, persons, firm or corporation who shall receive, bring or cause to be brought into the State of California, any nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds or fruit pits, or fruit or vegetables, or seed, shall immediately after the arrival thereof notify the state commissioner of horticulture, or deputy quarantine officer, or quarantine guardian of the district or county in which such nursery stock, or fruit or vegetables or seed are received, of their arrival, and hold the same without unnecessarily moving the same, or placing such articles where they may be harmful, for the immediate inspection of such state commissioner of horticulture, or deputy quarantine officer or guardian. If there is no quarantine guardian or state horticultural quarantine officer in the county where such nursery stock or fruit or vegetable, or seed is received, it shall then be the duty of such person, persons, firm or corporation to notify the state commissioner of horticulture, who shall make immediate arrangements for their inspection. The state commissioner of horticulture, deputy quarantine officer, quarantine guardian or such person or persons as shall be commissioned by the state commissioner of horticulture to make such inspection, or to represent said commissioner, is hereby authorized and empowered to enter at any time into any car, warehouse, depot or upon any ship within the boundaries of the State of California whether in the stream or at the dock, wharf, mole, or any other place where such nursery stock or fruit or vegetables or seed or other described articles are received or in which such nursery stock or fruit or vegetables or seed is imported into the state, for the purpose of making the investigation or examination to ascertain whether such nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, fruit, vegetables or seed is infested with any species of injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease.

If after such examination or inspection, any of the said described articles are found to be so infested or infected as aforesaid, then it shall be the duty of the owner, owners, or persons, firm or corporation having charge or possession thereof to so disinfect at his or their expense such portion or portions of the ship, dock, wharf, mole, car, warehouse or depot where said articles may have been located in such a manner as to destroy all infection or infestation present or that is liable to be present, and all articles or packages or soils apt to be so infested or infected shall be held until the said articles or packages or soils have been thoroughly disinfected and all injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease have been eradicated and destroyed; *provided, however*, that all articles of nursery stock, trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, fruits, vegetables or seed which are infested or infected with such species of injurious insects or their eggs, larvæ or pupæ or other animal or plant disease which may be or be liable to be injurious to the orchards, vineyards, gardens or farms within said state, shall be destroyed or reshipped out of the state as hereinafter provided. The said officer so making such inspection shall not permit any of the described articles so coming in contact with said infested or infected articles or any articles which might convey infection or infestation to be removed or taken from any such car, warehouse, depot, ship, dock, wharf or any other place until after such infection or infestation shall have been destroyed.

Sec. 2. Each carload, case, box, package, crate, bale or bundle of trees, shrubs, plants, vines, cuttings, grafts, scions, buds, fruit pits, or fruit or vegetables or seed, imported or brought into this state, shall have plainly and legibly marked thereon in a conspicuous manner and place the name and address of the shipper, owner, or owners or person forwarding or shipping the same, and also the name of the person, firm or corporation to whom the same is forwarded or shipped, or his or its responsible agents, also the name of the country, state or territory where the contents were grown and a statement of the contents therein.

Sec. 3. When any shipment of nursery stock, trees, vines, plants, shrubs, cuttings, grafts, scions, buds, fruit pits or seed or vegetables or fruit, imported or brought into this state, is found infested or infected with any species of injurious insects, or their eggs, larvæ or pupæ or other animal or plant disease or there is reasonable cause to presume that they may be so infested or infected, which would cause damage, or be liable to cause damage, to the orchards, vineyards, gardens or farms of the State of California, or which would be or be liable to be detrimental thereto or to any portion of said state, or to any of the orchards, vineyards, gardens or farms within said state such shipment shall be immediately destroyed by the state commissioner of horticulture, his deputy quarantine officer, quarantine guardians or other person or persons, who shall be commissioned by the state commissioner of horticulture to make such inspection; *provided, however*, that if the nature of the injurious insects, or their eggs, larvæ, pupæ or animal or plant disease be such that no damage or detriment can be caused to the said orchards, vineyards, gardens or farms of California or any of the same by the shipment of the same out of the state, then the said state commissioner of horticulture, his deputy quarantine officer, quarantine guardians or other person or persons who shall be commissioned by the state commissioner of horticulture to make such inspection, and who shall make such inspection, shall notify the owner or person, firm or corporation having possession or control of said articles to ship the same out of the state within forty-eight hours after such notification, and it shall be the duty of such owner or owners, or person, firm or corporation, to so ship said articles, but such shipment shall be under the sole direction and control of the officer so making the inspection and shall be at the expense of the owner or owners, his or their agent or agents, and for a failure to comply with such notice such owner or owners, his or their agent or agents shall be deemed guilty of a violation of the terms of this act and be punished accordingly and immediately after the expiration of the time specified in said notice said articles shall be seized and destroyed by said officer at the expense of the said owner or owners, his or their agent or agents.

Sec. 4. When any shipment of nursery stock, trees, vines, plants, shrubs, cuttings, grafts, scions, fruit, fruit pits, vegetables or seed, or any other horticultural or agricultural product passing through any portion of the State of California in transit, is infested or infected with any species of injurious insects, their eggs, larvæ or pupæ or animal or plant disease, which would cause damage, or be liable to cause damage to the orchards, vineyards, gardens or farms of the State of California, or which would be, or be liable to be, detrimental thereto or to any portion of said state, or to any of the orchards, vineyards, gardens or farms within said state, and there exists danger of dissemination of such insects or disease while such shipment is in transit in the State of California, then such shipment shall be placed within sealed containers, composed of metallic or other material, so that the same can not be broken or opened, or be liable to be broken or opened, so as to permit any of the said shipment, insects, their eggs, larvæ or pupæ or animal or plant disease to escape from such sealed containers and the said containers shall not be opened while within the State of California.

Sec. 5. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any fruit or vegetable or host plant which is now known to be, or hereafter may become a host plant or host fruit of any species of the fruit fly family *Trypetidæ* from any country, state or district where such species of *Trypetidæ* is known to exist and any such fruit, vegetable, or host plant, together with the container and packing, shall be refused entry and shall be immediately destroyed at the expense of the owner, owners or agents.

Sec. 6. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any peach, nectarine, or apricot tree or cuttings, grafts, scions, buds or pits of such trees, or any trees budded or grafted upon peach stock or roots that have been in a district where the disease known as "peach yellows" or the contagious disease known as "contagious peach rosette" are known to exist, and any such attempting to land or enter shall be refused entry and shall be destroyed or returned to the point of shipment at the option of the owner, owners or agent, and at his or their expense.

Sec. 7. No person, persons, firm or corporation shall bring or cause to be brought into the State of California any injurious animals known as English or Australian wild rabbit, flying fox, mongoose or any other animal or animals detrimental to horticultural or agricultural interests.

Sec. 8. Any person, persons, firm or corporation violating any of the provisions of this act shall be guilty of a misdemeanor and shall be punished by imprisonment in the county jail for a period not exceeding six months, or by a fine not exceeding five hundred dollars, or by both such fine and imprisonment.

Sec. 9. It is hereby determined and declared that this act and each and all of the provisions thereof, constitute and is an urgency measure necessary for the immediate preservation of the public safety and health. The facts constituting such necessity are as follows: There now exists in various islands and territory in close proximity to the State of California dangerous and injurious fruit and plant diseases and insects and animals, and heretofore fruits, vegetables, plants, seeds and other articles of horticulture and agriculture from said islands and territory have been and now are being shipped and brought into the State of California, which are to a large extent infested and infected with dangerous and injurious fruit and plant diseases and insects, their eggs, larvæ and pupæ, and which if continued to be brought into the state will cause great danger to the public health, and will greatly damage the horticultural and agricultural interests of said state, and will also be detrimental to the public health, and this act is necessary to provide ample power to prevent the introduction of such insects and diseases and injurious animals into the state and to prevent the spread of such disease, insects and animals.

Sec. 10. That certain act entitled "An act for the protection of horticulture, and to prevent the introduction into this state of insects, or diseases, or animals, injurious to fruit or fruit trees, vines, bushes, or vegetables, and to provide for a quarantine for the enforcement of this act," approved March 11, 1899, is hereby repealed.

Sec. 11. This act, being an urgency measure as above set forth, shall take effect and be in full force immediately from and after its passage.

Extracts from the Sanders Bill (see page 1650).

2. There is hereby created a board which shall be known as the "Horticultural Inspection Board" of (State), hereinafter called the Board, consisting of three (five) members, two (four) members of which shall be ex-officio members. The third (fifth) member shall be appointed by the Governor for a term of four years. Such third (fifth) member shall be a nursery man actively engaged in the growing of nursery stock. The members of said board shall serve without compensation, but shall receive their actual and necessary traveling expenses incurred in the discharge of their official duties within the provisions of (this act) (sections —— to ——, inclusive). This board is hereby vested with all powers necessary to carry out the provisions of (this act) (sections —— to ——, inclusive.)

Appointment.

3. The Board shall appoint some person qualified by scientific training and practical experience to be state nursery (and orchard) inspector, hereinafter called the inspector, who shall strictly enforce the provisions of (this act) (sections —— to ——, inclusive) as a police regulation of the (state) (commonwealth) under the direction and control of the Board.

Appointment of deputies.

5. The Board is hereby authorized to appoint on the recommendation of the inspector (deputies) (county horticultural inspectors) (district horticultural inspectors) who shall strictly enforce the provisions of (this act) (sections —— to ——,

inclusive) under the direction of the inspector, and they are hereby endowed with the same police power as the state inspector, and shall be furnished with official badges or other insignia of authority, which shall be carried while on duty.

6. The Board (State Horticultural Commission) shall have the power to prescribe, modify and enforce such reasonable rules, regulations and orders as may be needed to carry out the provisions of this act, and may publish an annual report describing the various phases of the inspection work, or may publish such other information as may seem desirable concerning the inspection and such insects and diseases as are covered by (this act) (Sections —— to ——, inclusive). Such rules and regulations to be printed from time to time and furnished free to interested parties.

Inspector's duties and powers.

7. The inspector or his deputies shall at least once each year inspect all nurseries and other places in which nursery stock is kept for sale in the state. For this purpose such state inspector or his deputies shall have free access, within reasonable hours, to any field, orchard, garden, packing ground, building, cellar, freight, or express office, warehouse, car, vessel, or other place, which it may be necessary or desirable for him to enter in carrying out the provisions of this act. It shall be unlawful to deny such access to the inspector or his deputies or to hinder, thwart or defeat such inspection by misrepresentation or concealment of facts or conditions or otherwise.

8. The inspector or his deputies shall have the authority to inspect any orchard, fruit or garden plantation, park, cemetery, private premises, public place, and any place which might become infested or infected with dangerous or harmful insects or plant diseases. He shall also have the authority to inspect or reinspect at any time or place any nursery stock shipped in or into the state and to treat it as hereinafter provided.

Diseased plant material on premises.

9. The inspector with the approval of the Board (State Horticultural Commission) is hereby empowered to prohibit and prevent the removal or shipment or transportation of plant material and any other material from any private or public property, or property owned or controlled by the state, or any area of the state (commonwealth) which in his judgment contains dangerously infested or infected nursery stock or plant or other material of any kind for such periods and under such conditions as in his judgment seems necessary in order to prevent the further spread of the infestation or infection, giving such notice thereof as may be prescribed by the Board; and during the existence of such order no person shall remove or ship from such area any such material whatsoever, except by special permission or direction (certificate) of the inspector.

10. It shall be unlawful for any person in this state knowingly to permit any dangerous insect or plant disease to exist in or on his premises. It shall also be unlawful to sell or offer for sale any stock infested or infected with such insect or disease.

11. In case the inspector or his deputy shall find present on any nursery or dealer's premises or any packing ground or in any cellar or building used for storage or sale of nursery stock any injurious insect or plant disease, he shall notify the owner or person having charge of the premises in writing to that effect, and shall withhold his certificate hereinafter provided for, until the premises are freed from such injurious insect or plant disease, as hereinafter provided. It shall be unlawful for any person after receiving such notice to ship or deliver or cause to be shipped or delivered any nursery stock from such aforesaid premises.

12. (1) If the inspector or his deputy shall find on examination any nursery, orchard, small fruit plantation, park, cemetery, or any private or public premises infested with injurious insects or plant diseases, he shall notify the owner or person having charge of such premises to that effect, and the owner or person having charge of the premises shall within ten days after such notice cause the removal and destruction of such trees, plants, shrubs or other plant material if incapable of successful treatment; otherwise, cause them to be treated as the inspector may direct. No damages shall be awarded to the owner for the loss of infested or infected trees, plants shrubs or other plant material under this act.

(2) In case the owner or person in charge of such premises shall refuse or neglect to carry out the orders of the inspector within ten days after receiving written notice, the inspector may proceed to treat or destroy the infested or infected plants or plant material. The expense thereof shall be assessed collected and enforced as taxes are assessed collected and enforced against the premises upon which such expense was incurred. The amount of such expense when collected shall be paid to and become a part of the fund used to enforce the provisions of (this act) (sections —— to ——, inclusive).

Imported stock.

14. Every person receiving directly or indirectly any nursery stock from foreign countries shall notify the (state) (county) (district) inspector of the arrival of such shipment, the contents thereof and the name of the consignor; and shall hold such shipment unopened until duly inspected or released by the inspector. In case any infested or infected stock is discovered in such shipment, the shipment shall be subject to the provisions of (this act) (sections —— to ——, inclusive).

Nursery certificate.

15. (1) The inspector shall cause to be issued to owners of any nursery in the state after the stock has been officially inspected as previously provided, and found to be apparently free from injurious insects or plant diseases, a certificate setting forth the fact of such inspection and the number of acres or fraction thereof inspected. Said certificate shall be valid not to exceed one year from (month) 1st.

(2) It shall be unlawful for any person to sell, to offer for sale or to remove or ship from a nursery or other premises, any nursery stock unless such stock has been officially inspected and a certificate or permit has been granted by the inspector.

Dealer's certificate.

16. All dealers within the meaning of this act, located either within or without the state, engaged in selling nursery stock in this state or soliciting orders for nursery stock within this state, shall secure a dealer's certificate by furnishing a sworn affidavit that he will buy and sell only stock which has been duly inspected and certified by an official state inspector; and that he will maintain with the inspector a list of all sources from which he secures his stock.

Agent's certificate.

18. All agents within the meaning of this act selling nursery stock or soliciting orders for nursery stock for any nurseryman or dealer located within the state or outside the state, shall be required to secure and carry an agent's certificate bearing a copy of the certificate held by the principal. Said agent's certificate shall be issued only by the (State) inspector to agents authorized by their principal or upon request of their principal. Names and addresses of such agents shall not be divulged by the inspector or the board.

19. The inspector shall at any time have the power to revoke any certificate for sufficient cause, including any violation of (this act) (sections —— to ——, inclusive) or non-conformity with any rule or regulation promulgated under (this act) (sections —— to ——, inclusive).

ÍNULA (ancient name). *Compósitæ.* Hardy herbaceous plants of the easiest culture and of rather coarse habit, with heads of yellow or orange, each 2 to 4 inches across, borne in summer.

Herbs, usually perennial, glandular, hairy: lvs. radical or alternate, entire or serrate: heads large, medium or small, solitary, corymbose, panicled or crowded at the crown; fls. tubular and ray, the rays yellow, rarely white; disk-fls. perfect, their tubular corollas 5-toothed: achenes 4–5-ribbed.—A genus of about 56 species, found in Eu., Asia and Afr. None of its near allies is cult.

There is such a great abundance of autumn-flowering yellow composites in the hardy border that only those inulas that bloom in early summer are particularly desirable. Elecampane, *I. Helenium*, is probably also cultivated for medicine. A preparation of the mucilaginous roots is common in drugstores. Inula flowers have as many as forty linear rays. The plants like a sunny position, grow vigorously in any garden soil, and are propagated by division or seed.

A. *Sts. panicled or corymbose.*

Helènium, Linn. ELECAMPANE. Fig. 1959. Tall, thick-stemmed: lvs. unequally dentate-serrate; root-lvs. elliptic-oblong, narrowed into a petiole; st.-lvs. half-clasping, cordate-oblong: outer involucral parts leafy, ovate. Wet, sandy and mountainous regions. Eu., N. Asia. Naturalized in Amer.—The roots are thick and carrot-like. For medicinal purposes, 2-year-old roots should be dug in Aug. If older, they are likely to be stringy and woody.

AA. *Sts. 1-fld., or with at most 2 or 3 heads.*

B. *Outer involucral parts linear and numerous.*

C. *Plants 2½ ft. tall or more.*

grandiflòra, Willd. Height 3–4 ft., the st. simple and hairy: lvs. elliptic-oblong, serrulate, all sessile; upper ones subcordate; lower ones 2–4 in. long: glands numerous: heads 3¼–4 in. across. Himalayas, Caucasus. G.F. 6:406.—Earliest blooming inula in cult. Bears orange-yellow fls. 5 in. across in June, and has bold but not coarse habit.

glandulòsa, Willd. Height 2½–4 ft.: lower lvs. oblong-spatulate, long-attenuate at the base, the uppermost oblong with a subcordate-decurrent base, all entire or very obsoletely denticulate: glands remote;

scale of involucre lance-shaped and hairy. Caucasus. B.R. 334. B.M. 1907. Gn. 22. p. 234; 25, p. 101; 49:6 and p. 7. J.H. III. 35:153; 63:139. R.H. 1881, p. 419. G.M. 33:541; 38:477. G. 5:337; 7:649, 651. Var. **laciniàta**, Hort., seems to be a trade name for the fimbriate form figured in G.M. 46:625.—Keller says it has deep golden-yellow, fringed, half-drooping rays. Rays are commonly said to be entire, but B.M. 1907 shows 2 minute teeth, and in B.R. 334 the fringes are more than ¼in. long. This is said to be the only cult. species that does not seed freely. The Garden pictures an orange variety.

CC. *Plants 2 ft. or less tall.*

Hoòkeri, C. B. Clarke. Height 1–2 ft., usually very shaggy above: lvs. 3–5 in. long, sessile or narrowed into very short petioles, oblong-lanceolate, acute at the base, minutely toothed, glandular: heads 1½–2½ in. across; rays "pale yellow," according to Hooker. Himalayas. B.M. 6411 (rays pure yellow).—Fls. orange-yellow, according to J. W. Manning. It is said to flower in Aug. and Sept., and has bright yellow fringed rays. However, in B.M. 6411 the rays have only 3 minute teeth.

1959. Inula Helenium. (×⅓)

británnica, Linn. A hairy perennial usually not over 18 in. high, with a simple st. and lanceolate slightly toothed lvs.: fls. lemon-yellow, the bracts linear and very numerous. June–Aug. Eu. and Asia.—Useful for its early bloom and small stature.

BB. *Outer involucral parts lanceolate and leafy.*

hírta, Linn. St. 12–15 in. high, simple: lvs. netted-veined, lanceolate or ovate-oblong, the lowest narrowed at the base, the others rounded at the base and half-clasping, all entire or finely ciliate. Eu., N. Asia.—Fls. July–Aug.

ensifòlia, Linn. (*I. bubònium,* Hort.). St. about 2 ft., simple: lvs. with numerous somewhat parallel nerves, narrowly linear-lanceolate: fls. large, yellow, the involucral parts appressed, not spreading. Eu., N. Asia. G.M. 41:559.—July, Aug. Rockery plant; blooms first year from seed if sown early.

Royleàna, DC. A striking, large-fld. elecampane with orange-yellow petals: st. unbranched, bearing numerous ovate, slightly toothed, hairy lvs. which are narrowed at the base into winged petioles: fls. very numerous in each head, showy; buds conspicuous, black. Himalayan region. F.S.R. 1:310. G.C. III. 38:264. Gn.W. 23:693. G. 30:117.—Suitable for somewhat protected places.

AAA. *Sts. racemosely clustered.*

racemòsa, Hook. f. A tall stout perennial, 1–5 ft., with a grooved st. and leathery lvs. 8–18 in. long: heads numerous, 1½–2 in. across, showy, the outer bracts with recurved tips. Himalayas.—Little known in Amer. and perhaps not hardy.

I. Óculus-Chrísti, Linn. Two ft.; an erect, somewhat branched, woolly perennial with oblong hairy lvs.: fls. yellow, the rays twice longer than the involucral bracts. Sold in England, but apparently unknown in Amer.

N. TAYLOR.†

IOCHRÒMA (Greek, *violet-colored*). *Solanàceæ.* Flowering shrubs cultivated outdoors in California and under glass in Europe.

In the wild, shrubs or small trees; spineless, glabrous or mostly stellate-tomentose: lvs. entire, often large: fls. purple, blue, scarlet, yellow or white, in clusters or on twin pedicels; corolla long-tubular or narrow-trumpet-shaped, with 5 short or very small lobes, the throat more or less closed by appendages or folds; stamens inserted in the tube, included or exserted; disk present or absent; ovary 2-celled: fr. a pulpy berry.—Species about 20, mostly in W. Trop. S. Amer.

A. *Fls. blue.*

lanceolàtum, Miers. Shrub, 4–8 ft. high, the young branches downy with stellate hairs: lvs. alternate, oval or elliptic-lanceolate, acute, entire, tapering below into a long petiole: umbels supra-axillary and terminal; fls. rich deep purple-blue; corolla-tube slightly curved, somewhat puberulent, the margin shortly unequally 5-lobed or -toothed and pubescent. Ecuador. B.M. 4338 and F.S. 4:309 (as *Chænestes lanceolata*).—Seedlings are said to vary in shades of violet or purple.

tubulòsum, Benth. Shrub, 4–6 ft., the sts. and lvs. pubescent or hairy: lvs. stalked, ovate, attenuate at base and acute or somewhat abruptly acuminate at apex: fls. deep blue, as many as 20 sometimes hanging in a graceful cluster; corolla about 1½ in. long, tubular, the brief margin or limb 5-toothed. Colombia. B.R. 31:20. F.S. 1:131.

grandiflòrum, Benth. (*I. Warscewíczii,* Regel). Handsome shrub, with terete pubescent branches: lvs. broadly ovate, rounded at base and acuminate at apex, pubescent above and paler beneath: fls. in a simple peduncled terminal several-fld. pendulous cyme, large and rich purple; corolla funnelform, the tube long and pubescent, the throat flaring or campanulate and the large limb with 5 triangular spreading-recurved lobes; filaments included, glabrous. Ecuador. B.M. 5301. F.S. 11:1163. H.F. II. 5:102. Gt. 4:130.—The *I. purpureum* of trade-lists may belong here.

AA. *Fls. scarlet, orange-scarlet or yellow (to white in cult.).*

fuchsioìdes, Miers. Shrub, glabrous or nearly so: lvs. often clustered, obovate to oval or oblong, very obtuse, tapering at the base into a short petiole: fls. more or less clustered, orange-scarlet, drooping; corolla thrice exceeding the 5-toothed and bursting calyx, the tube long-cylindrical and nearly straight, the limb 5-angled and with intermediate teeth; filaments included, downy at the base. Peru. B.M. 4149 and F.S. 1:157 (both as *Lycium fuchsioides*).—A white-fld. form is also offered.

flàvum, André. Bushy shrub, 6 or 7 ft., the young growth glabrous: lvs. alternate and stalked, oval-lanceolate, short-pubescent beneath, attenuate at both ends: fls. pale yellow, in drooping axillary clusters, tubular, 1½ in. long, the border or limb short-toothed. Colombia. R.H. 1898:360.

coccíneum, Scheidw. Shrubby, the branches pubescent: lvs. stalked, oblong, undulate and somewhat repand, long-acuminate, hairy on nerves and veins: fls. in an umbel-like fascicle, drooping, scarlet; corolla long-tubular, about 2 in. long, with a narrow border or limb; calyx about ¼in. long, broadly short-toothed. Cent. Amer. F.S. 12:1261.

L. H. B.

IÒNE (one of the nereids). *Orchidàceæ.* About a half-dozen pseudobulbous orchids of E. India, by some united with Bulbophyllum: lateral sepals usually connate and under the lip, the latter rather large, straight and rigid; pollinia 4, attached in pairs to 2 glands. *I. paleàcea,* Lindl. (*Bulbophýllum paleàceum,* Benth.), has drooping fls. about 1 in. long, many in erect spikes; sepals greenish with pink nerves; petals spreading, broadly oblong and 1–3-nerved; lip ovate-lanceolate: scape exceeding the lf., about 9 in. India. B.M. 6344. *I. siaménsis,* Rolfe. Pseudobulbs 1-lvd., 4-angled-ovoid: lvs. narrow-oblong, about 3 in. long: scapes nearly erect, slender, about 6 in. long, bearing a raceme about 2½ in. long that has 9–10 fls., which are about ⅓in. long, pale green with dull purple on lateral sepals and lip and with purple dots near margin of outer segms. Siam. Recent. *I. grandiflòra,* Rolfe. Pseudobulbs 1-lvd., ovoid: lvs. oblong, 2 in. or less long: scapes erect, 1-fld.; fl. dull lurid purple; sepals and petals oblong, acute; lip cordate-ovate, hirsute above, keeled beneath. Burma. Recent.

L. H. B.

IONÍDIUM CONCOLOR: *Hybanthus.*

IONOPSÍDIUM (Greek, *violet-like*). *Crucíferæ.* One pretty, tufted little plant, growing 2 or 3 in. high and bearing numerous small 4-petaled, lilac fls. from spring to fall. It is a half-hardy perennial from Portugal and N. Afr., but is treated as an annual. It is desirable for edgings in moist shady places, and for rockeries; also as a pot subject in window-gardening. In rich garden soil the plants make numerous runners. The fls. are about ½in. across, 1 on each stalk. They open white and turn lilac. The plant has been advertised as the diamond flower. This plant is referred by some to Cochlearia, a genus whose limits are very uncertain.

acaùle, Reichb. (*Cochleària acaùlis,* Desf.). Lvs. ovate-rotund, heart-shaped at the base; petioles proportionately very long: pods subrotund, notched. B.R. 32:51. Gn. 71, p. 90; 72, p. 398.—Summer to winter.

Wilhelm Miller.

IONÓPSIS (Greek, *violet-like*). *Orchidàceæ.* A small group of epiphytic orchids, numbering about ten species, many of which can probably be reduced to varieties of a few species. Most of the species are insignificant, only one or two being cultivated.

Tropical herbs without pseudobulbs, having very short sts., with few, narrow, sheathing, coriaceous lvs.: sepals subequal, erect, spreading, the dorsal one free, the lateral ones united into a short spur behind; petals like the dorsal sepals; labellum united to the base of the column, middle lobe large, expanded, 2–3 times as long as the sepals, 2-lobed; column short; pollinia 2; fls. small, in simple racemes or much-branched panicles. The fine specimen of *I. paniculata* figured in the Botanical Magazine has a panicle 10 in. long, 8½in. wide, with 5 branches, and about 80 fls., each ¾in. across and chiefly white, with violet markings near the center and a dash of yellow. In its native country it is said to remain in attractive condition from Sept. to May. The fls. are produced so freely and over so long a period that it is sometimes necessary to destroy the fl.-spikes, which are out of all proportion to the number of lvs. The plants succeed in the warmhouse under the same treatment as rodriguezias or the more delicate oncidiums.

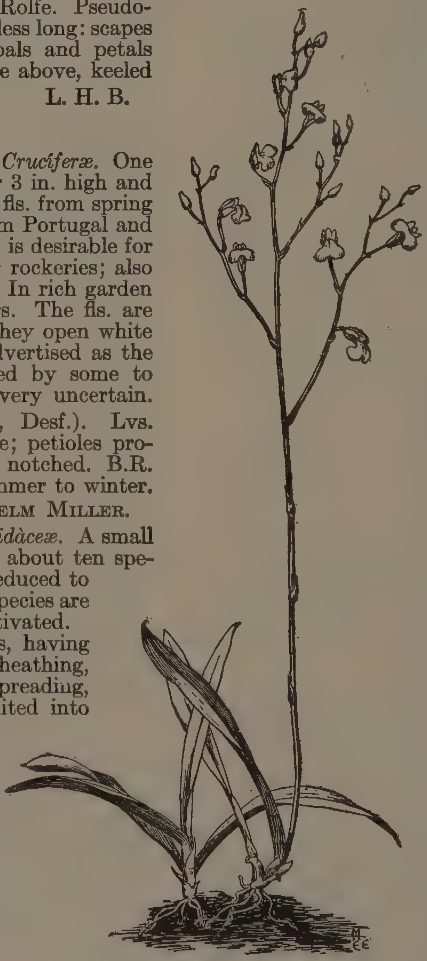
The best means of culture for the successful growing of these beautiful though delicate orchids is in shallow pans with plenty of small broken coal cinders for drainage, covered with the fine particles of fern root and chopped sphagnum gathered from the upland meadows. Plenty of heat and moisture during the growing season are essential. Rest them in winter at a temperature of 50° to 55° F. (Wm. Mathews.)

paniculàta, Lindl. Lvs. thick and channelled, linear-lanceolate, keeled, 2–3 in a cluster and about 6 in. long: panicle much branched and spreading, loaded with innumerable fls. of a delicate texture; sepals and petals very short, sharp-pointed, the petals wider; labellum very large, pubescent at base, with a 2-lobed rounded limb, which in some is almost entirely white, while in others it has a spot of purple or yellow on the disk. Winter. Brazil. B.M. 5541. F.S. 22:2333. A.F. 6:631. C.O. 1.—Very variable.

utricularioìdes, Lindl. Fig. 1960. Lvs. and general habit as in the last: sepals and petals bluntish; spur short; labellum almost twice as long as the petals; lobes subquadrate-rounded, white, streaked with red veins. Jamaica.

I. testiculàta, Lindl. Lvs. tufted, terete, acuminate: fls. whitish, small, numerous. Jamaica.

Heinrich Hasselbring.



1960. Ionopsis utricularioides. (×⅓)

IPECAC. The root of *Cephaëlis Ipecacuanha* (Vol. I, p. 714), a Brazilian plant not cultivated in North America. For wild or American ipecac, see *Gillenia stipulacea.*

IPOMŒA (according to Linnæus from *ips,* bindweed, and *homoios,* like, because of its resemblance to Convolvulus; but ips is a worm). Including *Batàtas, Operculìna,* and *Phárbitis. Convolvulàceæ.* Morning-Glory. Moonflower. Annual or perennial herbs, mostly twining, rarely trees (G.F. 7:364) or shrubs, widely distributed in tropical and temperate regions. They are remarkable for easy culture, quick growth and beautiful flowers; hence the genus includes several of our most popular plants for covering verandas and screening unsightly objects.

The generic characters of Ipomœa are not clearly defined. It is distinguished from Convolvulus by having but 1 capitate or 2–3 globose stigmas, while Convolvulus has 2 linear or ovate stigmas. From Calonyction and Quamoclit it is distinguished by its funnelform corolla-tube and the stamens usually included. St. mostly slender, twining or climbing,

LVIII. One of the many beautiful garden irises.

sometimes prostrate, diffuse or erect: lvs. alternate, entire, lobed or parted, often varying greatly on the same plant: fls. usually showy, borne singly or in cymes on axillary peduncles; corolla funnelform, salverform or bell-shaped (in one species bag-shaped), the limb sometimes entire, but usually 5-angled or 5-lobed (a 5-petalled form of *I. purpurea* occurs as a monstrosity), red, purple, blue, white or yellow, in various shades and mixtures; calyx without the bracts at the base, which appear in some species of Convolvulus, but the outer sepals are commonly larger. The fls. of most species open in early morning and last but a few hours under bright sunlight, hence the popular name. A few open only at nightfall.—Over 400 species of which more than 200 occur in Trop. Amer., chiefly in Mex.

"The Japanese morning-glories," also called "Imperial" and "Emperor" morning-glories, were introduced to the American trade from Japan in 1895. They are probably selected strains of *I. hederacea*, although some botanists consider them to be of hybrid origin, possibly *I. hederacea* × *I. tricolor*. Maximowicz referred them to *I. hederacea*, and this appears to be the more reasonable disposition. The culture of the "asagoa" in Japan amounted to a popular craze about 1830, the equivalent of $14 to $18 sometimes being paid for a single seed of the rare sorts. With political disturbances came a decline of interest, but more recently the popular fancy for morning-glories has again revived. The Japanese gardeners grow their plants almost entirely in pots, and by constant attention have made them vary into many curious oddities in flower and foliage. Several finely illustrated books on the morning-glory alone are published in Japan. See also "Century Magazine," 55:281 (1897). The Japanese ipomeas are sold in this country mostly in strains, each package of seed giving flowers of many forms and colors. There are some inferior strains offered, and the flowers from these are often disappointing; yet as a class the Japanese morning-glories are the most gorgeous and versatile of garden ipomeas. If the seeds are notched they will generally give bloom in six weeks from sowing.

Morning-glories are among the least exacting of garden plants as regards soil and site. Most species love a strong soil and sunny site, with plenty of water; but they will make the best of much that is uncongenial. The seeds of the annual kinds may be sown directly out-of-doors, but are preferably started indoors, at least in the North. If the plants are allowed to become slightly pot-bound before being transplanted, they will come into bloom earlier. Germination may be hastened and also made more certain by filing a small notch in each seed, or by soaking the seeds in warm water about two hours. The "moonflower" and the "Japanese morning-glories" particularly are likely to germinate poorly unless these precautions are taken.

The perennial ipomeas are grown from seeds in some cases, but mostly from cuttings of well-ripened wood, layers, or division of the rootstocks. Some of the greenhouse species, notably *I. Horsfalliæ*, rarely produce seed and are rooted from stem-cuttings with great difficulty. These are often propagated successfully by grafting well-ripened shoots on pieces of their own roots, or the roots of *I. pandurata*. *I. ternata* roots from cuttings more readily, and *I. Learii* and *I. Jalapa* are easily propagated from cuttings.

The rapid growth and dense foliage of most garden ipomeas make them especially valuable for covering arbors, verandas, walls, and for screening unsightly objects. *I. purpurea*, *I. tricolor*, *I. hederacea* are the most popular annual species for this purpose; and *I. Learii*, *I. setosa* and *I. pandurata* are among the best perennials. In the South, the perennials may be carried through the winter outside by cutting off the stems and mulching the roots heavily in the fall; in the North the tubers should be taken up and wintered like dahlias, keeping them perfectly dry in a cool greenhouse or frost-proof cellar. *I. leptophylla* is valuable for very dry soils. *I. Bona-nox* (see *Calonyction aculeatum*) is worthy of a place in every garden.

The tender perennials are seen to advantage when trained to pillars, trellises, or along the roof of a greenhouse. Their roots should be given plenty of room to forage and their tops to spread. *I. Horsfalliæ* and its closely related species, *I. ternata*, are very satisfactory for this purpose. After flowering, the strong shoots should be cut back and the plant rested. Several species, particularly *I. Learii*, *I. tricolor* and *I. hederacea*, make excellent pot-plants if they are kept somewhat pot-bound to induce flowering. The roots of nearly all the perennial species are more or less purgative; particularly *I. Purga*, from which comes the jalap of commerce, *I. Jalapa* and *I. cathartica*. *I. Batatas* is the common sweet potato.

The trade names of ipomeas are endlessly mixed. Thus, *I. mexicana* of the catalogues may be *I. hederacea*, *I. digitata*, *I. Jalapa*, *I. Bona-nox*, *I. Learii* or *I. tricolor;* but is rarely the true *I. mexicana* of Gray. "Moonflower" is often applied indiscriminately to several species of Ipomœa, but it should be restricted to species of Calonyction. It is evident that most of the plants now sold as *I. grandiflora* are forms of *Calonyction aculeatum*. *I. hybrida* is a trade name for strains of *I. purpurea* and *I. tricolor*. The "tree ipomœa" is *I. fistulosa*. The "Japanese" or "Imperial" morning-glories may be referred to *I. hederacea*. Other popular catalogue names are: Double morning-glory is mostly *I. purpurea fl.-pl.;* Brazilian morning-glory is *I. setosa;* hardy or perennial moonflower is *I. pandurata;* Ipomœa, Heavenly Blue, is *I. tricolor*.

INDEX.

acetosæfolia, 8.
alba, 10, 18, 19.
angustifolia, 17.
Antillana, 28.
arborescens, 5.
atro-cærulea, 10.
atro-sanguinea, 10.
aurea, 21.
azurea, 10.
Batatas, 33.
Bona-nox, 30.
bonariensis, 25.
Briggsii, 19.
Carletonii, 1.
carminata, 10.
carnosa, 8.
chrysantha, 27.
chryseides, 27.
corymbosa, 28.
cymosa, 28.
dealbata, 12.
Dickensonii, 10.
digitata, 24.
dissecta, 23.
Ferrandiana, 13.
ficifolia, 25.
filicaulis, 17.
fistulosa, 4.
flore-pleno, 10.
foliis marmoratis, 13.
fuchsioides, 15.
Goodellii, 4.
grandiflora, 13, 30.
hederacea, 13.
heterophylla, 9.
hirsutula, 11.
Hookeri, 18.
Horsfalliæ, 19, 20.
Huberi, 10.
insignis, 24.
integrifolium, 15.
Jalapa, 16, 29, 32.
kermesina, 10.
latifolia, 30.
Learii, 12, 14.
leptophylla, 2.
limbata, 13.
Lindheimeri, 9.
Lindleyana, 9.
littoralis, 8.
longifolia, 1.
macrorhiza, 29.
maritima, 7.
marmorata, 13.
mexicana, 11.
Michauxii, 29.
microdactylum, 15.
mutabilis, 12.
Nil, 13.
palmata, 24.
pandurata, 31.
paniculata, 24.
Perringiana, 25.
Pes-capræ, 7.
Purga, 16.
purpurea, 10.
rosea, 10.
rubro-cærulea, 18.
sagittata, 26.
scabra, 13.
Sellowii, 25.
setosa, 22.
sidæfolia, 28.
sinitata, 23.
sinuata, 23.
speciosa, 26.
stans, 3.
stolonifera, 8.
ternata, 20.
texana, 4.
Thomsoniana, 20.
tricolor, 18.
Tuba, 30.
varia, 10.
ventricosa, 30.
violacea fl.-pl., 10.
violacea-striata, 10.
Wolcottiana, 6.

KEY TO THE SPECIES.

A. *Plants erect, stout, perennial, shrubby or tree-like.*
  B. *Sts. erect or ascending from a tuberous root.*
    C. *Corolla white or cream-colored: lvs. lanceolate* . . . . **1. longifolia**
    CC. *Corolla purple.*
      D. *Lvs. linear* . . . . **2. leptophylla**
      DD. *Lvs. hastate and toothed* . . . . **3. stans**
  BB. *Sts. subshrubby, 4–10 ft. high: corolla pink-purple* . . . . **4. fistulosa**
  BBB. *Sts. woody, erect: arborescent: corolla white.*
    C. *Foliage more or less densely pubescent; lvs. ovate, cordate* . . . . **5. arborescens**
    CC. *Foliage glabrous; lvs. ovate-lanceolate, rounded or truncate at base*. . **6. Wolcottiana**
AA. *Plants twining, climbing or prostrate.*

B. *Sts. prostrate or creeping, not twining.*
C. *Lf.-blades suborbicular, obcordate or notched at apex: fls. blue or purple*........................ 7. **Pes-capræ**
CC. *Lf.-blades variously lobed or oblong-lanceolate: fls. cream-colored*.... 8. **stolonifera**
BB. *Sts. twining or climbing.*
C. *Sepals herbaceous, often elongated and hairy; ovary and caps. 3-celled, 6-seeded (Pharbitis).*
D. *Lvs. deeply 3–5-lobed*.......... 9. **Lindheimeri**
DD. *Lvs. entire or 3-lobed.*
E. *The sepals merely acute.*
F. *Corolla 1½–2-in. long: lvs. usually entire*.............10. **purpurea**
FF. *Corolla about 1 in. long: lvs. usually 3-lobed*............11. **hirsutula**
EE. *The sepals attenuate or caudate-attenuate.*
F. *The lvs. silvery-canescent or silky: corolla purple*.......12. **mutabilis**
FF. *The lvs. hispid to glabrate, not canescent.*
G. *Tips of sepals linear-attenuate, hispid below, the tips spreading*...............13. **hederacea**
GG. *Tips of sepals long-acuminate, not spreading, appressed pubescent with silvery hairs*...............14. **Learii**
CC. *Sepals thick, rarely subherbaceous and then not elongated.*
D. *Corolla salverform; stamens slightly exserted: st. woody below (Exogonium).*
E. *The corolla scarlet, 1½ in. long: lvs. lobed or entire*......15. **microdactylum**
EE. *The corolla blue or purple, 2½ to 3 in. long*...............16. **Purga**
DD. *Corolla not salverform; stamens rarely if ever exserted (Batatas and Operculina).*
E. *The plants annual: sts. glabrous.*
F. *Lvs. linear or lanceolate, subsessile: fls. small, white*.....17. **angustifolia**
FF. *Lvs. ovate-cordate: fls. large, red, blue, or purple*........18. **tricolor**
EE. *The plants perennial, often with large fleshy or woody roots or rootstocks.*
F. *Lvs. divided to the petiole into 3–9 separate, stalked or sessile lfts.: peduncles equaling or shorter than the petioles.*
G. *Fls. red: lf.-segms. sessile, tapering to both ends, margin wavy*............19. **Horsfalliæ**
GG. *Fls. white: lf.-segms. stalked, not tapering to the ends, margin not wavy*.........20. **ternata**
GGG. *Fls. yellow: lf.-segms. sessile, long-pointed*.........21. **aurea**
FF. *Lvs. deeply divided but not into separate lfts.*
G. *Pedicels thickened and fleshy; sepals accrescent in fr., setaceous; corolla subsalverform, purplish red*...22. **setosa**
GG. *Pedicels not thickened nor sepals accrescent.*
H. *Fls. white: segms. of lvs. much toothed or cut; petioles and sts. hispid*...23. **sinuata**
HH. *Fls. rose-purple: lvs. palmately 5–7-lobed to beyond the middle*........24. **digitata**
FFF. *Lvs. entire, angulate or lobed, not divided.*
G. *Sts., lvs. and peduncles densely hairy: corolla funnelform, its lobes obtuse: lf.-lobes unequal, blunt*....25. **bonariensis**
GG. *Sts. and foliage not hairy.*
H. *The lvs. sagittate, short-petioled: fls. 2–3 in. long, purple*................26. **sagittata**
HH. *The lvs. cordate.*
I. *Corolla small, ½–¾ in. wide.*
J. *Color of corolla yellow*..27. **chryseides**
JJ. *Color of corolla white: fls. in dense cymose clusters*.............28. **sidæfolia**
II. *Corolla large, 2–4 in. long.*
J. *Foliage whitish tomentulose: fls. cream-colored with a magenta throat*..............29. **macrorhiza**
JJ. *Foliage not whitish tomentulose.*
K. *Color of corolla white, 3–4 in. long: caps. large, 1 in. diam., operculate-dehiscent*..............30. **Tuba**
KK. *Color of corolla white with a magenta throat: foliage pubescent or glabrate; lvs. pale beneath*....31. **pandurata**
KKK. *Color of corolla pink, yellowish purple or purple.*
L. *Lvs. softly pubescent, plicate-veined: fls. pink or purplish*............32. **Jalapa**
LL. *Lvs. glabrous, acute, cordate, hastate or variously lobed*....33. **Batatas**

1. **longifòlia,** Benth. (*I. Cárletonii,* Holzin.). Sts. glabrous, erect or ascending from a large tuberous root: lvs. linear-lanceolate to oblong-lanceolate, nearly sessile: fls. large, 2–3 in. long, white. Prairies and plains, Okla. to Texas and Mex. and Ariz. Contr. Nat. Herb. 1:17.

2. **leptophýlla,** Torr. Bush Moonflower. St. 2–5 ft. high, with many slender, recurving branches: lvs. 2–4 in. long, entire: peduncle stout, 1–4-fld., usually

1961. Morning-glory, Ipomœa purpurea (×½) shorter than the lvs.; corolla about 3 in. across, funnelform, rose-pink, deepening to purple in the throat. Aug.–Oct. Dry plains, Neb. and Wyo., south to Texas and N. Mex. Plant World 7:5, 6.—This and the preceding species are adapted for very dry places because of the enormous tuberous rootstocks, which often weigh 100 pounds and extend into the subsoil for 4 ft. They sometimes thrive where no rain has fallen for 1–3 years. The plant is beautiful when in flower.

3. **stáns,** Cav. A beautiful erect, branching shrub with a thickened woody root: sts. and foliage finely pubescent: lvs. nearly sessile, oblong, hastate and deeply toothed at the base: fls. solitary on axillary peduncles, pink or purple, 2–2½ in. long. Mex.—The best of the several species of Mexican bush moonflowers, none of which is hardy.

4. **fistulòsa,** Mart. (*I. texàna,* Coulter). St. 4–10 ft. high, subshrubby, branching, smooth or minutely pubescent: lvs. 4–6 in. long, thickish, entire or nearly so: peduncles 1–2 in. long, mostly shorter than the petioles, few- to many-fld.; corolla about 3 in. long, bell-shaped, pink-purple. July–Sept. Brazil; now escaped from gardens in Mex. and S. U. S.—It is known to the trade chiefly as var. **Goòdellii** (*I. Goòdellii,* Hort.). This variety has lavender-pink fls., with a darker throat, and is apparently more floriferous and desirable than the type. It produces seed sparingly, but is easily rooted from cuttings. In the S. it is hardy if the st. is cut down and the roots mulched: in the N., the roots must be brought indoors. Advertised as the "tree ipomœa."

5. **arboréscens,** Don. An erect, woody, tree-like plant, reaching 15–20 ft. height: twigs and foliage finely velvety-pubescent: lvs. ovate-cordate: sepals oval, obtuse, ¼in. long, pubescent within and without; fls. white, 2 in. long: seeds black with a long coma of white hairs on the dorsal angles. Mex. G.F. 7: 364.—Requires a dry cool air like most of the cacti and makes an interesting companion plant to them in a cactus-house.

6. **Wolcottiàna,** Rose. Tree, 25–30 ft. high, often 1 ft. through, with slender, slightly drooping branches: lvs. ovate to ovate-lanceolate, 3–5 in. long, smooth: fls. numerous, in short racemes or corymbs; corolla about 2½ in. broad, white, broadly bell-shaped. Mex. G.F. 7:365.—Seeds do not germinate readily.

7. **Pes-càpræ,** Roth (*I. marítima,* R. Br.). St. creeping, seldom twining, 20–60 ft.: roots often 12 ft. long and 2 in. thick: lvs. 1–4 in. long, fleshy, roundish, often broader than long, with 2 glands at the base and prominently pinnate-veined: peduncles usually few-fld., equaling the petioles; corolla nearly 2 in. long, bell-shaped, margin scarcely lobed. Aug.–Oct. Trop. coasts of both hemispheres; drifting sands of coast, Ga. to Texas. B.R. 319.

8. **stolonífera,** Poir. (*I. carnòsa,* R. Br. *I. acetosæfòlia,* R. & S. *I. littoràlis,* Boiss. not Blume). Sts. glabrous, creeping and often rooting at the nodes: lvs. variously lobed or oblong-lanceolate, not cordate: fls. cream-colored, 1½ in. long. Circumtropical on sandy shores, S. C. to Fla. Cyrill, Pl. Rar. fasc. 1. pl. 5.

9. **Líndheimeri,** Gray (*I. heterophýlla,* Torr., not Ort.). Plant finely pubescent, hoary when young: lvs. deeply 5-cleft or 5-parted, all of the lobes or the 3 interior ones ovate to ovate-lanceolate, with a much contracted base: peduncle 1–2-fld.; corolla long-funnelform, about 3½ in. long, light blue. Rocky soils, W. Texas to N. Mex. Var. **Lindleyàna,** Hort. (*I. Lindleyàna,* Hort.), has smaller lvs., lighter colored fls., and is a more profuse bloomer. An improvement on the type, but more tender.

10. **purpùrea,** Roth (*Convólvulus màjus,* Hort. *Convólvulus purpùreus,* Linn.). TALL MORNING-GLORY. Fig. 1961. St. trailing or twining for 4–10 ft., branching from the base: peduncles slender, 1–5-fld., often longer than the petioles; corolla 1–2 in. long, light blue, purple, pink and diversely variegated. July–Sept. Trop. Amer. Escaped from gardens to waste places, Canada to Fla., west to Neb. and Texas, widely distributed in most tropical regions. B.M. 113, 1005, 1682. Gn. 21, p. 295; 27, p. 473.—One of the most popular of garden annuals. Some of its varieties resemble the entire-leaved forms of *I. hederacea,* but may be distinguished by their longer and more slender peduncles, umbellate pedicels, and oblong-acute sepals without the long tip usually found on *I. hederacea.* Seeds ripen freely on cult. varieties and may be gathered for future sowings. Among the host of garden forms are: **álba,** white; **atro-cærùlea,** dark blue; **atro-sanguínea,** dark purple; **azùrea,** sky-blue; **carminàta,** light crimson; **Díckensonii** (*Phárbitis híspida* var. *Díckensonii*), azure-blue; **Hùberi** (*I. Hùberi* var. *variegàta,* Hort.). Lvs. marked with silvery white, fls. variously colored and margined with white; **kermesìna** (*I. kermesìna*), scarlet; **rôsea,** blush-rose; **vària,** a trade name for packages containing a mixture of many kinds; **violàcea-striàta,** violet-purple. There are several double forms of *I. purpurea.* Var. **flòre-plèno,** Fig. 1962, has very large lvs.: fls. appearing much later than single varieties, semi- or much-doubled, bluish white streaked with light blue or pink. Intro. 1892. Said to be very floriferous and a good pot-plant. G.F. 5:593 (adapted in Fig. 1962). A.G. 14:246. Var. **violàcea fl.-pl.,** Hort., is entirely distinct from the preceding. Gt. 47, p. 133.

1962. Ipomœa purpurea var. flore-pleno.

11. **hirsùtula,** Jacq. (*Phárbitis diversifòlia,* Lindl. *I. mexicàna,* Gray). Like *I. hederacea,* but young lvs. entire or slightly angulate, becoming deeply 3-lobed and cordate, as in *I. hederacea,* the middle lobe broadest: peduncles as long or longer than petioles; corolla 1 in. wide, violet-purple, sometimes with crimson plaits; sepals merely acute, not attenuate and recurved as in *I. hederacea.* B.R. 1988. B.M. 4289.—The plants in the trade as *I. mexicana* are mostly *I. hederacea, I. digitata* and *Calonyction aculeatum. I. mexicana vera,* Hort., *I. mexicana grandiflora alba,* Hort., and *I. mexicana grandiflora hybrida,* Hort., are *Calonyction aculeatum* or *I. grandiflora.*

12. **mutábilis,** Lindl. (*I. dealbàta,* Hemsl. *I. Leàrii,* Meissn. not Paxt.). Perennial from a woody root: sts. densely and softly pubescent: lvs. orbicular-ovate, entire or 3-lobed, appressed silky-pubescent above, silvery canescent beneath: fls. 2–3 in. long, blue or purple with a white tube or throat. Mex. B.R. 39.—One of the most showy and ornamental species of the Pharbitis group.

13. **hederàcea,** Jacq. (*I. Nìl,* Roth. *I. scàbra,* Forsk. and Hort.). St. twining or climbing, 2–8 ft.: lvs.

2–5 in. long, ovate-cordate, the lobes ovate to ovate-lanceolate, entire, or the lateral lobes repand or denticulate: the middle lobe narrowed at the base: peduncle 1–3-fld., mostly shorter than the petiole; corolla funnelform, the tube usually white, the limb light blue, purple or rose, and in various combinations of these colors; sepals hairy, lanceolate, with long and often recurved tips. July–Oct. Widely naturalized from Trop. Amer. in fields and waste places, Pa. to Fla., west to Neb. and Mex. Perhaps native in the South. B.R. 85 and 276 (as *I. cærulea*). B.M. 188 (as *Convolvulus Nil*). Gn. 27, p. 473.—This species shows great variation in the form of its lvs., both on the same plant and on different plants. In some forms formerly known as *I. Nil*, the lvs. are nearly entire; in others they are very deeply lobed. Next to *I. purpurea*, this is now the most popular morning-glory in cult., and the intro. of the improved Japanese strains will extend its usefulness. Before the appearance of these oriental varieties in occidental gardens, the species had already varied into many distinct horticultural varieties; as var. **limbàta,** (*I. limbàta*, Hort.), with the corolla violet-purple, edged with white. B.M. 5720 (as *Pharbitis Nil*). Gn. 29, p. 32. Var. **marmoràta cœléstina,** large fls., marbled and striped with light blue. Gt. 44, p. 592. Var. **marmoràta ròsea,** fls. marbled with rose. Gt. 44, p. 76. Var. **fòliis marmoràtis,** lvs. marked with yellow, limb of corolla rose-color. Var. **grandiflòra,** large blue fls. Var. **Ferrandiàna,** similar to var. *grandiflora*. Aside from these strains, the following named varieties of Japanese ipomœas are offered: Antigone, lvs. variegated: fls. blue, with pink throat. Aglaia, lvs. variegated: fls. crimson, with white throat. Aseria, fls. dull copper-red. Ceres, like Aglaia, but fls. edged with white. Euphrosyne, lvs. variegated: fls. pure white, with pink throat. Princess, fls. spotted with carmine. Gt. 47, p. 133. A form with foliage dotted with white is shown in I.H. 43, p. 75. The various strains give fls. which are diversely scalloped, ruffled, fringed, double, and show a wonderful range of coloring.

14. **Leàrii,** Paxt. BLUE DAWN-FLOWER. St. a very rapid grower, often 30–40 ft. long, somewhat shrubby at the base: lvs. 3–6 in. long, cordate, acute, mostly entire or slightly 3-lobed, variable: fls. borne in clusters of 12–30, opening in succession; corolla 4–5 in. broad, bell-shaped, deep lilac, sometimes dark purple with five lighter plaits. Very beautiful. Aug.–Oct. Tropics of both hemispheres; widespread. B.M. 3928 (as *Pharbitis Leari*). B.R. 27:56 (as *Pharbitis Leari*).—A magnificent species for the warmhouse, but not usually satisfactory outside, at least in the N. One plant is on record as producing 60,000 fls. at the rate of 300 a day. When grown in the open the fls. are likely to be an unattractive coppery purple. Thoroughly naturalized in S. Calif., and a most useful plant for covering waste places, enbankments, and the like.

15. **microdáctylum,** Griseb. A glabrous, woody, perennial twining vine, several feet in height, the sts. often covered with rough corky projections: root large and woody: lvs. 3–5-lobed or sub-entire, thick: fls. scarlet, sub-salverform, about 1½ in. long, the limb as broad and slightly 5-lobed; stamens slightly exserted. Fla. Keys and Cuba.—This is often mistaken for **I. fuchsioìdes,** Griseb., a rare and little-known Cuban species, not found on the Fla. Keys and probably not in cult. Var. **integrifòlium,** House. Lvs. entire, oblong-ovate, subcordate or obtuse at the base. Commoner than the species. Intermediate lf.-forms are often found on the same plant.

16. **Púrga,** Hayne (*I. Jalápa*, Nutt. & Coxe, not Pursh). Lvs. sagittate-cordate, smooth: peduncles generally 1-fld., longer than the petioles; fls. rose-purple; corolla long-tubular, with a flat limb. Sept., Oct. Trop. Amer. B.R. 33:49 (as *Exogonium Purga*).—The "Jalap" of commerce is an active purgative made by grinding to a powder dried slices of the tuberous roots of this species. It was principally collected near Xalapa, Mex., of which Jalap is a corruption.

17. **angustifòlia,** Jacq. (*I. filicaùlis*, Blume). St. prostrate, trailing or rarely climbing, much-branched: lvs. 1–3 in. long, less than 1 in. wide, glabrous: peduncles exceeding the petioles, bearing 1–2 small, bell-shaped fls., which are yellowish white with a purple eye. Aug., Sept. Widely distributed in Trop. Asia, Afr. and Amer. B.M. 5426. B.R. 317 (as *I. denticulata*).—Sometimes grown in the warmhouse, but there is hardly enough foliage to set off the pretty dark-eyed fls.

1963. Ipomœa digitata. (×¼)

18. **trícolor,** Cav. (*I. rùbro-cærùlea*, Hook. *I. Hoòkeri*, Don and Hort.). St. tinged with purple, branched, 10–20 ft. high: lvs membranaceous, much-veined, short-acuminate: peduncle hollow and wand-like, longer than petioles, 3–4-fld.; fls. 3–4 in. wide, the tube white and limb red before expanding, at length purple or china-blue. Aug.–Oct. Mex. R.H. 1855:441 (as *Pharbitis rubro-cærulea*). B.M. 3297. P.M. 3:99. Gn. 27:72. G.C.III.53: 104.—One of the most beautiful of annual climbers. The fls. are often dashed, blotched and shaded with rose, or are entirely rose. It is likely to run to vine when out-of-doors unless the roots are confined in a box or pot to induce early flowering. It makes an excellent pot-plant for the greenhouse. Var. Heavenly Blue, from Calif., proves to be a blue form of *I. tricolor*, which is especially valuable for cut-fls. Var. **álba,** Hort., has pure white fls.

19. **Hórsfalliæ,** Hook. Fls. many, in a 2-branched cyme; corolla bell-shaped, the limb of 5 broad, rounded lobes, very showy. Cosmopolitan tropics. B.M. 3315. P.M. 3:50. F.S. 16:1647.—Perhaps the most popular ipomœa for winter-flowering in a warmhouse. If well treated it will climb 20–30 ft., and will bear hundreds of fls. each day in early winter. May also be grown out-of-doors, but it will not come into bloom till late fall unless the roots are cramped. Var. **álba,** Hort.,

is *I. ternata;* Lady Slade has pale rose fls.; var. **Bríggsii,** (*I. Bríggsii,* Hort.), or Lady Briggs, is generally considered better than the type for most purposes. It is a freer grower and bloomer, the fls. are a rich magenta-crimson, and it roots from cuttings much more readily than *I. Horsfalliæ.* This variety makes a fine plant in a 10-in. pot. G.M. 37:49. Var. *Thómpsonii,* or *I. Thomsoniàna,* Hort., is *I. ternata.*

20. **ternàta,** Jacq. (*I. Hórsfalliæ* var. *álba,* Hort. *I. Hórsfalliæ* var. *Thomsoniàna,* Hort. *I. Thomsoniàna,* Mast.). St. somewhat woody at base: lvs. usually 3-parted, the segms. elliptic or elliptic-oblong, fleshy, smooth: fls. trumpet-shaped, about 2 in. across. Otherwise like *I. Horsfalliæ,* of which it is often considered a variety. Probably from W. Indies. G.C. II. 20:817. F. 1884, p. 118.—Not considered quite so effective for greenhouse cult. as *I. Horsfalliæ.*

21. **aùrea,** Kellogg (*Operculìna aùrea,* House). A slender twining vine, woody below, with very large, white, tuberous roots: lvs. digitately 5-lobed: fls. 2–4 in. across, funnelform, with a widely expanded limb, golden yellow: the rhombic, entire, sub-repand lfts. often deciduous, as are the branches. Lower Calif.

22. **setòsa,** Ker. Brazilian Morning-Glory. Plant very vigorous, branching, covered with stiff purplish hairs: lvs. 3–10 in. wide, cordate, angular or 3-lobed, the middle lobe abruptly contracted below into a narrow neck: peduncles many-fld., longer than the petioles; fls. 2–4 in. wide, salverform, rose-purple. Aug.–Oct. Brazil. B.R. 335.—An excellent free-growing climber for covering arbors, and especially valuable for making a dense screen because of its very leafy habit. In the latitude of New York seeds sown in the open will give flowering plants in late August. It may also be treated as a warmhouse deciduous twiner. Var. Northern Light is said to be a cross with *Calonyction aculeatum.* Plant unusually vigorous, often growing 40–50 ft.: fls. lavender-pink.

23. **sinuàta,** Ort. (*I. dissécta,* Pursh, not Willd. *I. sinitàta,* Hort.). St. somewhat woody at base, covered with long yellowish hairs: lvs. smooth or nearly so, palmately 7-parted, the divisions lanceolate or narrowly oblong, more or less sinuately cut and toothed: peduncles 1–2-fld., longer than the petioles; fls. 1–2 in. wide, bell-shaped, white with purple center; calyx as long as the corolla-tube. June–Sept. Trop. Amer., and near the coast from Ga. to Texas.—In Texas it expands only 2–3 hours at midday, and is there called the "noon-flower." It may be treated as a coolhouse evergreen, and is worth growing for its delicate foliage alone. In the N. the tubers must be wintered in a cellar.

24. **digitàta,** Linn. (*I. paniculàta,* R. Br. *I. palmàta,* Hort., not Forsk.). Fig. 1963. St. trailing or climbing, 20–40 ft.: lvs. 3–7 in. wide, 5–7-parted, the segms. elliptic, sometimes spatulate, entire: fls. numerous, in a 2-branched cyme; corolla 1½–3 in. wide, broadly bell-shaped, 5-lobed, pinkish purple or pink: seeds with a dense tuft of dirty white wool springing from the apex. July–Sept. Tropics of both hemispheres. R.H. 1853:381. B.R. 62; 333 (as *I. platensis*). B.M. 3685 (as *I. platensis*). Gng. 2:311.—One of the best tuberous-rooted ipomœas for the garden or warmhouse. In the N. it may be used with fine effect if grown in a tub and trained to an adjacent pillar or trellis, the vine being cut off before frost and the tub stored. Farther south the tubers may be planted directly in the open, and will give a profusion of bloom nearly all summer. Var. **insígnis,** Hort. (*I. insígnis,* Ker). Lvs. not palmately divided, nearly entire or lobed, the under surface sometimes purplish. B.M. 1790. B.R. 75.—There are few plants of var. *insignis* in cult.

25. **bonariénsis,** Hook. (*I. ficifòlia,* Lindl. *I. Perringiàna,* Damm. *I. Séllowii,* Penny). St. branching, tinged with purple and covered with short stellate hairs: lvs. deeply cordate, 3–5-lobed, the middle lobe longest: peduncles several-fld., longer than the petioles; fls. 1½–2 in. wide, violet to lilac, the limb spreading into 5 crenate lobes. Aug.–Oct. Trop. Amer. and Afr. B.M. 3665. B.R. 27:13. P.M. 9:25. Gt. 47:1446.—Here belongs *I. Sellowii,* Penny, and probably Hort., not *I. Selloi,* Mart., which is a distinct species.

26. **sagittàta,** Lam. (*I. speciòsa,* Hallier, not Pers.). Sts. twining from a perennial root, slender and glabrous: lvs. strongly sagittate, short-petioled: fls. slender, about 3 in. long, purple. Marshes and fields, N. C. to Mex. and W. Indies.

27. **chrysèides,** Ker. St. slightly woody, much twining, smooth or branches slightly hairy: lvs. 1–2 in. long, ovate-cordate to sub-hastate, acute, entire or toothed, 3-angled, 3-lobed and repand: peduncles 1–7-fld., longer than the petioles; corolla ½–¾in. wide, funnel-shaped. July–Oct. Trop. Asia and Afr. B.R. 270.—It can be grown out-of-doors, but is tardy in blooming. Best treated as a warmhouse evergreen climber. *I. chryseides* is advertised abroad. *I. chrysántha,* Hort., described in American catalogues as having rich, glossy foliage and golden yellow fls., may belong here.

28. **sidæfòlia,** Choisy (*I. corymbòsa,* Don. *I. cymòsa,* Lindl. *I. antillàna,* Millsp. *Turbìna corymbòsa,* Raf.). A slender, climbing perennial vine, woody below: lvs. ovate, cordate, small or medium-sized: fls. borne in large cymose clusters on elongated branching peduncles; corolla white, 1½ in. long and broad; sepals somewhat wing-like in fr.: caps. turbinate, usually 1-seeded. Fla., W. Indies, and Trop. Amer.

29. **macrorhìza,** Michx. (*I. Micháuxii,* Sweet. *I. Jalápa,* Pursh, in Bot. Mag. 1813, not Pursh's description, 1814). Sts. perennial from a thickened woody root, trailing or climbing 6–8 ft. high, springing from an oblong root weighing 4–30 pounds: foliage whitish with a soft tomentulose pubescence; lvs. entire, repand, or lobed, 3–5 in. long, ovate-cordate, membranaceous, veiny: peduncles 1–5-fld.; sepals very unequal, the inner ones ½in. long and twice as long as the outer ones; fls. about 3 in. long, cream-colored, with a magenta throat. S. C. to Fla. and Mex. B.R. 342.—A very ornamental warmhouse climber and valuable for the garden if the tubers are started in the greenhouse before being set out; otherwise the plant seldom blooms much before frost. The "Jalap" of commerce does not come from this plant, but from *I. Purga.* The roots of *I. macrorhiza* are but slightly purgative.

30. **Tùba,** Schlecht. (*I. latifòlia,* R. & S. *I. ventricòsa,* Don. *I. grandiflòra,* Lam. *Calonýction grandiflòrum,* Choisy). A stout, twining, perennial, woody vine. foliage glabrous or nearly so; lvs. ovate, cordate, 5–10 in. broad, thickish in texture: fls. white, funnelform, about 4 in. long: caps. large, 1 in. diam. with an operculate dehiscence. Amer. Trop.—Some of the inferior strains passing as *I. Bona-nox* and its synonyms belong here. Not a proliferous flowerer, and in cult. rarely successful.

31. **panduràta,** G. F. W. Mey. Man-of-the-Earth. Wild Potato-vine. St. 2–12 ft. long: root very long and large (10–20 pounds): lvs. 2–4 in. long, long-petioled, usually cordate and entire, occasionally angulate, fiddle-shape or hastately 3-lobed: peduncles 1–5-fld., commonly a little longer than the petioles; corolla 2–4 in. wide, broadly funnelform with pointed lobes, white with a dark purple throat. May–Sept. Dry soils, Canada to Fla., west to Ont. and Texas. A.G. 12:637. R.H. 1893:574. B.M. 1603 (as *Convolvulus candicans*), 1939, and Gn. 27, p. 373 (both as *C. panduratus*). B.R. 588.—In some places this species is a very troublesome weed, which is almost impossible to exterminate because of its long tuberous roots.

It can easily be kept within bounds in the garden with a little care, and makes a very desirable plant for covering an old dead stump or back fence. The chief merit of *I. pandurata* as a garden plant is its hardiness; hence it is often sold as the "hardy" or "perennial moonflower." If well mulched the roots will stand 26° below zero. There is a double-fld. form. It is sometimes escaped in cult. grounds.

32. **Jalápa,** Lindl. (*Batàtas Jalápa,* Choisy). A slender, glabrous, twining vine from a large woody root: lvs. triangular-ovate, entire or 3-lobed, plicate-veined: peduncles usually very short, 1-fld.; sepals sub-equal, broadly ovate, obtuse, ¼in. long; fls. slender funnelform, 2–2½ in. long, pink or purple. A Mexican species, the roots of which possess purgative powers equal to those of *I. Purga.* L.B.C. 6:518.—The names of this and *I. macrorhiza* have been confused from the fact that this plant, figured by Lindley in 1813 (B.M. 1572) as *Convolvulus Jalapa* (*I. Jalapa,* Pursh, as synonym) is not the Carolinian plant described by Pursh under that name in 1814. The plant described by Pursh as *I. Jalapa* is the *I. macrorhiza* of Michaux.

33. **Batàtas,** Poir. (*Batàtas édulis,* Choisy). SWEET POTATO. Lvs. ovate-cordate, usually angular or lobed, variable, petioled: peduncles equaling or exceeding the petioles, several-fld.; corolla 1–2 in. wide. Origin probably from *I. fastigiata* of Trop. Amer. (*I. platanifolia,* R. & S.).—Largely cult. in many varieties for its edible tubers. See *Sweet Potato.*

Several species of slight ornamental value occur in the southern states, and are sometimes seen in cult. *I. desertòrum,* House. Resembling I. hederacea but rough-pubescent and adapted to drier situations. Ariz.—*I. lacunòsa,* Linn. Annual with small white fls., often with a pink limb. Pa. to S. C., Ill. and Texas.—*I. polyánthes,* R. & S. (I. umbellata, Mey.). Small yellow fls. in umbels. Fla. and Trop. Amer.—*I. trichocárpa,* Ell. S. C. to Fla., Kans. and Mex.—*I. tríloba,* Linn. Pink or purple corolla ⅔in. long.: lvs. 3-lobed. Fla., Ariz. and Trop. Amer.

The two following species of recent intro. are as yet not common in the trade: *I. Macalùsoi,* Mattei. Slightly pubescent, woody sts.: lvs. ovate-orbicular, abruptly acute and mucronate, deeply cordate; petioles long, somewhat villous: fls. axillary, in subsessile cymes; corolla large, campanulate, orange-colored, margined with red. Native of Italian Somaliland.—*I. Mahònii,* C. H. Wright. An erect shrub with oblong lvs. about 1¾ in. long and 1 in. broad, obtuse at both ends, entire: petioles ¾in. long: corolla-tube deep reddish purple, paler above, the limb white or slightly suffused with pink, over 3 in. broad. Native of Uganda.

See Quamoclit for *Ipomœa Quamoclit, I. coccinea, I. vitifolia,* and *I. hederæfolia.* See Calonyction for *I. Bona-nox* and *I. tastense.* *Ipomœa Howardii,* P. D. Barnhart, Pacific Garden 4: No. 9, p. 5, Aug. 1911=Quamoclit grandiflora.

H. D. HOUSE.†

IPOMÓPSIS: *Gilia.*

ÍPSEA (fancied resemblance to *ips,* a cynip insect or a worm). *Orchidàceæ.* Two or 3 terrestrial E. Indian pseudobulbous orchids, allied to Pachystoma, with which it has been united: lvs. long, narrow and plicate: scape sheathed; fls. few, large, highly colored. **I. speciòsa,** Lindl. (*Pachýstoma speciòsum,* Reichb.). Deciduous, tuberous-rooted, with erect scapes to 18 in. high: lvs. 5–8, long-petioled, 6–10 in. long: fls. several, bright yellow, fragrant, 2–3 in. diam., the lip oblong, with side lobes triangular and middle lobe obovate: pseudobulbs tufted. Ceylon. B.M. 5701. G. 26:189.—Blooms in winter. To be potted in fibrous loam, peat and leaf-mold, and rested after growth.

L. H. B.

IRESÌNE (Greek name for a harvest garland wound with wool: the flowers and seeds of these plants are woolly). *Amarantàceæ.* ACHYRANTHES. Ornamental-leaved bedding plants.

Low, spreading, climbing or erect herbs or subshrubs: lvs. stalked, opposite, the margins not toothed in the domestic species: fls. very small, bracteate, in axillary or terminal panicles, perfect or imperfect (plants sometimes diœcious), the perianth of one series terete, 5-parted, with ovate-oblong segms.; stamens 5; style short or none, the stigmas 2 or 3: fr. a utriculus.—Species 20–25 in Trop. and Subtrop. Amer. Two or 3 species are in common cult. as bedding-plants, because of their highly colored lvs. and sts. The first of these to be intro. was described before the fls. were known and it was referred to Achyranthes (*A. Verschaffeltii*), but in that genus the anthers are 2-loculed, whereas in Iresine they are 1-loculed. To gardeners they are still known as Achyranthes.

Because of ease of propagation, ability to withstand sun and shearing, and the bright colors, the iresines are amongst the most popular bedding-plants. Few plants are easier to grow. Stock plants are kept over winter in a cool temperature (as in a carnation house), and in February and March they are given more heat and moisture, and cut back, to get cutting wood. Cuttings root quickly in any good cutting-bed. For mass bedding, plants are usually set 6 to 10 inches apart. They will not withstand frost.

1964. Iresine Lindenii. (×⅛)

Hérbstii, Hook. f. (*Achyránthes Verschafféltii,* Lem.). Lvs. broadly ovate or orbicular, obtuse and notched at the apex, purple-red, with prominent arched veins, or in the commoner variety green or green-red with yellow veins (var. *aùreo-reticulàta*). S. Amer. B.M. 5499. H.F. II. 7:103. This was described and figured in Aug., 1864, by Lemaire as *Achyranthes* (?) *Verschaffeltii* (I. H. 11:409), and later by Van Houtte as *Iresine Verschaffeltii* (F. S. 15:1601). In July, 1864, however, Hooker had published it as *Iresine Herbstii,* in honor of Mr. Herbst, of the Kew Nursery, who intro. it from the River Platte. There are horticultural varieties with Latin names. *I. Wállisii,* Ort., is a small form, with numerous small roundish lvs., which are bronze-red or dark red above and dark blood-red beneath. *I. brilliantíssima,* has rich crimson color.

Líndenii, Van Houtte (*Achyránthes acuminàta,* and *I. acuminàta,* Hort.). Fig. 1964. Lvs. ovate-acuminate or lance-ovate, with less arching or curving veins, in the original form rich, deep blood-red, but in some garden forms with light-banded veins. Ecuador. F.S. 17:1737. G.Z. 13:32.—More pyramidal in habit than the other species, and now more common. To this species evidently belong the garden forms known as *I. Emersonii, I. Collensii* and *I. formosa.*

I. Biemuèlleri, Voss (Achyranthes Biemuelleri, Haage & Schmidt), is probably a garden form of one of the above. It is a compact, dwarf grower, withstanding severe cutting: lvs. and twigs rose-carmine.

L. H. B.

IRIÁRTEA (after Bernard Iriarte). *Palmàceæ.* Tall spineless palms, with cylindrical or swollen stems supported on a pyramid of exposed roots.

Leaves few, unequally pinnate; lfts. equilateral, cuneate, entire or erose, plicate; petiole channelled; sheath cylindrical: fls. small: fr. 1–2 in. long: stigmas eccentric or lateral in fr. This palm is separated from Ceroxylon by the cuneate lfts.—Species 10. Trop. S. Amer. *I. Bungerothii* was advertised in 1895 as Triartea, which was presumably a typographical error for Iriartea. This is a horticultural name for *I. exorrhiza,* Mart., but the plant is in cultivation under the former name.

exorrhìza, Mart. (*I. Bungeròthii,* Hort.). Trunk about 35 ft. tall, crowned by a congested cluster of 10–20 showy lvs., each bearing 15–20 pairs of lfts., the latter about 20 in. long and 1½ wide: spadices 1–4, appearing between the lvs.; fls. yellow: fr. olive-green, reticulate. Trop. S. Amer.—Doubtfully in cult. at this time (1913) in Amer.

N. TAYLOR.†

ÌRIS (Greek, *rainbow*). *Iridàceæ.* Plates LVIII, LIX. Showy and interesting flowers for outdoor bloom, widely known and planted; perennials with rhizomes or bulb-like root-stocks, mostly narrow long leaves, and commonly erect habit; includes the blue flag and fleur-de-lis.

Herbs with linear or ensiform equitant lvs.: st. simple or branched: fls. of 6 segms., the 3 outer reflexed, and the 3 inner usually smaller and erect, always narrowed to a distinct claw, 1 to many in terminal heads, from spathes which are formed of the upper bract-like lvs.; spathe stalked or sessile; style divided into 3 petal-like branches, which are bifid or crested at the tip; stigmatic surface immediately below the crests; ovary sessile or pedicelled, within the spathe.—Distinguished from the other members of the tribe except Hermodactylus and Moræa by the 2-winged style-branches, from Hermodactylus by the 3-celled caps., and from Moræa by the more or less connate perianth-segms. For monographs of the genus, see Baker's Irideæ, 1888, Lynch, The Book of the Iris, 1904, and the fine monograph of Dykes, The Genus Iris, 1913. The number of species of Iris recognized by different monographers ranges between 140 and 170. The synonomy includes something over 700 names. The extensive synonomy is an indication of the great variability and wide distribution of the genus. In general the irises are natives of the North Temperate Zone, but the different subgenera differ much in their distribution. The distribution of some of the subgenera is coextensive with that of the genus, while others are restricted to limited regions. The subgenus Apogon is the largest and also the most widely distributed section of the genus. Its representatives are found throughout temperate N. Amer., Eu., Asia and N. Afr. They extend from Alaska, Labrador and Kamtchatka in the north to Fla., Algiers and Honkong in the south. The members of the subgenus Pogoniris, which is the second largest and horticulturally the most important section, are found in Cent. and S. Eu. and N. Afr. and thence eastward to China and N. W. India. No members of this subgenus are indigenous to Amer. The small subgenus Evansia comprises a few species of crested irises which, with the exception of the two closely related American forms, *I. cristata* and *I. lacustris,* occur only in Japan and E. China. The American species differ widely from the far eastern ones in the absence of an evident stem. The subgenus Oncocyclus is a small section whose members are restricted to a limited region in Asia Minor, Syria, and Persia. Farther to the east, in Turkestan, the Oncocyclus irises are replaced by the members of the closely related subgenus, Regelia. In N. India in the region to the south of the Karakoram and Himalayan Mts. are found a few species constituting the subgenus Pseudoregelia, so named on account of the affinity of its members to those of the subgenus Regelia. The peculiar oriental subgenus Pardanthopsis contains only a single species, *I. dichotoma,* which is found in Manchuria and N. China. The bulbous irises comprise three subgenera, Xiphium, Juno, and Gynandriris. The subgenus Xiphium is sometimes divided into two sections, the Xiphiums proper, which occur in Spain, Portugal, Sicily and N. Afr.; and the reticulata irises, which are found in Asia Minor, Transcaucasia and Turkestan. The Juno irises occur in Spain, N. Afr., Asia Minor, Persia, and eastward to India. The single species of the monotypic subgenus Gynandriris is distributed from Portugal to N. W. India.

Something over 100 species of Iris, with innumerable garden varieties, are offered by dealers in America. Many of these, including the native species, are cultivated only to a slight extent, so that horticultural interest centers chiefly around the groups described below.

1. *German irises.*—Under this head may be grouped the tall European pogonirises and the numerous varieties and hybrids derived from them. Besides *I. germanica,* which may be taken as the type of this class, the principal species of the group are *I. aphylla, I. variegata, I. florentina, I. pallida, I. Cengialti, I. flavescens, I. plicata, I. Swertii, I. Kochii, I. lurida, I. neglecta, I. sambucina, I. squalens* and *I. hybrida.* Many of these which are usually recognized as species are undoubtedly of garden origin. *I. germanica* itself is not certainly known to occur in a native state. *I. florentina* or *I. albicans* is a common ornament in Mohammedan cemeteries and was undoubtedly distributed throughout the Mediterranean region by the Mohammedans, who carried it everywhere with them as an embellishment for graveyards. *I. Kochii, I. lurida, I. neglecta, I. sambucina* and *I. squalens* are probably hybrids of which there are innumerable forms in this group. *I. Swertii* and *I. plicata* are pale forms of *I. Cengialtii* and *I. pallida,* in which the color is absent except along the margin of the segments. *I. hybrida* probably represents a similar derivative of *I. variegata* in which the yellow color is absent. Owing to their diversity of origin, the varieties of this group have a great diversity of color, ranging from pure white through all shades of mauve and blue to dark purple. From *I. variegata* and *I. flavescens* the yellow-flowered varieties and those whose flowers are variegated with yellow were probably derived. The flowers of all the varieties are large and handsome, often stately, exhibiting beautiful variegation and shades of color. They are borne on stout, erect, branched stalks much exceeding the clumps of spreading leaves. All are hardy, and form excellent border plants, flowering in May and June.

2. *Japanese irises.*—All the plants cultivated as Japanese irises are referable to a single species, *Iris lævigata,* more commonly known as *I. Kaempferi.* The type of the species has been so much broken that its varieties constitute a distinct horticultural group, containing perhaps as many or more named varieties than the germanica group itself. So far as known, no hybrids or other species enter into the make-up of this class. The plants form strong clumps, attaining a height of 2 to 3 feet, and bearing several flower-stems. The leaves are slender, erect, growing almost parallel to each other. In the wild type the inner segments are erect and rather small. The cultivated forms fall into two groups,—the three-petaled forms in which the inner segments have been nearly suppressed while the outer segments constitute the showy part of the flower, and the six-petaled forms in which all the segments are large and spreading giving the flower the flat expanded form characteristic of the group. The flowers range in color from white through various shades of blue to deep purple, with the segments variegated with darker veins and streaks, or plain. All the varieties are hardy, and thrive best in cool, moist situations. They begin flowering in the latter part of June and continue through July.

3. *The tall apogon irises.*—Besides the Japanese irises, two other groups of apogon irises deserve mention on account of their ornamental value. These are the sibirica group and the spuria group. The species of the sibirica group which are of horticultural interest are *I. sibirica, I. sanguinea, I. Wilsonii,* and *I. Delavayi.* The plants of this group are characterized by long grass-like leaves growing in close tufts from which

arise clusters of tall branched flower-stems 2 to 3 feet in height. *I. sibirica* has several varieties ranging in color from deep blue to white. These, with the addition of *I. Wilsonii*, make it possible to have tall clumps of blue, white, and yellow irises of the sibirica type. *I. sanguinea*, which has the flowers partly hidden among the leaves is less ornamental than *I. sibirica*, in which the flowers are raised high above the leaves. *I. Delavayi* is a blue-flowered species which flowers in July when most other irises have passed. The plants of this group all thrive best in rather moist situations. Of the spuria group, only the tall ornamental forms closely allied to *I. spuria* are considered here. The most commonly cultivated forms are *I. spuria*, *I. halophila*, better known as *I. Gueldenstædtiana*, *I. orientalis*, *I. Monnieri* and *I. aurea*. These differ from each other only in minor characteristics such as color and slight modifications in the shape of the segments. They are frequently all regarded as varieties of a single type, *I. spuria*, but for horticultural purposes it is more serviceable to treat them as separate species. Besides those forms which may be said to approach specific rank, innumerable minor varieties exist in the group. The color of the flowers ranges from blue in *I. spuria* to bright yellow in *I. Monnieri* and deep yellow in *I. aurea*. In *I. orientalis* the flowers are pale yellow bordered with white. The proportion of white and yellow varies much in different specimens. The plants of this group are tall and stately with leaves 1 to 2 feet long, drooping gracefully above. The flower-stems usually rise high above the leaves, and bear two to three heads of flowers. Those on the lateral branches are held close to the main stem so that the whole inflorescence has the appearance of a spike. The stems are usually 2 to 3 feet high. Those of *I. aurea* are said to grow to a height of 5 feet in California. Some of the species are natives of swampy regions and consequently thrive well in wet places. All grow well, however, in almost any situation.

4. *Dwarf irises.*—Dwarf irises occur in several subgenera but the best-known and most commonly cultivated forms are the dwarf European pogonirises, including *I. pumila*, *I. pseudo-pumila*, *I. biflora*, and *I. Chamæiris*. These are remarkable for their numerous color varieties, which range from pale yellow to lilac, blue, purple, and very dark red. Most of the forms in cultivation are varieties of *I. pumila* and *I. chamæiris*, but many of the garden forms which pass as varieties of *I. pumila* are derived from *I. Chamæiris*. *I. pumila* and *I. Chamæiris* are the most satisfactory of the group, as the others are less hardy or less floriferous. *I. arenaria*, the Hungarian form of *I. flavissima*, thrives well in dry sandy situations. The most common dwarf forms among the apogon irises are *I. humilis*, *I. ruthenica* and the American *I. verna*. Of these, *I. verna* is the most striking because in all characteristics of habit and growth it resembles a pogoniris but lacks the beard characteristic of that group. *I. cristata* and its close relative, or perhaps subspecies, *I. lacustris*, are dwarf American forms belonging to the subgenus Evansia, or crested irises. The dwarf irises seldom grow over 9 inches high. They spread rapidly by their creeping rhizomes and soon form large patches. This habit makes them useful as border plants.

5. *Oncocyclus irises.*—The oncocyclus irises differ from other irises in several striking characteristics. The seeds have a creamy-white aril nearly as large as the seed itself. The stem is surmounted by a long, unkeeled tubular spathe which reaches beyond the top of the perianth-tube. The stem bears a single flower, which in some species is of enormous size, compared with the size of the plant. The segments, of which the inner are larger than the outer, present a most singular combination of somber colors. The peculiar colors are often due to the interlacing of numerous very thin veins, usually blue or brown, on a white or straw-colored ground. The most common shades thus produced are beautiful sky-blue, light gray, and brown to almost black. In some, all the segments are colored nearly alike, but in most species the inner and outer segments are differently colored. The species fall into two groups according to their geographical distribution. With their distribution other characteristics are curiously correlated. The species occurring in central and eastern Asia Minor, Transcaucasia, and the mountains of northern and western Persia are dwarf slender species differing from each other by well-marked characteristics. Those found in Palestine, Syria and Mesopotamia are tall, attaining a foot or more in height, and resemble each other so closely that they cannot be distinguished by any characteristic except the color of the flowers. These apparently are all varieties of a single species. In America the oncocyclus irises are not widely cultivated. The most commonly grown form is *I. susiana*. Many hybrids have been raised in Europe. For a monograph, see Foster, Gn. 43, pp. 130–135.

6. *Bulbous irises.*—About 20 species of bulbous irises are cultivated in America. They are rather dwarf, hardy and half-hardy bulbous plants, known chiefly for the brilliant colors and strong contrasts, and for their numerous flowers. The species most commonly found in gardens are *I. Xiphium*, better known as *I. hispanica*, and *I. xiphoides* or *I. anglica*. The latter is probably the oldest iris in cultivation. See Foster, G. C. II. 23, pp. 567 and 726, and Foster, Bulbous Irises (1892).

HEINRICH HASSELBRING.

The cultivation of irises.

As will be seen by their distribution, irises are especially adapted by their hardiness to growth in our gardens, though some forms, as the African, the Indian, and the Oncocyclus species, need special treatment or protection. In the main, the irises, from a cultural point of view, are like others of the various natural families, mostly very good—not to say commonplace—with a few decidedly inferior members. As there are nearly 170 species of irises, with countless varieties, they are interesting to the amateur collector and grower both for their variety and their general beauty of flower.

The life of iris flowers varies from three to six days. They are fragile, but if cut before the petals unroll may be forwarded to considerable distance without injury. This is the only way, in fact, by which the florist can market them. The botanists divide the irises into two main groups, the bulbous kinds and those with rhizomes, these groups being each divided by the varying characters of the more or less raised line in the middle of the fall of the flower. This, of course, gives no clue to cultural necessities or to time of flowering, two important details in a garden.

Considering the bulbous irises as a group, these are all hardy without protection in the latitude of New York city except *I. Histrio*, *I. alata*, *I. juncea*, *I. palæstina*, *I. tingitana*, *I. Vartanii*.

In the order of their flowering, the reticulata group is the earliest, *I. Bakeriana* and others starting into flower as soon as released by frost, usually in February or March. These are soon followed by the others of this group, the largest-flowered member being *I. histrioides*. A peaty, sandy soil seems to be most acceptable to this group, and no organic manure must be given them. A location, if possible, where they may be kept on the side of dryness in summer is desirable. The culture of these, like that of all exotic plants in our gardens, is, of course, tentative. If, on trial, they seem to be happy and increase from offsets or buds, they may remain in the borders indefinitely, but if during the second season they show no gain, the bulbs should be lifted and a trial made in another location. This group seeds freely, and the seed-pods will be found just under the soil surface.

Closely following this group are the so-called Juno irises, of which *I. persica* is the most familiar, though not the best example. These irises have somewhat large bulbs, with curious persistent, fleshy roots, and seem to thrive best in somewhat stiff soil, in sheltered locations, where they will be well baked during the summer. They flower in March and April, the best forms being *I. Rosenbachiana*, *I. orchioides*, *I. sindjarensis*, and *I. assyriaca*. They are desirable plants in the most exclusive gardens. They seed freely, and also increase by offsets.

About the same time as above will flower the *Iris tuberosa* ("The Widow"), which is neither bulbous nor an iris strictly, but has a weird beauty of its own, with its green and black flowers. This should have a summer baking. See *Hermodactylus*.

Planted out in the early fall, the so-called Spanish irises make an early start and produce leaves which are persistent during the winter and seldom injured here. In May and June they broaden out, and are then surmounted by very bright, distinct and charming flowers. Very satisfactory flowers, these, and of the easiest culture. They probably do best in spots inclining to moisture. The bulbs make offsets rapidly, and should often be divided and replanted. There are two forms and numerous flowers of this iris. The boldest form is that known as the "Thunderbolt." Spanish irises, under mild forcing are now largely grown by florists for early spring flowers.

The "English" irises, *I. xiphioides*, follow the "Spanish" in June and July. Their flowers are wider in all their parts, and in a limited range of colors, white and purple. "Mt. Blanc," pure white, is probably the most satisfactory of the group. The foliage of the English iris does not bear till early spring, and the varieties flourish in a rather drier position than the "Spanish."

The African bulbous irises, *I. juncea*, *I. Vartanii*, *I. alata*, are subjects for a coolhouse, though the former is rarely hardy here.

The rhizomatous irises may be divided into a number of sections, but in a cultural way may be broadly considered in two sections: those with thick, surface-creeping rhizomes, as the hybrid German, and those with more or less thin ones, as *I. sibirica* and *I. lævigata*, which are subterranean. While the former section comprises plants which grow in various conditions, some with the roots submerged, yet in a general way they have mostly surface-creeping rhizomes. These are best transplanted soon after flowering, at which time they commence a new growth. It is customary for the nurserymen to supply these in the fall, which usually leads to the loss of a season, as they often fail to become established when planted late. The foliage of the iris indicates a sun-loving family, and irises should be planted in full exposure in rich, but not manured soil, well drained. The rhizomes should be planted flat and covered to half their diameter. If the rhizomes are in a growing condition, no further care will usually be necessary with the larger number of the species, but if the rhizomes are dormant and partly dried up, as they are frequently on receipt, care should be taken that they have not much moisture till they start into growth, otherwise they are likely to rot. Not every iris will grow in every garden, but the failure to establish these plants is most often caused by too much exposure to excitement of light, warmth and moisture when the plant is not ready to convert its reserve into food. Valuable species should have the protection of a frame in such circumstances till it seems safe to plant them out. If carefully treated and not excited, apparently hopeless dried-up rhizomes may often be saved. Most of these irises in common cultivation increase rapidly, and should be divided and replanted every two or three years; otherwise the rhizomes become matted and the abode of grass. Among them will be found some of the showiest flowers of the family.

Usually in early May *I. Chamæiris* and its variety *I. olbiensis* flower, followed quickly by the dwarfer *I. pumila* and its white form *I. attica*. Forms of *I. lutescens*, Lam., quickly follow, after which *I. germanica*, *I. florentina* and the host of "hybrid German" varieties come rapidly forward and give a great wealth of color. Everyone is familiar with the great bearded purple *I. germanica*, perhaps the most generally cultivated iris. There are larger-flowered forms of this: *I. amas* and *I. macrantha*. *I. germanica alba* seems to be a variety of *I. albicans*. This and *I. florentina* are the usual white-flowered forms seen at this time. Of bold, lighter purple kinds, *I. pallida* and its hybrids are then preëminent.

The German irises of the garden are not varieties of *I. germanica*, but hybrids of various species, as *I. pallida*, *I. variegata*, *I. sambucina*, *I. squalens*, *I. lurida* × wild forms and *I. neglecta*, *I. amœna*, *I. plicata* and *I. Swertii*, which are known only in gardens. Naturally these vary much in stature, time of flowering, size and coloring of flowers. They may be had in almost endless variety, but a typical collection may be made with comparatively few plants.

Among the best forms of the "hybrid German" irises are: *I. aphylla*—Bridesmaid, Madame Chereau, Swertii; *I. amœna*—Compte de St. Clair, Fairy Queen, *reticulata alba*, Victorine; *I. neglecta*—Cordelia, Wagner; *I. pallida*—Khedive, Mad. Pacquitte, Queen of May, Walmer; *I. squalens*—Arnols, Jacquiniana, Harrison Weir, Mons. Chereau; *I. variegata*—Beaconsfield, Darius, Hector, Honorable, Prince of Orange.

June is flowering time for many iris species, many of which are uncommon, but of the more available forms one could scarcely neglect the native *I. hexagona*, the dark La Mance form of which is very distinct and amongst the handsomest of the family. A white form of this is not hardy here. *I. fulva*, another native plant with copper-colored flowers, is also interesting. Irises with distinct forms are *I. Monnieri* and *I. orientalis* (or *I. ochroleuca*), both of which have obliquely growing rhizomes and enjoy moisture.

For margins of water *I. Pseudacorus*, with yellow flowers, is invaluable, and our natives, *I. versicolor* and *I. caroliniana* seem as happy in the moisture as in the uplands. The iris rhizomes which require deep planting are mostly smaller and thinner than those of surface creepers. The species with these roots are mostly strong-growing plants, rapidly increasing and requiring an abundance of moisture, though there are some notable exceptions to be mentioned later. Of the members of this group, *I. sibirica*, in several purple and white forms, is a common garden plant. *I. ensata* is a common Asiatic iris with small flowers borne among the narrow foliage, which is as ornamental as some of the large grasses.

The Japanese irises, which usually end the general display of irises, are a remarkable example of type-breaking, the occidental gardeners having worked up from *I. lævigata* a wonderful variety of colorings and variation in number of petals, though the colors may be included in about half a dozen general types. There are few handsomer flowers than good forms of the white Japanese iris. This iris may be grown on the upland, but it does not do its best in such locations, for it is particularly susceptible to good treatment, and to produce large flowers both water and manure are essential. Peter Barr, the veteran fancier of good plants, wrote from Japan, after consulting one of the oldest cultivators, that "this iris is grown in the rice-fields in winter and watered each month while at rest with human manure (cow manure would do); as soon as young growth appears no more manure is given and the ground is flooded. When growth has ended the water is withdrawn."

One of the most curious things in connection with the Japanese iris is that though these plants have been in cultivation here since soon after the treaty ports were first opened, they seem to have excited little attention from gardeners until within a few years. Yet the first importations were as handsome as the later. In this connection it may be said that Japan has also *I. gracilipes*, a dark purple hardy form, and *I. japonica* or *I. chinensis*, one of the beauties of the family but, like *I. tectorum* (the roof iris), another crested kind, needing here greenhouse protection and well worth it. There is, however, a perfectly hardy crested iris, the beautiful dwarf *I. cristata* of the upper southern states—a charming plant for a front border or rockery. Equally dwarf are our lake irises *I. lacustris* and *I. verna*.

The west coast of the United States is fortunate in possessing some beautiful and distinct irises, mostly of the wiry-rooted, thin-leaved type. They have not yet been fully separated botanically, and they are most difficult things to establish in eastern or other gardens, so that there are really very few in cultivation.

I. macrosiphon, *I. Hartwegii*, *I. Douglasiana*, *I. bracteata*, *I. tenax*, *I. longipetala*, *I. tenuis* and *I. Purdyi* is a list which will interest the searcher after interesting plants. Max Leichtlin, who has a genius for growing difficult things, has been successful in establishing *I. bracteata*, *I. macrosiphon* and *I. Purdyi*. He says, "My experience is that they cannot be moved unless in full vegetation. We must grow them from seed, and not touch the seedlings until they have formed a solid rootstock. After this and movement to grow has begun, they can be safely handled and transplanted like other irises."

Seed should be sown in the open in autumn, plants appearing in the spring should be undisturbed, and in the fall covered with a frost-proof frame. They should flower the second (or third) season. After flowering they may be shifted carefully, but must always have protection as they naturally commence to grow very early and frosts are fatal to them. Only in this way is there much chance of success with these rare plants. Some of the species have been flowered here under harsh conditions but they were survivals of large numbers of collected plants.

There remain to be considered two allied groups, the oncocyclus and regelia. These are considered by amateurs the most interesting groups of the iris family—interesting in the amateur's vocabulary meaning something rare and difficult. At the best, these plants give few flowers, but they compensate for this by their distinct and quaint beauty. The best-known member of the family, *I. susiana*, has been in cultivation several hundred years, but is by no means yet a common plant. It takes more kindly to cultivation than any other of the groups, will usually flower in the border the first year after planting if the spring is not too rigorous; and gardens are not unknown where, from some conditions of fortunate placing or soil, they continue to flourish. It cannot be said that there is any hard and fast formula for growing these irises. They vary among themselves as to their requirements, and need special and different treatment in different gardens and climates. These irises are natives of Palestine, Asia Minor, the Caucasus, central Asia and Persia regions, all of which are hot and dry in summer, with a settled and sometimes severely cold winter and a genial spring. In some of the regions they are protected by a covering of snow in winter while dormant, but Palestine and Persia have open winters, and their irises make growth at this time. After cultivating most of the species for a number of seasons, the writer's experience does not lead him to dogmatize much on their cultivation or to approve of many special devices which have been put forward from time to time as the solution of the problem. The consensus of opinion among the growers who have had the best success with these plants is about as follows, premising that one is dealing with plants which are perfectly hardy: The rhizomes are received with the Dutch bulbs in the fall, at which time they are dormant and leafless. It is well to store them in a cool place and plant out in November in a bed of fairly light and well-drained soil in a border fully exposed. They require no protection, but if the climate is one where frosts and thaw alternate, it is well to give the ground a covering while frozen to keep it firm. The irises so planted will seldom spear here till genial weather arrives, and with plentiful supplies of moisture at the root will give flowers from strong buds. After flowering, or, more accurately, flowering time, one is forced to choose between two methods of treatment. If the garden is high, dry and hot, the best procedure is to cover the beds with a glass frame sufficiently large to protect them from moisture and allow the rhizomes to bake. This frame may be removed in the late fall. If the leaves appear, as some of them are likely to do, they may be left unprotected until very severe weather sets in, that is, usually in December. Coal-ashes have also proved satisfactory, though unsightly. Foliage does not seem to become as soft under them as under leaves or mats. If the spring is genial, with weather steadily becoming warm, the plants, being uncovered as soon as the conditions will seem to warrant, should be in the best possible shape to reward one with their noble blooms. It is the lack of this genial spring in the latitude of New York which, however, leads often to cultural troubles. The leaves, having been protected, are none too hard, and, with the constant alternate thawing and freezing, and the high winds, hot and cold, the plants need constant watching and application of needed covering till really genial weather. Otherwise the foliage is blighted and no flowers are produced. The most satisfactory way, if one is more interested in results than in garden problems, is to grow oncocyclus and regelia iris and the numerous hybrids which are now available continuously in a coldframe. The frame should be located where drainage is perfect with no bottom moisture, so that the plants may be kept perfectly dry and baking after the blooming season. The plants should be protected from hard freezing after leaves are formed, but should not be protected enough to make them soft. The trouble of this procedure is well worth while if one wishes a rare display.

In gardens which are low and never free from moisture, the best procedure is that followed in Holland, lifting the rhizomes in July and taking them under cover in dry earth, planting out again in the fall. In this case care should be used in lifting not to injure the numerous fleshy roots. The Palestine and Persian forms of these irises are considered the most difficult to cultivate, from their habit of early growth.

Irises are not only increased by the division of the rhizomes or by offsets, but may be rapidly grown from seed, which they usually produce freely, though, in most cases, they require artificial fertilization. A large number of the common irises of gardens are hybrids, and of late years a number of beautiful hybrids have been produced between some of the rarer oncocyclus species, and between these also and common forms, as *I. variegata*, and so on. There are still opportunities to produce many new and untried crosses, and experiments in this line are recommended. The pollination of the iris is simple. The anthers should be removed when the flower first opens, and preserved in paper or vials, properly marked. The pollen will retain its potency for a week or perhaps longer, and may be applied to the stigma of the flower selected (the anther of which has been removed promptly) with a camel's-hair brush. The stigma will be found near the apex of the petal-like style, and is ready for pollination when the upper edge drops down and exposes the upper surface. Many iris seeds germinate with considerable irregularity, and failure to start promptly should not lead to discouragement or discarding of the pan in which the seeds are sown.

J. N. Gerard.

The iris in California.

Because such a large proportion of the iris come from around the Mediterranean and so are accustomed to a thorough baking and drying out in summer, their culture is especially satisfactory in California and the range of varieties available so large that some may be found in flower in all but the late summer months. The first rains usually start a few of the dwarf and tall bearded iris into a premature flowering, this being so regular in the case of the *Iris Kochii* that it is now being sold as a fall bloomer. *I. stylosa* (*I. unguicularis*) also flowers in the fall and early winter, accompanied at the latter time by the smaller bulbous irises, such as *I. reticulata*. From February on, the dwarf bearded irises (*I. pumila* and the many slightly taller forms of *I. Chamæiris*) are covered with masses of flowers in various shades of cream, yellow, blue, and purple. In March and April one has a choice of the tall bearded or so-called German iris, the oncocyclus group, *I. spuria*, *I. ochroleuca*, *I. aurea*, *I. Monnieri*, and their cross-bred relatives, as well as the native Californian species and the moisture-loving Siberians. May sees the Spanish irises at their best, followed toward the end of the month by the English iris, and the season ends in June or July with the big Japanese.

The cultural directions for California are simple, varying somewhat with each main group. The tall bearded varieties grow so easily and are so clean and so nearly evergreen that the type (*I. germanica* and its white form) is often used for planting between sidewalk and curb. Yet the many beautiful kinds to be found in the *I. pallida*, *I. plicata*, *I. neglecta*, *I. variegata*, and *I. squalens* sections are not very often seen, although their culture is quite as easy. All they require is sunlight and a place which becomes quite dry in the summer, the easiest possible conditions to supply in California. They dislike shade and standing moisture. Soil is not important, as equally fine results have been secured in the heavy adobe of the valleys and in gravelly hillside loams. Divide to single rhizomes and replant when they show signs of being crowded. This is best done just after blooming or in late summer, but it is possible at any time of the year.

Next to the above, the bulbous Spanish irises give the best garden effect and lead in usefulness as cut-flowers. The little bulbs should be at least 3 inches underground by October, if possible, as they dry up if left too long before planting. Distance apart is a matter of taste, but they may go as close as 3 inches if space is valuable, and may even be used as a top crop between tulip or daffodil bulbs to keep up the show in a small garden. Plant in any cultivated soil, but see that drainage is good, as the stems rot off if subjected to stagnant water. After blooming, do not cut the stems to the ground if flowers are desired next year, for the slight foliage is needed to ripen the bulbs. Many of the best varieties, however, are so cheap that where ground is valuable they may be discarded after blooming, though if left to ripen properly they will increase so rapidly that division will be necessary every other year. English irises are not nearly so satisfactory, though their flowers are larger. They need much more moisture than the Spanish irises, and are more to be recommended to those who can give plenty of water and partial shade.

The oncocyclus and regelia irises do better in California than anywhere else in America, as they must be dried off in summer and no artificial means are necessary here. Contrary to European practice, the best success is achieved by planting as soon as received in October and encouraging growth so that the plants will be ready to bloom in March and April. No special soil is recommended, but it is desirable to cater to their lime-loving taste by incorporating old plaster and bone-flour in the earth. They are nowhere easy plants to grow, so, if success be achieved the first year, leave the roots alone. Under these conditions, *I. susiana*, *I. atrofusca*, *I. iberica*, *I. Lortetii*, *I. Korolkowii*, and others bloom quite well. The Juno irises do fairly well under these same conditions, but are still rather an experiment.

Most striking features of many gardens in April are huge clumps of *I. orientalis* (*I. ochroleuca*). For culture these can be grouped with *I. spuria*, *I. aurea*, and *I. Monnieri*, as all like lots of water during their growing season, which is fortunately our rainy one, but again somewhat contrary to experience elsewhere they can get through the dry season without irrigation.

The Siberian and Japanese iris, however, need moisture as much here as elsewhere, and, though the amount required may be lessened by heavily mulching the bed with rotten manure, they are certainly less adapted to our natural conditions than the other sections of the genus. In the warmer, sunnier parts of the state, the flowers often burn badly and have to be protected with lath screens, an unsightly arrangement. Their most suitable place is in a Japanese garden where they can get the overflow of a pool, and if this is in the summer-fog belt they are quite satisfactory.

The Californian iris are well worthy of garden cultivation, *I. Douglasiana*, with its range of color from purple through lilac to buff, being especially attractive. Do not dig up the wild plants when in bloom, as they will not move well at that time. Either raise from seed or lift them when growth starts in at the beginning of the rainy season, this being the only safe time to move any of the native species.

Twenty-five distinct tall bearded irises for California, omitting only expensive novelties:

Asiatica (Kharput), amas, Kochii.

Pallida, pallida dalmatica (Princess Beatrice), Albert Victor, Queen of May, Madame Paquette.

Madame Chereau, Mrs. Reuthe.

Mrs. Horace Darwin, Victorine (weak grower), Isolene.

Perfection, Cottage Maid.

Darius, Gracchus, Hector, Mrs. Neubronner.

Jacquesiana, King of Irises.

Cengialtii, florentina, flavescens, cypriana superba.

Sydney B. Mitchell.

Orris-root cultivation.

Orris-root (corruption of *iris-root*) is apparently the product of *I. germanica* and related species; the violet-scented roots are used for perfumery powders, dentrifices, and for bad breath; the "fingers" made from the rhizomes are used for teething babies.

As orris-root is no longer used for artificial violet, the price has receded to normal, and probably if grown in this country would not pay. However, as it is likely to be of interest to the public and experimenters, the following notes are quoted from L. J. Keena, Florence, Italy, in a commercial publication.

"The soil in which this root is grown has much to do with the quality, as well as with the quantity and fragrance of the root, and therefore with its commercial success. This plant grows in different kinds of soil, but that best adapted to its growth is the stony mountain soil. This, however, must be scientifically prepared so that the under soil will not remain compact, for that would be disastrous to the plant during the summer months. In a loose soil containing sand the roots grow well, but are less odorous and compact. Rich yellow soil is still less adapted to its culture, as the plants die quickly. The rich land near manure-piles produces a great quantity of plants, but the roots are neither of good quality nor fragrant, and when dried shrivel up and are consequently discarded by the buyers. The situation or lay of this land matters little, though the best ground is usually found on hillsides. The plant also grows high up in the mountains, where snow and ice make the cultivation of it difficult. In these high places the root takes a few years more to reach its full growth.

"The most suitable soil for orris-root is that which has been prepared by spring seeding with some variety of leguminous plant, and which has been well prepared and deeply plowed. The best months for planting the iris are August and September, although it may be planted as late as the first part of October. The first two months mentioned, however, are preferable for the planting, as the plant begins to grow immediately upon being placed in the ground.

"The best method for planting in soil that has already been prepared is to make holes with a hoe about 16 inches apart, beginning at the bottom of the hill One plant should be placed in each hole resting on the wall of the hole and having its root just reach the bottom. This permits the perfect development of the bulbous root. To insure good production, the soil should be hoed in May and again in September. Irrigation is not beneficial to the plants, as the roots become less compact in irrigated land and there is a dangerous tendency toward fermentation. Fertilizing the soil with manure has the same effect, but if the production of a large number of plants is desired, a system of fertilizing with rich soil can be adopted. The best fertilizer is the seed "lupino" (*Lupinus albus*), which, after being cooked in an oven, is placed in small quantities near each plant at the September hoeing of the first year, if it is to be a two years' growth, and in September of the second year, if for a three years' growth. If the field is to be replanted with orris-root the soil should be well fertilized, and grain, grass or some other crop grown thereon for three or four years.

"The gathering of this product begins during the last fifteen days of June, and is carried on in the following manner: Several men hoe out the plant as a whole, distributing only so many of the plants as can be handled by the rest of the force during the following day, because the plants dry quickly when exposed to the sun and wind. The plants are then carried to a shelter, where the bulbous part of the root is cut off, care being taken to leave enough of the root extensions to insure a good growth for the following years. The bulbous root is then cleaned and scraped free of all imperfections. After the scraping, it is washed by hand in a succession of basins of running water.

"The roots for market are then dried in the sun, with provisions for covering and protecting from the ruinous effects of rain. It is well to set the roots outside before sunrise in order that they may receive the bleaching effect of the dew. After eight days' exposure to a strong sun, the orris-roots can be taken in under cover and packed in a dry place. Preferably the roots should be pulpous and as white as possible. Artificial drying in ovens or in any other manner depreciates the value of the product by making it less than if sun-dried. In the drying process the weight of the root becomes two-thirds of what it was when cut from the plant."

INDEX.

acoroides 73.
acuta, 65.
alata, 89.
alba, 3, 6, 25, 65, 67.
Alberti, 24.
albicans, 25.
albopurpurea, 84.
amœna, 31.
anglica, 100.
aphylla, 14, 20, 21.
arenaria, 11.
Aschersonii, 57.
asiatica, 19.
assyriaca, 96.
atrofusca, 49.
atropurpurea, 6, 30, 44, 49.
atroviolacea, 6, 18.

INDEX, CONTINUED.

attica, 6.
aurea, 81.
azurea, 6.
Bakeriana, 108.
balkana, 10.
Barnumæ, 42.
Battandieri, 99.
benacensis, 14.
bicolor, 6.
biflora, 8.
biglumis, 61.
Biliottii, 26.
Bismarckiana, 51.
Bloudowii, 11.
bohemica 14.
Boissieri, 102.
Bornmuelleri, 86.
bosniaca, 10.
brachycuspis, 77.
bracteata, 68.
cærulea, 6, 94, 105.
candida, 3.
caroliniana, 76.
caucasica, 92, 94, 98.
Cengialti, 13.
Chamæiris, 9.
chinensis, 3, 5.
chrysantha, 41.
cælestis, 6.
concolor, 37.
cretensis, 67.
cristata, 1, 3.
cuprea 72.
cyanea, 105.
cypriana, 29.
dalmatica, 19.
Danfordiæ, 86.
darwasica, 38.
Delavayi, 63.
desertorum, 83.
dichotoma, 52.
Douglasiana, 70.
Eggeri, 44.
ensata, 61.
erratica, 7.
Ewbankiana, 46.
falcata, 14.
Fieberi, 14.
filifolia, 103.
fimbriata, 3, 5.
flava, 73.
flavescens, 22, 23.
flavissima, 11.
flexuosa, 65.
florentina, 25.
fœtidissima, 82.
Fosteriana, 93.
fragrans, 8, 61.
fulva, 72.
fumosa, 97.
furcata, 14.
Gatesii, 47.
germanica, 30.
gigantea, 80.
gracilis, 6, 14, 66.
graminea, 59, 61, 69.
Grant-Duffii, 57.
Gueldenstædtiana, 79.
hæmatophylla, 61, 64.
halophila, 79, 83.
Hartwegii, 56.
Haussknechtii, 87.
Haynei, 49.
Heldreichii, 87.
Helenæ, 43.
hexagona, 75.
hispanica, 99.
Histrio, 106.
histrioides, 105.
honorabilis, 15.
humilis, 53.
hungarica, 14.
hybrida, 31.
iberica, 40.
imbatrica, 22.
intermedia, 81.
italica, 9.
Jacquesiana, 34.
japonica, 5.
juncea, 101.
Junonia, 28.
Kaempferi, 84.
Kochii, 17.
Kolpakowskiana, 109.
Korolkowi, 37.
Krelagei, 105.
lacustris, 2.
lævigata, 84.
Leichtliniana, 37.
Leichtlinii, 36.
lineata, 38.
longipetala, 62.
longispatha, 61.
Lortetii, 48.
lupina, 45.
lurida, 16, 45.
lusitanica, 99.
lutea, 6.
lutescens, 9.
macrosiphon, 55.
Madonna, 25.
major, 50, 105.
mandschurica, 12.
Mariæ, 43.
maricoides, 110.
Milesii, 4.
minor, 11.
missouriensis, 71.
Monnieri, 78.
nazarena, 51.
neglecta, 32.
nepalensis, 30.
nertschinskia, 64.
nikitensis, 59.
notha, 83.
nudicaulis, 8, 14.
obtusifolia, 22.
ochroleuca, 80.
oculata, 98.
olbiensis, 9.
orchioides, 94, 98.
orientalis, 64, 80.
oxypetala, 61.
pabularia, 61.
palæstina, 90.
Pallasii, 61.
pallida, 19, 73.
panormitana, 7.
paradoxa, 39.
persica, 87.
plicata, 20.
prismatica, 66.
Pseudacorus, 73.
pseudo-pumila, 7.
pumila, 6.
purpurea, 87.
Reichenbachiana, 10.
Reichenbachii, 10.
reticulata, 30, 105, 106.
Rosenbachiana, 88.
ruthenica, 53, 54.
Saarii, 45.
sambucina, 33.
sanguinea, 64.
Sari, 45, 51.
scorpioides, 89.
setosa, 77.
sibirica, 64, 65.
sicula, 19.
Sieheana, 87.
sikkimensis, 35.
sindjarensis, 96.
Sintenisii, 69.
Sisyrinchium, 110.
sogdiana, 83.
speciosa, 19, 67.
spectabilis, 99.
Sprengeri, 46.
spuria, 83.
squalens, 34.
Statellæ, 7.
stenophylla, 87.
stolonifera, 36.
stylosa, 67.
subbiflora, 8.
sulphurea, 6.
superba, 30, 67.
susiana, 50.
Suworowi, 38.
Swertii, 21.
Tauri, 87.
taurica, 6.
tectorum, 3.
tenax, 60.
tingitana, 104.
Tolmieana, 71.
tripetala, 77.
trojana, 27.
unguicularis, 67.
urmiensis, 41.
Urumovi, 69.
vaga, 36.
variegata, 15, 65, 73.
Vartanii, 107.
verna, 85.
versicolor, 74.
violacea, 6, 37.
virescens, 9.
virginica, 66, 74.
warleyensis, 95.
Willmottiana, 91.
Wilsonii, 58.
xiphioides, 100.
Xiphium, 99, 104.

KEY TO THE SUBGENERA.

A. *Rootstock a short, thick, or a slender creeping rhizome.*
  B. *Outer segms. of the perianth distinctly crested on the claw and the lower part of the blade*..... EVANSIA. Species 1–5
  BB. *Outer segms. of the perianth bearded with multi-cellular hairs.*
    C. *Seeds without a conspicuous aril*........... POGONIRIS. Species 6–34
    CC. *Seeds with a conspicuous creamy white circular aril.*
      D. *Aril much smaller than the seeds: lvs. not fully grown at flowering-time*........... PSEUDOREGELIA. Species 35
      DD. *Aril nearly as large as the seed itself: lvs. fully grown at flowering-time.*
        E. *St. 1-headed, 1–3-fld*................ REGELIA. Species 36–38
        EE. *St. 1-headed, 1-fld.: beard diffuse on the claw and the lower part of the blade*......... ONCOCYCLUS. Species 39–51

BBB. *Outer segms. of the perianth without a beard or crest, sometimes pubescent.*
C. *Infl. a regular raceme: seeds conspicuously winged*............PARDANTHOPSIS. Species 52
CC. *Infl. not a regular raceme: seeds not conspicuously winged*...........APOGON. Species 53–85
AA. *Rootstock a bulb.*
B. *Inner segms. of the perianth small, often minute, spreading or deflexed*........ JUNO. Species 86–98
BB. *Inner segms. of the perianth large, erect.*
C. *Stamens not adhering to the style-branches.* XIPHIUM. Species 99–109
CC. *Stamens adhering to the style-branches*...... GYNANDRIRIS. Species 110

SUBGENUS EVANSIA.

A. *St. none or very short, evidently exceeded by the lvs.: plants dwarf.*
B. *Perianth-tube very slender, exceeding the bracts*.................. 1. **cristata**
BB. *Perianth-tube expanded above, not exceeding the bracts*.............. 2. **lacustris**
AA. *St. evident, equaling or exceeding the lvs.: plants large.*
B. *Pedicel much shorter than the spathe*......................... 3. **tectorum**
BB. *Pedicel about as long as the spathe or only slightly shorter.*
C. *Lvs. thin, distinctly ribbed, both surfaces slightly glaucous*....... 4. **Milesii**
CC. *Lvs. thick, smooth, with a glossy upper- and a glaucous under-surface*...................... 5. **japonica**

1. **cristàta,** Soland. Plant dwarf: rhizome slender, creeping: lvs. ensiform, thin, 4–8 in. long, green: st. 1–3 in. high, flattened, 1-headed, bearing 2–3 lvs.: tube slender, 1½–2 in. long; limb blue; outer segms. obovate, 1–1½ in. long, crested; inner segms. shorter, naked. April, May. Mountains of Ky., Va., and the Carolinas. B.M. 412. Gn. 45, p. 127. L.B.C. 14: 1366.

2. **lacústris,** Nutt. Similar to *I. cristata* in size and foliage except that the lvs. are rather narrower and sometimes wavy margined and the perianth-tube is only ½–1 in. long, shorter than the spathe-valves: fls. blue; segms. expanded above: caps. ovoid, borne on a pedicel of about its own length. Shores of Lakes Huron, Michigan, and Superior.

3. **tectòrum,** Maxim. (*I. chinénsis,* Bunge. *I. cristàta,* Miq. *I. fimbriàta,* Klatt). Fig. 1965. Lvs. 1 ft. long, ensiform, thin, strongly ribbed: st. 1½ ft., subterete: heads on long peduncles; tube 1 in. long; limb bright lilac; outer segms. 2 in. long, obovate; claw half as long as the blade, streaked with violet, with a wavy edge and a large, laciniate, white and lilac crest running up the claw and half up the blade; inner segms. spreading, nearly as large, plain lilac, short-clawed. Sent to Eu. in 1872 by Dr. Hance. Cult. in China and Japan. B.M. 6118. F.S. 22:2282. Gt. 716. Gn. 50:272. G.C. III. 35:355; 44:142. J.H. III. 44:146. G.L. 17:348. Var. **álba,** Dykes (*I. tectòrum* var. *cándida,* Hort.). Fls. pure white, with few faint yellow veins at the base of the segms. Comes true from seed. Gt. 57: 1571. Gn. 70, p. 15. G.C. III. 40:216. G.W. 10:525.

1965. Iris tectorum. (×¼)

4. **Milesii,** Foster. Lvs. 7–8 on the st., 2–3 ft. long and 2–3 in. broad, thin, strongly ribbed: st. 2–3 ft. high, branched, bearing 4–5 heads: fls. bright lilac, lasting only a day; outer segms. oblong-cuneate, claret-purple, whitish in the center, spotted and veined with lilac, furnished with a deeply laciniated yellow crest; inner segms. oblong, spreading; style-crests deeply toothed. Himalayas. B.M. 6889.—Near *I. tectorum,* but inferior.

5. **japónica,** Thunb. (*I. chinénsis,* Curt. *I. fimbriàta,* Vent.). Fig. 1966. Lvs. ensiform, thick, smooth, 1–1½ ft. long: st. slender, as long as the lvs., with a raceme of lilac fls.: tube ¾in. long; outer segms. 1–1½ in. long, with crimped margins, yellow on the claw, crested; inner segms. smaller. Winter. Japan and China. B.M. 373. Gt. 511. Gn. 28:120; 77, p. 142. J.H. III. 31:185. A.G. 12:704. F.R. 2:149.—An evergreen greenhouse plant except in Calif. where it does very well outdoors in a shady border.

SUBGENUS POGONIRIS.

A. *Plants dwarf: lvs. generally less than 9 in. long.*
B. *Tube of the perianth 1 in. or more in length.*
C. *St. obsolete or very short*......... 6. **pumila**
CC. *St. present, 1–10 in. long.*
D. *Spathe-valves not keeled or only the outer one slightly keeled.*
E. *The st. almost entirely hidden by clasping lvs.*
F. *The spathe-valves lanceolate, membranous, green*.. 7. **pseudopumila**
FF. *The spathe-valves oblong, green or scarious above*... 8. **biflora**
EE. *The sts. bare above, with 1–2 reduced lvs. below the center.* 9. **Chamæiris**
DD. *Spathe-valves acutely keeled*....10. **Reichenbachii**
(See also I. imbricata No. 22)
BB. *Tube of the perianth short or none.*
C. *Spathe-valves green or only partly scarious.*
D. *Rhizome slender, stoloniferous: sheaths splitting into fibers*....11. **flavissima**
DD. *Rhizome more compact: sheaths not splitting into fibers*......12. **mandshurica**
CC. *Spathe-valves scarious, even in the bud*........................13. **Cengialti**
AA. *Plants tall: lvs. generally more than 1 ft. long.*
B. *St. scarcely overtopping the lvs.*
C. *The st. branched below the middle*........................14. **aphylla**
CC. *The st. branched above the middle, or unbranched.*
D. *Spathe-valves wholly green when the first fls. open, often flushed with purple, inflated*.........15. **variegata**
DD. *Spathe-valves partly scarious when the first fls. open.*
E. *Fls. dull purple*............16. **lurida**
EE. *Fls. dark violet*.............17. **Kochii**
DDD. *Spathe-valves entirely scarious at flowering-time*...........18. **atroviolacea**
BB. *St. much overtopping the lvs.*
C. *Spathe-valves entirely scarious at flowering-time or even in the bud.*
D. *Fls. pale purple or lilac*.......19. **pallida**
DD. *Fls. white; segms. veined and flushed with purple or lilac on the margins.*
E. *Sts. 2–3 ft. high*............20. **plicata**
EE. *Sts. 1–1½ ft. high*..........21. **Swertii**
CC. *Spathe-valves green or partly scarious.*

D. *Fls. yellow.*
E. *The spathe-valves membranous, much inflated, almost wholly green*.............22. **imbricata**
EE. *The spathe-valves firm, not inflated, almost wholly scarious*...................23. **flavescens**
DD. *Fls. purple, violet, lilac, or white; inner segms. sometimes yellowish.*
E. *Spathe-valves much inflated*..24. **Alberti**
EE. *Spathe-valves scarcely inflated.*
F. *Lateral heads subsessile*...25. **florentina**
FF. *Lateral heads stalked.*
G. *The spathe-valves narrow acuminate, almost wholly green, scarious only at the tip and edges*..............26. **Biliottii**
GG. *The spathe-valves narrow acuminate, scarious in the upper half and much tinged with purple*.................27. **trojana**
GGG. *The spathe-valves broad, navicular, not tinged with purple.*
H. *Lvs. glaucous, broad*..28. **Junonia**
HH. *Lvs. slightly glaucous, blue-green, comparatively narrow*....29. **cypriana**
GGGG. *The spathe-valves broad, navicular, much tinged with purple*..........30. **germanica**

The following four forms cannot be separated from each other and from some of the foregoing forms by strictly botanical characteristics. They are probably varieties of hybrid origin as indicated in the descriptions.

Outer segms. blue to pale violet or white; inner segms. white...............31. **hybrida**
Outer segms. blue to bright lilac; inner segms. lighter....................32. **neglecta**
Outer segms. blue-purple with faint darker veins; inner segms. smoky yellow and pale purple...........33. **sambucina**
Outer segms. lilac-purple; inner segms. smoky yellow and pale lilac.......34. **squalens**

6. **pùmila,** Linn. (*I. violàcea,* Sweet. *I. taùrica,* Lodd. *I. cærùlea,* Spach). Fig. 1967. Lvs. linear, 2–4 in. long: st. none or very short, 1-headed: spathe-valves scarious at the tip: fls. fugitive, yellow, or bright or dark lilac; limb 2 in. long. Austria–Hungary, Asia Minor, S. Russia. L.B.C. 16:1506, 1574. R.H. 1903:132. G.M. 49:225 (var. *bicolor*); Gn. M. 15:360.—A dwarf, hardy plant, spreading rapidly in borders. Has many color varieties ranging from dark reddish purple to light purple and yellow. Var. **áttica,** Boiss. & Heldr. (*I. áttica,* Boiss. & Heldr.). Lvs. narrow, falcate: fls. pale straw-yellow tinged with green; segms. with inconspicuous purplish veins, the outer with a purplish or greenish brown patch. Gt. 11:377. Var. **violàcea,** Ker. Fls. bright blue. B.M. 1261. Var. **lùtea,** Ker. Fls. pale yellow. The common yellow form. B. M. 1209. —The following trade names which are self-explanatory have been applied to some of the numerous color-varieties of this species: *I. alba, I. atropurpurea, I. atroviolacea, I. azurea, I. bicolor, I. cælestis, I. lutea, I. sulphurea. I. gracilis,* E. Berg, is probably a hybrid of this species.

7. **pseudo-pùmila,** Tineo (*I. panormitàna,* Tod.). Lvs. ensiform, glaucescent, 6–9 in. long, narrowed suddenly to an oblique tip: st. 1-headed, 6–8 in. long, clothed with bracts, 1-fld.: tube 2–2½ in. long; spathe-valves green: fls. varying from yellow to bright lilac; outer segms. oblong unguiculate, 2–2½ in. long; inner segms. rather broader. Mountains of Sicily. *I. Státellæ,* Tod., is a hybrid or a sport of this species. The seeds give rise to typical *I. pseudo-pumila* plants. B.M. 6894 is *I. erratica,* Tod. Probably a similar hybrid.

8. **biflòra,** Linn. (*I. subbiflòra,* Brotero. *I. fràgrans,* Salisb. *I. nudicaùlis,* Hook.). Lvs. 6–9 in. long: st. 2–10 in. long, compressed, usually bearing 2–3 small clasping lvs. which entirely hide it: fls. bright violet-purple; outer segms. obovate-cuneate, 2–2½ in. long, with dark veins and a beard of long, yellow hairs; inner segms. obovate, unguiculate, lighter, with faint veins. Portugal and N. Morocco. B.M. 1130.

1966. Iris japonica (×⅓). No. 5.

9. **Chamæìris,** Bertol. (*I. olbiénsis,* Henon. *I. lutéscens,* Lam. idem, Delarb. *I. viréscens,* Delarb.). Lvs. 3–6 in. long, ½in. broad: st. 1–10 in. long, bare above with 1–2 reduced lvs. below the middle: fls. bright yellow; outer segms. obovate-cuneate, tinged and veined with brown; inner segms. oblong. May. Italy, France. B.M. 2861, 6110. Gn. 63, p. 26.—Distinguished from *I. pumila* by the evident st., the shorter tube, and the more inflated and less membranous spathe-valves. Var. **itálica,** Parl. Fls. dark violet.

10. **Reìchenbachii,** Heuffel. (*I. bosnìaca,* Beck. *I. balkàna,* Janka. *I. Reichenbachiàna,* Baker). Rhizome stout; tufts crowded: lvs. 3–6 in. long, ¼–¾in. wide, increasing in size after flowering-time: st. 6–10 in. long, 1-headed, bearing 1–2 reduced lvs.: spathes 1–2-fld., 1½–2 in. long; valves ventricose, green, or slightly scarious: fls. reddish brown-purple with bluish white beard, or yellow with orange beard; outer segms. obovate, cuneate, 2 in. long, 1 in. broad; inner segms. oblong-elliptical, emarginate, suddenly constricted to a canaliculate claw. Bosnia and Herzegovina to Bulgaria and Macedonia.—Resembles *I. Chamæiris,* but differs in the flattened, acutely keeled spathes and the thin texture of the fls. The yellow-fld. forms are often slightly veined with purple.

11. **flavíssima,** Pall. (*I. arenària,* Waldst.). Lvs. thin, linear, 4–8 in. long: st. 1–6 in. long, 2–3-fld.: limb bright yellow; outer segms. 1–1½ in. long, ¾in.

broad; inner segms. oblong, narrower. Hungary, N. E. Asia and Altai region to Mongolia. B.R. 549. G.C. III. 29:337.—*I. arenaria* is the Hungarian representative of *I. flavissima*. It is smaller than *I. flavissima*, but otherwise scarcely distinct. Var. **Bloudòwii,** Ledeb. (*I. Bloudòwii,* Ledeb.). More robust with broader lvs., a longer st. and larger fls. Gt. 29:1020. Turkestan, Siberia and China. Var. **minor,** Hort. Smaller.

12. **mandshùrica,** Maxim. Lvs. from a short creeping rhizome whose sheaths are not split into fibers, ensiform, 6–8 in. long, ½in. broad: st. 1-headed: spathe 2-fld.; valves 1½–2 in. long, membranous, green with a scarious edge: pedicel short: fls. yellow; tube ½in. long; outer segms. 1½–2 in. long, ½in. broad, obovate-cuneate, truncate, with a yellow beard; inner segms. narrower and shorter; crests of style-branches obtuse, dentate. S. Manchuria.—Near *I. flavissima,* from which it is distinguished by the more compact rhizome and wider lvs.

13. **Céngialti,** Ambrosi. Lvs. ensiform, yellowish green, glaucous, 6 in. long, ½in. broad: sts. 6–12 in. long, usually exceeding the lvs., 1–3-headed: spathes 2-fld., 1 in. long, brown-scarious in the bud but not silvery white like those of *I. pallida:* fls. bright lilac; outer segms. obovate-cuneate, veined with brown-purple on the pale claw, with a beard of white orange-tipped hairs; inner segms. obovate, short-clawed. Lombardy, S. Tyrol.—A dwarf species closely allied to *I. pallida.*

14. **aphýlla,** Linn. (*I. bohèmica,* Schmidt. *I. hungárica,* Waldst. & Kit. *I. furcàta,* Bieb. *I. falcàta,* Tausch. *I. Fièberi,* Siedl. *I. nudicaùlis,* Hook. *I. benacénsis,* Kerner). Lvs. glaucescent, 6–12 in. long: st. equaling the lvs., sometimes forked low down, leafless: spathe-valves greenish, tinged with purple: fls. dark lilac; outer segms. obovate-cuneate, 2–2½ in. long; beard white; inner segms. broader, obovate. E. Eu. B.M. 2361, 5806. B.R. 801. L.B.C. 20:1970.—The plant commonly cult. as *I. gracilis* is probably *I. aphylla.*

15. **variegàta,** Linn. Lvs. 1–1½ ft. long: st. equaling the lvs.: outer segms. oblong-cuneate, claret-brown toward the tip, much veined with brown on a yellow ground; beard bright yellow; inner segms. erect, oblong, bright yellow, veined. Austria, Turkey and S. Russia. Long in cult. B.M. 16. Gn. 14:12; 52:364 (var. *aurea*). G.M. 54:126. Var. **honorábilis,** Hort. Yellow, shaded with brown.

16. **lùrida,** Soland. Lvs. 1 ft. long, slightly glaucous: st. not much overtopping the lvs., 3–4-headed: spathe-valves green flushed with purple, scarious above, very ventricose, not keeled: outer segms. obovate-cuneate, reflexed from half-way down, dead purple at the top, veined with dull purple on a yellowish ground below; beard yellow; inner segms. broader, dull purple. S. E. Eu. B.M. 986, also B.M. 669, which is probably a different plant.

17. **Kòchii,** Kerner. Lvs. 12–15 in. long, glaucescent: st. as long as the lvs., 3–4-headed: spathe-valves lanceolate, the outer herbaceous; the inner partly scarious, tinged with purple along the edge: outer segms. obovate, with a broad cuneate claw, 3½–4 in. long, 1¾ in broad, dark violet; claw veined with brown; beard yellow; inner segms. broadly obovate, clawed, dark violet, somewhat lighter than the outer. Istria, near Trieste and Rovigno.—Probably a form of *I. germanica* or a hybrid between that species and *I. aphylla.*

18. **atroviolàcea,** Lange. Lvs. very glaucous, 1 ft. long: st. equaling the lvs.: spathe entirely scarious: fls. dark violet, very fragrant; outer segms. obovate-cuneate, 3 in. long; beard white, tipped with yellow; inner segms. as long, 2 in. broad, orbicular. Late May.—Known only in cult. Probably either *I. germanica* var. *atropurpurea* or *I. Kochii.*

19. **pállida,** Lam. (*I. asiática,* Stapf. *I. sícula,* Tod.). Lvs. 1–2 ft. long: st. much exceeding the lvs., 2–3 ft. high: spathe-valves wholly scarious before the fls. expand: fls. fragrant, violet, rarely white; outer segms. obovate-cuneate, 3½ in. long; inner segms. orbicular. Crete, Rhodes, Syria, Palestine. B.M. 685. Gn. 33:32; 50, p. 119. G.M. 38:441. G. 29:179. G.L. 23:147. J.H. III. 54:437 (var. *delicata*). R.B. 30:145 (variety with variegated lvs.).—The spathe-valves entirely scarious even in the bud, the more complicated infl. and the fragrant fls. distinguish this species from *I. germanica.* Var. **dalmática,** Hort. Lvs. 2 in. wide, broader than those of the type, very glaucous: st. shorter and stouter than that of the type: fls. lilac-purple. The finest form of *I. pallida.* J.H. III. 56:545. Var. **speciòsa,** Hort. Tall, with large, light blue fls.

20. **plicàta,** Lam. (*I. aphýlla,* Hort., not Linn. *I. aphýlla* var. *plicàta,* Ker). Rhizome, st. and lvs. as in *I. pallida:* outer segms. obovate, pure white in the center, conspicuously veined with lilac toward the margin and on the claw; inner segms. very plicate, white tinged with lilac on the margin. B.M. 870.—Known only in cult. Probably derived from *I. pallida.*

21. **Swértii,** Lam. (*I. aphýlla* var. *Swértii,* Ker.) Much dwarfer than *I. florentina* and *I. pallida.* St. 1–1½ ft. long: spathe-valves flushed with violet: outer segms. 2–2½ in. long, obovate-cuneate, white, faintly veined and flushed with purple on the margin; inner segms. as large, much crisped, pure white, except the purple keel and margin.—Fragrant. Known only in cult.

22. **imbricàta,** Lindl. (*I. flavéscens,* Sweet. *I. obtusifòlia,* Baker). Lvs. about 6 in a tuft, broadly ensiform, pale green, 6–8 in. long at flowering time: st. 12–20 in. long, bearing a terminal and several nearly sessile lateral clusters each subtended by a ventricose navicular bract: spathe-valves oblong navicular, 2–3 in. long, green, membranous, very ventricose: fls. greenish yellow; tube 1 in. long; outer segms. obovate-cuneate, 2 in. long and 1 in. broad, veined with brown on the claw; inner segms. erect, rounded oblong, subcordately unguiculate, mottled with brown on the claw. Transcaucasia and N. Persia. B.R. 31:35. B.M. 7701.—Confused with *I. flavescens,* from which it differs by the membranous inflated green spathe-valves.

1967. **Iris pumila.** One of the best dwarf species (×⅓). No. 6.

23. **flavéscens,** DC. Lvs. 12–15 in. long: st. 2–3 ft. high, bearing 3–4 heads: spathes 2–3-fld., not entirely

scarious at flowering-time: fls. bright lemon-yellow; outer segms. obovate-cuneate, 2½ in. long; beard deep yellow; inner segms. obovate, pale yellow. G.C. III. 48:95.—Known only in cult.

1968. Iris germanica. Typical of many species in which the beard is confined to the midrib. (×⅙)

24. **Álberti,** Regel. Lvs. ensiform, glaucous, 1½–2 ft. long: st. exceeding the lvs., bearing 5–6 heads in a loose panicle: spathe-valves mostly green, very slightly scarious at tips: outer segms. obovate-cuneate, 2 in. long, bright lilac, with a rudimentary crest and a dense beard of white, yellow-tipped hairs, veined; inner segms as long and broader than the outer, with convolute claws, lilac. Discovered in Turkestan by Dr. Albert Regel. Gt. 999. B.M. 7020.

25. **florentìna,** Linn. Rhizome fragrant when dried (orris-root): lvs. 1–1½ ft. long: st. exceeding the lvs.: fls. white; outer segms. 3½ in. long, tinged with lavender; claw yellowish veined with purple; inner segms. as large, white. Cent. and S. Eu. B.M. 671. Gn. 16:82; 51, p. 295. G.M. 54:127. —Flowers early, with *I. germanica.* Hardy. Var. **álbicans,** Lange (*I. álbicans,* Lange. *I. florentìna* var. *álba,* Hort.). Pure white. Spain to Cyprus. Var. **Madónna,** Hort. Fls. blue; spathe-valves flushed with purple.

26. **Bilióttii,** Fost. Lvs darker green, more distinctly striated, and more rigid than in *I. germanica,* about 20 in. long, 1½–1¾ in. broad: st. several-headed, 2½–3 ft. long: spathe-valves narrow, acuminate, nearly 2 in. long, ventricose, scarious only at the tips: outer segms. obovatc-cuneate, reddish purple, with many dark veins; beard white, tipped with yellow; inner segms. orbicular unguiculate, 2 in. broad, bright blue-purple. Late June. Trebizond.—Very near *I. germanica.*

27. **trojàna,** Kerner. Lvs. very acute, glaucescent: st. over 3 ft. high, much branched and overtopping the lvs.: pedicel none: fls. bright violet-purple; outer segms. obovate; blade longer than the claw; claw white, bordered with yellow and veined with brown-purple; inner segms. elliptic, suddenly narrowed to a claw; style-crests broad, denticulate. Troad, Asia Minor. G.C. III. 53:170.

28. **Junònia,** Schott & Klotschy. Rhizome stout, compact: lvs. 12–14 in. long, 1¾ in. wide, glaucous: st. 20–24 in. high, bearing a terminal head of 2 fls. and 4 lateral branches, the lowest about 3–4 in. long: spathe 1½ in. long, with pale green valves, scarious in the upper half: pedicel none: outer segms. obovate-cuneate, purple-violet, whitish at the throat and on the claw, veined with yellowish brown; inner segms. obovate, abruptly unguiculate, pale violet, veined and spotted with red-brown on the paler claw. Cilician Taurus.—Differs from *I. pallida* in the spathe-valves, which are only partly scarious at flowering-time.

29. **cypriàna,** Foster & Baker. Plants tall, the branching st. being 3 ft. high, bearing many fls. 6–7 in. diam.: outer segms. obovate-cuneate, reddish lilac, with thin, darker veins; claw whitish, with greenish brown veins; inner segms. oblong-unguiculate, lilac, spotted with reddish brown on the claw. June, July. Cyprus.—Very near *I. pallida,* from which it differs only by the longer navicular spathe-valves, which are not entirely scarious at flowering-time, and the more obovate segms.

30. **germánica,** Linn. Fig. 1968. Lvs. 1–1½ ft. long: st. 2–3 ft. high, usually with a 2-fld. terminal head and one short and one longer lateral branch, each bearing a single fl.: spathe-valves tinged with purple, scarious in the upper half: outer segms. obovate-cuneate, 2–3 in. long; beard yellow; inner segms. as large, obovate, connivent. Cent. and S. Eu. Early May, June. B.M. 670. B.R. 818. I.H. 40: 182 (var. *Gypsea,* pure white). Gn. 48:242 (dark purple var.). Gn. M. 15:362. Var. **reticulàta supérba,** Hort. Outer segms. purple, veined; inner segms. lavender. Var. **nepalénsis,** Dykes (*I. nepalénsis,* Wallich. *I. germánica* var. *atropurpùrea,* Hort.). Purple King. Fls. red-purple; outer segms. darker, almost black-purple.

31. **hýbrida,** Retz. (*I. amæ̀na,* DC.). Differs from *I. neglecta* by its longer spathe-valves, and its pure white or faintly lilac-tinted outer segms. and style-branches. June.—Known only in cult.

32. **neglécta,** Hornm. Lvs. slightly glaucous, 12–15 in. long, ensiform, purple at the base: st. taller, 1½–2 ft., many-fld.: spathe-valves green below at flowering-time, much tinged with purple: outer segms. obovate-cuneate, very obtuse, 2 in. long, violet-blue on the margin, whitish veined with blue in the center; beard yellow; inner segms. erect or connivent, oblong, as large as the outer, pale lilac. June. B.M. 2435.—Known only in cult. Probably a hybrid between *I. pallida* and *I. variegata.*

33. **sambùcina,** Linn. Differs from *I. squalens* in its less robust habit, narrower segms. and elder-like odor. The outer segms. are colored and veined with claret not lilac-purple; inner segms. emarginate. Late May. Cent. Eu. B.M. 187. (According to Dykes this figure is probably *I. squalens,* while plate 787, *I. squalens,* probably represents *I. sambucina.* Both forms are very likely hybrids between *I. pallida* and *I. variegata.*)—Tall and handsome.

34. **squàlens,** Linn. Lvs. glaucous, 1–1½ ft. long: st. 2–3 ft. high, much branched and many-fld.: spathe-valves subscarious: outer segms. obovate-cuneate, upper part plain lilac-purple; claw yellow, veined with lilac; beard yellow; inner segms. as large, obovate, dull lilac and yellow, or brownish and yellow. Cent. Eu. to Caucasus. B.M. 787. (See note under *I. sambucina.*) J.H. III. 48:481.—Many of the German irises of cultivators belong to this form. Var. **Jacquesiàna,** Hort. Outer segms. dark red-violet, yellow at base; inner segms. tawny yellow. Late. One of the best.

SUBGENUS PSEUDOREGELIA.

35. **sikkiménsis,** Dykes. Lvs. 4–8 in. long at flowering-time, later 12–18 in. long, ½–¾in. wide, pale green, ensiform: st. 4–6 in. long, bearing a single head of 2–3 fls.: spathes 2–3 in. long, lanceolate; valves scarious in the upper one-third and along the edges, keeled: tube 1½–2 in. long; outer segms. obovate, contracted to a cuneate claw, 2½ in. long, 1 in. broad, dark lilac, mottled with a deeper shade; beard of white orange-tipped hairs; inner segms. spreading, with an oblong, deeply emarginate blade suddenly contracted into a canaliculate claw, pale lilac; faintly mottled with a deeper shade at the base; style-crests triangular, revolute. Probably from Sikkim.

SUBGENUS REGELIA.

A. *Rhizomes wide-spreading, stoloniferous* . . 36. **stolonifera**
AA. *Rhizomes compact.*
  B. *Lvs. ensiform: outer segms. suddenly contracted into a claw* . . . . 37. **Korolkowi**
  BB. *Lvs. linear: outer segms. gradually narrowed to a claw* . . . . 38. **darwasica**

36. **stolonífera,** Maxim. (*I. Lèichtlinii,* Regel. *I. vàga,* Foster). Rhizome slender, wide-creeping: lvs. in tufts, not contiguous, ensiform, 1–1½ ft. long, scarcely glaucous: st. 1–2 ft. long, almost wholly concealed by clasping lvs., 1-headed, bearing 2–3 fls.: outer segms. 2–2½ in. long, oblong-cuneate, bright lilac, suffused with bronze toward the margin, with a yellow beard; inner segms. oblong, as broad as the outer, claw also bearded. Turkestan. Gn. 52:222. B.M. 7861. Gt. 36:1244 (rootstock only). G.C. III. 32:242. Gn.W. 24:382. Var. **vàga,** Foster, has larger fls.

37. **Korólkowi,** Regel. Rhizome short-creeping: lvs. glaucous, 1 ft. long: st. 1 ft. long, bearing 2–3 reduced lvs. and a single head of 2–3 fls.: spathe-valves 2–3 in. long, keeled, acuminate, green flushed with purple: limb 2½–3 in. long, pale yellowish white, veined with red-brown in the type; outer segms. oblong, 1 in. broad, with a brown beard and a brown patch on the throat; inner segms. as large, erect. May. Turkestan. B.M. 7025. Gn. 28:484. G.C. III. 4:37. Gt. 22:766; 40:1358.—Very hardy. One of the earliest. Variously colored lilac, and so on in cult. Var. **cóncolor,** Foster. Purplish lilac, veined darker. Var. **Leichtliniàna,** Foster. Creamy white, with brownish veins. Var. **violàcea,** Foster. Violet, with dark veins.

38. **darwásica,** Regel (*I. Suwórowi,* Regel. *I. lineàta,* Foster). Lvs. thin, linear, 1 ft. long, ½in. wide, very glaucous, bluish green: st. 1 ft. high, bearing 2–3 reduced lvs. and a single head of fls.: spathe-valves 3–3½ in. long, green or slightly flushed with purple, sharply keeled and very pointed, longer than the tube: outer segms. oblong-cuneate, ½in. broad, 2 in. long, closely veined with oblique lines of claret-purple on a greenish yellow ground; beard blue; inner segms. oblong, with a long claw, often faintly bearded, veined and tinted on the margins with claret-purple. Bokhara. B.M. 7029. Gt. 36:1244.

SUBGENUS ONCOCYCLUS.

A. *Outer segms. of the perianth ligulate, much reduced* . . . . 39. **paradoxa**
AA. *Outer segms. of the perianth not much smaller than the inner.*
  B. *Lvs. linear, narrow, not over ½in. wide, more or less falcate: plant slender: st. usually not over 6–8 in. high.*
    C. *The outer segms. deflexed from the base, very concave* . . . . 40. **iberica**
    CC. *The outer segms. deflexed from the middle, convex.*
      D. *Fls. uniformly colored, not conspicuously veined,*
        E. *Signal patch darker, but of the same color as the outer segms.*
          F. *Color of fls. yellow* . . . . 41. **urmiensis**
          FF. *Color of fls. reddish purple* . 42. **Barnumæ**
          FFF. *Color of fls. lilac* . . . . 43. **Mariæ**
        EE. *Signal patch not of the same color as the outer segms.; fls. purplish black* . . . . 44. **atropurpurea**
      DD. *Fls. conspicuously veined on a ground of different color.*
        E. *Outer segms. obovate-cuneate.* 45. **Saarii**
        EE. *Outer segms. lanceolate pointed* . . . . 46. **Ewbankiana**
  BB. *Lvs. ensiform or linear, over ½in. broad, scarcely falcate: plant larger, stout: st. usually a foot or more high.*
    C. *Inner and outer segms. similarly colored.*
      D. *Fls. light-colored gray or lilac.*
        E. *Outer segms. marked with numerous fine purple veins and sprinkled with minute purplish dots more crowded on the throat; fls. very large* . . 47. **Gatesii**
        EE. *Outer segms. dotted and veined with crimson or reddish brown, with a reddish patch at the throat:; fls. smaller* . . . . 48. **Lortetii**
      DD. *Fls. dark-colored, mostly brownish or purple.*
        E. *Segms. almost uniformly dark purple* . . . . 49. **atrofusca**
        EE. *Segms. heavily veined and spotted with black-brown on a lighter ground* . . . . 50. **susiana**
    CC. *Inner segms. blue to pale blue; outer segms. densely spotted and veined with purple-brown* . . . . 51. **Bismarckiana**

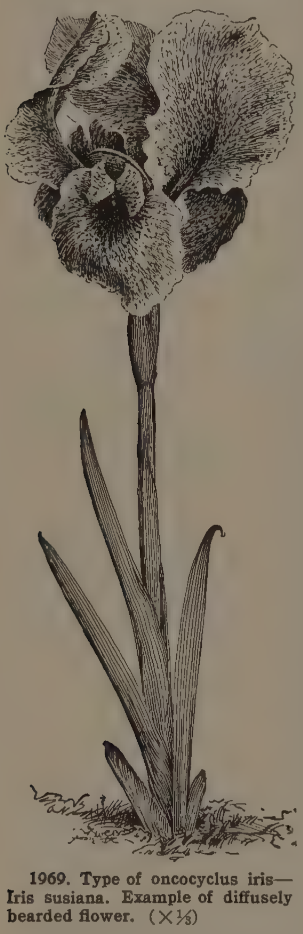
39. **paradóxa,** Stev. Plants dwarf: lvs. linear, 3–6 in. long: st. 2–6 in. high: fl. large; outer segms. reduced to a mere claw, dark, covered with a dense pile; inner segms. 2 in. long, orbicular, lilac to white. Mountains of Ga. and N. Persia. B.M. 7081. Gn. 32:584; 46, p. 173; 59, p. 248 (var. *choschab*). Gt. 386. G.C. III. 29:104 (var. *choschab*).—A fl. with singular combinations of color. Grows in dry situations, but requires shelter in winter. Long cult., but not common.

40. **ibèrica,** Hoffm. Dwarf, with a large fl.: lvs. 3–6 in. long, narrow, very falcate: st. 3–4 in. long outer segms. rounded-obovate, 2 in. broad, pale bro closely veined and blotched with purple-brown a with a shining dark patch on the throat; inner seg

connivent, pure white, faintly veined, with a few wine-red spots at base. Caucasus and mountains of Armenia and Persia. B.M. 5847. Gt. 386 and 713. F.S. 19: 1963. R.H. 1873: 370. Gn. 10:526; 43, p. 131; 72, p. 349. I.H. 19:106. G.C. II. 11:693; III. 53:399. F. 1873:25. F.M. 1875:168.—Hardy. The color of the fls. varies considerably in this species. In some the inner segms. are nearly white, while in others they are nearly as dark as the outer. The species is chiefly distinguished by the curious spoon-shaped concave outer segms. and the depressed style-branches which give the fls. an appearance different from the other members of this group.

41. **urmiénsis,** Hoog (*I. chrysántha,* Baker). Rhizome short-creeping: lvs. linear, 1 ft. long, thick and firm, glaucescent with a pale margin: st. slender, as long as the lvs.: spathe-valves lanceolate-acuminate, 4 in. long, pale green, chartaceous: fls. pale yellow; outer segms. oblong, emarginate, 3 in. long, reflexed from near the base, with a bright orange beard; inner segms. erect, obovate-cuneate, as long as the outer and broader; style-branches yellow, an inch broad, with large quadrate entire crests. Probably near Lake Urumiah in N. W. Persia. B.M. 7784. Gn. 58, p. 375. G.C. III. 28:373.

42. **Bárnumæ,** Baker & Foster. Lvs. about 5–6 in a tuft, slender, linear, about 6 in. long, less than ½in. broad: st. 2–6 in. long, bearing a single sheathing lf.: spathe-valves 2 in. long, green with purple tips and margins: outer segms. obovate-cuneate, reflexed, 2 in. long, 1 in. broad, passing into a cuneate claw, dark reddish purple with darker veins and a triangular beard of yellow purple-tipped hairs; inner segms. obovate-orbicular, connivent, 3 in. long, 2½ in. broad, suddenly contracted into a short claw, reddish purple, lighter than the outer segms. and with more conspicuous veins and few scattered hairs on the claw. Mountains of Armenia. B.M. 7050.



1969. Type of oncocyclus iris—Iris susiana. Example of diffusely bearded flower. (×⅓)

43. **Màriæ,** Barbey (*I. Hélenæ,* Barbey). Lvs. very falcate, 3–4 in. long: st. 3–6 in. long, with 2–4 short lvs.: limb pale lilac, with fine red-brown veins; outer segms. orbicular, 2½ in. long, with a dark purple patch at the throat; inner segms. larger, more rounded. Desert between Egypt and Palestine. Discovered 1880. Gt. 42, p. 488; suppl. pl. J.H. III. 28:302. G.M. 37:215.

44. **atropurpùrea,** Baker (*I. Éggeri,* Hort.). Lvs. 6 in. long: st. 6–8 in.: outer segms. oblong, 2 in. long, purplish black, without veins, with a yellow patch on the throat and a beard of yellow, black-tipped hairs; inner segms. larger, of the same color, with discernable veins; style-crests small. Easily distinguished by its rather small, uniformly colored fls. Gt. 40:1361; 42, p. 489; suppl. pl.

45. **Saàrii,** Schott (*I. Sàri,* Aut. *I. lupìna,* Foster). Rhizome short, stout: lvs. about 6 in. long, finally 1 ft., linear-complicate: st. 3–6 in. long, with 2 reduced lanceolate lvs.: pedicel very short: fls. bright lilac, large as in *I. susiana;* tube 1 in. long; outer segms. obovate-cuneate, 1½–2 in. broad, reflexed from half way down; inner segms. oblong, with a short claw. Very near *I. iberica,* from which it differs chiefly by its bright lilac fls. Asia Minor. B.M. 7904. G.C. III. 36:147. Var. **lùrida,** Boiss. Segms. brownish white with many brown-black spots near the center, and numerous brownish lines toward the margin, the outer with a brown-black spot at the throat. Gn. 43:130; 54, p. 59.

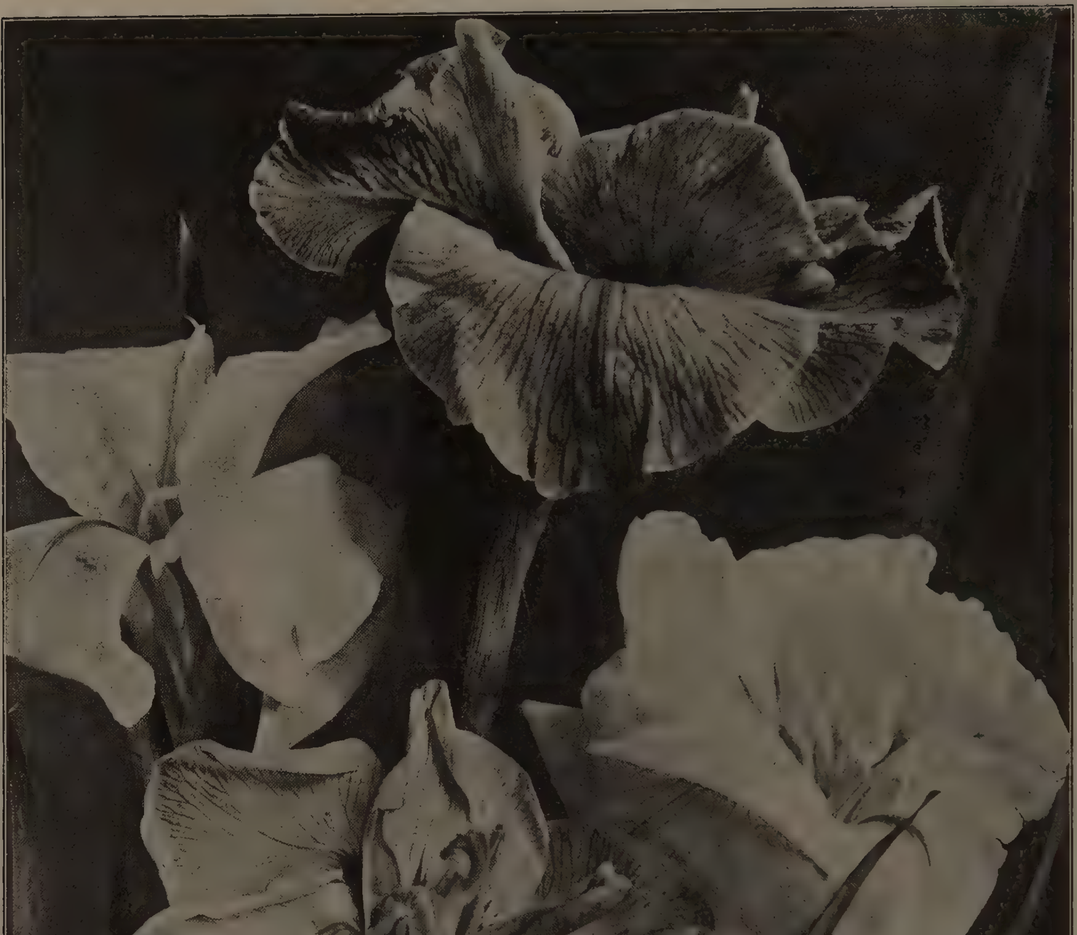
46. **Ewbankiàna,** Foster (*I. Spréngeri,* Siehe). Rhizome slender, similar to that of *I. iberica:* lvs. 6–8 in. long, glaucous, very narrow and somewhat falcate: st. 2–4 in. high, bearing 2–3 reduced lvs.: spathe 1-fld., 2¼ in. long; valves narrow, inflated, green: outer segms. lanceolate, pointed, horizontally extended, not recurved, creamy or grayish white, marked with conspicuous, irregular, jagged, purple-brown veins, with a purplish black patch at the throat; beard of stout yellow hairs tipped with brown; inner segms. ovate-lanceolate colored like the outer and marked with jagged brown-purple veins which become more broken on the claw; style-branches almost uniform chocolate-brown. Mountains of Persia and Transcaucasia. R.H. 1901, p. 399. Gn. 70, p. 15. G.C. III. 29:407; 36:50. —The venation, together with the ground-color, gives the fls. at a distance a uniform gray tone. Not particularly beautiful.

47. **Gàtesii,** Foster. Habit and foliage of *I. susiana:* outer segms. orbicular, 3–5 in. broad, cream-white, sometimes sky-blue, covered with a network of fine veins, giving them a light gray tint; inner segms. larger, pale purple or yellow. Dry regions, Armenia. B.M. 7867. Gn. 43:130 and p. 131; 52, pp. 88, 279; 72, p. 422. G.C. III. 8:17. A.G. 13:60. G. 20:299.—The largest-fld. of its subgenus. Fls. about twice as large as in *I. susiana.* Quite hardy.

48. **Lortétii,** Barbey. Lvs. less than 1 ft. long: st. about 1 ft. high, bearing 2 reduced lvs.: spathe-valves 5 in. long, green or slightly scarious above: outer segms. obovate, much reflexed, 3 in. broad, whitish, finely veined and spotted with red-brown, with a dark spot at the throat; inner segms. orbicular, connivent, pale gray, with red-brown veins. Lebanon. B.M. 7251. Gn. 43:130; 48, p. 337. Gt. 42, p. 490. G.C. III. 12: 153. G.M. 36:386; 40:250. R.H. 1902, p. 404. R.B. 32: 173.—Quite hardy N.

49. **atrofúsca,** Baker (*I. atropurpùrea* var. *atrofúsca,* Baker. *I. Hàynei,* Mallett). Lvs. pale green, 1 ft. long: st. 1 ft. long, hidden by the sheathing inner lvs.: limb dark purple-brown; outer segms. obovate, 3 in. long, with a dark spot on the throat; inner segms. larger and broader; style-branches very convex; crests large. Palestine. B.M. 7379. Gn. 48, p. 8; 50:332 and p. 333. Gt. 42, p. 488; suppl. pl. Gn. W. 24:399. J.H. III. 48:361. G.M. 47:258.

50. **susiàna,** Linn. Mourning Iris. Fig. 1969. Lvs. very glaucous, 6–9 in. long, nearly 1 in. broad: outer segms. obovate, 3 in. long, brownish purple, veined and spotted with black-brown, with a brown beard; inner segms. brownish white, spotted with violet-brown and black. Asia Minor and Persia. B.M. 91. F.S. 11:1087, 1088. R.H. 1859, pp. 322, 323. Gn. 32, p. 193; 39:340; 66, p. 173(?). G. 1:136, 264; 33:203. G.C. III. 51:20. Gn.M. 10:120. Gn.W. 23:426, suppl. A.F. 16:1375.—The best known of



LIX. Japanese irises.—Iris lævigata.

this group. Said to have been intro. from Constantinople in 1753. Name from a city in Persia. Not entirely hardy N., but a good pot-plant. Var. **màjor,** Hort. Bluish, tinted brown.

51. **Bismarckiàna,** Damman (*I. nazarèna,* Hort. *I. Sàri* var. *nazarèna,* Foster). Habit of *I. susiana,* and fls. as large: lvs. 8 in. long: st. 12–18 in. high: outer segms. orbicular, yellowish, densely spotted with purple-brown, with a dark purple-brown spot at the end of the beard; inner segms. orbicular, short-clawed, sky-blue from numerous blue veins on a creamy white ground. N. Palestine. B.M. 6960 (as *I. Sari* var. *lurida*); 7986. R.H. 1902, p. 405. J.H. III. 56, p. 497 (as *I. Sari* var. *nazarensis*). I.H. 42, p. 78(?). Gt. 42, p. 487; suppl. pl. G.M. 40:250.

SUBGENUS PARDANTHOPSIS.

52. **dichótoma,** Pall. Rhizome slender: lvs. 6–8 in a fan-shaped cluster, 8–12 in. long, 1½ in. wide: st. 2 ft. high, much branched, bearing 6–10 heads: spathes not over ½in. long, scarious, 3–5-fld.: fls. fugitive, opening only in the afternoon, twisting spirally when withering; outer segms. with a subquadrate blade contracted into a broadly cuneate claw, whitish, spotted with lilac-purple; inner segms. spreading, oblong-unguiculate, whitish and light purple. August. Irkutsk and Transbaikalia to Manchuria and China. B.M. 6428. B.R. 246.—Although the fls. last only a few hours, they are produced in great profusion so that usually 4–6 are open at the same time.

SUBGENUS APOGON.

A. *Lvs. linear, generally less than ½in. broad.*
B. *Lf.-sheaths splitting into fibers.*
C. *Spathe-valves green.*
D. *Tube of the perianth evident, usually more than ½in. long.*
E. *St. with 1–2 long lvs. immediately below the spathe*....53. **humilis**
EE. *St. bearing a reduced lf. and springing from a pair of reduced lvs. at the base*.....54. **ruthenica**
EEE. *St. sheathed by 1–2 narrow reduced lvs*...............55. **macrosiphon**
DD. *Tube of the perianth short or obsolete, usually less than ½in. long.*
E. *Fls. yellow.*
F. *St. wiry, with a single sheathing lf. low down*.....56. **Hartwegii**
FF. *St. slender, bearing 2 lanceolate sheathing lvs*....57. **Grant-Duffii**
FFF. *St. hollow, bearing a much-reduced lf. near the middle*...................58. **Wilsonii**
EE. *Fls. some shade of blue or white.*
F. *St.-lvs. long, usually over 1 ft. and exceeding the st*..59. **graminea**
FF. *St.-lvs. reduced.*
G *Rhizome slender: lvs. pink at base*.........60. **tenax**
GG. *Rhizome stout, compact.*
H. *Caps. long, narrow*...61. **ensata**
HH. *Caps. fusiform tapering at both ends*.....62. **longipetala**
CC. *Spathe-valves scarious only in the upper part or along the edges.*
D. *Inner segms. suberect, extended obliquely*...................63. **Delavayi**
DD. *Inner segms. erect, connivent*....64. **sanguinea**
CCC. *Spathe-valves entirely scarious.*
D. *St. hollow*.......................65. **sibirica**
DD. *St. solid*.......................66. **prismatica**
BB. *Lf.-sheaths not splitting into fibers.*
C. *St. nearly obsolete*..............67. **unguicularis**
CC. *St. present; clothed with sheathing bracts.*
D. *Perianth-tube short, funnel-form*......................68. **bracteata**
DD. *Perianth-tube slender, as long as the ovary* ....69. **Sintenisii**
CCC. *St. present, bearing 1–2 lvs.*
D. *The lvs. purplish at base: st. scarcely overtopping the lvs*...70. **Douglasiana**
DD. *The lvs. not purplish at base: st. much exceeding the lvs*.......71. **missouriensis**
AA. *Lvs. ensiform, generally much over ½in. broad.*
B. *Plants large.*
C. *St. bearing several long lvs.*
D. *Fls. reddish brown*............72. **fulva**
DD. *Fls. yellow*...................73. **Pseudacorus**
DDD. *Fls. blue, purple, or lilac to white.*
E. *Inner segms. at least half as long as the outer.*
F. *The lvs. somewhat glaucous* 74. **vesicolor**
FF. *The lvs. green, not glaucous.*
G. *Outer segms. 3–4 in. long; fls. sessile*.......75. **hexagona**
GG. *Outer segms. 2½–3 in. long; fls. pedicelled*....76. **caroliniana**
EE. *Inner segms. minute, setose*..77. **setosa**
CC. *St. bearing 2–4 reduced lvs.*
D. *Fls. yellow.*
E. *Outer segms. with an orbicular blade.*
F. *Plants tall, 2–3 ft. or more: fls. without veins or spots*.78. **Monnieri**
FF. *Plants smaller, scarcely exceeding 1½ ft.: outer segms. faintly veined on the claw*...............79. **halophila**
EE. *Outer segms. with an obovate blade; fls. white and pale yellow*..................80. **orientalis**
EEE. *Outer segms. with an oblong blade; fls. golden yellow*....81. **aurea**
DD. *Fls. blue, purple, lilac or white.*
E. *Seeds orange-red or scarlet: fls. inconspicuous*.........82. **fœtidissima**
EE. *Seeds brown: fls. showy.*
F. *Sts. bearing several lateral spicate heads below the terminal one*...........83. **spuria**
FF. *Sts. bearing a terminal head and often a stalked lateral head*..................84. **lævigata**
BB. *Plants dwarf*.....................85. **verna**

53. **hùmilis,** M. Bieb. (*I. ruthénica,* Ker ex parte). Rhizome wide-creeping: lvs. linear, up to 12 in a tuft, glaucous, 6–12 in. long: st. not more than 1–1½ in. long, bearing 2 long lvs. immediately below the spathe: spathe 1-fld.; outer segms. with a suborbicular blade and a long cuneate claw, deep blue-purple with deeper veins, whitish on the throat, with deep purple veins; inner segms. oblanceolate, unguiculate, blue-purple. Caucasus to Georgia and Hungary. Gn. 10, p. 379. —Distinguished from *I. ruthenica* by the 2 long lvs. which arise below the spathe and are 2–3 times as long as the latter.

54. **ruthénica,** Ker. Lvs. linear, in crowded tufts, 6 in. long at flowering-time, becoming 12 in. long: st. slender, 1–8 in. long, but often obsolete; 1-headed: pedicel ¼–2 in. long: tube twice as long as the ovary; outer segms. with an oblong blade rather shorter than the claw, lilac, veined and dotted with bluish purple on a whitish ground near the center and lower part of the blade; inner segms. lanceolate, with narrow claws, deep purple-violet. April, May. China, Siberia and Cent. Asia. B.M. 1123, 1393. Gn. 50, p. 187. G.W. 15:132.—Violet-scented.

55. **macrosìphon.** Torr. Plants rather dwarf, 6–12 in. high: lvs. grass-like, green, 12 in. long, exceeding the fls.: st. 3–6 in. long: pedicels very short: tube 1½–3 in. long; outer segms. obovate-cuneate, undulate, pale yellow to cream, with a network of brownish crimson or bright lilac veins; inner segms. rather small, colored like the outer. Free-flowering. Calif. and Ore. Gn. 52, p. 126. —Torrey says the fls. are bright lilac and the lvs. less than 4 lines wide. The color varies from white to cream-yellow and purple.

56. **Hártwegii,** Baker. Lvs. few (2), 6–12 in. long, finely veined: st. 6 in. long, with a linear lf. low down: pedicel 1–1½ in. long: limb pale yellow; outer segms. with an oblong blade, shorter than the claw. Calif. —Rarely cult.

57. **Grant-Dúffii,** Baker (*I. Áschersonii,* Foster). Lvs. about 1 ft. long: st. 6 in. high, with about 2 lvs., 1-headed: outer segms. with a yellow blade, much shorter than the claw; claw veined with lilac on a yellowish white ground. Palestine. B. M. 7604. Gn. 61, p. 288. Gt. 42; suppl. pl.—Not valuable commercially.

58. **Wílsonii,** Wright. Plants tall, growing in clumps like *I. sibirica* and throwing up clusters of fl.-sts.: lvs. linear-ensiform, 2 ft. long and ½in. broad, slightly glaucous, drooping above: st. about as long as the lvs., 2- or 1-fld., bearing a small lf. at the middle: spathes somewhat herbaceous, 2½–4 in. long: pedicels triangular, 1–5 in. long: outer segms. 2 in. long, ¾in. wide, oblong or obovate-elliptic, pale yellow, veined and dotted with purple on the throat, and on the broad claw; inner segms. oblong-lanceolate, narrowed to a slender claw, pale yellow, mottled with reddish brown at the edges. W. China.—A tall yellow form suitable for cult. with the blue and the white forms of *I. sibirica.*

59. **gramínea,** Linn. (*I. nikiténsis,* Lange). Lvs. linear, 15–36 in. long, strongly ribbed: st. compressed, angled, slender, solid: pedicel 1–1½ in. long: limb bright lilac, copiously veined; outer segms. with an orbicular blade ½in. broad and shorter than the broad claw; claw dull yellow, veined with purple; inner segms. erect, nearly straight. May. Cent. and S. Eu. B.M. 681.—Long cult.; mentioned by Lobel, Clusius and Gerarde. Distinguished from *I. sibirica* by its solid, angular st.

1970. Iris unguicularis. Type of smooth-petaled iris (×⅓). No. 67

60. **tènax,** Douglas. Sheaths short: lvs. 6–12 in. long: st. 6–12 in. long: pedicel ½–2 in. long: outer segm. broadly obovate, with an acute point; blade about as long as the claw, bright lilac, with purple veins and a variegated white and yellow spot on the throat; inner segms. shorter, waved. April, May. Dry soils, Brit. Col. and Ore. Intro. to England 1826. B.M. 3343. B.R. 1218. Gn. 53:518. G.M. 50:867.—Hardy.

61. **ensàta,** Thunb. (*I. gramínea,* Thunb. *I. biglùmis,* Vahl. *I. hæmatophýlla,* Link. *I. Pállasii,* Fisch. *I. longispàtha,* Fisch. *I. oxypétala,* C. A. Mey. *I. fràgrans,* Lindl.). Sheaths large: lvs. 1–3 ft. long: st. 2–12 in. long, flattened, bearing a single terminal head: pedicel 2–4 in., often longer than the spathe: limb loose, bright blue or lilac; outer segms. oblanceolate, 2 in. long; blade shorter than the claw, veined with dark blue, yellowish on the throat; inner segms. slender, erect, bright blue. Russia, Japan, Caucasus. B. M. 2331, 2528. B.R. 26:1. Gt. 1011.—Hardy. Variable. Var. **pabulària,** Naudin (*I. pabulària,* Hort.). Said to be distinct. Larger, with lvs. purplish red near the base. Used as a forage plant. Does well in driest situations. Gt. 47:1452. Described by Wittmack, Gt. 47, p. 369. The seeds should be sown in beds, and the young plants set out the following spring, 10 in. apart each way, where they are to remain.

62. **longipétala,** Herb. Lvs. 1–1½ ft. long, narrow, ensiform: st. stout, solid, compressed, 1½ ft. high: fls. bright lilac; outer segms. obovate, reflexing half way down; claw veined with violet on a white ground. Calif. B.M. 5298.

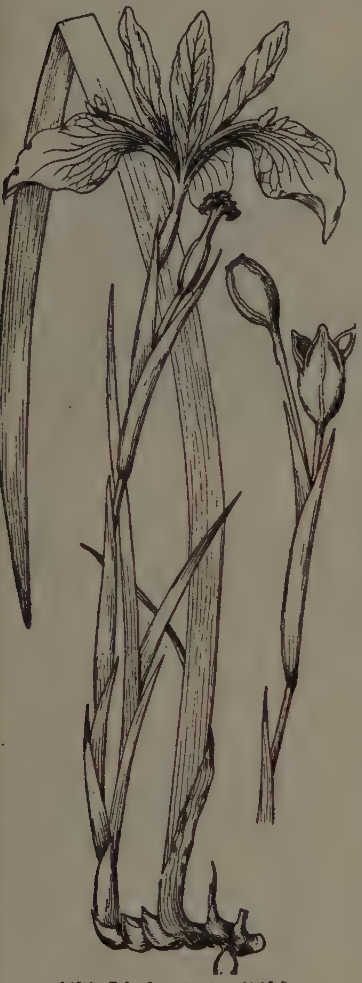
63. **Delavàyi,** Mich. Lvs. 2–2½ ft. long, often nearly 1 in. broad: st. 3–5 ft. high, bifurcate: spathe-valves green: outer segms. reflexed from the middle, oblong, obtuse or emarginate, brilliant violet, spotted with white on the lower half; claw yellow, veined with lilac; inner segms. oblong-lanceolate, acute, erect, violet. Thibet. B.M. 7661. R.H. 1895, p. 399. —Large plants, with the fl.-stalks erect, high above the lvs.

64. **sanguínea,** Donn (*I. orientàlis,* Thunb. *I. sibírica* var. *sanguínea,* Ker. *I. nertschínskia,* Lodd. *I. hæmatophýlla,* Fisch. *I. sibírica* var. *orientàlis,* Baker). Lvs. linear, glaucous, often tinged with red-purple at base, 18 in. long and ⅓–½in. broad: st. about as long as the lvs., bearing a terminal head of 2–3 fls. and rarely a lateral head: spathes slightly scarious at flowering-time, often reddish purple: outer segms. with a suborbicular blade, narrowed abruptly to a short claw, bright lilac, yellowish white at the throat, veined with purple; inner segms. broadly oval, connivent, darker blue. Manchuria. Korea, and Japan. B.M. 1604. L.B.C. 19: 1843.—Often regarded as a variety of the Cent. European *I. sibirica,* which has short subglobose caps. and fls. raised high above the lvs., while *I. sanguinea* has longer trigonal caps. with fls. borne among the lvs.

65. **sibírica,** Linn. (*I. acùta,* Willd.). Compact, tufted: lvs. green, not rigid, 1–2 ft. long: st. slender, terete, fistulose, much overtopping the lvs., simple or forked, bearing several clusters of fls.: spathe small, narrow, acute, entirely scarious at flowering-time: limb bright lilac-blue; outer segms. 1½–2 in. long, with an orbicular blade gradually narrowed to a slender claw, veined with bright violet, whitish toward the claw; inner segms. shorter, erect. Cent. and S. Eu. and E. Siberia. Intro. in 1796. B.M. 50. R.H. 1898,

p. 23. G.W. 12:678. Gn.M. 15:362.—Common in cult. The plants form large, compact clumps, producing many long flowering sts. from the center. Each st. usually has a terminal cluster of 2–5 fls. and 1 lateral head. Var. **variegàta,** Hort., has variegated lvs. Var. **acùta,** Hort. Narrow-lvd. Var. **flexuòsa,** Murray (*I. flexuòsa,* Murray. *I. sibírica* var. *álba,* Hort.). Fls. white with crisped segms. B.M. 1163.

66. **prismática,** Pursh (*I. grácilis,* Bigel. *I. virgínica,* Muhl.). Plant tall, slender: lvs. mostly shorter than the st., grass-like: st. 1–2 ft., simple or forked, flexuous: spathes 1–2-fld.: pedicel long, exceeding the spathe: outer segms. 1½–2 in. long; blade shorter than the claw, bright lilac, yellow on the throat, marked with purple and darker veins; inner segms. erect, bright lilac. May, June. Wet grounds, New Bruns. to Pa. and N. C. B.M. 1504.


1971. Iris bracteata. (×½)

67. **unguiculàris,** Poir. (*I. stylòsa,* Desf. *I. creténsis,* Janka). Fig. 1970. Lvs. about 6 in a tuft, finally 1½–2 ft. long, bright green: st. nearly obsolete: spathes 2–3-fld.; valves 4–6 in. long, scarious at the tip only, shorter than the tube: tube 5–6 in. long, filiform, exserted from the spathe; limb bright lilac, rarely white; outer segms. 2½–3 in. long, 1 in. broad, with a yellow keel, streaked with lilac on a white ground at the throat; inner segms. oblong. Jan., Feb. Algeria, Greece and Islands, Asia Minor and N. Smyrna. B.M. 5773; 6343. R.H. 1900:300. Gn. 24:68; 46:248; 49, p. 236; 50, p. 187. G.C. III. 25:85. F.S.R. 35, p. 131. G. 9:590; 34:115. G.L. 19:48; 22:378. Gn. W. 20:159.—Not hardy, but useful for cutting in early winter. Fragrant. Var. **álba,** Hort. White form; spring. C.L.A. 5:134. Gn. 68, p. 381. Var. **supérba,** Hort. Bluish purple. Oct. and later. Var. **speciòsa,** Hort. Fls. well above the foliage, deep reddish purple.

68. **bracteàta,** Wats. Fig. 1971. Rudimentary lvs. brown, very rigid; produced lvs. 1 to few, much exceeding the st., 1–2 ft. long, one side green, the other glaucous, edge revolute: st. 1-headed, angled, 2–3 in. to 1 ft. long, sheathed with bracts 2–4 in. long: tube short, funnelform; outer segms. 2–3 in.; blade ovate, as long as the claw, pale yellow, veined with bluish purple; inner segms. shorter, erect, yellow; style-branches long, narrow. June. Discovered in 1884 by Thomas Howell, in Ore. G.F. 1:43 (adapted in Fig. 1971). G.C. III. 39:401; 52:328. G.M. 50:161.—Intro. 1888.

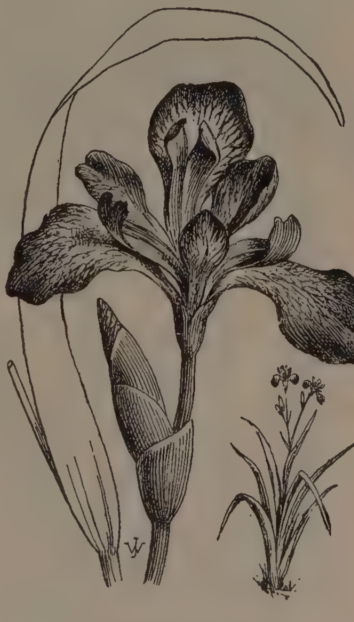
69. **Síntenisii,** Janka (*I. gramínea* var. *Síntenisii,* Richter. *I. Urúmovi,* Velenovski). Lvs. narrow, linear, acuminate, 8–18 in. long, ¼–½in. broad: st. round, not flattened as in *I. graminea,* slender and flexuous, 4–12 in. long, almost entirely clothed by 2–3 reduced lvs. and bearing a single head of 2 fls.: spathe-valves narrow, linear, acuminate, keeled, the inner longer than the outer: ovary tapering to a long neck taking the place of the perianth-tube: fls. bright lilac, 1½ in. long; outer segms. with an obovate blade and a slightly pandurate claw, bluish purple, whitish toward the throat, marked with purple veins and with reddish purple veins on the claw; inner segms. oblanceolate with a cuneate claw deep blue-purple; style-crests lanceolate. S. Italy, Balkan Peninsula, Asia Minor and Turkey.

70. **Douglasiàna,** Herb. Rhizome stout, short, creeping: lvs. about 6 in a tuft, broadest in the middle, strongly ribbed, 1–2 ft. long: st. 1–2 ft. high, usually simple, with 1 long bract-lf.: tube ½–¾in. long: fls. 3–4 in. diam.; outer segms. obovate-spatulate, spreading and recurved, pale lilac, with a white disk and purple veins; inner segms. shorter, erect, lanceolate, acuminate, pale lilac, veined. Calif. B.M. 6083. Gn. 50: 272.—Exists in an endless variety of color-forms, varying from pale lilac to deep violet with considerable variation in the veining.

71. **missouriénsis,** Nutt. (*I. Tolmieàna,* Herb.). Lvs. pale green, finely ribbed, 1–1½ ft. long: st. 1–2 ft. long, usually exceeding the lvs., bearing a single large lf. low down: pedicel long: tube very short; limb bright lilac; outer segms. obovate, 1 in. broad, yellow near the claw; inner segms. oblong, emarginate, straight, erect. Wet soil. S. D. and Mont. to Ariz. B.M. 6579. Gn. 50:186.—Not common in cult. Flowers early.

72. **fúlva,** Ker (*I. cùprea,* Pursh). Lvs. thin, bright green, 1½–2 ft. long, not exceeding the st.: st. 2–3 ft. high, forked low down; lower st.-lvs. 1 ft. long: pedicel produced: tube greenish yellow, 1 in. long; limb loosely expanded, bright reddish brown or copper-colored, variegated with blue and green; outer segms. obovate-cuneate, emarginate; inner segms. smaller, spreading. Late June. In swamps, Ill. to Ga., La. and Texas. Intro. into England 1811 by Lyon. B.M. 1496. Gn. 53:518. Mn. 5:61.

73. **Pseudácorus,** Linn. (*I. acoroìdes,* Spach. *I. flàva,* Tornab.). Lvs. 1½–3 ft. long, equaling the st.: st. stout, terete, 2–3 ft., bearing several long lvs. and several clusters of fls.: limb bright yellow; outer segms. broadly obovate, 2–2½ in. long, yellow, with a bright spot and radiating brown veins on the claw; inner segms. scarcely longer than the claw of the outer, oblong. May, June. Eu., Syria and the Barbary states; naturalized in N. Y., Mass. and N. J.—The plants


1972. Iris versicolor (×½). No. 74

form fine, large clumps, bearing numerous flowering stalks. Var. **variegàta,** Hort. Lvs. striped with creamy white. Var. **pállida,** Hort. Fls. pale sulfur-yellow.

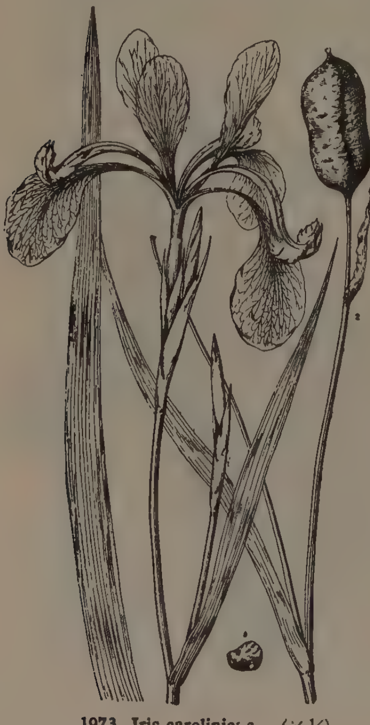
74. **versícolor,** Linn. (*I. virgínica,* Linn.). Fig. 1972. Lvs. slightly glaucous, 1½–2 ft. long: st. forked low down and often branched above, 2–3-headed: tube very short; limb violet-blue; outer segms. spatulate, 2–3 in. long, variegated with yellow on the claw and veined with purple; inner segms. oblanceolate, much smaller. British N. Amer. and N. U. S. Intro. into England 1732. B.M. 21, 703.

75. **hexagòna,** Walt. Lvs. 2–3 ft. long: st. usually simple, 3 ft. long, 2–3-headed, with several large lvs., the upper ones exceeding the fls.: spathe-valves sometimes lf.-like: tube 1 in. long, green, dilated upward; limb bright lilac; outer segms. 3 in. long; blade obovate, with a bright yellow keel on the claw; claw downy; inner segms. shorter, erect; style-branches very concave, green, with a central lilac band. Ky. to Texas. and Fla. B.M. 6787.

76. **caroliniàna,** Wats. Fig. 1973. Lvs. 2–3 ft. long, bright green: st. stout, simple or branched: tube ½in. long; limb lilac, variegated with purple and brown; outer segms. broadly spatulate, 2½–3 in. long, with narrow claws; inner segms. narrower, nearly erect. Differs from *I. versicolor* by its green lvs. Discovered by W. A. Manda in N. C. B.M. 8465. G.F. 6:335 (adapted in Fig. 1973).

77. **setòsa,** Pall. (*I. brachycúspis,* Fisch. *I. tripétala,* Hook.). Lvs. thin, green, 1–1½ ft. long: st. deeply forked, much exceeding the lvs.: tube ¼in. long; limb bright lilac; outer segms. 2–2½ in. long; blade 1 in. broad, suddenly narrowed at the claw, copiously veined; inner segms. very small, ½in., cuneate, large-cuspidate; style-branches large, crested. E. Siberia, Japan, and N. W. Amer. to Labrador and Maine. B.M. 2326; 2886. Gt. 322.

78. **Monnièri,** DC. Lvs. slightly glaucous, 2–3 ft. long: st. stout, terete, 3–4 ft. long, with several sessile clusters of fls.: limb 2½–3½ in. long, lemon-yellow, without veins; blade of outer segms. orbicular, 1–1½ in. long, equaling the claw; inner segms. oblong-unguiculate, 1 in. broad. Origin not certainly known. Found in the garden of Lemonnier at Versailles. G. 25:389.—Not showy except in masses. This and *I. orientalis* and *I. aurea* are very closely related and together with *I. halophila* are perhaps all forms of *I. spuria. I. Monnieri* is uniformly bright lemon-yellow, free from veins or spots. By its coloring, it differs from *I. orientalis* and by the orbicular blade of the outer segms. from *I. aurea,* in which the blades are oblong. Often attributed to Crete.



1973. Iris caroliniana. (×½)

79. **halóphila,** Pall. (*I. Gueldenstædtiàna,* Lepech.). Lvs. pale green, 1–1½ ft. long: st. stout, terete, 1½–2 ft. long, often bearing 1–2 spicate clusters below the end one: limb pale yellow; outer segms. with an orbicular blade ½–¾in. broad, shorter than the claw, which has a bright yellow keel and faint lilac veins, inner segms. shorter, erect. Asia. B.M. 1515 (*I. spuria* var. *stenogyna,* Ker).

80. **orientàlis,** Mill. (*I. ochroleùca,* Linn. *I. gigantèa,* Carr.). Fig. 1974. Plants growing in strong clumps: lvs. 2–3 ft. long, 1 in. or more broad, slightly glaucous: st. 3 ft., stout, terete, about as long as the lvs., with 2–3 spicate clusters of fls.: outer segms. obovate, 1 in. broad, as long as the claw, yellow, paler or white toward the margin; inner segms. oblong, 1 in. broad, lemon-yellow to whitish. Asia Minor and Syria. B.M. 61. Gn. 20:272; 38:462; 46, p. 362; 50, p. 186; 69, p. 25; 72, p. 622. Gn. M. 15:360. R.H. 1875, p. 357.—One of the largest of the irises. Grows in almost any situation. White forms of this plant are in cult. but no purple forms are known. See note under *I. Monnieri.*

1974. Habit sketch of Iris orientalis. (×$\frac{1}{20}$)

81. **aùrea,** Lindl. Lvs. scarcely glaucous, 1½–2 ft. long: st. 3–3½ ft. long, stout, terete, with 1–2 sessile lateral clusters below the end one: spathes 2–3-fld.: pedicel long: limb bright yellow; outer segms. with an oblong undulate blade 1 in. broad, as long as the claw; inner segms. less than ½in. broad, with much-waved edges. July. W. Himalayas. B.R. 33:59. Gn. 31:52. G. 25:388. B.M. 1131 (as *I. spuria* var. *halophila*).—Intro. by Dr. Royle. The color is a rich golden yellow, much deeper than that of *I. Monnieri* and the others of this group. See *I. Monnieri.* Said to grow up to 5 ft. high under favorable conditions. Var. **intermèdia,** W. I., in G.C. III. 28:22. Intermediate between *I. aurea* and *I. orientalis.* Deep yellow, with crisped segms. like *I. aurea,* but having the obovate outer segms. and narrow inner segms. of *I. orientalis.* Fls. late, with *I. aurea.*

82. **fœtidíssima,** Linn. GLADWIN. Lvs. 1–1½ ft. long: st. compressed, 2–3 ft. long, 2–3-headed: tube ½in long; limb bright lilac; outer segms. 1½–2 in. long, with a suborbicular blade equaling the claw; inner segms. shorter, oblanceolate. Cent. and S. Eu., England, Afghanistan and Algeria. Gn. 47, p. 30. G. 19:543.—This plant is very distinct, and is easily recognized by the odor of the broken lvs. The caps. remain on the plants in winter, bursting open and displaying rows of orange-red berries. The fls. are rather inconspicuous. There is a whitish variety with brown veins, and a variety with white-striped lvs. A pale yellow form veined with green also occurs occasionally.

83. **spùria,** Linn. Lvs. firm, linear, glaucescent, 1 ft. long, longer after flowering: st. overtopping the lvs., bearing 1–3 spicate heads: pedicel shorter than the spathe: tube ½–¾in. long; limb bright lilac; outer segms. with an orbicular, spreading blade ½in. broad and half as long as the claw; claws broad, concave, lilac, with a yellow keel and purple veins; inner segms. shorter, straight, oblanceolate; style-crests small. Cent. and S. Eu. B.M. 58. Var. **nòtha,** Bieb. (*I. halóphila,* Ker). More robust: lvs. 1 in. broad: spathes larger:

st. 2–3 ft. high. Caucasus to Kashmir. B.M. 875.—Hardy. Var. **desertòrum,** Ker. Fls. pale lilac; claws of the segms. yellow. B.M. 1514. Var. **sogdiàna,** Bunge (*I. sogdiàna,* Bunge). A variety with gray-lilac fls.

84. **lævigàta,** Fisch. (*I. Kaémpferi,* Sieb. *I. álbopurpurea,* Baker). Japanese Iris. Figs. 1975, 1976. Lvs. thin, ensiform, 1–1½ ft. long: st. much overtopping the lvs., obscurely angled, 1–3-headed: pedicel ½–2 in. long: tube short; limb blue, violet, etc., sometimes white, spreading, 3–5 in. across; outer segms. broadly ovate-oblong, obtuse; with a yellow spot on the claw; claw short, distinct; inner segms. oblanceolate, erect, conniving or spreading; style-branches with bifid, incurved lobes. E. Siberia and Japan. Intro. by Von Siebold, and flowered at Ghent in 1857. B.M. 6132; 7511. I.H. 5:157. F.S. 20:2073, 2074; 23:2431–6. Gt. 442; 29:1003. Gn. 9:476; 16:198; 21:424; 55, p. 105; 60, p. 349; 74, pp. 336, 363, 365; 75:226. R.H. 1890, p. 188. G.C. II. 2:47; III. 13:165, 169; 14:501; 44:141. A.G. 19:596. Gng. 1:256; 5:163; 6:339; 7:145. J.H. III. 28:205. F.E. 10:777. F.M. 1874:137; 1880:403. G.W. 2:66; 12:220 (var. *alba*). Gn.M. 5:343; 15:361. C.L.A. 3:179. G. 19:195. R.B. 36:245 (as *I. japonica*). G.F. 1:259 (adapted in Fig. 1975).—On account of the presence of a prominent ridge, formed by one or more veins along the middle of the lvs. of *I. Kaempferi,* this species is sometimes considered as distinct from *I. lævigata.* If the species are distinct, the numerous cult. forms of Japanese irises are probably all derived from *I. Kaempferi* since, at least so far as available material from forms cult. in the U. S. shows, all have the prominent midrib on the lvs.

1975. Japanese iris.—I. lævigata.

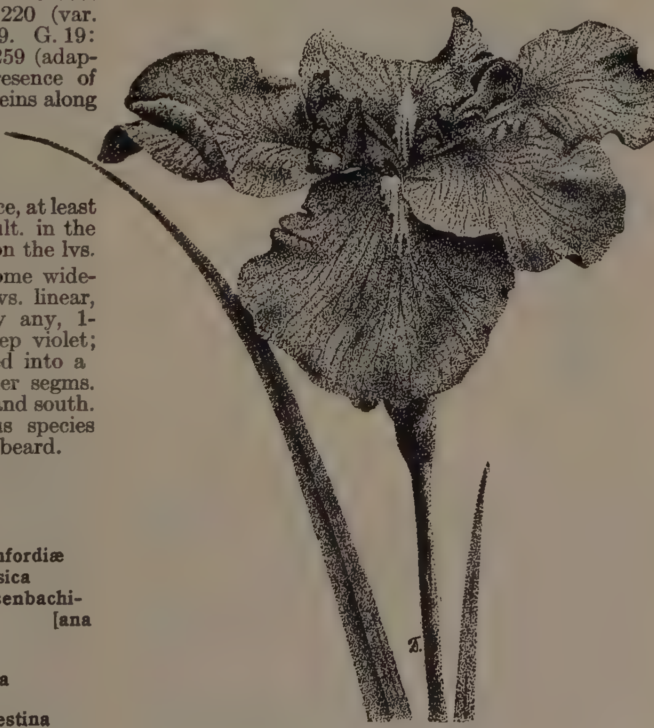
85. **vérna,** Linn. Dwarf, 6 in. high: rhizome wide-creeping: sheaths not splitting into fibers: lvs. linear, slightly glaucous, 3–8 in. long: st. scarcely any, 1-headed: tube slender, 1½ in. long; limb deep violet; outer segms. 1½ in. long, obovate, narrowed into a slender yellow, slightly pubescent claw; inner segms. erect, smaller, violet. Shade, Ohio, Ky., Va. and south. L.B.C. 19:1855. B.M. 8159.—An anomalous species with the habit of a pogoniris but lacking the beard.

SUBGENUS JUNO.

A. *St. very short or none.*
B. *Lvs. very short at flowering-time.*
C. *The lvs. hollow, tetragonous*......86. **Danfordiæ**
CC. *The lvs. linear complicate*........87. **persica**
CCC. *The lvs. lanceolate, falcate*........88. **Rosenbachiana**
BB. *Lvs. 3–9 in. long at flowering-time, lanceolate, falcate at base.*
C. *Fls. bright lilac: hairs on the outer segms. blunt*............89. **alata**
CC. *Fls. yellow; hairs on the outer segms. with globular tips*.......90. **palæstina**
AA. *St. 3–15 in. long, sometimes obscured by the crowded lvs.*
B. *Lvs. with a distinct white horny margin.*
C. *Plants dwarf: st. hidden by the crowded clasping lvs.*
D. *Claw of the outer segms. winged.*
E. *Fls. lavender or purple*......91. **Willmottiana**
EE. *Fls. yellow*................92. **caucasica**
DD. *Claw, of the outer segms. not winged*...................93. **Fosteriana**
CC. *Plants tall, 1 ft. or more: internodes evident.*
D. *Outer segms. gradually contracted into a claw*..........94. **cærulea**
DD. *Outer segms. suddenly contracted into a claw*..........95. **warleyensis**
BB. *Lvs. without a conspicuous white horny edge.*
C. *Claw of the outer segms. winged.*
D. *Fls. slaty lilac*...............96. **sindjarensis**
DD. *Fls. smoky yellow*............97. **fumosa**
CC. *Claw of the outer segms. not winged*......................98. **orchioides**

86. **Dánfordiæ,** Boiss. (*I. Bórnmuelleri,* Hausskn.). Fl.-sts. 2–4 in. high: lvs. very short at flowering time finally a foot long: fls. bright yellow, 1½ in. diam.; outer segms. with an orbicular blade spotted with brown; claw cuneate; inner segms. reduced to minute, spreading, subulate teeth; style-crests large. Spring. Cilician Taurus. B. M. 7140. Gt. 39:1327. Gn. 37:462; 67, p. 89. G.C. III. 27:170.—Fragrant.

87. **pérsica,** Linn. Bulb ovoid: lvs. 4–5, 2–3 in. long, becoming 6 in. long after flowering time, with white obscurely ciliated edges: st. short, 1-headed: tube 2–3 in. long; limb pale lilac; outer segms. with an orbicular blade with a dark purple blotch, an orange keel, and purple lines and spots; claw auriculate; inner segms. small. Asia Minor and Persia. B.M. 1. Gn. 11, p. 207; 14:490; 33:558; 54, pp. 103, 470; 66:8. F.S. 10:1045. G.C. III. 7:577. R.H. 1912, p. 454.—Should



1976. Japanese iris.—Iris lævigata, better known as Iris Kaempferi. (×½) be lifted in summer. Var. **purpùrea,** Dykes (*I. purpùrea,* Siehe). A bright purple variety. Fine. Var. **Sieheàna,** Dykes (*I. Sieheàna,* Lynch. *I. Haussknéchtii,* Siehe). Similar to var. *purpurea,* but with larger, silvery gray fls. marked with reddish purple. B.M. 8059. G.C. III. 35:251. Var. **stenophýlla,** Dykes (*I. stenophýlla* Hausskn. & Siehe. *I. Heldreìchii,* Hort.). Fls. pale blue; outer segms. blackish blue at the tip, with spots of the same shade on the rest of the blade; keel yellow; crests of the style-branches nearly as large as the outer segms., suborbicular, crenate. Cilician Taurus. B.M. 7734. G.C. III. 27:171. Gn. 59, p. 225; 76, p. 132. F.S.R. 2:328. Var. **Taùri,** Dykes (*I. Taùri,* Siehe). Fls. bright violet-purple veined with white on the lower part of the blade and on the claw of the outer segms.; keel deep orange; inner segms. depressed, 3-lobed. B.M. 7793. G.C. III. 29:191. Gn. 61, p. 93.

88. **Rosenbachiàna,** Regel. Lvs. 4–5, finally 6–8 in. long and 2 in. broad: st. short, 1–3-headed: outer segms. obovate-cuneate; blade reflexed, white at the tip, deep purple in the middle and creamy below, with a yellow keel and dark lilac veins; inner segms. spreading or reflexed, obovate, pale lilac. The color of the fls. is very variable. Mountains of Turkestan. B.M. 7135. Gt. 35:1227. Gn. 33:558 J.H. III. 28:189. G.C. III. 7:577. G.M. 34:171. C.L.A. 5:134; 9:410.

1977. Iris orchioides.—A good species for pots or the open. (×¼)

89. **alàta,** Poir. (*I. scorpioìdes,* Desf. *Xìphium planifòlium,* Mill.). Lvs. about 6, plane, 6–9 in. long: st. very short, 1–3-fld.: tube 4–6 in. long; outer segms. 3–4 in. long, obovate-cuneate, bright lilac, variegated with white, and having a yellow keel down the claw; inner segms. obovate-unguiculate, spreading from the base of the outer; style-crest large, laciniately toothed. Spain to Sicily and Algeria. B.M. 6352. B.R. 1876. Gt. 40:1351 (vars.). Gn. 10, p. 579; 54, p. 102. G.C. III. 45:52. G.M. 35:614. G. 1:665; 11:689; 35:55. Gn.W. 20:185.—Winter-flowering. Plants very dwarf.

90. **palæstìna,** Boiss. Lvs. 3–6 in. long: st. very short, 1–3-fld.: tube 2–3 in. long: fls. pale yellow, tinged with lilac; outer segms. oblong, upper one-fourth reflexed; claw auriculate; inner segms. minute, narrowly lanceolate. Mountains of Palestine.—Fls. in winter. Very near *I. caucasica,* but distinguished by its longer acuminate spathes and the color of the fls.

91. **Willmottiàna,** Foster. Lvs. about 8, with a white horny edge, broad, not acutely channelled, deep glistening green: st. 6–8 in. high, 4–6-fld.: fls. sessile, lavender or pale purple; tube 2 in. long; outer segms. oblong, with a white patch at the throat, marked with veins and patches of deeper purple, claw with white and purple markings; outer segms. small, depressed, cuspidate; style-crests small, triangular. Mountains of E. Turkestan. Gn. 59, p. 411; 75, p. 128; 66:8. G.C. 47:364; III. 29:271.—Resembles *I. caucasica* in habit and size but has narrower spathe-valves which are not inflated.

92. **caucásica,** Hoffm. Lvs. about 6: st. very short, 1–4-fld.: fls. pale or bright yellow; outer segms. with an ovate blade and a very broad rhomboidal claw, with small auricles and a toothed or ciliated crest; inner segms. oblanceolate. Caucasus to Asia Minor, etc. Gt. 1874:800. C.L.A. 9:409.—Dwarfer habit than *I. orchioides.*

93. **Fosteriàna,** Aitch. & Baker. Lvs. 8–10 in. long: st. 6–8 in. long, 9–12 in. long after flowering, hidden by the clasping lvs., 1–2-fld.: outer segms. yellow, streaked with black, obovate-cuneate; claw not auriculate; inner segms. shorter, obovate, bright purple. March. Afghan and Russian boundary. B.M. 7215.—Very different from the allied species *I. orchioides* and *I. sindjarensis,* and so on, on account of the difference in color of the sepals and petals.

94. **cærùlea,** Fedtsch. (*I. caucásica* var. *cærùlea,* Regel. *I. orchioìdes* var. *cærùlea,* Hort.). Lvs. about 8: st. about 15 in. high, bearing 3–4 fls. in the axils of the lvs.: fls. bright lilac; outer segms. with a ligulate claw expanded slightly at the base and an obovate-oblong blade with a conspicuous whitish crest and a yellow blotch on the throat; inner segms. pendent, with a narrow pointed lanceolate blade. Turkestan.

95. **warleyénsis,** Foster. Lvs. 6–7, 6 in. long, 1–1½ in. broad, with a conspicuous horny margin: st. 1 ft., 3–5-fld.: fls. sessile; outer segms. with a strap-shaped claw expanding into an orbicular blade, deep violet with a whitish crest and an orange patch at the throat, claw pale violet with deeper markings; inner segms. narrow, pale blue, purple, or violet, cuspidate. Turkestan. B.M. 7956. Gn. 61, p. 241; 72, p. 635. G.C. III. 31:386. J.H. III. 44:339. F.S.R. 3:344. G.M. 46:322.

96. **sindjarénsis,** Boiss. Lvs. about 8, crowded, distichous, glossy above, conspicuously striated below, 8–10 in. long, 1½–2 in. broad: st. 6–9 in. long, 3–6-fld.: fls. slaty lilac; outer segms. with an obovate, reflexed blade narrowed to a claw, with darker lilac lines and a small yellow crest; inner segms. oblong, clawed. Feb. Deserts of Mesopotamia. B.M. 7145. G.C. III. 7:365. J.H. III. 28:227; 48:97. Gn. 69, p. 134. Gn.W. 21:260; suppl. pl.—Plants ½ft. high. Var. **assyrìaca,** Lynch (*I. assyrìaca,* Hort. or Hausskn.), is a white variety from Mesopotamia. Gn. 69, p. 195. C.L.A. 9:409.

97. **fumòsa,** Boiss. & Hausskn. Lvs. about 10: st. 6 in. long: outer segms. spatulate-oblanceolate, recurved above the middle, claw with a yellow crest; inner segms. minute, spatulate, toothed. The fls. are greenish yellow, shaded with smoky gray. Dry fields, Syria.—Perhaps a variety of *I. sindjarènsis.*

98. **orchioìdes,** Carr. (*I. caucásica,* Regel). Fig. 1977. Lvs. about 6: st. 12–15 in. long, with distinct internodes: spathes 1-fld., 2 in. long: fls. yellow; outer segms. with an obovate blade, and a purple blotch on each side of the crest of the claw; inner segms. oblanceolate, less than an inch long, and generally sharply deflexed, with a long filiform claw. B.M. 7111. Gn. 53, p. 482. R.H. 1880, p. 337. Spring. Var. **oculàta,** Maxim. Blade of the outer segms. more spotted.

SUBGENUS XIPHIUM.

A. *St. 1 ft. or more in length.*
  B. *Tube very short or none.*
    C. *Claw of the outer segms. pandurate*...................... 99. **Xiphium**
    CC. *Claw of the outer segms. broadly cuneate*................100. **xiphioides**
  BB. *Tube usually more than ½in. long.*
    C. *Outer bulb-coats thick and leathery.*101. **juncea**
    CC. *Outer bulb-coats thin membranous.*
      D. *Outer segms. with a rudimentary beard*....................102. **Boissieri**
      DD. *Outer segms. not bearded.*
        E. *Inner segms. obovate-lanceolate, emarginate*..........103. **filifolia**
        EE. *Inner segms. lanceolate, pointed*................104. **tingitana**
AA. *St. very short or none.*
  B. *Lvs. acutely quadrangular.*
    C. *The lvs. very short at flowering time*........................105. **reticulata**
    CC. *The lvs. long, much overtopping the fls.*
      D. *Inner segms. oblanceolate*......106. **Histrio**
      DD. *Inner segms. linear-lanceolate*....107. **Vartanii**
  BB. *Lvs. cylindrical, 8-ribbed*..........108. **Bakeriana**
  BBB. *Lvs. linear, channelled with thickened edges*.....................109. **Kolpakowskiana**

99. **Xíphium,** Linn. (*I. hispánica,* Hort. *I. spectábilis,* Spach). SPANISH IRIS. Fig. 1978. Lvs. about 1 ft. long: st. 1–2 ft. high: pedicel long. tube obsolete; outer segms. 2–2½ in. long, violet-purple, yellow in the center; inner segms. as long, but narrower. Late June. Spain and N. Afr. B.M. 686. Gn. 20:442; 30, p. 385; 54, p. 471.—Long cult. and well known. Hardy in N. J. in protected situations. Var. **lusitánica,** Foster (*I. lusitánica,* Ker). Fls. yellow. B.M. 679. Var. **Báttandieri,** Foster. Fls. pure white, except the orange keels of the outer segms. Lvs. very glaucous. Algeria.

100. **xiphioìdes,** Ehrh. (*I. ánglica,* Hort.). ENGLISH IRIS. Lvs. about 1 ft.: st. 1–2 ft.: fls. dark violet-purple in the typical form; outer segms. orbicular, yellow in the center; inner segms. shorter, oblong. French and Spanish Pyrenees. B.M. 687. R.H. 1891:36; 1907, p. 446. Gn. 30, p. 384; 31:212; 54, p. 471. Gn.M. 15:362. G.W. 12:547 and p. 549 (vars.).

101. **júncea,** Poir. (*Xíphium júnceum,* Klatt). St. slender, erect, rigid, 9–18 in. high, bearing 1 (rarely 2) golden yellow fls., 2–3 in. diam.: lvs. rigid, slender, rush-like, 18–24 in. long: outer segms. with an orbicular blade shorter than the cuneate claw, recurved and veined with brown; inner segms. erect, oblanceolate. May, June. Algeria, Tunis, etc. B.M. 5890. Gn. 54:470.

102. **Boissièri,** Henriq. Lvs. linear, very deeply channelled, 1 ft. long: st. about a foot long, bearing few, reduced lanceolate lvs. and a single fl.: outer segms. 1½ in long; blade obovate, reflexed, as long as the cuneate claw, bright lilac, with a yellow keel running down the claw, slightly bearded; inner segms. as long as the outer, erect, obovate, clawed, bright lilac. June. S. Portugal. B.M. 7097.

103. **filifòlia,** Boiss., not Bunge (*Xíphium filifòlium,* Klatt. *X. tingitànum,* Hook.). Slender and leafy, about 2 ft. high, bearing 1–2 bright violet-purple fls. 2–2½ in. diam.: lvs. about 1 ft., those of the non-flowering bulbs twice as long, weak, flexuous, convolute: outer segms. with a narrow claw expanding suddenly into a reflexed, suborbicular blade, bright yellow down the center; inner segms. erect, obovate-lanceolate, erose, notched. S. Spain and N. W. Afr. B.M. 5928; 5981.—Intro. 1869. Hardy.

104. **tingitàna,** Boiss. & Reut. (*I. Xíphium,* Desf.). St. stout, 1–2-headed, about 2 ft. high, hidden by the sheathing bases of the stout, falcate lvs., of which there are 6–7 on the st., the lower about 1 ft. long: fls. 2–3 in a cluster; outer segms. 3 in. long, with an obovate, reflexed blade, pale lilac, yellow in the center, and with a bright yellow keel down the claw; inner segms. shorter, oblanceolate, erect, incurved. Tangiers. B.M. 6775. Gn. 36:294; 63, p. 41; 71, p. 404; 74, p. 349; 75, p. 323. G.C. III. 37:339; 40:24; 48:16, 17. G.M. 40:377. J.H. III. 50:429.

105. **reticulàta,** Bieb. Lvs. 2–4 in a tuft, short, erect quadrangular, with horny edges, elongating to 1½ ft.: st. very short: tube 3–6 in. long; fls. bright purple, very fragrant; outer segms. 2 in. long, yellow at the claw, with a low yellow crest; inner segms. narrower. Mid-April. Asia Minor and Persia. B.M. 5577. F.S. 5, pp. 509. R.H. 1890, p. 133; 1912, p. 454. Gt. 779; 13:452. Gn. 20:112; 54, p. 471; 59, p. 233. G.C. II. 11:501; 21:217; III. 52:339. F. 1860:161. G. 19:466. G.M. 51:695. F.W. 1871:225. Var. **histrioìdes,** Foster (*I. histrioìdes,* Dykes). Outer segms. much mottled with white and lilac on the claw and broad, orbicular blade. Asia Minor, Persia, and the Caucasus. Gn. 42:364; 62, p. 42 and 77, p. 42. G.M. 51, p. 87. J.H. III. 34:111.—Early-flowering, and fine for pots. Var. **Krèlagei,** Regel. Fls. red-purple, varying

1978. Iris Xiphium.—Type of bulbous iris. (×¼) greatly in shade; claw conspicuously veined. The common wild form of the Caucasus. Nearly odorless. L.B.C. 19:1829. Gt. 22:779. R.B. 18:60. G.C. II. 21:217. Var. **cærùlea**, Hort. Azure-blue. Var. **cyànea**, Regel. Blue. Gt. 23:797. Var. **màjor, Hort.** Like the type, but larger. Gn. 60, p. 198.

106. **Hístrio,** Reichb. f. (*Xiphium Histrio,* Hook. f. *I. reticulàta* var. *Histrio,* Foster). Plants tufted, slender and flaccid: lvs. quadrate, with horny edges, deeply grooved on each face, 1 ft. long: st. very short, very slender, 1-fld.: fls. 3 in. diam.; tube 3–4 in. long, blue above; outer segms. obovate-spatulate, spreading, deep blue, with a yellow line in the center bordered with white and spotted and shaded with blue; inner segms. erect, oblanceolate, blue. Feb. Mountains of Palestine. B.M. 6033. Gn. 9, p. 29; 33:558. G.C. III. 12:729; 21:105; 45:55.—Related to *I. reticulata,* differing only in its paler, odorless fls., which are produced several weeks earlier.

107. **Vártanii,** Foster. Lvs. usually 2, 8–9 in. long, slender, finally longer: st. very short, hidden: tube 2½ in. long; outer segms. with a narrow claw, suddenly enlarged into an ovate-lanceolate blade, pale, slaty lilac, with darker veins and a crisp yellow crest down the claw; inner segms. erect, almost linear-lanceolate, pale lilac. Dec. Palestine, near Nazareth. B.M. 6942. Gn. 77, p. 69.—Not scented.

108. **Bakeriàna,** Foster. Lvs. 3–4, 6–9 in. long, finally a foot or more after flowering, hollow, cylindrical, 8-ribbed: fls. single, on a short peduncle, fragrant; tube 3–6 in.; outer segms. with a long, obovate-elliptical claw, and a small, ovate, reflexed blade, intense violet, creamy in the center, with a yellow streak down the claw; inner segms. shorter, erect, oblanceolate, lilac; style-crests large. Feb., March. Armenia. B.M. 7084. Gn. 37:462. G.C. III. 7:293; 21: 103; 45:53. J.H. III. 34:177; 42:142. G.M. 40:118.

109. **Kolpakowskiàna,** Regel (*Xiphium Kolpakowskiànum,* Baker). Lvs. 5–6, wrapped round by a sheath at the base, very short at the flowering time, but growing longer, linear, channelled, with thickened edges: scape very short, 1-fld.; tube 2–3 in. long; outer segms. with a long, erect claw and an ovate, acute blade, deep violet-purple with a yellow keel down the claw; inner segms. oblanceolate, erect, pale lilac. Mountains of Turkestan. B.M. 6489. Gn. 17, p. 75; 33:558. Gt. 1878:939.—Very near *I. reticulata,* fls. at the same time, and is sweet-scented.

SUBGENUS GYNANDRIRIS.

110. **Sisyrínchium,** Linn. (*Moræa Sisyrinchium,* Ker. *Xiphium Sisyrinchium,* Baker. *I. maricoìdes,* Regel). St. 6–12 in. high, stout or flexuous, 1–3-headed: lvs. 2, slender, as long as the st.: fls. fugitive, lilac-purple, with a yellow, oblong spot on the outer segms. which are oblong-spatulate; inner segms. narrow-lanceolate, erect, pale; style-crests large, lance-deltoid. Widely spread through S. Eu., Afr. and Asia. B.M. 1407 (not good), and 6096.—Easily killed by frost. In *I. maricoides,* Regel, the filaments are said to be distinct from each other and from the style.

Of some of the names, found in catalogues, no complete description is available: *I. àmas,* Hort. Germanica group.—*I. angustìna.* Deep yellow, marked with maroon. Garden form of I variegata.—*I. angustíssima,* Hort. Fls. dark purple.—*I. brachysìphon.* Pale blue. Rhizomatous.—*I. británnica.* Pale pink, with the outer segms. veined with purple. Garden form of I. squalens.—*I. Brooksiàna,* Hort. Mauve-purple.—*I. candiàna.* Outer segms. reddish purple; inner segms. light lavender. Germanica.—*I. coreàna.* Like I. sibirica, early and a free bloomer.—*I. edìna.* Light purple and violet. Var. of I. neglecta.—*I. Físheri.* Apogon.—*I. Gladstoniàna.* Hybrid of I. atropurpurea. Pale black, with yellow markings. —*I. grácilis,* Lichten.=Moræa tenuis. See also index, p. 1668.—*I. Guáldii,* Hort.—*I. ignitítia,* probably Ignacite, a form of I. neglecta. Lilac, with the outer segms. shaded purple.—*I. ligulàris.* Purple. Germanica. —*I. macrántha,* Hort. Germanica. —*I. nígricans.* Lvs. short ensiform: fls. dull black to deep black. Distinct from I. atropurpurea by its uniform dark color and dwarf foliage. Oncocyclus.—*I. páncrea,* probably pancrace, var. of I. variegata. Buff and purple.—*I. Robinsoniàna,* F. Muell.=Moræa Robinsoniana.—*I. Rùdinii,* Hort., Herb. Fls. black-brown and claret. Said to be stronger and more free-flowering than the other oncocyclus irises.—*I. tuberòsa,* Linn.=Hermodactylus tuberosus. —*I. Vogeliàna.* Similar to I. persica and I. Rosenbachiana, but earlier-flowering. Fls. variable in color, silver-gray predominating, with violet, rose or lilac markings. Var. *grandiflòra.* Large-flowering.

The following are garden hybrids, sometimes cult.: *I. interrégna* =I. germanica × I. pumila. Several color vars., pale yellow, citron, lavender, and claret-red: fl.-sts. 18 in. high, holding the fls. well above the lvs. —*I. mónspur,* Foster=I. Monnieri × I. spuria. Said to be very ornamental.—*I. ochro-aùrea* or *ochaùrea,* Foster=I. orientalis × I. aurea. Outer segms. rich yellow with a cream-colored border; inner segms. erect, yellowish, bilobed at the apex. 5 ft. —*I. páravar* or *I. párvar,* Foster=I. paradoxa × I. variegata. Sts. 2-fld.: fls. dark purple with the bases of the segms. pale brown with darker markings. G.C. III. 29:398.—*I. síndpers,* Van Tubergen=I. sindjarensis × I. persica. Intermediate between the parents in foliage and general habit. Free-flowering: fls. blue like those of I. sindjarensis but lacking the conspicuous patch at the apex of the outer segms.

The following species are sometimes cult: *I. gracílipes,* Gray. Rootstock slender, wide-creeping: lvs. finally 1 ft. long, ⅓in. broad: st. 8–10 in. high, forked once or twice: spathes of a single, membranous, scarious valve which reaches about the top of the tube, 1-fld.: fls. purple or lilac; outer segms. obovate-cuneate, deeply emarginate, about 1 in. long, white in the middle, veined with purple and bearing a yellow crest; inner segms. oblanceolate emárginate, smaller, uniformly colored. Japan. B.M. 7926.—A small pretty iris of the Evansia group.—*I. Púrdyi,* Eastwood. Rootstock thin and wiry: lvs. 1 ft. long and ⅓–½in. wide. thick, sub-erect: st. 4–6 in. long, entirely covered by the short inflated bracts: spathe-valves 1½–2 in. long, inflated, the outer slightly keeled: fls. pale straw-yellow; tube 1¼–1½ in. long; outer segms broadly lanceolate, veined with brownish purple; inner segms. lanceolate, spreading, faintly veined. Gt. 35: 1222 (as I. Douglasiana) —An iris of the apogon group closely related to I. bracteata from which it differs by the long linear perianth-tube.—*I. ténuis,* Wats. Rootstock slender, wide-creeping: lvs. thin, ensiform, 1 ft. long, ½in. broad: st. equaling the lvs., branched: spathe-valves scarious, 1 in. long, 1-fld.: outer segms. oblong-spatulate, white, yellow at the throat and marked with purple veins; inner segms. smaller, erect, emarginate. Ore. G.F. 1:6. Apogon.—Rare, found only in Ore., and not in cult. except possibly in collections.

Two Chinese species recently offered in England are *I. Bulleyàna,* Dykes. Foliage grass-like: fls. described as of pretty form though not striking, deep blue; standards blue-purple and falls mottled with same color on creamy ground.—*I. Fórrestii,* Dykes. Lvs. grassy, linear, 12 in., glaucous beneath: sts. numerous, about 12 in.: spathes green, with 1 or 2 fls.: falls with veins of dark red or purple-brown; blade drooping, pale lemon-yellow, sometimes with purplish veins. G.C. III. 47:418.

HEINRICH HASSELBRING.

IRONWOOD: Usually *Ostrya virginica;* in S. Calif., *Lyonothamnus floribundus*; in Ariz. *Olneya Tesota*; in Texas, *Bumelia lycioides.* Many hardwooded plants bear this name.

IRRIGATION. Irrigation in its broadest sense includes all problems of collecting, storing, delivering, and applying water to the land through the construction of dams, reservoirs, canals and laterals, and the application of power when necessary to deliver the water; while in a restricted horticultural sense it is a method of cultivation, having for its object to increase and regulate the water-supply in the soil.

In this latter sense, irrigation is a necessary practice in the arid regions, and is advisable in the humid regions in proportion to the intensity of the cultivation and the value of the crop grown. Thus in Florida, with an average of 60 to 70 inches of annual rainfall—usually well distributed—irrigation has been largely introduced in the past few years for horticultural crops and even for tobacco, as an insurance against loss or damage by the occasional droughts. The first cost of a small irrigation plant in Florida, for 20 acres or over, is said to be approximately $100 to $150 an acre; the interest on which, and the necessary repairs, would amount to $5 to $10 an acre each year. This is a small expenditure to insure a crop against loss or injury where the value to the acre is so great as in many horticultural lines. Irrigation is needed not only to prevent the actual death of the plants, but to promote a uniform, rapid, and continuous growth, which is necessary for the development of the finest texture or flavor of the commercial crop.

King has shown that the value of a crop saved in Wisconsin, such as the strawberry, in a season when the crops generally are injured by drought, may pay all the expenses of the original cost of the irrigation plant.

In the semi-arid regions west of the 100th meridian, with a rainfall of 20 inches or less, crops are liable to be entire failures three or four years out of five; while with an irrigation plant there should not be a failure one year in five. In the arid regions with less than 15 inches of rain, irrigation is a necessity on most soils. Here the work has been highly organized and systematized, so that the cost of water delivered at the field amounts to $2 to $5 an acre each year. Under skilful management, the most abundant yields are secured. The most careful management is required in the application of water to prevent serious injury to the land and to avoid actual injury to the crop in rendering the plants tender and liable to disease, and in maintaining the quality and flavor, both of which are liable to depreciate unless good judgment is displayed in supplying water.

Sources of water-supply.

The principal sources of water-supply are streams, surface wells, artesian wells, and the storage of storm waters. For small irrigated tracts near cities, the city water-supply may often be used to advantage. In other localities the nature of the conditions will determine the most economical source from which to secure the water. Perpetually flowing streams, if situated in such a way that water can be carried to the land by gravity, have the advantage of cheapness of construction and maintenance. On the other hand, if the stream supplies others in the community, there is liable to be trouble and expense in establishing and maintaining water-right claims and in securing water when needed for the crop. Questions arising out of the water-rights on streams and rivers in the western states, with the various state laws, the multiplicity of court decisions on the most intricate legal questions—both in different states and different countries along the line of the stream—the absence in most states of adequate police or judicial powers vested in the irrigation commissioner, have led to the most perplexing and bewildering state of affairs, and have involved the states and individuals in enormous costs for lawsuits, resulting in many cases in the apportionment of many times the volume of the stream to the settlers along its bank.

The large planter must seek some perennial and abundant supply of water, as is furnished by streams, but it is safe to say that all streams of any size in the western part of the United States are already appropriated to their fullest extent, although the water so appropriated is not all in present use. Smaller planters are much more independent with some of the other sources of supply mentioned above. Wells from 10 to 20 feet deep, with pumps operated by windmills, or wells of a maximum depth of 50 feet operated by many forms of gasolene, hot-air or portable engines, attached to direct-acting pumps or centrifugal pumps, form in general a very satisfactory means of irrigating small areas.

Over limited areas artesian wells have been very successfully used. If they are flowing wells delivering a considerable stream, they can be used over small areas without storage reservoirs, or over much larger areas with reservoirs. They should be capped in all cases, where possible, so that the flow can be stopped when not actually needed.

In many places it is possible, at a comparatively small expense, to construct a dam to collect the storm waters. The magnitude and expense of such work will depend entirely on the configuration of the surface, the area of the watershed, the volume of the water to be handled as well as the nature of the soil, and the material out of which the dam is to be constructed.

Methods of raising water.

Various methods are used for raising water from streams, wells, or storage reservoirs which may lie below the general level of the land to be irrigated. Hydraulic rams are sometimes used for small areas, but these are not economical when a small volume of water is at hand, as only about one-seventh of the water can be collected. Open buckets carried on an endless belt, operated by either windmills, or steam-power or even horse-power, are used with success and offer the advantage of cheap construction. The ordinary cylinder or plunger pumps are usually employed when the water has little or no sediment, and are operated by windmills or by steam or other form of engine. When the water carries considerable sediment such pumps are liable to wear away rapidly, and the centrifugal pump is the most economical form to use. The relative first cost of equipment for pumping with windmills or with gasolene or hot-air engines of approximately equal horse-power is about the same. The windmill, however, is dependent upon a mean velocity of wind of about 8 miles an hour, while the engine may be operated at any time, and is thus more reliable when either form of motive power is taxed to nearly the extreme limit. There are many kinds of windmills on the market, and many forms of home-made construction are in use

Storing and conducting water.

Storage reservoirs for streams and for storm waters vary in size and in cost as well as in mode of construction according to the character of the land, size of area, volume of water, nature of the material of construction, and demand for the water. The construction of such reservoirs sometimes involves engineering problems of the most difficult kind, demanding the expenditure of immense sums of money.

In the use of windmills, it is necessary to have small distributing ponds or tanks, as the direct flow from the pump is usually so small and varies so much with the velocity of the wind that it cannot be depended on to water any considerable area. Where it is stored it can be turned out on the land in large volumes, so that it spreads over the surface and waters the whole area uniformly. For an ordinary windmill the ponds are from 50 to 100 feet square. They can be stocked with fish and thus be a source of some revenue and variety in the family supplies. Unless the pond is situated on a slight elevation, the earth for the embankment must be taken from the outside. The banks are usually made with a slope of 1½ to 1 foot. For a bank 5 feet high and 2 feet across the top, the side would be about 7½ feet and the base about 13 feet wide. If the ground is at all pervious to water, the bottom of the pond should be protected from undue seepage and loss of water by puddling. This should be done with clay, if this is obtainable. This puddling is often done by driving horses or cattle in the pond while the surface is wet. A pond of the size indicated above, operated by a windmill where the mean wind velocity is about 8 miles an hour, will irrigate from 3 to 5 acres of land in the semi-arid regions. Such a pond could be counted upon to irrigate from 5 to 10 acres where, as in the East, only one or two irrigations would be required during the season. The size of the reservoirs and the area they will irrigate, when supplied by steam or other kind of engine, will depend upon the available water-supply and upon the size of pump and power used.

Ditches and flumes.

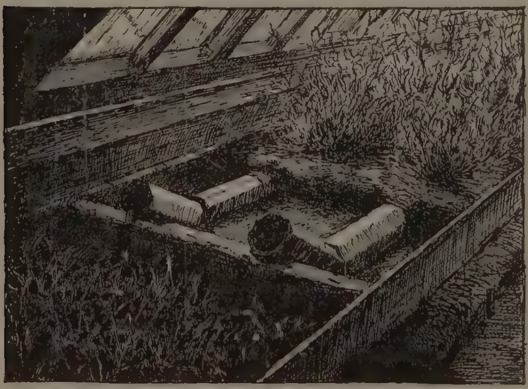
The water is usually carried from the stream or storage reservoir by gravity in open ditches. This involves loss by evaporation from the surface and by seepage through the soil. When the water-supply is limited and its value is consequently great, terra-cotta pipes, iron pipes, cement or wooden pipes may be used. When the surface of the country is uneven and ravines have to be crossed, flumes are used to carry the water on an even grade across the depression. These flumes may be iron pipes, open wooden troughs, or wooden pipes held together with substantial hoops. If the depression is not too great the ditch may be built up on an earth embankment. When the water has to pass through a gravelly soil, or when for other reasons the soil is very pervious, special precautions should be taken to prevent seepage by using pipes, cementing the sides of the open ditch, or puddling the ditch with clay or similar material.

Application of water.

The water is usually applied to the ground by flooding over the whole surface. For this purpose the surface must be perfectly level and the ground carefully prepared, so that the water will flow uniformly and quickly over the entire area and be of uniform depth throughout. When crops are cultivated in rows or on beds, the water is allowed to flow down in the troughs between the rows, and there must be a sufficient head of water to reach the ends of the rows in a reasonably short time, so that the whole width of the field will be properly watered.

Where the surface of the ground is so uneven that surface flooding cannot be used, basins are formed by throwing up slight ridges, with a plow or other implement, and the water turned into these basins in succession and allowed to accumulate to a sufficient extent. This method is particularly applicable to fruit trees, although it is occasionally used in other crops. In very sandy soils the water is occasionally carried through the field in wooden troughs, which admit of sufficient seepage to water the land. This prevents the undue seepage which might occur in such soils if the water was flowed over the surface. Another method is to distribute the water through the field in iron pipes, with openings at frequent intervals, in which nozzles can be attached to deliver a fine spray over a small area. With four or five such nozzles an attendant can water a considerable area of ground in the course of a day. Such an irrigating outfit in Florida was supplied with a power equivalent to about one horse-power an acre. The mains and laterals were of 1-inch or 1½-inch iron pipes laid near the surface of the ground, the laterals about 100 feet apart, with hydrants every 50 feet. Tanks were originally used, but it was found desirable to pump directly into the mains to insure a sufficient pressure.

Care should be exercised in applying water to the land. Where water is plentiful there is a common practice of using such an excess as to injure the flavor of fruit, increase the liability of disease, and eventually injure the land by the accumulation of seepage waters and of alkali. As a rule, there has been very much more damage from over-irrigation than from the use of too little water. The first two or three years a soil usually requires a considerable amount of water, but after becoming well moistened to a considerable depth it should require comparatively little water thereafter to maintain its fertility. As it is not easy to apply just the proper amount, the excess should be provided for. If there is any reason to fear lack of drainage, the land should be thoroughly underdrained before irrigation is started, or at any subsequent time when the need of it becomes apparent.


1979. Sub-irrigation with two runs of tile.

Irrigation always should be supplemented by the most thorough cultivation. After going to the expense of watering the soil in this way, it is poor economy to allow the water to escape by evaporation or otherwise; therefore every precaution should be used in thorough, subsequent cultivation and in the exclusion of weeds, to conserve the moisture so applied. The intelligent horticulturist will find that in the use of this expensive method of maintaining a proper water-supply in the soil, it is incumbent upon him, even more than if the method were not used, to give careful attention to all the ordinary methods of preparation and cultivation in order to maintain the advantages he has established by the irrigation plant. MILTON WHITNEY

Sub-irrigation in the greenhouse.

The term sub-irrigation is used to describe a method of supplying water to the roots of plants by means of some form of conduit placed below the surface of the soil. In greenhouse operations, the essential features of the plan are a level water-tight bench-bottom, and tile, or pipes, to serve as conduits for the water. The tile, or pipes, are laid directly on the bench-bottom, and over these the soil is spread, usually to the depth of about 6 inches. When water is introduced in sufficient quantities through the tile or pipes, it passes out at the joints, or perforations into the soil.

When applied to greenhouse operations, the term sub-watering has been proposed by E. S. Goff, for the reason that irrigation is used to denote watering on a large scale out-of-doors. It may be said, however, that the words watering and irrigation do not indicate the scale of operations with any degree of accuracy; therefore it seems as well to use an old word as to coin one, especially when the familiar word expresses the meaning intended.

Experiments in watering plants by this method were begun in the winter of 1890 and 1891, at the Ohio Experiment Station. The suggestion came from the result obtained in an effort to check the lettuce rot. Water was introduced to the soil in boxes by means of a pipe, in a manner similar to the method often employed in watering hills of melons and cucumbers. When the plants were watered in this manner, the lettuce showed so much more vigor than that watered in the ordinary way, that operations were begun at once on a larger scale; first in a bed on the ground having a clay bottom, then on a water-tight bench, made of lumber, and finally, on tile benches, covered with cement.

In all of the earlier experiments the water was introduced through pipes, or drain-tile, laid about 2 feet apart on the bottom of the benches. Goff has used brick instead of tile, placing them near enough together to touch. They were set on edge in a galvanized iron pan, made for the purpose. J. C. Arthur clipped off the corners of the bricks, so as to facilitate the flow of water. The Ohio Station has modified this plan by using common drain-tile, laid so as to touch, thus covering the entire bench bottom, instead of lines of tile every 2 feet, as at first.

Benches made of lumber have proved unsatisfactory because of the swelling and warping of the boards. Solid beds on the ground have not been successful, except where an impervious clay bottom existed. Galvanized iron adds greatly to the cost of construction, and lasts only a short time. The only suitable bench for greenhouse sub-irrigation is one made of materials which are not acted upon by water.

A well-made tile-and-cement bench seems to be the only form of construction that will meet the requirements. Such a bench does not cost so much as to preclude its use, and will last as long as any other part of the greenhouse. In describing such a bench, it will not be necessary to enter into details, except such as relate to the method of watering under discussion. The bench must be water-tight, and this essential condition is secured by spreading a layer of cement, an inch or more in thickness, over the tile bottom. It is not a matter of any moment whether flat tile or common drain-tile are used, except in the quantity of cement required. The cement must be spread with care, so as to secure a perfectly flat level bottom, otherwise the water will not flow uniformly in all directions. The sides of the benches are made of cement also, but need be only 2 or 3 inches high, or of sufficient height merely to retain the water. Boards or slate are placed outside the cement wall to retain the soil. The tile-bottom may rest on iron or wood cross-pieces. Wood has been in use for this purpose at the Ohio Station for twenty years and shows no signs of decay, because it is out of reach of the water.

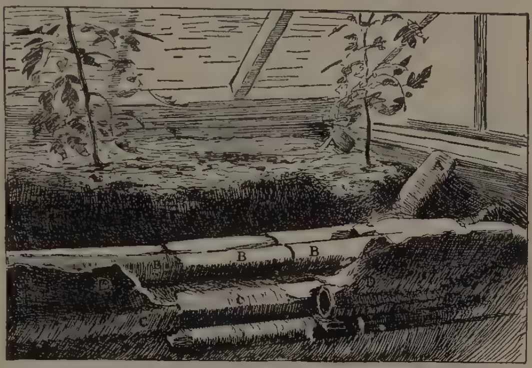
Twenty years' experience shows that a perfectly constructed bench-bottom, with the tile laid 2 feet apart, will serve satisfactorily in distributing the water to all parts of the bed, provided the tile are straight, so as not to impede the flow of water. The tile are laid in the same manner as tile-drains, and lengthwise or crosswise the bed, as preferred. Better results are usually secured if they are laid crosswise than lengthwise, as it is difficult to secure an even flow from long lines of tile. A little cement or mortar is used at each joint simply to hold the tile in place when the soil is put in the bench, but not enough to impede the flow of water from the joints. The first tile where the water is introduced is laid at an angle, one end resting on the edge of the bench side. This leaves a wide opening at the first joint, which is closed with cement. A better plan is to use a curved sewer-pipe for the inlet, but this is not always available. The picture (Fig. 1979) shows how the tile is laid on the bench bottom, being a view of a side bench in a carnation-house.

Following Goff's suggestion in the use of brick, tiles have been used over the entire bench-bottom with good results, and it seems probable that this will be found to be the best form of construction, as it appears more certainly to insure an even distribution of water. The method of construction is the same as above described, for the two plans differ only in the number of tiles employed to distribute the water. When the bench-bottom is covered with tile, placed near enough together so that the soil will not fall between, it will readily be seen that water introduced at any point will flow to all parts of the bed in and around the tile. It needs simply to be brought up to such a level that it will reach the soil, when capillary attraction will complete the distribution. Fig. 1980 shows a bench in a tomato house constructed after this plan. *AA* are the inlets; *B* the irrigating tile, from which the soil has been removed; *C* is the tile bench-bottom, covered with cement. The same size of tile, viz., 2½- or 3-inch, is used both above and below. *D* is the cement side, which has been broken away to show the method of construction. The outer board has been removed also.

The cost of construction need not be discussed here, except to state that the only items extra, more than are required in any well-constructed greenhouse, are the cement bottom and the tile in which the water is distributed.

A plan has been devised for applying water to small plants in flats which may properly be mentioned under this head. The flats are shallow boxes with slatted bottoms. When the plants require water, the flats are placed in a shallow vat of water and allowed to remain until the surface of the soil appears to be damp, or even wet.

A watering in this manner is far more efficient than by the ordinary method. Taken in connection with sub-irrigation in the benches, a crop of lettuce can be brought to marketable size nearly two weeks earlier than when surface-watering is practised. Anything like a full discussion of results of experiments in watering plants in the greenhouse by sub-irrigation would be too voluminous for an article in this connection. A brief review of the results obtained at some of the stations, together with a short discussion of some general principles, will serve the purpose intended. The increase in weight of lettuce from sub-irrigated plats over those watered in the ordinary manner has been reported by Rane, as 25 per cent and by Goff and Cranefield as 26 per cent. At the Ohio Station the range has been from 25 to 100 per cent. In the latter case the result was obtained by commencing with the plants as soon as taken from the seed-bed, and carrying the two lots through to the termination of the experiment, one by watering altogether on the surface of the soil, the other by subirrigation. Each of the experimenters speaks of a gain in earliness of several days, by sub-irrigation. Rane secured similar results with long-rooted radishes by this method of watering, but not with the turnip-rooted sorts, while Munson doubled the crop by watering below. Better results have usually been secured at the Ohio Station with the turnip-rooted than with the long varieties, but in all cases there has been a gain in favor of sub-irrigation, varying from 50 to 100 per cent. Rane found that sub-irrigation increased the yield of tomatoes, but the gain was not large. Essentially the same results have been secured in Ohio. The tomato crop has not been greatly influenced by the manner in which the water was applied, and the same is true of beets, while sub-irrigated cucumbers and parsley have shown a decided gain over surface-watered. Carnations, roses, chrysanthemums, sweet peas, violets and smilax have been under experiment by the two methods of watering, and while no such marked results have been secured as with lettuce and radishes, the sub-irrigated plats have shown superiority over those watered in the ordinary manner, in nearly all cases. With carnations the improvement has been mainly in length and stiffness of stem.



1980. Sub-irrigation with several rows of tiles.

Aside from the increase of crop secured by sub-irrigation, there are other considerations which may be urged in its favor, and these are embodied in the following general propositions:

1. *Watering by sub-irrigation in the greenhouse saves labor.* The amount of labor saved depends mostly upon the completeness of the arrangements for watering, but there is a saving in the number of applications as well. It is possible to reduce the time employed in watering a house, or series of houses, to one-fifth the time usually required.

2. *Watering by sub-irrigation assures an abundant and uniform supply of water to all parts of the bed.* Perfect construction of the benches is assumed in this case, but with such construction watering becomes almost automatic, the only care necessary being to look after such portions of the beds as may, by position, be subject to unusual conditions of air or sunlight.

3. *Where sub-irrigation is practised in the greenhouse, the surface of the soil does not become compacted, but retains its original loose, friable condition.* It is true that where frequent syringing is practised the surface of the soil becomes more or less hardened, but not to the extent that occurs in surface-watering, and the condition is easily remedied, whereas in the other case it is not. It follows that a heavier soil may be used for sub-irrigation than with surface-watering.

Still other considerations might be urged in favor of this method of watering, but many of them would apply to special cases only. Regarding the effect of the method upon insects and diseases, but little can be said. Lettuce rot is less prevalent upon sub-irrigated plats than upon those which are surface-watered, but in extreme cases plants succumb to the disease, whichever method of watering is practised. Munson found that radishes suffered more from the attacks of millipedes upon sub-irrigated plats than upon plats watered in the usual manner. Nematodes work upon the roots of roses, whichever way the plants are watered. The manner of watering has no apparent effect upon the red-spider. Even in houses watered wholly by sub-irrigation this pest is no worse than in houses where the water is applied to the surface of the soil. It may be said, however, that nearly all classes of plants are more easily kept in a healthy growing condition, and are thus better able to resist enemies of all sorts, when sub-irrigated than when supplied with water in the ordinary way.

This method of applying water to plants in greenhouse benches has now been sufficiently tested to determine its value. All that now remains is to devise ways and means to utilize what is known concerning it. The adaptation to suit particular cases must be made by individuals, but this will be far easier in the future than in the past, because better methods of construction prevail than formerly. The success of sub-irrigation in the greenhouse is now simply a question of mechanics.

W. J. Green.

Irrigation for vegetable-growers and other gardeners.

In this Cyclopedia, it is not the purpose to discuss the general agricultural practice of irrigation but rather those phases that apply particularly to gardening operations. In arid countries, the garden irrigation practice will naturally follow the general methods of the region. In humid countries or regions, the practices may be very special. In the growing of strawberries and garden vegetables in the eastern United States, special irrigation practices are developing, and these may be briefly considered.

Success in crop-growing depends on many factors. If one of these factors is deficient to such an extent as to limit the crop in yield or quality, no excess of the other factors will suffice to make up the lack. Thus, if nitrogen is present in the soil in only very minute quantities, no amount of phosphorus or potash will enable the plant to offer the husbandman a worthy harvest. In vegetable-gardening the amounts expended in making the various conditions favorable are relatively large. Accordingly, if one factor is deficient, the loss is very heavy. Perhaps the moisture factor is more often to be charged with the responsibility for poor returns than any other single deficiency.

We are told that 10 inches of rainfall in a year is sufficient for the production of successful crops under the methods of dry-farming. We are told that 20 inches of precipitation is sufficient for the production of successful crops under ordinary farm methods—provided it is well distributed throughout the year. Most places in the eastern states enjoy from 30 to 40 inches of rainfall a year. Nevertheless, there is hardly a season in which crops, and especially vegetable crops, do not suffer for lack of moisture during at least a month. The solution of this seeming paradox lies in the fact that our rainfall is poorly distributed through the growing season. We may have as much as 9 inches in a single month, and occasionally less than 1 inch. The total for three months in succession may be as low as 4 inches. Even such a condition as this does not frequently appear upon the weather records; for a period of drought may be followed by torrential rains sufficient to make up the average rainfall after the harm is done.

In view of these conditions, it is necessary that the vegetable-grower take measures to prevent the loss, through lack of sufficient moisture, of all the time and money that he has invested in land, tillage, fertilizer, seed, planting, cultivation, and care, to say nothing of the loss of the profit which he may reasonably expect. He may accomplish much by so managing his land as to conserve to the utmost the rainfall that is his. He may leave his land rough over winter to prevent run-off, he may harrow frequently till planting time, he may maintain an effective mulch throughout the season; even so through lack of rainfall—through absence of moisture to be conserved—he may lose his whole crop or so much of it that he might better have left the ground unplanted.

Within the past ten years, the possibilities of irrigation have become apparent to many vegetable-producers. They have found that the elimination of the moisture factor as one of the obstacles to successful crop-production has made possible larger yields, better quality and early maturity, with all the advantages in economy of management and in returns that accompany these gains. Irrigation has proved of especial value when sowings are made in midsummer for autumn maturity, at transplanting time, and as crops approach harvest.

Surface irrigation is practised to a very limited extent in the East. The method consists in conducting water along the end of the plat to be irrigated and allowing it to flow into furrows between the rows of the crop. It is best to permit the water to reach the far end of the row as soon as possible and then allow it to be absorbed evenly throughout the length. If this is not done, the part of the field next the supply-ditch will receive much more water than the remainder. This form of irrigation is useful on level land where there is abundance of water and where the soil is suitable. Light soils drink up the moisture so rapidly that an even distribution of the water is difficult and uniform results may not be secured.

Boston gardeners employ hose in watering their plantations. A system of underground pipes is installed in such a way that 50 feet of hose will reach all parts of the block. The cost of installation for the first acre is reported in a Massachusetts bulletin as being about $65 and successive acres may be piped for approximately $50. An acre may be given 1 inch of water by one man, using 1¼-inch hose, in five or six hours. Hose irrigation is objectionable on account of the disturbance of plants, the danger of injury to the physical condition of the soil, the amount of labor, and the frequent replacement of hose.

Sub-irrigation is practised in certain districts of Florida and on some muck land areas in the North. In the Sanford, Florida, district, which is typical, the water-supply is from artesian wells. The land is underlaid with tile which is accessible at both its highest and its lowest points. Thus it serves for both watering and drainage. The impervious bottom which underlies the soil is essential for the successful operation of the plan. On the muck lands of the North, the object is accomplished by closing the drainage outlets and so raising the water-table that the surface soil is moistened. It is not good practice to keep the water-table high, because it inhibits the proper root-development of the plants.

Growers of vegetables in the eastern half of the United States are using various types of overhead irrigation far more than other methods. These systems usually involve the establishment of lines of pipe mounted on posts and carrying either sprinklers or small nozzles. These lines are so spaced that the ground may be evenly covered by the spray. Some types of sprinklers are so constructed as to revolve and cover an area of perhaps 25 feet radius. These are objectionable because they cannot cover the ground as evenly as other types.

More commonly employed are small nozzles which consist merely of a threaded plug of brass through which a straight hole is accurately drilled. These are set in holes in the pipe-line. Recently various modifications and improvements in these nozzles have been made. The nozzle line is screwed together and mounted on the posts, and a special machine equipped with a small level is used for tapping and threading the holes. The nozzle line is mounted with a union in which is set a handle for turning to cast water far to each side or to cover the near gound by throwing vertically. The nozzles are usually spaced about 3 feet apart and throw a fine solid stream which breaks at some distance from the opening. When the water reaches the ground, it is a fine mist similar to a light rain. Twenty-five to forty pounds of pressure is sufficient to cover a belt ranging from 20 to 30 feet on either side of the line.

A long line, of say 300 feet, would consist of 100 feet of 1¼-inch pipe, 100 feet of 1-inch pipe, and 100 feet of ¾-inch pipe.

Nozzle lines are supported in many different ways. The consensus of opinion at present is that they should be about 7 feet above the ground to avoid interference with work that is being done. These posts must be set 15 feet apart to carry ¾-inch pipe and a little farther apart for larger sizes. Posts of pipe or wood are most commonly used, but suspension from a cable supported by posts 100 feet or so apart is gaining in favor with vegetable-gardeners.

Occasionally, for temporary purposes, as for a single watering of young strawberry plants, the pipes are simply laid on the ground and turned by the handles in the usual way. Other growers have small horses which may be placed on the ground to carry the line temporarily. Mechanism has been devised by which a large number of lines may be automatically controlled from a single point, turning the spray constantly from one side to the other.

The main at the end of a field may be buried and the lines supplied through risers, or it may be carried on the first post of each of the rows which support the nozzle lines.

Comparatively few gardens are so located that a suitable supply of water is not available at reasonable cost. There are several possible sources. Some gardeners pump directly from streams or ponds, ordinarily using a gasolene engine and the triplex type of pump. In other sections, where the water-table is relatively near the surface, and where the ground-water is abundant, wells are sunk. Some employ a number of driven wells and gather water simultaneously from all of them. At Rochester, New York, many wells of large diameter with concrete walls are to be found. The method of sinking them is ingenious. A circular ditch of the desired diameter, say 15 to 25 feet, and about 2 feet wide and 4 feet deep is dug. In this is built by means of wooden forms a concrete ring. The lower edge of this ring is beveled outward at an angle of perhaps 30°. The ring is strongly reinforced and short bits of pipe are inserted radially. After the concrete in this ring has set and the forms have been removed, the work of digging is begun within. The earth is removed, one man seeing that it is taken evenly from the sides of the well under the sharpened edge. As the work progresses the ring sinks into the ground and radial concrete blocks are built upon it to serve as a wall. The well may be sunk to a depth of 20 or even 25 feet. The large diameter offers great gathering surface, and an abundance of water may be secured from a stratum that would not yield a sufficient amount by means of small wells.

Many gardeners in the neighborhood of cities are able to utilize the municipal water-supply, taking advantage of the low rates which are granted to large users. Some are able to procure water at a cost as low as 6 cents a thousand gallons. This is about as cheap as pumping.

Many questions arise as to the handling of irrigation-water. The practices have not been worked out nearly so fully in the East as in the West. Almost no well-planned experimental work has been conducted, and opinions among users vary greatly. Although a few prefer to apply water in small amounts and frequently, most seem to think that thorough irrigation is preferable. Most men water at night or when it is cloudy, but some do not hesitate to apply even in midday, thinking that the plants are benefited by the cooling. It is well so to plan the work that the ground will not be muddy at harvesting-time. With tomatoes, precautions must be taken against cracking. This is usually occasioned by heavy watering after the plants have been kept quite dry. Lettuce requires special care to avoid the development of rots of various sorts.

The use of irrigation-water does not relieve the grower of the necessity for good drainage or careful conservation of moisture. The former guards against overwatering or heavy rains which may come just after a thorough irrigation. The latter saves water, which is costly and keeps the soil in better physical condition.

Overhead irrigation systems are used to some extent for spraying, for the application of fertilizers, and for frost protection. In some cases the water is heated before it passes to the nozzle lines.

It makes little difference how perfect a system of irrigation equipment one may have installed, or how smoothly the pump works, or what a beautiful spray the nozzles throw on the crop if the returns are not sufficient to justify the outlay. This suggestion raises the questions of cost and of gain in market value of the crop. The first cost for equipping an acre is stated by manufacturers to be in the neighborhood of $125 to $150, making use of new pipe. Some men have economized in various ways and have achieved the desired result at lower cost, although many figures that are given are misleading because the very important labor of the owner in installing the system has been neglected.

It requires 27,152 gallons of water to cover an acre 1 inch deep. This amount of water is applied through $\frac{1}{32}$-inch nozzles at the usual spacings in eight and one-half hours. Water may be pumped ordinarily at 2 to 6 cents a thousand gallons.

Many growers can give very inspiring figures as to the results that they have secured by means of irrigation equipment. One well-known New Jersey grower is reported on first-rate authority to have secured twenty-five tons of beets to the acre and 620 bushels of potatoes from the same area. A crop of onions worth $1,500 has been taken off a 5-acre piece early enough to permit a later crop of Golden Self-blanching celery to be matured. Another grower reports that an outlay of $300 to $400 saved several thousand dollars worth of celery, whereas an unwatered acre and a half was a complete failure.

The Ontario Agricultural College reports experiments as follows:

	Irrigated.	Non-irrigated.
Maturity—		
Leaf	June 22	July 4
Head	July 10	July 26
Weight of crop—		
Leaf	20 lbs., 5 ozs.	11 lbs., 3 ozs.
Head	25 lbs., 15 ozs.	9 lbs., 1 oz.
Quality	Fine	Bitter

At the outset it was pointed out that the heavy cost involved in making conditions favorable for crop-production renders it almost essential that vigorous measures be taken to prevent loss by drought. Now that the possibilities and advantages of irrigation have been indicated, it is well to emphasize the importance of making every other condition favorable. If every factor is favorable except the moisture factor and one other, and money is invested in irrigation, and the other factor prevents the maturing of a profitable crop, the situation of the grower is worse than before by the amount of his new investment.

An application of water equal to an inch of rain over an acre requires 27,152 gallons, as has been said.

To deliver this water, No. 1 Skinner nozzles with pressure of forty pounds should be placed 4 feet apart in the line and the lines should be 56 feet apart; nine hours and twenty-three minutes at forty pounds pressure is the time required. The disharge for each nozzle is 24.1 gallons a minute.

Ninety-four and two-tenths feet of elevation gives forty pounds pressure.

A four horse-power gasolene engine and duplex pump will deliver approximately 100 gallons a minute at thirty pounds pressure, at a cost of roughly 10 cents an hour.

A 2½-inch pipe will deliver 100 gallons a minute at a distance of 100 feet, and a 3½-inch pipe is required for distances between 500 and 700 feet.

With No. 1 outdoor nozzles, a nozzle line 150 feet long may be composed entirely of ¾-inch pipe.

A line 250 feet long needs 100 feet of ¾-inch and 150 feet of 1-inch pipe.

A line 700 feet long needs 90 feet of ¾-inch, 160 feet of 1-inch, 175 feet of 1¼-inch, 175 feet of 1½-inch and 100 feet of 2-inch pipe. PAUL WORK.

ISABÈLIA (Isabel, Comtesse d' Eu, patroness of horticulture). *Orchidàceæ.* One Brazilian creeping epiphyte, 1-lvd., with small reticulated pseudobulb, said to require treatment of maxillaria. *I. virginàlis*, Rodr. Fls. white, solitary; sepals nearly equal, the middle one free, the others connate and produced into a spur; petals small, narrow, the lip upright, entire. O. 1911, p. 8.—Apparently little known in cult.

L. H. B.

ÌSATIS (ancient name, of obscure meaning). *Crucìferæ.* Herbs, for ornament and for dyeing.

Annual, biennial, perennial; erect, branching, glabrous or pubescent or rarely tomentose: lvs. undivided, the upper ones clasping and auricled: fls. small, yellow, many in lax racemes, without bracts; sepals and petals 4: pod large and mostly flat, pendulous, linear to oblong or obovate or even nearly circular, indehiscent, strong-ribbed on either side, 1-seeded, the stigma sessile; radicle mostly incumbent.—Species about 50, Eu., N. Afr., Asia.

This genus includes the dyer's woad, *I. tinctoria*, formerly cultivated for a blue dye but no longer advertised. Cæsar relates that the ancient Britons used the woad for staining their bodies, and the word Britain itself comes from an old Celtic word meaning painted. Before indigo became common in Europe, the dyer's woad produced the chief blue coloring matter for woolen cloth. The introduction of indigo in the seventeenth century destroyed this important industry, not without opposition. Dioscorides and Pliny mention both the dyer's woad and indigo.

tinctòria, Linn. Rather tall; glabrous or nearly so, and glaucous: biennial, 1½–3 ft.: st.-lvs. lanceolate, entire, sessile, somewhat arrow-shaped: fls. small, yellow, borne in early summer, on panicled racemes: instead of a pod, opening lengthwise by valves, it has a closed fr. like the samara of an ash, 1-celled, 1-seeded, indehiscent, wing-like. S. E. Eu. and probably eastward; now widely naturalized in Eu.—The cult. form is sometimes distinguished as var *satìva*, DC., with broad glabrous lvs.

glaùca, Auch. Perennial, glaucous, the st. thick, 2–4 ft., and bearing a large panicle: lvs. glabrous, entire, the radical oblong and the cauline very small: fls. yellow: pod about ½in. long, linear-oblong, obtuse or truncate-retuse. Asia Minor, Persia. G.M. 47:492.—Offered abroad.

I. Boissieriàna, Reichb. Annual, 12 in.: basal lvs. cuneate-oblong, toothed; upper lvs. entire, oblong: fls. yellow: pod pubescent, various. Turkestan.

L. H. B.

ÍSCHARUM: *Biarum.*

ISCHNÓSIPHON (name refers to the narrow corolla-tube). *Marantàceæ.* Upward of a dozen calathea-like perennial herbs or bamboo-like plants of S. Amer., belonging to that group of the family having 1-celled rather than 3-celled ovary (and so differing from Calathea and Phrynium, and agreeing with Ctenanthe and Maranta, but differing from the last two in having a solitary staminodium). Lvs. large, coriaceous or soft: fls. geminate, in an elongated cylindrical spike; sepals 3, free, long-linear; corolla-tube narrow and much elongated, the lobes lanceolate or oblong-lanceolate; stamen-tube nearly obsolete; staminodium petal-like, large, obovate: caps. elongated, very unequally 3-valved, 1 valve dehiscent. Tall often branching plants with leafy sts., very little, apparently, in cult. They are treated as calatheas or marantas. **I. leucophæ̀us**, Koern. (*Maránta màjor* and *Calathèa màjor*, Hort.). Two feet and more, nearly simple: basal lvs. ovate or oblong, acuminate, more or less cordate at base, farinose beneath: racemes simple, about 6, slender; corolla white or rose-colored, the tube upward of 1 in. long, the lobes oblong-lanceolate. Panama to Brazil. **I. bambusàceus**, Koern. (*Calathèa bambusàcea*, Poepp. & Endl.). Bamboo-like, becoming 30 ft. or more tall, much branched, with graceful shoots: lvs. small (3–5 in. long), somewhat ovate-lanceolate, attenuate-acuminate, green above and glaucous beneath: raceme short and sessile, solitary or twin; corolla-lobes whitish yellow, lanceolate, the tube exserted and about 1 in. long. Peru.

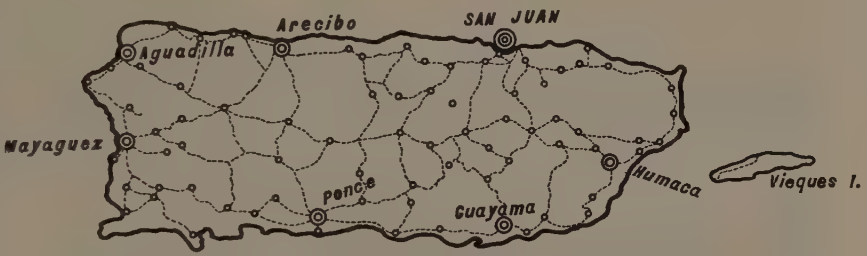
L. H. B.

ISLAND DEPENDENCIES, Horticulture in. The island dependencies of the United States comprise territories in both Atlantic and Pacific waters. They are all tropical, however, and therefore may be considered together horticulturally. The islands that call for special treatment in this work are Porto Rico, Hawaii, Philippines, Guam, and the American part of the Samoan group (Tutuila). The inclusion of these wide-scattered territories in this Cyclopedia brings in the flora of the tropics, although it is intended to discuss, in the regular entries in the different volumes, only the most important or outstanding species; to endeavor to comprise all cultivated plants that might find home or lodgment in these islands would be to describe practically all tropical subjects, and this would be far too large an undertaking for a work of this character.

The geographical articles in this Cyclopedia are gathered under three heads,—British North America, Island Dependencies, North American States. In the last symposium will also be found an account of Panama in its horticultural relations. All these articles should give the reader a comprehensive view of the horticultural possibilities of the North American continent north of Mexico, and of the tropical territories that have become attached to the United States. They depict a surprising range of natural conditions and resources, and indicate a very real horticultural conquest of a relatively new part of the earth's surface.

Porto Rico.

The island of Porto Rico (Fig. 1981) is rectangular in form, about 100 miles long and 35 miles wide. Its area is about one-twelfth of that of Cuba and nearly the same as that of Jamaica. It lies in 18° north latitude and 65° to 67° west longitude, which places it 600 miles due east of Jamaica. Although Porto Rico is mountainous, the mountains are low and rolling, but few of the short ranges exceed 2,000 feet in elevation, making practically all of the area suitable to some branch of agriculture. The low plains extending a few miles inland from the sea and reaching for the most part around the island, and the numerous plains and low rolling areas between the ranges of mountains, afford a variety of rich soils, of temperatures and of elevations, which has developed extensive horticultural interests and operations. The rainfall is generally considered heavy, although the sea-breezes and varying temperatures of different elevations cause a great difference in rainfall between different sections. In all parts of the island, excepting the western and southern areas, the rainfall is fairly well distributed through the year, although the season for heaviest rainfall is from May until December, which is the only season when the western and southern sections have an abundance of rain. In sections in which drought continues through the winter months, irrigation is often employed. The elevated sections are well supplied with rains and are drained by numerous ravines, creeks and small rivers, which afford an abundance of power and opportunity for irrigation. In inches, the annual rainfall varies from 37, in the southwestern parts of the island, to 135 on the higher mountains in the northeastern part, the average for the island being 77.



1981. Porto Rico.

The climate is healthful and delightful, the temperature being almost ideal. Because the island is small and has a moderate elevation, and lies in the zone of the trade-winds, the climate is uniformly warm and comfortable. The coolest month is January, which has an average temperature of 73°, while August, the warmest month, has an average of 79°. The mean daily temperature is quite constant, the change from day to night temperature being 20° to 25°. The average daily maximum temperature along the coast in summer is 87° and the daily minimum temperature in inland sections is 65°.

The population of the island, according to the census of 1910, was 1,118,012, which allows 320 persons to the square mile. All persons but a small percentage are engaged in agricultural pursuits.

The soils of Porto Rico are of many types, and grade from very heavy clays to light sandy loams. The hills and mountains are, for the most part, red clays, while the valleys between them and the coastal plain are heavy dark loams, grading in some places into sandy loams. While the soils are usually fertile, many crops respond to a complete fertilizer. There are practically no swamps in Porto Rico, although during the season of excessive rains ditching is necessary to drain large areas of the level coastal plains. Except in areas near the sea surface, drainage is good; however, poor drainage of the subsoil in some areas is a hindrance to horticultural crops.

Horticulturally the island is divided into three sections: The narrow sandy plains which skirt the coast are well adapted to coconut culture. The slightly elevated plains and low rolling lands between the flat coastal plains and the more elevated portions of the island on the north have been proved to be well suited to pineapple and citrous fruit-growing, while the highest mountain ranges that traverse the central part of the island are devoted almost entirely to coffee. Sugar-cane growing is confined mostly to the heavy soils of the coastal plains.

The leading horticultural crops are citrous fruits, coffee, coconuts, pineapples, vegetables, bananas and other tropical fruits. The agricultural industries are sugar-cane, tobacco-growing and stock-raising.

The most attractive field for the horticulturist in Porto Rico is citrus-culture. This industry has made wonderful progress since the American occupation, over 3,000 acres now being given up to it, while there were no commercial groves at the time of the occupation. Grapefruit, oranges, lemons, limes and other less important citrous fruits are cultivated, although attention is given mostly to grapefruit and oranges. In the area adapted for citrus-culture, the temperature is ideal for tree-growth and fruit-production. Care must be taken, however, in selecting the orchard site to secure subsoil which will drain well and areas protected from the winds. The trade-winds are in some places constant enough to hinder a normal tree-growth and to prevent the best development of certain fungi which prey on injurious scale insects. Where there is not natural wind-protection, a belt of tall-growing trees is planted on the windward side of the grove for shelter. Several leguminous crops, such as jack beans, velvet beans and cowpeas grow to perfection and are used extensively as cover-crops and green-manure crops.

Four ship lines furnish excellent transportation between the island and New York, the ocean rates being much less a box to New York than from Florida or California.

Grapefruit seems to be especially well adapted to Porto Rico conditions and is receiving first attention among horticultural crops. The trees are very vigorous, come into bearing early and are very prolific. The quality of the fruit is excellent and Porto Rican grapefruit is throughout the year a favorite product in the northern markets. The fruiting season for this crop is very long. The main crop is harvested during the winter and spring months but each week throughout the year Porto Rican grapefruit is offered on the market. Varieties "Duncan" and "Marsh Seedless" are the most popular.

Oranges have been more extensively planted than grapefruit though they do not seem so well adapted to the conditions, and the planting of them has practically ceased. Like grapefruit, the trees bear early and are prolific, and the fruit is of a high quality. Dis-

1982. A native hut in Porto Rico.

eases and insects cause but little damage. Oranges are found growing wild throughout Porto Rico, though most numerous through the western mountains, which are planted to coffee. These wild orange trees, grown under the protection of the coffee shade trees, produce a beautiful clean fruit which matures during the driest season and develops an excellent flavor and quality. These wild oranges are given no culture and the fruit is sold on the tree by the coffee plantation owner to packing firms in the western seacoast towns, who box and ship them to northern markets. Until within late years, unexperienced packers have brought Porto Rican wild oranges into disrepute by shipping great quantities of poorly packed or immature fruit, which reached the market in bad condition. The lack of good roads into the interior of the island prevents the marketing of thousands of boxes of fruit annually and allows quantities of boxes to be bought for a few cents a box. While the wild fruit is handled for the most part by the natives of the island, the cultivated oranges and grapefruit are practically all grown and marketed by Americans.

Pineapples have been one of the most profitable crops in Porto Rico for several years, as the price of the fruit has been high and weather conditions favorable for production. The old Spanish belief that pineapples were not profitable except in the locality of Lajas, a town in the western part of the island, was soon disregarded by the American settlers and at present this crop is found in many parts of the island. The commercial plantings are confined to two varieties, the Cabezona, meaning in English "large-headed," and Red Spanish. The former is grown for canning and the latter for shipping fresh. Most of the Red Spanish variety is grown in sections near Rio Piedras, where the soil is a light sandy loam, and from Bayamon to Arecibo, where the soil is an open, well-drained red sandy loam; however, they grow well in many other locations. The chief demands of the pineapple are well-drained, well-aërated soil, abundance of sunshine and a good supply of complete fertilizer where the surface soil is not naturally rich. This crop is practically free from insects and diseases. The plants are very prolific and can be brought into bearing at any season of the year. As the northern market shows a preference for Porto-Rico-grown pineapples, the industry bids fair to become still more important. Though the practice varies with conditions, the usual cultivation method is to plow the soil and by plow and hand labor work it into beds a few inches high, leaving ditches to afford drainage. The beds are made wide enough to provide for two to six plants set from 12 to 18 inches apart. Of the 10,000 plants to the acre, which is the number usually set, 90 per cent are expected to bear fruit the first crop. Fertilizer is applied at the time of planting and at intervals during the growth of the plant. As the first crop of fruit matures, suckers spring from the base of the plants and produce a second crop. On the most suitable land three or four crops are allowed to develop from suckers, though seldom more than two are considered profitable. The Cabezona variety is grown for canning principally, although profitable shipments of fresh fruit have been made. In the western end of the island, and especially in the area from Lajas to Mayagüez, the conditions are especially adapted for the growing of this variety. In this area a great quantity of the fruit is grown and sold to canners by the ton.

1983. A grapefruit grove in Porto Rico.

FRUIT SHIPPED FROM PORTO RICO TO THE UNITED STATES AND FOREIGN COUNTRIES DURING THE TWELVE YEARS ENDING JUNE 30, 1912.

Year	Oranges	Pine-apples	Canned pine-apples	Coco-nuts	Grape-fruit	Other fruits
1901....	$84,475	......	......	$8,334	......	$16,992
1902....	51,364	......	......	12,720	......	9,898
1903....	230,821	......	......	326	......	61,956
1904....	352,646	......	......	......	......	81,214
1905....	125.422	......	......	......	......	130,478
1906....	295.633	$27,826	$42,186	129,793	......	7,420
1907....	469.312	64,831	63,519	174,957	$7,586	3,737
1908....	630.720	172,779	98,203	206,704	44,535	11,320
1909....	401,912	442,780	117,830	204,498	76,310	18,154
1910....	582,716	555,044	106,587	218,870	162,749	9,851
1911....	703,969	641,291	149,744	258,169	309,698	11,123
1912....	584,414	684,774	258,671	308,883	525,048	15,972

At the present time, the coffee industry is flourishing, as both weather conditions and prices are favorable. Aside from the influence of changing tariffs, practically the only drawback to this great industry is severe storms which once in a series of years visit the island, usually coming in the coffee-ripening season. Porto Rican coffee is not well known in the United States, but throughout the West Indies and in some European countries it is a favorite among coffees and brings high prices, selling for several cents a pound higher at wholesale than Brazilian coffee. The mountainous region of the central and western part of the island is given up mostly to coffee and affords a splendid field for its culture. The best coffee in Porto Rico grows on the well-drained upland areas and reaches its highest perfection at 1,500 and 2,000 feet. Throughout this coffee-growing area, the air is always cool and refreshing and conditions for health are almost ideal. As the coffee is prepared for market on the plantations and can be transported to the seacoast markets or to the main roads leading there by pack animals, the lack of good roads does not hinder this industry as it does others in this section. Throughout the area devoted to coffee the land is cheap, in many localities not exceeding $30 an acre. Coffee may be grown in Porto Rico for 5 cents a pound and on a good plantation from 300 to 400 pounds an acre is an average crop. At the present price of 15 cents a pound, handsome returns are realized. Practically all plantations devoted to this crop are large and under Spanish or Porto Rican management. It is a rare exception when any fertilizer is applied to coffee. As the plantations are rolling and the trees set but a few feet apart, no animal cultivation is given and the only cultural work is confined to shallow hoeing and weeding.

There is no crop in Porto Rico which yields such regular and satisfactory returns as the coconut palm. Without cultivation or fertilizing, the trees bear good crops of large nuts which bring first-class prices in the United States markets. The narrow strip of sandy coastal plain, which rarely exceeds ½ mile in width and for the most part skirts the island, is ideal for coconuts, as the sandy loam affords perfect drainage, which is the principal requisite for this crop. Most of the suitable land has been planted and is in bearing. The trees are planted from 25 to 30 feet apart each way and bear in five to eight years, depending on the fertility of the land. The area devoted to coconuts in Porto Rico is small, and practically all of the product is exported to the United States, the only demands at home being for drinking the water from the half-mature nuts and for making coconut-oil and its products.

The temperature in Porto Rico is ideal for vegetable-growing, but injurious influences of excessive rains and prolonged droughts, together with the rather heavy poorly aërated soils, make commercial vegetable-growing practically a failure so far as shipping to foreign markets is concerned. When irrigation is practised, excellent crops of lettuce, radishes, turnips, carrots, tomatoes, peppers, cucumbers, and so on, are grown, but usually at a cost so high that export is not profitable. Large quantities of vegetables are grown and sold at a very low price for home consumption. The most productive crops and those that can always be depended upon are the starchy root crops including ñame, yautias, dasheens and yuca. These products are not exported, although they are grown by every Porto Rican family on the island where the farm or dooryard is large enough for them. One exception is yuca (Manihot) which is grown by commercial firms and the starch extracted in a modern factory near Bayamón.

Bananas are found growing in all parts of the island and form a part of the daily diet of both Porto Ricans and foreigners. They are grown in dooryards, along streams, in orchards, as windbreaks for young citrous trees, as shade for newly planted coffee trees and throughout the hilly coffee plantations. A number of the best varieties, including yellow- and red-fruited kinds, and those for eating raw and for cooking, may be found in plenty on nearly every farm.

As is true with other West Indian Islands, the mango is the most popular fruit. It is truly the apple of the tropics. Until late years but little has been done to improve the quality of mangoes in Porto Rico, and there are but few of the choice strains growing here. The favorite kinds grow in the Mayagüez district. The fruiting season continues for several weeks during which time this fruit is one of the chief articles of food among some of the poorer classes. No effort is made to export the mango. At home they are used only in the fresh state except that fully grown green fruit is made into sauce which resembles apple sauce very closely, both in appearance and flavor. No orchards of native mangoes are cultivated, as the trees grow wild and produce well with no care. The federal experiment station and a few commercial fruit-growers are introducing and distributing superior varieties from other countries, notably East India and the Philippine Islands. These imported varieties are thrifty and the fruit of a very superior quality.

The avocado tree requires a well-drained soil and prefers one of a rich neutral loam. It does not grow well on all parts of this land and reaches its heaviest production on the west end of the island near Isabella and Aguadilla. The fruits are so plentiful, however, that those of highest quality may be purchased in markets at 1 or 2 cents each during the few weeks of harvest. Among other fruits that may be found in quantity in the markets of the island are mamey, anona, caimito, nispero, papaya and guayaba.

Among the agricultural industries, cane- and tobacco-growing and animal-production are important undertakings. Most of the cane is grown on the low coastal plain which reaches around a large part of the island and in some places is several miles in width. In these areas the soil is well adapted to the industry and as the temperature is even and never low a good yield can be depended upon each year. In 1901, the exports of sugar were less than 70,000 tons; in 1911 they were nearly 323,000, and during 1912, 367,000,—five times greater than they were eleven years ago,—and they are still increasing, having advanced 10 per cent during the past year (1913). The external sales of this product yielded $31,500,000 against less than $5,000,000 in 1901.

1984. A pineapple field in Porto Rico.

Tobacco is grown to some extent in all parts of the island, though most of the Porto Rican output is grown in the vicinity of Cayey, Caguas and Gurabo. In these sections an excellent product is grown and it is the chief industry. Quoting from the report of Governor Colton for 1912,—"The output of cigars was more than fourteen times greater than in 1901, since which year it has continuously increased until the sales of 1911–12 reached 281,000,000, an increase of 10,000,000 over the preceding year. Of these 170,000,000 were consumed upon the mainland and 111,000,000 in Porto Rico."

Great interest is shown by the people of the island in promoting scientific agriculture and agricultural education. Institutions engaged in this work are the Federal Experiment Station, an Agricultural College, a Sugar Producers' Experiment Station supported by the sugar-growers, and a Board of Agriculture.

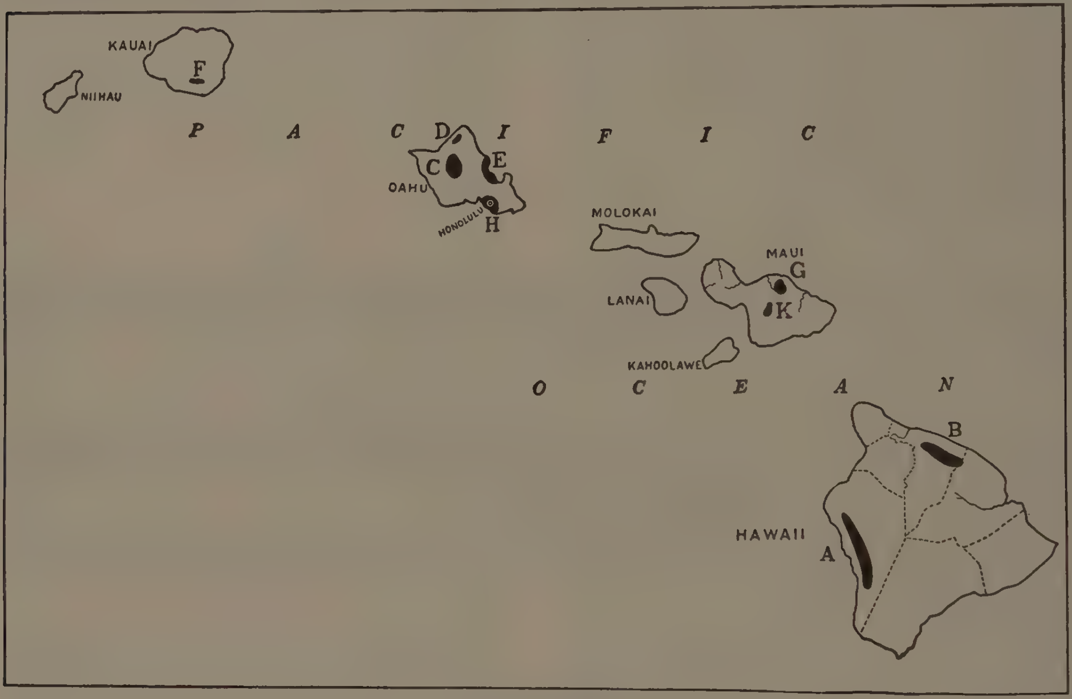
C. F. Kinman.

Hawaiian Islands.

The group known as the Hawaiian Islands (Fig. 1985) is located about 2,100 miles from San Francisco in a southwesterly direction. These were named the Sandwich Islands by the discoverer, Captain Cook, but this designation was abandoned many years ago for the original native name, taken from that of the largest member of the group, Hawaii. Since annexation to the United States, the Hawaiian Islands have been officially known as the Territory of Hawaii. Disregarding small and unimportant islands, Hawaii lies between the parallels 18° 50′ and 23° 5′ north latitude and between the meridians 154° 40′ and 160° 50′ west longitude. The five most important islands have an area of about 6,200 square miles, or rather less than that of Massachusetts, and extend about 380 miles from northwest to southeast.

It is hardly correct to speak of the climate of Hawaii, for there are so many different climates in this small area. The extent of the rainfall, for example, which forms so important a factor in the horticultural conditions of a country, is decidedly divergent in different regions and even in localities within a few miles of each other. To understand the climatic conditions, it is necessary to recall that these islands are of volcanic formation, their central parts and the larger part of their area being occupied by rugged and high mountains, descending sometimes gradually, sometimes precipitously to the sea and with valleys or tablelands lying between the ranges and narrow plains near the coast. Being in the path of the northeast trade-winds, the windward side of the islands receives an abundant rainfall throughout the year, while the southwest shores are comparatively dry. Thus, at Honolulu, on the southwest shore of Oahu, the annual rainfall averages about 38 inches, while that of the city of Hilo, on the windward side of the island of Hawaii, measures 12 feet. Even within a very narrow range, as, for example, the limits of the city of Honolulu, there is great variation in rainfall, certain localities receiving frequent rains throughout the year, while others only 2 or 3 miles distant practise irrigation constantly. Some of the great sugar-cane plantations depend wholly upon the natural supply of water, while others could not grow cane at all without their expensive systems of artesian wells and irrigation.

Similarly there is a great variation in the temperature in different parts of this small but important country, but exceedingly slight variations with the changing seasons. The windward side is cooler than that which is sheltered by the mountains, but in no part of the islands is the heat so intense as would be expected from their location within the tropics. Only rarely, in the hottest localities, does the mercury rise to 90° F. Again, the variation in elevation from sea-level to many thousand feet gives a like variation in temperature, so that some of the mountains of the largest island are covered with snow during a part of the year. In short, so far as climate is concerned, the Hawaiian Islands offer all that could be asked for great and diversified horticultural industries.



1985. Hawaiian Islands.

Only a small proportion of the total area of the country is suitable for cultivation. The lands lying near the shore and along the lower slopes of the mountains are occupied almost exclusively by sugar-cane, with an occasional banana plantation and with rice and taro growing on the low valley bottoms which can be kept submerged for these aquatic plants. The cane-belt rises to an elevation of only a few hundred feet on some plantations, limited by the cost of pumping water, but in some other localities it extends to nearly 2,000 feet. These lower lands are well adapted to the growth of tropical fruits and such, together with many of the vegetables and flowers of the temperate and tropical zones, may be found in gardens. Above the cane-belt are lands also suited to such tropical crops as pineapples and coffee, and still higher there are some areas where apples, peaches, plums and many temperate-zone fruits may be grown, although none of these crops has become the basis of an industry. The regions on the map, designated by the letters *A* and *B* are the two most noted coffee-producing sections; *C*, *D*, *E*, *F*, and *G* are localities in which pineapple-growing has become an important industry; *H*, indicating the district lying about the city of Honolulu, locates the area where there is probably the greatest variety of introduced horticultural plants; at *K*, known as the district of Kula, on the Island of Maui, potatoes, corn and other temperate-climate crops have been grown for many years and were shipped to California to supply the needs of the gold-seekers in 1849 and the years following before the agricultural industries of that state were developed.

The growing of pineapples is not only the leading horticultural pursuit but ranks next to sugar-production among the industries of the Islands. Hawaii is widely known for its pineapples. It is only within the last decade that this crop has risen to large importance. The beginnings of the industry were near Honolulu and the first large plantation was about 14 miles from that city in a northwesterly direction, on the foothills sloping from the Koolau Mountains. A little farther to the northwest a small colony of American farmers settled at Wahiawa on virgin lands, said to be useless except for grazing. They found that the pineapple attained perfection on their lands and the industry began to extend rapidly from that center. Several thousand acres have been planted on the foothills and the plains between the mountains, and considerable areas have been devoted to the crop on the north and east sides of the island. Other centers are to be found as indicated above on Maui, Kauai and more recently on Hawaii. Only a small fraction of the crop is marketed as fresh fruit, the greater portion being sold in the can. Large canneries are in operation in all the centers of production, owned and controlled by the larger plantations. The price paid for first quality pines is about $20 a ton. The total output for the season of 1912 is estimated at a little over 1,000,000 cases of two dozen cans each and valued between $3,000,000 and $4,000,000. At the present rate of planting it appears that the annual pack will again be doubled within a few years. The products of the pineapple cannery include not only canned fruit in several forms as sliced and grated pineapple but recently the juice is being bottled in much the same way as grape juice. A syrup is also made from the juice and one factory is engaged exclusively in this business.

The fresh fruit trade is also increasing and shipments are made by nearly every steamer to the mainland, where they are distributed to all parts of the Pacific states and a few are sent to the East. Carload shipments have been made to the great central markets, but the Hawaiian pineapple-growers have devoted their attention chiefly to the more conservative method of disposing of their product as canned fruit, which has found a ready market in the United States.

Most of the pineapples are produced under the plantation system, the units varying from a few hundreds to several thousands of acres each. A few individual planters are in the business and at the present time their number seems to be increasing through the opening of homestead lands by the government.

The pineapples are grown just above the cane-belt, but in places in which water is insufficient for cane, the pines extend almost to sea-level. The soil upon which they are grown is usually rather a heavy loam, subtended often with a clay substratum. Since the plant will not endure standing water, drainage is one of the important problems. Underdrains of tile or rock are not in use, but surface ditches or depressions are provided to carry off the surplus water of heavy rains. Deep plowing is practised to break the almost impervious layer which develops just beneath the cultivator teeth. The use of giant powder for the purpose is now being tried. Both these practices can be conducted only when the plants have been removed from the fields, which it is necessary to do in preparation for replanting every four or five years.

Another problem of the pineapple-planter is to avoid excessive manganese in the soil, for the plant is very sensitive to an excess of this element. A few places in the pineapple region have been found where soils, otherwise excellent, have proved useless for this crop. It is easy to discover its presence by chemical analysis and usually by the appearance of the soil which, therefore, can be avoided or devoted to other crops less sensitive to manganese.

1986. Hawaiian vegetation. Showing the royal palm as it grows in Honolulu.

The method of culture is to set the plants in single, double or triple rows and cultivate thoroughly between them by mules and with hoes. Sheds are not thought of in Hawaii for there is never frost in the pineapple area. The first crop matures in sixteen to twenty-four months and is followed by a rattoon crop a year later. A second rattoon and occasionally a third may be taken from the field before plowing up the old plants and replanting. The Smooth Cayenne is the chief variety in cultivation, but another smooth-leaf variety has become somewhat mixed with the stock and all have passed usually for Cayenne. These are the only varieties now in commercial cultivation in Hawaii, although very many kinds have been tested and some continue in gardens.

Banana-growing is an older industry but it has not made as rapid progress as the pineapple. For several years the export trade has run from about 180,000 to 200,000 bunches a year, netting the growers about 50 cents a bunch when prices are good. Banana-growing for export is confined almost entirely to Oahu, since this is the only island which enjoys frequent and direct steamship communication with the mainland. The island of Hawaii ships a few bananas on its regular boats but these do not run with sufficient frequency to encourage extensive plantings. The fruits are shipped to San Francisco and practically all are consumed in that market or those immediately around the Bay. The bananas are grown in small plantations varying in size from 2 to 50 or more acres. They are owned and operated chiefly by the Chinese who unite in companies for the purpose. The lands occupied are generally at a low elevation, for the commercial banana does not prosper, in most parts of Hawaii, above 1,000 feet, and it is important, with so bulky a product, to be near the shipping port or a connecting railway. Most of the bananas, therefore, are grown along the line of the railway which circles one end of Oahu, or in the immediate vicinity of Honolulu. The plants are set at distances varying from 8 by 8 feet to 12 by 12 feet and receive water by irrigation, by natural rainfall or by capillarity when the plants are grown on ridges thrown up in swamp-lands with wide canals between the ridges. The Chinese or Cavendish banana (*Musa Cavendishii*), almost exclusively, is grown for export, although the Jamaica or Martinique variety, common in all the American markets, has been introduced and distributed. There are many varieties of bananas that are indigenous to Hawaii, and some of these are being cultivated in yards and gardens. One class of these varieties, known as the Maoli group, is grown in a small way commercially and finds a ready sale in the local market as a banana for cooking. These, when well baked or fried, are far more delicious than any of the bananas found in the American markets and a trade in them should be developed, for they are well adapted for shipping.

Coffee-growing is conducted as a small industry and there are a few rather large plantations. About fifteen years ago the trees were planted quite extensively and it appeared as though the crop would be exceedingly profitable; but cheap coffee imported from Brazil depressed prices in the American markets to a degree which caused the uprooting or abandonment of most of the plantings. A few of the original planters continue in the business and produce a high grade of coffee which has made a good reputation. The name "Kona" coffee has been applied to much of the product because the district of Kona on the island of Hawaii is one of the leading coffee districts. The total output for the year ending August 15, 1911, was about 5,200,000 pounds. The coffee-growing districts lie chiefly above the cane in localities which are well supplied with rain, as along the northeast side of Hawaii and in Kona on the west side.

Citrous fruits are found in yards and gardens in many varieties of orange, lemon, lime, pomelo, shaddock and other species, but there are few citrous orchards. Seedling oranges are shipped to Honolulu, in fifty-gallon casks, from Kona, where they grow in a half-wild and uncultivated condition. A few limes are also sent to this market. The oranges are of excellent flavor but because of inferiority in appearance and packing they sell at low prices.

The avocado, sometimes erroneously called the alligator pear, is found in nearly every dooryard and garden and recently a few orchards have been planted. The fruit is always in demand and sells at high prices even in the local market, good fruits bringing from 8 to 15 cents each at retail or from 60 cents to $1 a dozen on the trees. Previous to the advent of the Mediterranean fruit-fly (*Ceratitis capitata*), avocados were shipped to California and in experiments conducted by the Hawaii Experiment Station, these fruits were sent in refrigeration to Chicago and arrived in good condition. They sold at wholesale in San Francisco for about $2.50 a dozen. Satisfactory methods of propagating the best varieties and of handling the fruit were completed only a short time before the Mediterranean fly made its appearance and interest was being manifested in the planting of orchards of avocados for the marketing of the fruit on the mainland. Although the insect infests the avocado very rarely, it has been found in a few instances, which fact has placed this fruit on the quarantine list at the California ports. For these reasons, the growing of avocados, which at one time seemed likely to develop into an important industry may not be widely extended until the status of the pest is changed. There is room, however, for considerable extension to supply the growing local market and the culinary departments of ocean liners.

The mango is even more widely distributed than the avocado and prospers in a great variety of soils up to 500 or 600 feet. It is found even higher than this but does its best in the warm and dry lowlands if irrigated. There are many varieties, including some superb sorts of local origin as well as the renowned East Indian kinds and Cochin-China type. Of the Indian varieties, the Pirie gives most promise, but several others, as Mulgoa, Alphonse, Jemshedi and Brindabani, have done well. The Smith and the Wooten are two of the best of local origin. None of these better varieties is widely disseminated, partly on account of their recent introduction and partly because ready methods of rapid multiplication have not long been developed. For this reason, it is impossible to find any choice mangoes in the local markets, the few that are sold being disposed of privately at about 5 cents a fruit. This condition will not continue for many years, for the choice sorts are now being disseminated. The mango also is under quarantine on the mainland because of the Mediterranean fruit-fly, but the best varieties could be profitably grown for the local markets and for supplies to passenger ships. Certain fine varieties are quite resistant to the attacks of the fly.

1987. A banana plantation in the Hawaiian Islands.

Guavas (*Psidium Guajava*) cover the hillsides, the jungles in many places being composed chiefly or wholly of this tree. The wild fruit is gathered and used in the making of guava-jelly and jam, the greater part of which is consumed locally. A few selected varieties of this species and of the strawberry guava (*P. Cattleianum*) are cultivated in gardens.

The papaya (*Carica Papaya*) is the most important breakfast fruit in Hawaii and is grown in almost every dooryard as well as in small orchards. It is of very easy culture, coming into bearing within a year from planting and continuing for several years to produce good fruit on almost any well-drained soil. For this reason it is a fruit for the rich and the poor alike. The tree is propagated chiefly by seeds and as there has been very little attempt to keep strains pure, there is a very wide variation in flavor and other qualities. The difficulty of keeping pure strains has been complicated by the fact that most papayas are diœcious and it is impossible to know the inherent qualities of the male trees. But fortunately there is a hermaphrodite type and with this there is hope of establishing reasonably stable varieties of good quality.

A great variety of tropical and semi-tropical fruits and nuts is to be found in these islands. A list of some of the more important of these is as follows:

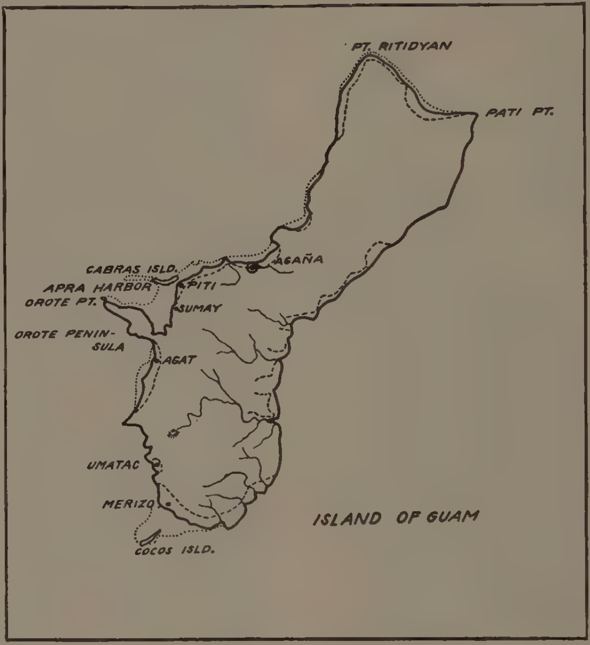
- Ananas sativus (pineapple).
- Artocarpus:
  - (*a*) Artocarpus incisa (bread-fruit).
  - (*b*) Artocarpus integrifolia (Jack-fruit).
- Annona:
  - (*a*) Annona muricata (soursop).
  - (*b*) Annona squamosa (sweet-sop or sugar-apple).
  - (*c*) Annona reticulata (custard-apple or bullock's heart).
  - (*d*) Annona Cherimola (cherimoya).
- Anacardium occidentale (cashew).
- Averrhoa Carambola (carambola).
- Ægle Marmelos (Bael fruit; elephant apple; or Bengal quince).
- Achras Sapota (sapodilla).
- Aleurites Moluccana (kukui nut).
- Areca Catechu (betelnut).
- Bunchosia sp.
- Citrus:
  - (*a*) Citrus sinensis (sweet orange).
  - (*b*) Citrus Aurantium var. Amara (sour or Seville orange).
  - (*c*) Citrus Limonia (lemon).
  - (*d*) Citrus sp. (rough lemon).
  - (*e*) Citrus aurantifolia (lime).
  - (*f*) Citrus grandis (pomelo or grapefruit).
  - (*g*) Citrus grandis (shaddock).
  - (*h*) Citrus nobilis (Mandarin orange).
  - (*i*) Citrus japonica ("China" orange, or kumquat).
  - (*j*) Citrus Medica var. genuina (citron).
  - (*k*) Citrus mitis (Calamondin orange).
- Canarium commune (pilinut).
- Carica:
  - (*a*) Carica Papaya (papaya).
  - (*b*) Carica quercifolia (dwarf papaya).
- Chrysophyllum Cainito (star-apple).
- Casimiroa edulis (white sapota).
- Coccoloba uvifera (shore-grape).
- Cocos nucifera (coconut).
- Cocos Gaertneri
- Claucena Lansium (the wampi).
- Diospyros decandra (Cochin-China persimmon).
- Durio zibethinus (durion).
- Eriobotrya japonica (loquat).
- Eugenia:
  - (*a*) Eugenia malaccensis (mountain apple).
  - (*b*) Eugenia Jambos (rose apple).
  - (*c*) Eugenia uniflora (Cayenne or Surinam cherry).
  - (*d*) Eugenia sp. (1, white water apple).
  - Eugenia sp. (2, red water apple).
  - (*e*) Eugenia myrtifolia (brush cherry).
  - (*f*) Eugenia Jambolana (black plum or jambolan plum).
- Ficus Carica.
- Garcinia:
  - (*a*) Garcinia Mangostana (mangosteen).
  - (*b*) Garcinia sp. (African mangosteen).
- Hibiscus Sabdariffa (roselle).
- Inocarpus edulis (mape, or Polynesian chestnut).
- Lucuma nervosa (egg-fruit).
- Malpighia glabra (Barbados cherry).
- Musa (banana):
  - (*a*) Musa Cavendishii (Chinese banana).
  - (*b*) Musa sapientum (including practically all other common edible bananas).
- Mangifera indica (mango).
- Mammea americana (mammee apple or St. Domingo apricot).
- Monstera deliciosa (delicious monster).
- Macadamia ternifolia (Australian nut).
- Morus alba (the mulberry).
- Morus nigra (the mulberry).
- Morus multicaulis (silkworm mulberry).
- Nephelium (genera Litchi and Euphoria):
  - (*a*) Nephelium Litchi (litchi).
  - (*b*) Nephelium Longana (longan).
- Noronhia emarginata.
- Olea europæa (olive).
- Persea gratissima (avocado).
- Passiflora (the passion flower fruits):
  - (*a*) Passiflora lauriflora (yellow water-lemon).
  - (*b*) Passiflora edulis (purple water-lemon).
  - (*c*) Passiflora quadrangularis (granadilla).
  - (*d*) Passiflora alata (granadilla).
- Psidium (guava).
  - (*a*) Psidium Guajava (sweet, sour, and lemon guavas).
  - (*b*) Psidium Cattleianum (strawberry guava).
- Phœnix dactylifera (dates).
- Punicum Granatum (pomegranate).
- Phyllanthus acida (Indian gooseberry).
- Phyllanthus Emblica (emblic myrobolan).
- Physalis peruviana (poha).
- Rubus Macraei (akala).
- Rubus hawaiiensis (Hawaiian wild raspberry).
- Spondias dulcis (Wii fruit, or Tahitian Vii apple).
- Terminalia Catappa ("Kamani" [foreign] tropical almond).
- Tamarindus indicus (tamarind).
- Theobroma Cacao (cacao).
- Vitis (grape: chiefly V. vinifera and V. labrusca).
- Vanilla planifolia (vanilla).
- Vaccinium reticulatum (ohelo).
- Zizyphus Jujuba (Jujube).

Vegetable-gardening is conducted chiefly by the Chinese and Japanese, who grow most of the more easily managed vegetables. Nearly all the vegetables found in the mainland markets can be grown in Hawaii, but some require special skill and a few demand an elevated location. All the cucurbits are difficult of culture except in isolated localities because of the prevalence of the melon fly (*Dacus cucurbitæ*), which also attacks less seriously tomatoes, peppers, and a few other vegetables. Sweet corn, peppers, and tomatoes were shipped experimentally to San Francisco as winter vegetables and realized good prices, but it was necessary to discontinue this trade because the melon fly had been found to some degree in each of these vegetables and is not known in California. Sweet potatoes, which are so easily grown here, have been shipped to San Francisco during the spring and early summer months, and early onions, chiefly of the Bermuda type. Both of these bring high prices, being easily grown in good quality for the opportune season in the market, and each may become the basis of a rather important trade if no insect or disease prevents its being shipped.

Taro (*Colocasia antiquorum* var. *esculentum*) furnishes the chief food of the native Hawaiians and is much used by foreigners also. It, therefore, requires a considerable area of land to supply the local market. There are many varieties of taro and some of the best succeed only under submerged conditions and for this reason, this crop, with rice, occupies most of the valley bottoms, where water can be led readily from the streams. Other varieties which succeed with less water are grown in moist lands where there is a heavy rainfall. Very few Hawaiians now engage in growing taro extensively, the industry being conducted chiefly by the Chinese. The plant has a large corm or rootstock and is propagated by cuttings from the top of this or of the smaller offsets. The crop matures in ten to fifteen months and the corm which is rich in a very easily digestible starch, furnishes most of the food, although the tender young leaves are also eaten. Taro is eaten as a vegetable and makes a good substitute for the potato, but its chief use is in the making of poi, the most important Hawaiian dish, which is prepared by crushing the steamed corm with stone pounders or more recently by American-made machinery. It is about the consistency of paste and is eaten after it has been allowed to ferment for a few days. Taro flour under various trade names has been placed upon the American markets.

Hawaii is a land of flowers, but many of the most beautiful blooms are on large trees and vines. Among the most striking of these are the royal poinciana (*Poinciana regia*), golden showers (*Cassia fistula*), pink showers (*Cassia grandis*), pink and white showers (*Cassia nodosa*), bougainvillæa, petrea, beaumontia, alamanda, bignonia, and plumeria. The night-blooming cereus flourishes and presents a magnificent sight when in flower. The old Hawaiian custom of bedecking guests at a feast or embarking friends at a departing vessel is still kept up, and it is one of the unique and beautiful scenes in Hawaii when a steamer engaged in the Honolulu-San Francisco run leaves the Hawaiian port, with all its passengers decorated with "leis" (pronounced lays) or wreaths of flowers. Until recent years, this constituted the chief market for cut-flowers. During the last eight or ten years a considerable cut-flower trade of the American type has grown up and there are several Americans now in the business and also a number of Japanese florists.

The city of Honolulu supports a number of small parks, containing some interesting and curious plants. In gardens, owned by private individuals, are many more rare and beautiful plants. The great Moanalua estate, the property of Samuel M. Damon, with its parks and gardens, is one of the most interesting places of Honolulu for the admirer of plants, and no plant-lover should pass by the islands without visiting these grounds, which are traversed by the public road and thus generously made available to all who are interested. Another strikingly beautiful sight which no one who is in Honolulu at the right time should fail to see, is the 1,000 feet or more of night-blooming cereus at the Oahu College grounds. The exact seasons of flowering are impossible to predict, but there is usually a grand display for several nights in May or June and again in August or September.



1988. The island of Guam.

Literature.—The literature of horticulture in Hawaii is limited. The only book devoted exclusively to the subject is "Fruits of the Hawaiian Islands," by G. P. Wilder, Hawaiian Gazette Company, Ltd., Honolulu. The bulletins and reports of the horticultural department of the Hawaii Experiment Station cover a part of the field and are as follows: "The Banana in Hawaii," Bulletin No. 7; "Citrus Fruits in Hawaii," Bulletin No. 9; "The Mango in Hawaii," Bulletin No. 12; "Marketing Hawaiian Fruits," Bulletin No. 14; "Shield-budding the Mango," Bulletin No. 20; "The Avocado in Hawaii," Bulletin No. 25; "Fruit-marketing Investigations in 1907," Press Bulletin No. 21; "Pineapple Shipping Experiments in 1908," Press Bulletin, No. 22; "The Pineapple in Hawaii," Press Bulletin No. 36; Annual Reports 1901 to date. See also "Index to Publications of the Hawaii Agricultural Experiment Station, July 1, 1901 to December 31, 1911." Numerous references to horticultural subjects are to be found in "The Hawaiian Forester and Agriculturist," the "Paradise of the Pacific," "The Mid-Pacific Magazine," and other periodicals.

J. E. Higgins.

Guam.

The island of Guam (Fig. 1988), belonging to the group of islands known as the Ladrones or Marianas, lies in the Pacific Ocean between the parallels 13° 14′ and 13° 40′ north of the equator, and between the meridians 144° 37′ and 144° 56′ east of Greenwich. A line drawn almost due west from Guam strikes, at a distance of about 1,200 miles, the San Bernardino Passage dividing the island of Samar from the southern extremity of Luzon and marks the relative position of Guam and the Philippine Archipelago. Of the fourteen islands composing the Mariana group, Guam is the largest and its position the most southerly. It is of historic interest as the first stopping place of Magellan after passing beyond the South American coast on that remarkable voyage of exploration for the Spanish crown in 1521. The island did not, however, assume a place of special interest in the minds of the American public until the year 1898 when, by the provisions of the treaty of Paris concluding peace between the United States and Spain, it became territory of the United States.

Guam has a warm and humid climate. The temperature is remarkably equable throughout the year; and no physical or other influences exist to cause perceptible variation in temperature in different parts of the island. Absolute temperatures seldom rise above 95° F. in the heat of the day or fall below 70° F. at night. The average annual rainfall is in the vicinity of 120 inches; and a very large percentage of the yearly precipitation occurs during the period from July to November inclusive. During the remainder of the year rainfall is erratic and uncertain. The climatic factor most potent in retarding horticultural progress is the occasional furious hurricanes or typhoons. These storms occur more or less frequently and sometimes with such sweeping force as to leave the island vegetation almost completely devastated of all its foliage.

The northern portion of the island is an inclined forest-covered plateau, rising from near sea-level at a point a short distance north of Agaña to an elevation of some 500 or 600 feet at the northern extremity of the island and to an almost equal elevation along the east coast. The soil of this plateau is of coral derivation and at many points is underlaid with partially disintegrated coral limestone covered at many points with but a few inches of soil. This territory is well drained and has a fertile soil usually well adapted to the cultivation of horticultural products. On it coffee grows luxuriantly and yields abundant crops of berries of a specially superior flavor. Cacao (*Theobroma Cacao*), producing the so-called chocolate bean of commerce, was grown in this district with much success prior to the severe typhoon that ruined the plantations in 1900. The lack of fresh water streams or other domestic water-supply prevents the rapid development of this district. The remaining portion of the island lying south of Agaña has a rolling contour and is traversed by numerous river valleys made fertile by sediment deposited from the surrounding hills. These valleys afford favorable conditions for the cultivation of coconuts and many of the tropical fruits. Constant and heavy rains during the period of excessive rainfall have leached the hill lands, rendering them of little value for horticultural purposes. The island's highest elevation is found in the peak "Humuyong Manglo," signifying "the mountain whence the winds issue." This peak is located in the southwestern part of the island and reaches an altitude of 1,274 feet. A strip of strand, varying in width but usually under a mile in extent, fringes a greater part of the coast-line. The soil of this low land has been formed partially from the washings and erosions from the surrounding hills and partially from shell, calcareous sands, and the like, of marine formation. Due to the fertility of this soil and to its proximity to the sea which furnishes fish and transportation facilities for the exchange of supplies between the different parts of the island, all the principal villages have been established here, and here also horticulture is more extensively practised than in any other part of the island.

The advantages of a well-defined economic system, involving the principles of labor-division as practised in modern enlightened communities, are unrecognized in Guam. In general, every man is his own fisherman, his own tradesman, and husbandman of the trees and plants required to feed his own family. The local market demands under such a system are decidedly limited; and the tendency is naturally in the direction of small plantings and indifference toward the improvement of varieties and methods of cultivation. There are neither nurseries nor seed farms on the island. Plants of the banana, pineapple, and the like, grow from suckers, but aside from those species which propagate naturally, the fruits trees are the simple result from chance seedlings voluntarily produced from discarded seed, with but little effort being made to foster or preserve them. The practice of perpetuating superior forms by the various methods of asexual propagation is unknown to the Guam planter.

Agricultural implements are of the crudest and most antiquated type. The native plow is an awkward home-made wooden contrivance with a single handle and a rough cast moldboard and point. It is drawn by a water buffalo and tears and thrusts aside the soil, leaving a ragged furrow about 4 inches wide. A man with a buffalo and one of these implements, working on an eight-hour-day basis, will require at least five days to plow in a most ineffectual manner 1 acre of land. In addition to the plow, a simple little hand tool, the fosiño, on the principle and of the construction of a scuffle-hoe, is the only implement in common use for tilling the soil.

Regardless, however, of the primitive methods of the people, Guam is essentially a land of agriculture. It has no other possible natural resource. With a moderately fertile soil and a climate permitting the planting and harvesting of crops during 365 days of the year, the island is a garden specially created for the farmer. How rapidly the development of the agricultural industries may come, or how remote the time when the full possibilities of the island may be achieved, is a matter of mere conjecture, but the absolute necessity of improvement is daily becoming more manifest. Education is rapidly creating a higher and more expensive standard of living and this increased expense must be balanced by correspondingly augmented production from the soil. Lack of shipping facilities has seriously impeded progress in horticultural lines and until improvement is brought about there is little to encourage the establishment of the fresh fruit industry upon a commercial basis. Products for export must necessarily be limited to such of the less perishable crops as coconuts, coffee, and cacao, and to articles preserved by some of the various methods, of which pickling, bottling, canning, and evaporation are examples.

The coconut (*Cocos nucifera*) was found growing in Guam at the time of the discovery by the Spaniards. Safford observes that "the first accurate description of the coconut was published by Dampier from observations made by him in Guam in 1686." This is the most important product of the island, copra, the dried kernel of the nut from which the coconut-oil of commerce is expressed, constituting the only article of export. The nut is also variously used in cookery, and furnishes one of the principal feeds for both poultry and hogs. Aside from the nut itself, the leaf is split through the midrib from the terminal end and the pinnæ of each plaited together, forming from each frond two crude but effective shingles for thatching the roofs of buildings. The fact that probably 95 per cent of the dwellings in Guam are thatched with this material indicates the extent to which the leaves are used for this purpose. Toddy, a popular beverage, non-intoxicating when first drawn, is collected from an incision in the flower-stalk; and this, by the process of boiling, is converted into syrup, and, by a further continuation of the process, sugar is obtained. Fermented toddy is an intoxicant and is extensively employed in lieu of yeast in making bread. It is also used in the preparation of vinegar or, by distillation, a highly alcoholic liquor, known as "aguardiente," is produced.

The native devotes but little attention to his trees; yet natural conditions are favorable, and the trees flourish and yield good crops regardless of neglect. Bud-rot has not made its appearance on the island. Cattle running at large cropping off the young trees, and rats which gnaw off the young immature nuts, are, as a matter of fact, the only serious enemies of the plantation. In Guam, crops are gathered to a limited extent during all seasons of the year, but the general tendency is to confine pickings as much as possible to the dry season, when weather conditions facilitating the process of air-drying the copra usually prevail. Drying with artificial heat is never practised. That part of the output going to the export trade is disposed of to Japanese traders who ship by sailing schooners to Yokohama where the oil is expressed and the residual meal employed to increase fertility of Japanese gardens. To give some idea of the importance of the industry, the following custom-house records covering the exports for the annual periods ending June 30, for the past three years are given:

Period	Tons	Value
1909–10	534.5	$33,610.11
1910–11	870.5	51,058.80
1911–12	1047.0	59,924.10

Fruit of bananas and plantains, Musa species, grow in rich profusion everywhere and form an important food staple of the people. Plantations are not established systematically and are confined to small areas of land contiguous to the home. Total neglect of the plantation is common and when cultivation is at all practised it consists of the occasional removal of weeds and grasses and the application of this organic matter and a small amount of surface soil about the base of the plants. This mulch of soil and litter serves two purposes, according to the season of its application. In hot dry weather it cools the soil and assists in the conservation of moisture, and in the season of heavy rainfall its rapid decomposition adds fertility to the root-feeding areas of the soil.

Among the forms common in Guam, the Chinese dwarf or Cavendish banana (*Musa Cavendishii*), known in the vernacular of Guam as chotda Guahu (the Oahu banana), is the only well-known commercial variety. It is of comparatively recent introduction and is not well distributed. Chotda Dedos (the finger banana) is so named from the long slender form of the fruit, lending a fancied resemblance to the fingers on a human hand. Chotda Haya (pronounced hadya—signifying native or unintroduced banana) is supposed to have been the earliest form cultivated on the island. Chotda Dama is similar and possibly identical to the variety "Gloria" of the Philippines, which Blanco refers to *M. paradisiaca ternatensis.* Chotda Manila (*M. paradisiaca cinerea*) has been introduced from the Philippines, where it is known as Letondal or Latendan. This variety, though inferior in flavor and subject to cracking and dropping from the bunch when ripe, is a heavy-yielding sort and consequently a most popular one. Probably 75 per cent of the bananas annually produced on the island are of this variety. Chotda tanduque (*M. paradisiaca magna*), a favorite fruit of the plantain type, eaten both cooked and uncooked, is also of Philippine introduction. Other good varieties of recent introduction which may be expected to assume leading places in the future are, the Bungulan (*M. paradisiaca suaveolens*), the Lacatan (*M. paradisiaca lacatan*), from the Philippines, and the Brazilian banana from the Hawaiian Islands. The Jamaica or Bluefields banana was introduced into Guam during the fiscal year 1912 by the United States Department of Agriculture.

1989. A native hut in Guam; roof thatched with coconut leaves. Sour-sop (Annona muricata) in left foreground

The leaves and false stem of the banana are relished by cattle and after maturing their fruit these constitute a valuable by-product.

Breadfruit (*Artocarpus incisa*) grows in great luxuriance in the warm humid climate of Guam, and it is probably nowhere more abundant or more highly esteemed. Uncultivated and uncared for, the copious supply of nutritious food which it yields during its long fruiting season from June to December is wholly a gift of Nature. Both the seed-bearing variety and the more highly improved seedless form of *A. incisa* exist in extensive forests. The breadfruit is not a commercial article, yet the important part which it plays in the domestic economy of the people renders it worthy of mention in a work of this character. In addition to the value of the fruit for human food, the immature fruits are fed to cattle and hogs and the ripe fruit also constitutes a most valuable hog-feed. The leaves of the breadfruit tree are largely employed as a fodder for cattle and the fondness shown for them by the native cattle is not acquired; for cows imported from the United States manifest an equal relish for them at the first feeding. In this connection the necessity of providing the young plants with protection from cattle is indicated.

The coffee shrub (*Coffea arabica*), and to a more limited extent the Liberian species (*C. liberica*), are successfully grown, and especially is this true in the district of Yigo in the northern part of the island and at Sinahaña situated on an elevation south of Agana. It is said that during the latter part of the Spanish régime when direct shipping means existed between Guam and Manila, an export trade of considerable importance was enjoyed and that the Guam product was recognized for its superior quality. Coffee is now more sparingly grown than in former times and within the past few years the output has not been sufficient to supply the home demand. The absence from Guam of the coffee fungus, *Hemileia vastatrix*, so widely distributed throughout the Old World Tropics and so destructive to the coffee industry wherever it exists is both interesting and significant. Aside from field-rats, which feed upon the sweet pulp, dropping the naked berry to the ground, there are no serious pests to contend with in Guam. Even with the limited acreage adaptable to coffee-culture, the industry is entirely capable of development to the extent of not only supplying the home demand but also of furnishing a considerable surplus for export.

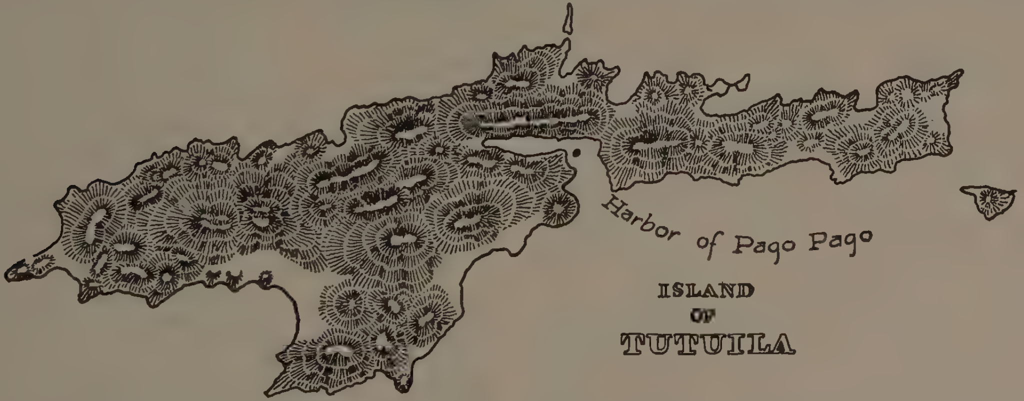
The mango (*Mangifera indica*), a most delicious tropical fruit, is grown in Guam in two races, both of which come true to seed, or at least practically so, and are propagated only by that method. The "Guam mango" is of medium size, contains but little fiber and is free from the disagreeable taste of turpentine, common to some of the inferior varieties, when it is properly ripened. It is identical with the common "Carabao" mango of the Philippines. In the quality of its fruit this variety is superior, but on the island of Guam it possesses the disadvantages of light and irregular bearing-habits. Another feature in the cultivation of this species that tends to discourage planting is the fact that trees require from twelve to twenty years to grow from the seed to a state of production. Owing to these habits of slow development and light yields, the supply of mangoes is insufficient to meet the demand for them and the same conditions create an ever-ready market-price of 5 to 10 cents United States currency for a fruit. Large trees claimed to be more than 100 years old, measuring as much as 9 feet in circumference of the trunk and from 50 to 60 feet in top diameter, are common.

The "Saipan mango" introduced from the island of that name, now seat of the German government in the Marianas, is a small fruit weighing about four ounces. It is full of a coarse fiber and is inferior in flavor. The tree of this variety is of comparatively small dimensions, comes into bearing in four to seven years from the seed, and is a regular and heavy bearer. As a fruit this race is of little importance, but as a stock upon which to inarch the "Guam mango" it should prove valuable, as its less vigorous root-system should result in dwarfing the tree of the Guam variety and in rendering it more prolific.

In addition to the more important fruits noted above, others of more or less value abound in great variety. Lemons and limes of fair quality and oranges of an inferior grade are plentiful. The bullock's-heart (*Annona reticulata*) grows spontaneously, and the sour-sop (*A. muricata*) and sweet-sop (*A. squamosa*) are common fruits. The papaya (*Carica Papaya*), in a degenerate form, has escaped from cultivation and grows in great profusion throughout the island. Excellent papayas are grown from introduced seed of improved forms, but hybridization between these and the native papayas results in a reduction in the size of the fruit with each successive generation. When careful methods of hand pollination are not practised, the use of introduced seeds of the best improved varieties is found essential to best results. The avocado (*Persea gratissima*) has been introduced since the establishment of American government on the island and the remarkable vigor and heavy yields of a few trees indicate a bright future for this new fruit. Pineapples, small in size and of fair quality, are found in neglected plantings. The United States Department of Agriculture has introduced plants of the Smooth Cayenne pineapple, which promises great improvement over the native variety. The sapodilla (*Achras Sapota*), the cashew (*Anacardium occidentale*), the carambola (*Averrhoa Carambola*), the Otaheite apple (*Eugenia malaccensis*), the guava (*Psidium Guajava*), and the tamarind (*Tamarindus indica*), are all listed in the catalogue of island fruits.

A discussion on vegetable-gardening in Guam must essentially treat of possibilities rather than of achievements. Gardening is practised to a very limited extent and in accordance with the most antiquated methods. Among the most common temperate-zone vegetables, tomatoes, potatoes, cabbage, sweet corn, and garden peas are not successful. Beans in wide variety of types, radishes, lettuce, okra, eggplants, peppers, cucumbers, muskmelons, and watermelons are all successfully produced. Important rootcrops, handled more as field than garden products, are yams, taro, and sweet potatoes. The most important food staple cultivated on the island is maize. Rice was formerly grown extensively, but now nearly all the rice consumed on the island is imported. Tobacco is also successfully cultivated by the natives. Peanuts are common and are grown entirely from vine cuttings. The difficulty of preserving the vitality of many of the common garden seeds in the warm humid climate of Guam is one of the principal causes of the present indifferent attitude shown by the native farmer toward the cultivation of the vegetable-garden.

A few species of valuable tropical hardwoods are found in the forests of Guam but owing to extravagant and wasteful cuttings, the better grades of timber are becoming comparatively scarce. Among the most important of these species, *Afzelia bijuga*, known in Guam as "ifit," is extensively used for general construction purposes and as a cabinet-wood. *Calophyllum inophyllum*, generally designated as "palo maria," is usually employed in cabinet-work and the construction of cart wheels. *Claoxylon marianum*, the "panao" of the Chamorro, is specially valued for flooring purposes. *Heritiera littoralis*, called "ufa," is utilized in making plow-beams, while *Ochrocarpos obovalis* and *Premna Gaudichaudii*, known respectively as "chopag" and "ahgao" are extensively employed in the construction of buildings.



1990. Tutuila.

A systematic flora of the island has recently been published by E. D. Merrill ("An Enumeration of the Plants of Guam," Philippine Journ. Science, Vol. IX, 1914). Merrill points out the affinity of the Guam flora with that of the Malayan region, practically all the indigenous genera being of wide Indo-Malayan distribution. The nearest approach to an endemic genus is Saffordiella, which also is found on the island of Yap. Among the new orchids described by Ames are species of Bulbophyllum, Liparis, Eulophia, Phrætia, Cœlogyne, Saccolobium, and Dendrobium. Among the conspicuous forest trees, Merrill describes several banyans, the sacred nunus of the natives, *Ficus mariannensis* and *F. Saffordii;* the yoga, *Elæocarpus joga*, a lofty tree with buttressed trunk and clusters of bluish grape-like fruit; a new almendra, or talisai, *Terminalia Saffordii*, with edible almond-like fruit; and several species of Eugenia. He also describes several new shrubs, among them, *Macaranga Thompsonii* and *Phyllanthus Saffordii*, belonging to the Euphorbiaceæ; *Grewia mariannensis*, closely allied to the Polynesian *G. malococca;* a number of Rubiaceæ, including species of Hedyotis, Morinda, Oldenlandia, Psychotria, and Tarenna; and *Discocalyx megacarpa*, a plant with erect habit, glossy green leaves, and bright red berries.

For further information on the horticulture of Guam, see "The Useful Plants of Guam," by Safford, and the Annual Reports of the Guam Agricultural Experiment Station.

J. B. Thompson.

Tutuila.

The most important island of American Samoa (Fig. 1990) is situated about 4,200 miles southwest of San Francisco in latitude 14° 20′ south and longitude about 170° 40′ west of Greenwich. Although smaller than the German islands, Savaii and Upolu, lying to the westward, it is more important strategically on account of its remarkable natural land-locked harbor, Pago-Pago, the precipitous walls of which afford safety to an entire squadron even during the violent hurricanes which sometimes sweep the group. Tutuila has an area of about 54 square miles, with a population of nearly 4,000 inhabitants. Like other islands of the group, it is volcanic with barrier coral reefs surrounding it. The forest-clad mountains rise to a height of about 3,000 feet. Several other neighboring islands belonging to the United States have a combined area of not more than 25 square miles and a population of 2,000 inhabitants. The group known as Manua, lying a degree to the eastward of Tutuila, is composed of the small islands Tau, Ofu, and Olosenga, the first formed like a great mole-hill, the other two rising precipitously from the sea. Rose Island, lying 70 miles to the eastward, is a typical coral atoll almost circular in shape.

The islands are swept almost continually by the trade-winds, and there is abundant rainfall. The climate is healthful, the volcanic soil quickly arbsorbing the precipitated moisture. December, the warmest month, has a mean temperature of about 87° F.; July, the coolest month, a mean temperature of about 78° F.

American Samoa is governed by an officer of the United States Navy, detailed by the Secretary of the Navy. The wisdom of the government in dealing with the natives is shown by its methods of administration. Ancient Samoan customs are followed as closely as possible. The villages choose their own chiefs from those who have hereditary rights to the position, subject to the governor's approval. The villages are grouped into counties ruled by high chiefs and the counties are grouped into three great districts, Eastern Tutuila, Western Tutuila, and the District of Manu'a, each of which has at its head a chief appointed by the governor. The customs officer is a naval officer and the health department is under a medical officer of the Navy, who has charge of the island dispensary and the hospital, or sick quarters, of the station. At the end of each year there is held a general fono, or assembly to which all parts of the islands send delegates. In this assembly matters of general interest are discussed, new laws recommended, complaints and suggestions are listened to, laws are explained, and information given regarding all matters affecting the welfare of the natives and the administration. Suffrage is restricted to the heads of families (matais) in accordance with Samoan custom, the family and not the individual being considered the unit of society.

1991. Samoan dwelling thatched with sugar-cane leaves, with side blinds of coconut-leaf mats, on the sloping shore of Pago-Pago Bay, Island of Tutuila. Surrounding vegetation: bananas, coconut palms, breadfruit tree, and 'ava pepper (Piper methysticum), a large mango tree in the distance.

There are no public lands in American Samoa. Even the land occupied by the Naval Station was acquired from the native owners by purchase. A few small tracts are owned by foreigners, who acquired their titles before the American occupation. Only one plantation is owned by a white man, and he is connected by marriage with one of the highest chiefs of Samoa. On his plantation in a valley on the north side of Tutuila, he has planted coconut trees, rubber, cacao, and a small amount of coffee. On account of the small amount of arable land there is no opportunity for Americans to become planters in these islands.

The only product of commercial importance is copra, the dried meat of the coconut. All the beaches are fringed with coconut palms. At the mouths of streams where the water is brackish, there are mangrove thickets composed chiefly of Rhizophora and Bruguiera. Surrounding the thatched huts of the natives are many ornamental plants, including *Hibiscus rosa-sinensis*, the beloved aute of the natives, who adorn themselves with its bright red flowers; trees of the fragrant *Canangium odoratum*, here called "moso'oi," from the flowers of which the natives make garlands and prepare a scented oil for anointing their bodies; clumps of pandanus, from the leaves of which they weave their mats; ironwood (*Casuarina equisetifolia*) called "toa," from the trunks of which they make spears and war-clubs; *Piper methysticum* from the roots of which they prepare their national drink called "'ava;" and nearby are usually clumps of bananas and plantains; patches of taro (*Colocasia antiquorum* var. *esculenta*) the starchy roots of which form one of their most important food staples; trees of breadfruit (*Artocarpus incisa*) magnificent mango trees; the Polynesian "chestnut" (*Inocarpus edulis*), called "ifi;" several varieties of yams (Dioscoreæ) the paper mulberry (*Broussonetia papyrifera*), from the inner bark of which the women make bark-cloth, the widely spread *Hibiscus tiliaceus*, here called "fau," from the bark of which they make cordage; urticaceous plants, fau-songa (*Pipturus argenteus*) and fau-pata (*Cypholophus macrocephalus*), from the fiber of which they make their shaggy mats and their fishing nets; dracæna-like *Cordyline terminalis*, here called "ti," from the leaves of which they make skirts worn while fishing on the reef; besides many other interesting and useful plants.

Though much of the island is too steep for cultivation, every foot of the soil near the coast seems to yield useful plant products, and edible sea-weeds are secured from the shallow lagoons between the shore and the surrounding reefs.

The slopes of the mountains as well as the valleys are covered with rich humus formed principally by the decay of vegetable matter together with a slight proportion of decomposed volcanic rock. Nearly all tropical plants which have been tried have been grown successfully. Oranges, grapefruit, lemons, limes, citrons, the mango, alligator pear (aguacate, or avocado), papaya, pineapple, are among the introduced fruits. The citrous fruits are subject to scale. The lemons are mostly thick-skinned and of inferior quality. Bananas of many varieties are cultivated, each family having a banana-patch for its own use. Certain varieties are allowed to ripen and eaten raw, while others are gathered immature, before the starch has turned to sugar, and are cooked as a vegetable. The varieties growing in Samoa before its discovery are known as "fa'i Samoa," while those introduced by the whites are called "fa'i papalangi." Banana leaves are used for table-cloths, umbrellas, wrapping-paper (with the mid-rib removed), improvised hats (when it rains), and, when dried, for cigarette wrappers. In addition to the cultivated species there is a wild banana in the mountains, called "soa'a" (*Musa Fe’i*, Bart.), which yields a black dye. Of this species which bears its fruit in an erect raceme, the natives have a story telling of a battle between the soa'a and the fa'i. The soa'a was victorious and ever since it has kept its head erect, while the conquered fa'i is compelled to bow its head earthward as a token of its humiliation.

Several varieties of taro (*Colocasia antiquorum* var. *esculenta*) are cultivated, some of them in marshy places, others in clearings made in the forest. On the island of Tutuila there is not much marsh taro in comparison with upland taro. The latter is usually planted in virgin soil in holes made by a digging-stick. Very little care is afterward bestowed upon it except to keep the patches weeded. Marsh taro requires a constant supply of fresh water. The starchy roots must be thoroughly baked to destroy their acridity, which, like that of our Indian turnip, is caused by minute needles of oxalate of calcium (raphides). Closely allied to the taro is the giant taro, *Alocasia macrorhiza*, called "ta' amu" by the Samoans. Several kinds of ta'amu occur in Samoa, all of which are probably varieties of *A. macrorhiza*. They are propagated like upland taro. The roots, which sometimes reach a great size, in times of scarcity are an important food staple. The enormous satiny leaves are used for covering the native ovens. The young leaves of taro are cooked in various ways as a vegetable. One of the most agreeable dishes, called "palusami," is composed of the expressed cream of grated coconut meat combined with young taro leaves and a little salt water wrapped in an outer covering of leaves and baked in a native oven. The fermented paste made from taro known in the Hawaiian Islands as "poi" is unknown in Samoa.

Yams (*Dioscorea Batatas*), called "ufi" by the Samoans, resemble the forms known on the island of Guam as "dago." The tubers often grow to an enormous size. The plants are propagated by cuttings, each of which must possess an eye or bud from which the new plant springs. The plantations are made in clearings in the woods, stones are laid around the young plants and stakes are placed for the plants to climb upon. In about six months after planting the tubers are ready for food. As the propagation and gathering of yams are more difficult than in the case of taro, they are not so extensively grown, though they thrive well and are well liked by the natives.

Tacca pinnatifida, Forst., called "masoa" by the Samoans and commonly known as "Polynesian arrowroot," yields an excellent starch, which is used principally for pasting together the filmy beaten bast of the paper mulberry in making bark-cloth (siapo). It is also an article of food and is sometimes prepared with coconut custard in the form of dumplings or puddings. In Tahiti the natives braid beautiful hats from the epidermis of the flower-scapes and petioles of this plant. As with the yams, the tubers are mature when the plants die down. When fresh they are bitter. The starch is prepared by grating the tubers to a fine pulp which is put into a vessel of water. This becomes milky and the solid particles are removed by straining. After standing for some time, the starch settles and the clear liquid is poured off. This plant grows spontaneously in Samoa, but it is sometimes cultivated.

Rice is not cultivated. Though it was introduced into the island of Guam before the discovery of that island by Europeans, it was entirely unknown to the ancient Polynesians of the central and eastern Pacific.

The breadfruit (*Artocarpus incisa*) is planted about every village. It grows in the form of a symmetrical tree with spreading top. Its curved limbs furnish the Samoans with rafters for the roofs of their best houses; the viscid milky latex is used by them for many purposes; and the large lobed leaves are eaten with relish by all herbivorous animals. The fruit, gathered before it is quite ripe, is prepared for food in a variety of ways. It is often eaten with pork, fish, or fowl, sometimes with a sauce of cooked custard expressed from grated coconut meat; or in the form of dumplings cooked in this custard. As the breadfruit season is limited, quantities of the fruit are placed in pits and allowed to ferment, somewhat after the manner of sauer-kraut. Though the fermented substance has a very offensive smell, it is nutritious, and is made into cakes and baked. "Masi," the name of these cakes, is now a general term applied to all kinds of biscuits and crackers. The trees are propagated from suckers, to which a portion of a root of the parent plant is left attached. The young trees grow rapidly and in three or four years bear fruit.

The Polynesian "chestnut" (*Inocarpus edulis*) is a magnificent forest tree belonging to the Leguminosæ. Its fruit roasted in the shell has somewhat the taste of chestnuts and is much eaten by the Samoans. Its wood is hard and durable, of fine texture and very tough. It has the remarkable quality of burning readily while green.

Sugar-cane is grown to some extent. It has been grown by the Samoans from prehistoric times, but not for commercial purposes. No sugar is made on the island. The cane is relished especially by the children, who suck its sweet juice. Its principal use is in furnishing an excellent durable thatch for the houses of the natives.

Tobacco is grown in small quantities very much after the fashion pursued in other countries, first in seed-beds, then transplanted. It is consumed by the natives, both male and female, in the form of cigarettes wrapped with dry banana leaves.

Piper methysticum, called "kava" in some parts of Polynesia and "'ava" in Samoa, is extensively grown for the sake of the narcotic infusion prepared from its root. This is prepared with great ceremony in the presence of the chief or head of a family by young girls. In former times, the root was first chewed and then placed in the wooden bowl in the form of quids upon which cold water was poured from a coconut water-bottle; but now the root is rasped on an improvised grater made by puncturing holes in a sheet of tin. The infusion is not allowed to ferment but is drunk fresh, each person present partaking of it in succession in the order of his rank. 'Ava-drinking in Samoa is never indulged in so extensively as to become a vice, but the beverage is a wholesome and refreshing stimulant. 'Ava takes the place in Samoa of the betel pepper (*Piper Betel*) of the Philippines and the island of Guam, the leaves of which are chewed with areca nut and a little lime. The latter has never found its way into eastern Polynesia.

In the woods there are valuable hardwood trees, many of which are clothed with epiphytal orchids, lycopods, and ferns, and the slopes of the mountains yield rich returns to the botanist in rare ferns and other plants, especially graceful tree-ferns.

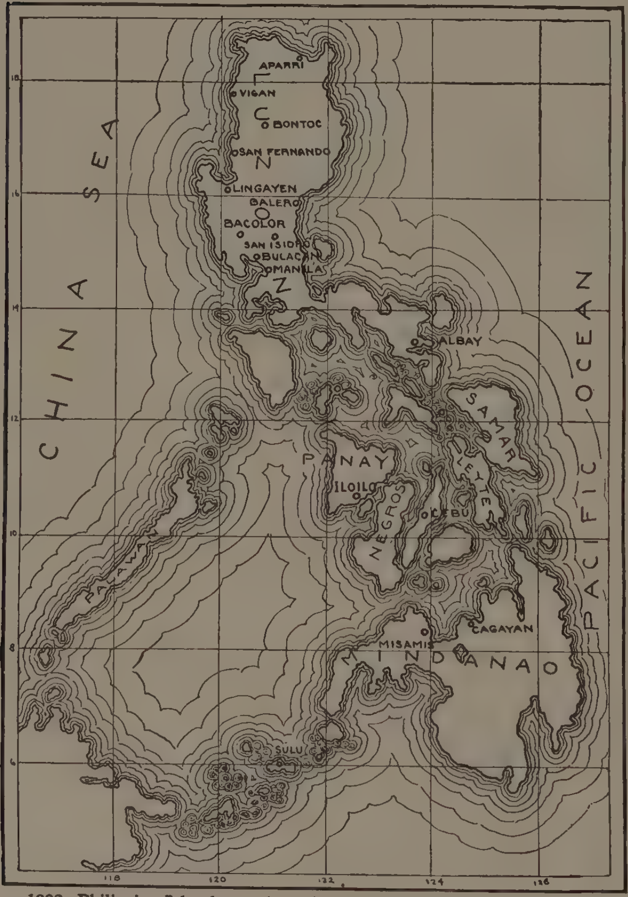
In the vicinity of Pago-Pago the most common trees are the fau (*Hibiscus tiliaceus*); milo (*Thespesia populnea*); lama, or candle-nut (*Aleurites moluccana*) called "kukui" in the Hawaiian Islands; toi (*Alphitonia excelsa*); tavai (*Rhus simarubæfolia*); masame (*Antidesma sphærocarpum*); tamanu, a species of Maba; and fetau (*Calophyllum inophyllum*). The futu (*Barringtonia speciosa*), a beautiful tree with glossy leaves and white flowers with crimson stamens, bears a peculiar four-angled fruit which is used in Samoa, as in Guam, for stupefying fish in tide pools on the coral reefs. The appearance of the red blossoms (aloalo) of the ngatæ (*Erythrina indica*) marks an epoch in the Samoan calendar. The ifilele, which is identical with the valuable ipil of Guam (*Intsia bijuga*), is prized for its durable hard wood, and is much used for house posts. The fragrant flowers of the langaali (*Aglaia edulis*), like those of *Canangium odoratum*, are used to scent the coconut-oil with which the natives anoint themselves. The fruit of the vi (*Spondias dulcis*) is highly prized by the natives and that of the nonu-fiafia (*Eugenia malaccensis*) is also eaten. The giant banyans (Ficus sp.), rising like great hillocks above the general level of the forests and remarkable for their numerous aërial prop-like roots, are regarded by the Samoans to be the dwellings of spirits (*aitu*). The Samoans have legends and songs regarding many of their forest trees and shrubs, one of which called "The Battle between the Trees and Stones" is translated by Augustin Kraemer in his monumental work, "Die Samoa-Inseln" (Vol. I, p. 361, 1902), to which the reader is referred. See also "American Samoa," a general report by Governor W. M. Crose, dated June 22, 1912, Washington 1913; and F. Reinecke's "Flora der Samoa-Inseln," Engl. Bot. Jahrb., Vols. 23 and 25, 1897, 1898.

W. E. Safford.

Philippine Islands.

The Philippines (Fig. 1992), lying between the Pacific and the China Sea, extend almost due north and south from Formosa to Borneo and the Moluccas, and cover about 700 miles of longitude and 1,000 miles of latitude (from 4.40° to 20° north latitude, and 116.40° to 126.30° east longitude). The archipelago comprises 3,141 islands, having a total area of 127,853 square miles, and has a population of above 8,000,000 inhabitants. The largest islands are Luzon, with an area of 40,969 and Mindanao with 36,292 square miles.

The Philippines are of volcanic origin and in consequence the topography of the archipelago is characterized by a broken surface and more or less rugged mountains in all islands of any importance. Between the mountain ranges and on the banks of some of the largest rivers lie several rich, level valleys awaiting the advent of the cultivator, areas which are eminently suited for the cultivation of rice, corn, sugar, tobacco, hemp, and coconuts. The principal plains are found in Isabela and Cagayan Provinces, watered by the Cagayan River; in Tarlac and Pangasinan, watered by the Agno; and in Nueva Ecija and Pampanga, through which flows the Pampanga. The Cottabato Valley in the Moro Province is irrigated by the Mindanao River. The interior of Mindanao, from the mountain ranges east of the Agusan River to Lake Lanao in the west, consists of a remarkable series of level tablelands of great fertility between the mountains and cañons at an elevation ranging from 1,000 to here and there exceeding 2,500 feet.



1992. Philippine Islands, to show the general form of the archipelago.

The climate is remarkably mild and free from extremes, though there is considerable variation in temperature due to altitude. The Weather Bureau of the Philippines distinguishes three types of climate peculiar to the Philippines: (1) That of Sorsogon, Albay, Ambos Camarines, Catanduanes, and adjacent islands, the eastern coast of Luzon from the seashore to the mountains in Tayabas, eastern Isabela, and Cagayan, the north and east coast of Samar, the east and north coast of Mindanao and adjacent islands, the valley of the Agusan River, and the east coast of Leyte; this climate is characterized by an average rainfall of 3,090 millimeters, well distributed throughout the year, mean temperature 79.8° F., lowest recorded temperature, 62.4° F., highest 110.3° F., the greatest rainfall being in December, and the least in May, June, and July. (2) That of the provinces of Batangas, Bataan, Ilocos Norte, Ilocos Sur, Zambales, Union, Rizal, Western Bulacan, Pampanga, Nueva Ecija, Tarlac, Pangasinan, the west coast of Panay, Mindoro and Mindanao, with an average rainfall of 2,120 millimeters, falling mainly from May to October with a distinctly dry season during December, January, February, March and April; mean temperature 80.5° F., highest recorded temperature 103.1° F., lowest 57.7° F. (3) That of the extreme north of Luzon, including the Cagayan Valley and the Batanes Islands, the shores of Laguna de Bay, the west coasts of Samar, and Leyte, the north and east coasts of Panay, Negros, Cebu and Bohol, Davao Gulf and the south end of the Zamboanga Peninsula; annual rainfall 1,882 millimeters, falling mainly from September to January, with a short dry season in February, March, and April, mean temperature 79.7° F., highest recorded temperature 100° F., lowest, 59.9° F.

The following export statistics for the years 1897 and 1911 illustrate the development of the plant industries in the Philippines during the last fourteen years:

1897

Manila hemp	$8,571,850
Sugar	6,911,535
Copra and coconuts	2,687,978
Tobacco products	2,128,380
Indigo	72,379
Coffee	45,648
Candlenut products	35,219
Ilang-ilang oil	24,937
Sappan wood	23,323
Copal	22,562
Maguey fiber	13,687
Fruits	8,393

1911

Manila hemp	$16,141,340
Copra	9,899,457
Sugar	8,014,360
Tobacco products	3,605,567
Bamboo hats	301,141
Maguey fiber	254,053
Copal	49,716
Ilang-ilang oil	47,404
Gutta-percha	41,065
Fruits and nuts	23,568
Sappan wood	16,220
Kapok cotton	11,324
Coffee	366
Cacao	199

By comparing these statistics it will be seen that the exportation of hemp has about doubled during this period; copra has leaped into second place instead of sugar, of which there has been a comparatively small increase; the production of maguey fiber has increased over twenty-fold.

Rice, of which there are about 1,000 varieties more or less, is the most important cereal in the Philippines. The principal rice-producing provinces are, in the order of their importance, Pangasinan, Nueva Ecija, Tarlac, Ilocos Norte, Bulacan, Pampanga, and Capiz.

Corn succeeds well, but is of comparatively limited cultivation, Cebu and Pangasinan being the chief producers; however, corn-growing is greatly on the increase. Mungos and cowpeas are the only legumes grown under field-culture, but are not cultivated extensively.

Manila hemp is the leading export article; it is obtained from the leaf-stems or petioles of the abacá (*Musa textilis*), and is grown principally in Albay, Leyte, Ambos Camarines, Sorsogon and Samar.

Copra is the next important export. Tayabas, Laguna, Albay, Samar, Moro, Cebu, Capiz, and Leyte are the source of most of the copra, and the culture of the coconut is on a steady increase.

Sugar, the fourth most important crop, is cultivated primarily in the Provinces of Occidental Negros, Pampanga, Batangas, and Iloilo.

Most of the tobacco is grown in Isabela, Cagayan, Cebu, La Union and Pangasinan.

The statistics below relate to the six principal crops of the Philippines for the fiscal year 1911.

Crop	Area Hectares	Product	Amount produced	Approximate total value in provincial markets
Rice..........	1,043,757	Cleaned rice	574,842,682 kilos	$32,995,940
Abaca.........	404,160	Manila hemp	171,879,598 kilos	13,750,367
Coconuts......	208,476	....	....	....
Average of 200 trees per hectare	....	Ripe nuts for food	154,980,726 nuts	13,130,636
		Copra	118,323,114 kilos	
		Coconut oil	6,602,966 liters	
		Palm wine	37,649,880 liters	
Sugar-cane.....	120,313	Crude sugar	243,924,574 kilos	12,196,238
Corn..........	302,516	Shelled corn	186,404,700 liters	4,361,869
Tobacco.......	69,015	Leaf tobacco	25,518,132 kilos	3,444,947

Both fruit- and vegetable-culture have been greatly neglected in the Philippines, notwithstanding the fact that the soil is almost everywhere of great fertility and that a great number of vegetables succeed well and produce abundantly when properly cared for.

Coconuts, with the steady and increasing demand for copra and other coconut products, are undoubtedly destined to become not only the chief horticultural industry in the Philippines but the leading industry in the archipelago. If a coconut plantation is well located and intelligently cared for there is probably no other enterprise in the Philippines today that offers so large a return with so little care and expenditure. (See Philippine Bureau of Agriculture, Bulletin No. 17.)

Coffee (*Coffea arabica*) was a very profitable crop until the entrance of the coffee blight (*Hemileia vastatrix*) about twenty-five years ago, which gradually destroyed the hitherto very profitable coffee-plantations. Coffee-culture is now of little or no importance, and coffee to the value of $255,039 was imported in the fiscal year ending 1911. *Coffea liberica*, *C. robusta*, and the Maragogipe hybrid have been introduced in order to revive the coffee industry, but without avail. From the present outlook, coffee-growing will never become an important industry until a blight-resistant variety shall have been found that is equal in quality to the Arabian coffee.

The cacao (*Theobroma Cacao*) was long ago introduced into the Philippines, and large areas are well adapted to the culture of this tree, particularly in Mindanao, but although found in all provinces, even the home demand for cacao has never been supplied, and the cacao products imported into the Philippines in 1911 amounted to $261,935. The reasons for this neglect of what would undoubtedly be a profitable industry are that hemp, coconuts and sugar-cane, which require less attention and care, yet yield profitable returns, have been more than the cacao adapted to the agricultural educational standard so far attained by the population in the Philippines. It should not be forgotton, however, that systematic cacao-culture has never been introduced, either by the Spaniards, or by the Americans after their occupation of the archipelago. It cannot be doubted but that cacao will some day become one of the most important of the Philippine agri-horticultural exports.

Fruit-growing, in the pomological sense of the word, is scarcely even in its infancy. Fruits, fresh, canned and dried, were imported to the value of $241,686 in 1911, while the total horticultural exports for the same year were but $24,053. It is thus seen that the foreign markets are all neglected, and yet there is no doubt but that Hongkong could readily absorb many times the amount of fruit that is sent there and that much could be exported to Japan, China and Cochin-China, and even Australia. This latter country imported in 1910 citrous fruits alone to the value of $107,445 from California and the Mediterranean countries, and, in fact, the Philippines themselves, the home of some of the citrous fruits, yearly import oranges, pomelos and lemons that are far inferior to the home-grown product; canned pineapples are imported from Singapore and Hawaii. However, there has been an awakening during the past year to the anomaly of this situation, and considerable attention is beginning to be paid to the fruit industry.

Owing to the long distance to the principal large foreign markets, and the perishable nature of most of the fruits cultivated, the Philippine Islands can hope to export but few fresh fruits, such as mandarins, oranges, pomelos, bananas and mangoes, and while the production of fresh fruit for export should become a considerable item, the manufactured products—fruit canned, dried, crushed and grated, made into jams, jellies, marmalade, fruit syrups, flavoring extract and wine—are destined to be of primary importance. In this form the Philippine fruits can compete with others for the world's markets.

Two fruits only, the banana and the mandarin, can be said to be systematically planted and cultivated, and even then the care they receive is primitive. Practically all the mandarins are grown in a small district in Batangas; budding and grafting is never practised; marcottage is sometimes employed in the propagation of particularly choice fruit trees, principally the chico. Even the mango, the most famous of the Philippine fruits, is grown on the edges of the rice-paddies, on hillsides and along the roads, instead of in regularly planted orchards.

Also, there are many districts in the Philippines in which such hardy and vigorous species as the mango, tamarind, chico, and breadfruit have not yet been introduced and there are others such as the bauno (*Mangifera verticillata*), marang (*Artocarpus odoratissima*), and kambog (*Dillenia speciosa*), which are unknown except in their native habitat.

The banana (*Musa sapientum*, *M. paradisiaca*, and *M. humilis*) is the most important of the Philippine fruits as a food; the flower-buds are eaten as a vegetable. There are probably over one hundred varieties of bananas in the Philippines, of which the following are the most important in order of their enumeration: Lacatán, Latundán, Sabá, Gloria, Bungulan, Daliring señora, Butuan, Matabia, Lacatán morado, Ni-lanzon, Tundoc. These varieties occur under many synonyms.

Next to the banana, the papaya (*Carica Papaya*), is the most generally grown fruit in the Philippines; a very good variety of this fruit is being gradually disseminated. The second most important fruit commercially is the mandarin (*Citrus nobilis*), which has already been referred to. The trees are all seedlings, but the fruit is nevertheless remarkably good and uniform in appearance, size, and quality. The production of the other citrous fruits is very limited, and in the order of their importance they are: Pomelo (*Citrus grandis*), calamondin (*C. mitis*), lime (*C. aurantifolia*), orange (*C. sinensis*), cabuyao (*Papeda histrix*). The variation in these species is very great and several natural hybrids occur. (See Philippine Bureau of Agriculture, Bulletin No. 27.)

1993. Typical house near Manila. Roof made of nipa palm.

1994. A typical laborer's hut in Manila. Also made of nipa palm.

1995. A hay (rice grass) carrier in Manila.

The mango (*Mangifera indica*) is the third most important commercial fruit in the Philippines and, excepting the mandarin, the only one that is exported. The three most important types of mangoes are Carabao, Pico and Pahutan. Only the first two are worthy of cultivation. Cavite, Cebu, Bohol, Nueva Ecija, Pangasinan and Zambales lead in mango-production. (See Philippine Bureau of Agriculture, Bulletin No. 18.)

The pineapple (*Ananas sativus*) is grown chiefly for its fiber and is cultivated principally in Samar, Occidental Negros, Tayabas and Bulacan. Bataan supplies Manila with pineapples during its season; the variety grown is of good quality and flavor. Cayenne and Spanish were introduced in 1912. The chico (*Achras Sapota*) is grown to a considerable extent and is of good quality; the guava (*Psidium Guajava*) is naturalized everywhere; the lanzon (*Lansium domesticum*) is well esteemed, and Manila is fairly well supplied with this fruit during its season. The soursop (*Annona muricata*) and the sugar-apple (*Annona squamosa*) are the most generally grown fruits of the genus; the custard-apple (*Annona reticulata*) is less esteemed. The duhat (*Eugenia jambolana*) is the most generally distributed species in the genus; the yambo (*Eugenia Jambos*) is very rare. The mangosteen (*Garcinia Mangostana*) and durian (*Durio zibethinus*) have not yet been introduced north of Mindanao.

The betelnut (*Areca Catechu*) is of great local importance at present but the use of this stimulant is decreasing.

The above are the most important of the Philippine fruits. The following are grown to more or less extent:

Alubihod (*Spondias mangifera*), alupag (*Euphoria cinerea*), bauno (*Mangifera verticillata*), bignay (*Antidesma bunius*), bitoñgol (*Flacourtia sepiaria*), bobog, (*Sterculia fœtida*), camanchile (*Pithecolobium dulce*), camia (*Averrhoa Bilimbi*), carambola (*Averrhoa Carambola*), cashew (*Anacardium occidentale*), catmon (*Dillenia philippinensis*), cereza (*Muntingia calabura*), chico-mamey (*Lucuma mammosa*), ciruela (*Spondias purpurea*), citron (*Citrus medica*), date (*Phœnix dactylifera*), fig (*Ficus Carica*), granadilla (*Passiflora quadrangularis*), grape (*Vitis vinifera*), iba (*Phyllanthus acidus*), igot (*Eugenia* sp.), jak (*Artocarpus integrifolia*), kambog (*Dillenia speciosa*), kaki (*Diospyros Kaki*), kayam (*Inocarpus edulis*), lemoncito (*Triphasia aurantiola*), libas (*Garcinia Vidallii*), longan (*Euphoria Longana*), mabolo (*Diospyros discolor*), macopa (*Eugenia javanica* and *E. malaccensis*), manzanita (*Zizyphus jujuba*), marang (*Artocarpus odoratissima*), mulberry (*Morus nigra*), pangi (*Pangium edule*), pili nuts (*Canarium ovatum*, and *C. pacyphyllum*), pomegranate (*Punica granatum*), santol (*Sandoricum indicum*), strawberry (*Fragraria vesca*), tamarind (*Tamarindus indica*), togop, (*Artocarpus elastica*), zapote (*Diospyros Ebenaster*).

As the islands are becoming better explored, other fruits will undoubtedly be added to this list.

The following fruits have been introduced by the Bureau of Agriculture within the last few years:

The avocado (*Persea gratissima*), cherimoya (*Annona Cherimola*), roselle (*Hibiscus Sabdariffa*), hevi (*Spondias cythereæ*), hogplum (*S. lutea*), tiess (*Lucuma Rivicoa* var. *angustifolia*), boracho (*Lucuma salicifolia*), ceriman (*Monstera deliciosa*), tree tomato (*Cyphomandra betacea*), caranda (*Carissa Carandas*), carissa (*Carissa bispinosa*), *Cecropia palmata*, pitanga (*Eugenia uniflora*), caymito (*Chrysophyllum Cainito*), *Dillenia indica*, ginepap (*Genipa americana*), *Phyllanthus emblica*, bael (*Ægle Marmelos*), cattley guava (*Psidium Cattleianum*), biriba (*Rollinia orthopetala*), casimiroa (*Casimiroa edulis*).

During the past year, the leading varieties of citrous fruits have been introduced from their respective countries; also a large collection of mango varieties from India.

The most important vegetables are the sweet potato, here called camote (*Ipomœa Batatas*), ubi (*Dioscorea alata*), bolót (*D. fasciculata*), ñame (*D. sativa*), and gabe (*Colocasia antiquorum*), of all of which there are several varieties. If the cassava (*Manihot utilissima*) may be classed as a vegetable, this is another of great importance. The tomato, eggplant, sitao (*Vigna Catjang*), patani (*Phaseolus lunatus*), sincamas (*Pachyrhizus angulatus*), squash (*Cucurbita maxima*), and pumpkin (*Cucurbita Pepo*) come next in importance.

The following vegetables are also grown in the Philippines: Apalia (*Momordica balsamina*), batao (*Dolichos Lablab*), beet (*Beta vulgaris*), buting (*Phaseolus vulgaris*), cabbage (*Brassica oleracea*), cadyos (*Cajanus indicus*), carrot (*Daucus Carota*), chile (*Capsi-

cum minimum and *C. annuum*), coletis (*Amarantus oleraceus*), condol (*Benincasa cerifera*), cucumber (*Cucumis sativus*), endive (*Cichorium Endivia*), garlic (*Allium sativum*), lettuce (*Lactuca sativa*), libato (*Basella rubra*), magtambocao (*Canavalia ensiformis*), malungai (*Moringa oleifera*), melon (*Cucumis Melo*), mungo (*Phaseolus Mungo*), mustard (*Brassica juncea*), okra (*Hibiscus esculentus*), onion (*Allium Cepa*), pacupis (*Trichosanthes anguina*), panarien (*Tacca pinnatifida*), parsley (*Carum Petroselinum*), patola (*Luffa acutangula* and *L. ægyptiaca*), pea (*Pisum sativum*), pechay (*Brassica Pe-tsai*), potato (*Solanum tuberosum*), radish (*Raphanus sativus*), seguidilla (*Psophocarpus tetragonolobus*), turnip (*Brassica Rapa*), upo (*Lagenaria vulgaris*), watermelon (*Citrullus vulgaris*).

The sago palm (*Metroxylon Rumphii*) is indigenous in Mindanao and used by the inhabitants of that island in the preparation of sago.

The climatic conditions and soil for the cultivation of many of the spices are excellent. Certain species of vanilla grow wild in Mindanao and Luzon, and cinnamon (*Cinnamomum zeylanicum*) is indigenous to Mindanao. Black pepper (*Piper nigrum*), and ginger (*Zingiber officinale*) have been introduced, but nothing has ever been done to encourage systematic cultivation of spices. If the spice industry was properly fostered by the government until it was fairly well established, good varieties introduced and care taken to exclude dangerous fungi and insect enemies, it is believed that this industry would have a promising future in the Philippines.

It appears evident, from the researches made by E. D. Merrill, that there already was a botanical garden in existence in Manila in 1787, located where the Singalong Experiment Station of the Bureau of Agriculture now is. This was one of the first institutions of its kind established in the Philippines if not in the entire Orient. It was abandoned by the Spaniards, at what date is unknown.

The present botanical garden, so called, established in 1858, south of the Pasig River and west of Intramuros, containing an area of about 5 hectares, is a park rather than a botanical garden. The construction of Malate Park, intended to cover over 40 hectares is now in progress.

During the last two years, the Bureau of Education has paid special attention to school-gardening, which, if wisely persisted in, will undoubtedly greatly assist in elevating the standard of horticulture in the Philippines. Both the Bureau of Agriculture and the Bureau of Education are making large annual distributions of vegetable seeds, and the Bureau of Agriculture maintains two agri-horticultural demonstration farms, one located at Trinidad, Benguet, and the other in Iloilo. Coincident with the reorganization of the Bureau of Agriculture in force from the beginning of the fiscal year 1912, provision was made still further to extend the activity of the extension and demonstration work, and a division of horticulture was created. Much work has already been accomplished by this division in collecting data relative to Philippine horticulture, and work is in progress to assemble all food plants for study at the experiment stations. (Relative to the activities of the Bureau of Agriculture, consult the "Philippine Agricultural Review," a monthly publication issued by the Bureau.)

The Philippine Agricultural College, Los Baños, provides a course in horticulture and maintains a garden and nursery for practical demonstration work.

P. J. WESTER.

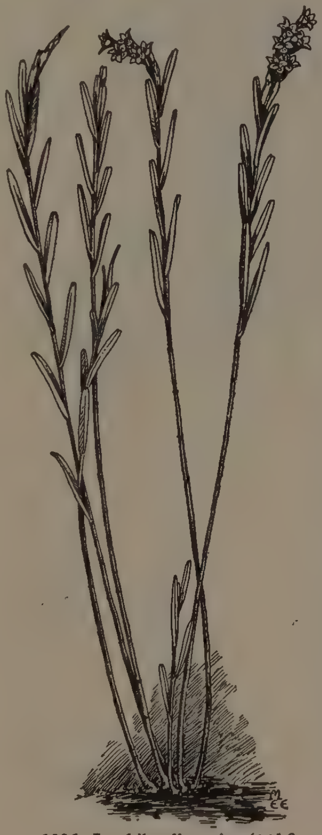
ISMÈNE: *Hymenocallis.*

ISNÁRDIA: *Ludvigia.*

ISOCHÌLUS (Greek, *equal lip*). *Orchidàceæ.* A group of tufted orchids, little cultivated. Plants epiphytic, with tall, slender, leafy sts., without pseudobulbs, bearing a few small fls. at the summit: sepals erect, free, keeled; petals similar but plane; labellum like the petals and united with them to the base of the column, somewhat sigmoid below the middle; column erect, long, without wings; pollinia 4.—About 5 species, Trop. Amer.

lineàris, R. Br. Fig. 1996. Slender, ¾–1⅓ ft. high, leafy: lvs. distichous, linear, striate, obtuse, emarginate, 1½ in. long: fls. purple, borne in a short, terminal spike. March. Growing on rocks and trees in thick woods, Jamaica, Trinidad, Brazil, etc. B.R. 745. L.B.C. 14: 1341. **I. màjor,** Cham. & Schlecht., of Mex., is taller, fls. larger and darker colored. HEINRICH HASSELBRING.

ISÓLEPIS: *Scirpus.*



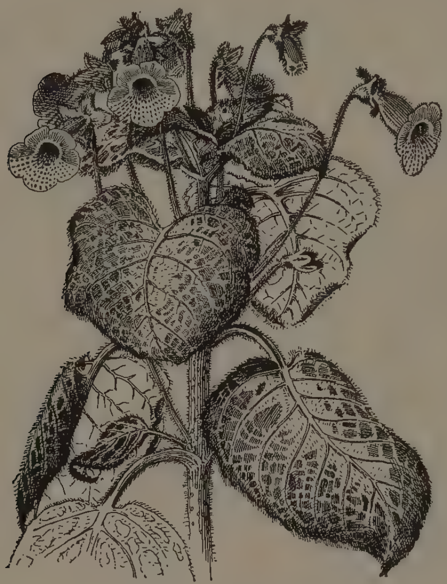
1996. Isochilus linearis. (×¼)

ISOLÒMA (*equal border*). Includes *Tydæa, Gieslèria, Sciadocàlyx, Brachylòma. Gesneriàceæ.* Greenhouse plants, very closely allied to Gesneria and Achimenes.

From Gesneria it is distinguished by absence of well-formed tubers and characters of caps. and anthers, and the 5 lobes of the disk equal; from Achimenes in the more tubular fls. and lobed disk. From Vanhouttea and Diastema the genus is separated technically by the open æstivation. Herbs, with creeping rhizome or base or roots: lvs. opposite, usually villose as in Gesneria: fls. scarlet, orange or vari-colored, usually peduncled in the axils; corolla cylindrical, enlarged above, erect or declined, the limb subequally 5-parted.—Species perhaps 50 in. Trop. Amer.

The culture is the same as for achimenes and gesneria. Seeds of the newer hybrids come quickly, and plants bloom the same year. It is probable that the pure species are not in the trade. Like achimenes, gesneria and gloxinia, they have been much hybridized and varied. It is probable that they are hybridized with achimenes and gesneria. It is not known how the current forms have originated. Some of the recent ones have fringed flowers (Gn. 55:348). Because of the variation and hybridization in cultivation, the names in this group are much confused, although few of them appear to be in the trade. The confusion is increased, also, by change in the generic name, from Isoloma to Kohleria. The genus Kohleria was founded by Regel in Flora, April, 1848. Later in the same year, Decaisne founded Isoloma in Revue Horticole, taking up, however, the name from Bentham who had used it for a section of Gesneria in his "Plantæ Hartwegianæ" in April, 1846. In 1848, also, Decaisne founded the genus Tydæa on *Achimenes picta* of Bentham (1844); but this genus is now by common consent included in

Isoloma (or Kohleria). When this plant, which is apparently the best known garden form, is taken over into Isoloma, it would naturally become *I. pictum;* but the plant first regularly given the name *pictum* under Isoloma is *I. pictum* of Planchon, 1850–51 (and Regel, 1854), which is founded on the *Gesneria picta* of Hooker (1849), and this is a very different plant from the cultivated *Achimenes* (or *Tydæa*) *picta*, and the latter must take a new name; and it assumes the name given it by Nicholson in 1888, *I. bogotense.*


1997. Isoloma bogotense. (×⅓)

bogoténse, Nichols. (*Achímenes pícta*, Benth., B.M. 4126, 1844. *Tydæa pícta*, Decne., R.H. 1848:468. *Kohlèria bogoténsis*, Fritsch, in Engler & Prantl, Nat. Pflanzenf. IV. 3*b*, 178, 1893. *Isolòma Tydæa*, Bailey, Cyclo. Amer. Hort. 836, 1900. *Isolòma píctum*, Hort., not Planch.). Fig. 1997. One to 2 ft., hairy: lvs. cordate-ovate, coarsely serrate, spotted and reticulated with pale green or silvery green, with a broad light zone down the center: fls. single, on long axillary sts., nodding, the orifice oblique and lobes obtuse, the upper longitudinal half of the fl. red, the lower half yellow and red-spotted. Colombia. B.M. 4126 (adapted in Fig. 1997). B.R. 31:42. F.S. 1:17, 18. *I. pictum*, Planch., F.S. 6:586 (*Gesneria picta*, Hook. B.M. 4431), is a different plant, apparently not in commerce.

amábile, Mott. (*Tydæa amábilis*, Planch. & Lind.). Erect, hairy: lvs. ovate, more or less tapering to the petiole, bluntly serrate, purplish on the veins: fls. hairy, pendent, dark rose dotted with purple, paler inside. Colombia. B.M. 4999. R.H. 1859, p. 25. F.S. 10:1070.

hirsùtum, Hort. Fig. 1998. Erect, hirsute on st. and lvs., free-flowering: lvs. ovate, acute, prominently petioled, close-toothed: fls. several on an axillary peduncle, hirsute, orange-scarlet, the rounded lobes darker-marked. Origin not clear. To be compared with the next.

eriánthum, Decne. (*Gesnèria eriántha*, Benth. *Brachylòma eriánthum*, Hanst. *Kohlèria eriántha*, Hanst.). Erect, 2–4 ft., the sts. and lvs. more or less fleshy and soft-hairy: lvs. long-petioled, ovate-lanceolate, dentate: fls. several on a peduncle, 1½–2 in. long, orange-red or cinnabar-red, the lobes rounded and the 3 lower spotted. Colombia. B.M. 7907.

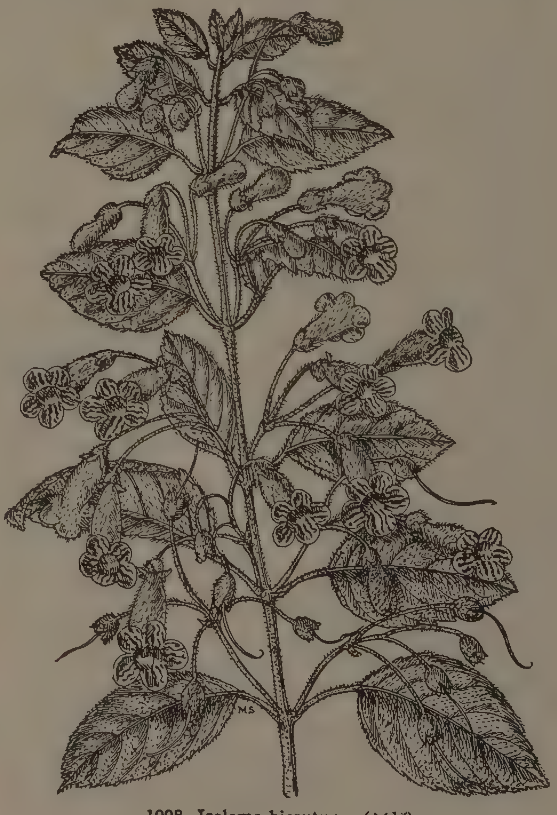
Cecíliæ, Nichols. (*Tydæa Cecíliæ*, André). Much like *I. amabile*, but lvs. marked with violet and silvery zones or blotches: fls. 2 or 3 from each axil, the fls. pale rose outside and striped in the throat, and the limb purple-spotted. Colombia. I.H. 23:260.

ocellàtum, Benth. & Hook. (*Achímenes ocellàta*, Hook). Short-hairy on the st.: lvs. ovate-acuminate, serrate, green: fls. small, on peduncles shorter than the lvs., the tube and short, rounded lobes red, the segms. marked with whitish and black spots. Panama. B.M. 4359.

jaliscànum, Wats. Fig. 1999. Herbaceous or somewhat woody at the base, 1 ft., pubescent: lvs. opposite, oblong-lanceolate to ovate-lanceolate to ovate, short-acuminate, short-stalked, serrate: fls. 2–4 on an axillary peduncle, the corolla an inch long, tubular and short-lobed, pubescent, scarlet. Mex.—A worthy plant, probably not in the trade. L. H. B.

ISONÁNDRA (Greek, *equal anthers*). *Sapotàceæ. Isonandra Gutta* (=*Palaquium Gutta*, Burck.). is a large-leaved East Indian tree belonging to this genus, which furnishes the best commercial gutta-percha. The name has appeared in one southern catalogue, but the plants were found to be not true to name. This plant should be called *Palaquium Gutta.* In Palaquium the floral parts are in sixes, stamens twelve and the seeds have no albumen, while in Isonandra the floral parts are in fours, the stamens eight, and the seeds albuminous.

Gútta, Hook. (properly *Palaquìum Gútta*, Burck.) One of the GUTTA-PERCHA TREES. Lvs. leathery, elliptic, abruptly pointed, 4 in. or more long, rusty-tomentose beneath, the primary nerves 24–30 on each side: fls. in axillary clusters on very short pedicels, the corolla ⅓in. long and with 6 elliptic obtuse



1998. Isoloma hirsutum. (×¼)

lobes; stamens 12; ovary 6-celled, becoming a small ovoid berry with 1 or 2 seeds: tree 40 ft. This is scarcely a horticultural subject. Malaya. R.H. 1898, p. 441.

ISOPỲRUM (from the Greek for *like*, and *wheat*, as the seeds resemble those of wheat). *Ranunculàceæ*. Dwarf stemless herbs sometimes used in the wild garden. Annual, or rootstock perennial: lvs. decompound, ternate; lfts. 3-lobed or cut, membranous: fls. white, regular, few or solitary, on slender scapes; sepals 5–6, deciduous; petals 5, very small or wanting: carpels 2–20, sessile; ovules 3 or more.—Fifteen to 20 species in temperate regions of the northern hemisphere. **I. thalictroìdes,** Linn., is cult. in alpine gardens, and has graceful foliage resembling a maidenhair fern. Six to 12 in. high: rootstock creeping: cauline lvs. alternate, 3-lobed or 3-foliolate: fls. white, resembling an anemone, in few-fld. terminal panicles; sepals oval, obtuse. W. Himalayas. April, May.—Thrives in any good garden soil. Prop. by seeds or by division of the roots in autumn. Very ornamental and good in masses. **I. grandiflòrum,** Fisch. Lvs. long-petioled; lfts. small, 2–3-lobed: scapes 3–4 in., equaling the lvs.; fl. solitary, 1–1¼ in. diam. Himalayas. G.C. III. 50:396. L. H. B.

1999. Isoloma jaliscanum. (×½).

ISÓTOMA (Greek, *equally cut* or *divided;* referring to the corolla, and true only by contrast with Lobelia). *Campanulàceæ*. Lobelia-like herbs, but with an entire corolla-tube (or only partially slit), and stamens attached near the top of the corolla: lobes of corolla 5 and nearly equal, spreading; upper anthers with terminal tufts: fls. solitary or in racemes, blue, purple or white (at least in the cult. species): lvs. alternate, entire, dentate or pinnatifid or even twice-pinnatifid: plants of various habit, some species erect, others creeping or acaulescent; annual or perennial.—Species 8, of which 6 are Australian, 1 W. Indian, and 1 in the Society Isls.

axillàris, Lindl. Perennial, flowering the first year so as to appear annual, but forming at length a hard rootstock, erect, with few spreading branches, 6–12 in.: lvs. linear, irregularly pinnatifid, 2–3 in. long, lobes linear: pedicels axillary, 2–6 in. long; fls. large, bluish purple, pale outside. Austral. B.M. 2702 (as *Lobelia senecioides*) and 5073 (as *Isotoma senecioides* var. *subpinnatifida*, which has the lobes again more or less pinnatifid). B.R. 964.—Probably not now in cult.

petræ̀a, F. Muell. Like the above, except that the lvs. are ovate-oblong or elliptical, with linear or lanceolate teeth or lobes which are not longer than the breadth of the body of the blade. Austral.—The plant in the trade is said to have cream-colored fls., and is sold as a "lemon verbena," a name which properly belongs to *Lippia citriodora.* L. H. B.

ISÒTRIA (Greek, *in equal threes*). *Orchidàceæ.* Terrestrial plants, with elongated fleshy roots, and scapose stem with a whorl of leaf-like terminal bracts. Flowers solitary or in 2's, erect or ascending; sepals narrow, about equal, longer than petals; lip somewhat 3-lobed, spurless, erect, crested; pollina 2, powdery-granular, tailless.—Species 2, E. U. S. See *Pogonia.*

verticillàta, Raf. (*Pogònia verticillàta*, Nutt.). Scapes 8–16 in. tall; bracts elliptic to oval, abruptly acuminate; sepals linear, 1–2 in. long, longer than the linear petals; lip erect, 3-lobed. E. U. S. B.B. 1:468.

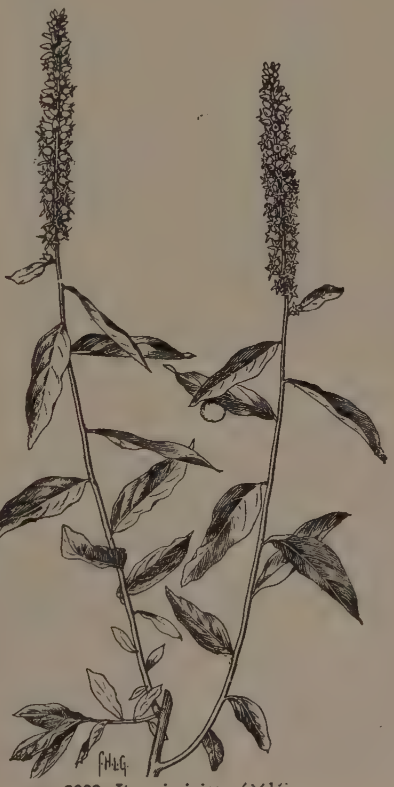
George V. Nash.

ISOTỲPUS: *Onoseris.*

ÌTEA (Greek name of the willow, applied here because it has willow-like leaves, or perhaps because it grows near the water). *Saxifragàceæ;* by some placed in a separate family, *Iteàceæ*. Trees and shrubs, numbering about 6 species, inhabiting tropical and subtropical Asia, and one of them in North America, *I. virginica*, a low, upright, somewhat coarse shrub, best known by its long, erect racemes of small white flowers appearing about July 1, in Massachusetts, and its brilliant autumn coloring.

The genus is characterized by alternate, narrow lvs., fls. in simple racemes which are terminal or axillary, white: calyx 5-toothed, with persistent lobes; petals 5, very narrow; stamens 5; ovary oblong, 2-celled: fr. a very narrow or a conical caps., which is 2-grooved, 2-parted when mature: some of the species are evergreen.

virgínica, Linn. Virginian Willow. Fig. 2000. A shrub, 1½–6 ft. high, usually not more than 2–3 ft. high, of upright, somewhat slender habit: lvs. deciduous, alternate, oblong, pointed, minutely serrate, smooth green above, pale and slightly pubescent below, petioled, without stipules, 1–3 in. long: fls. fragrant,



2000. Itea virginica. (×¼)

white, in solitary, erect, hairy, simple, dense, terminal racemes 2–6 in. long, given a greenish white effect by the stamens and pistils, not particularly showy, appearing late June and July. Pa. and N. J. to Fla. and La. B.M. 2409.—In nature it inhabits low, wet places. In cult. it seems to adapt itself to almost any soil. It is not perfectly hardy N., but grows rapidly and seems enduring of both sun and shade. In ornamental use it is planted in masses or mixed with other shrubs of similar character in the shrubby border or at the edge of woods. Its somewhat coarse character does not favor its approach to more refined objects. In autumn it becomes a brilliant red. It is prop. from seed, by cuttings and by division of roots, which spread slowly and form clumps of sts. It may be collected from the wild.

ilicifòlia, Oliver. Evergreen shrub, with holly-like spiny-toothed broadly elliptic lvs.: fls. small, greenish white, almost sessile, in a terminal drooping raceme 1 ft. or less long. Cent. China. G.C. III. 34:375; 42:123; 50:96. G.M. 54:567.—Hardy in parts of England.

A. Phelps Wyman.
L. H. B.†

ÌVA (named after *Ajuga Iva*, from its similar smell). *Compósitæ*. A genus of about twelve species of American shrubs or shrubby herbs with flowers suggesting those of Artemisia, or the common ragweed, but from which it differs in having heads all of one kind, the bracts of the involucre not united. This includes **I. frutéscens,** Linn, the MARSH ELDER or HIGH-WATER SHRUB, a native hardy perennial of no garden value, which is, nevertheless, on record as having been cultivated. It grows 3 to 12 feet high in salt marshes and on muddy seashores, has serrate leaves and flowers as inconspicuous as those of a ragweed. See B. B. 3:292 and the manuals.

IVÈSIA: *Potentilla.*

IVY. The common or English ivy is Hedera. **Boston I.**=*Parthenocissus tricuspidata.* **German I.**=Climbing Senecio and *Herniaria glabra.* **Ground I.**=*Nepeta Glechoma.* **Kenilworth I.**=*Linaria Cymbalaria.* **Poison I.**=*Rhus Toxicodendron.*

ÍXIA (Greek, *bird-lime;* said to refer to the juice). *Iridàceæ.* Attractive bulbs (cormose) from the Cape of Good Hope, with grass-like foliage and spikes of flowers in early spring, exhibiting a wide range of colors; usually flowered under glass, but can be grown in the open in the North with good protection.

Corm mostly globose, tunicated, fibrous-coated or nearly naked: st. simple or the infl. branched, about 1–2 ft. tall, bearing an erect spike or raceme of mostly 6–12 fls.: lvs. at the base of the st., erect, with perhaps a few smaller cauline ones: fls. funnelform or salverform with a slender sometimes elongated tube, and 6 nearly or quite equal segms., the colors white, yellow, orange, lilac, pink, crimson, red, purple or even green; stamens 3, attached in the throat, the filaments free or connate at the base; ovary obovoid or oblong, 3-celled and many-seeded, the style filiform with slender lobes: fr. a membranaceous obtuse 3-valved caps.—Species about 25 in S. Afr., 1 in Trop. Afr.

Ixias number their cultivated forms by the hundreds. Next to crocuses and freesias they have no rivals in point of popularity among spring-blooming bulbs of the iris family. Culturally they belong to the same class with babiana and sparaxis, which are also desirable and distinct in general appearance and coloring, but are surpassed by ixias in popularity and in number of varieties. Botanically, these three genera belong to the ixia tribe, in which the flowers are spicate, not fugitive and never more than one to a spathe. The stamens of Ixia are equilateral; those of Babiana and Sparaxis unilateral. Ixias have about six erect grass-like leaves arranged in two ranks; Babiana has plaited, hairy leaves. Bulb catalogues give no hint as to the parentage of the numerous named varieties. They may not mention *I. maculata* nor *I. columellaris,* which are probably the important parent stocks. Of the species recognized by Baker in Flora Capensis, apparently only *I. viridiflora* appears as a trade name, but *I. speciosa* and *I. paniculata* may be advertised under their synonyms *I. craterioides* and *I. longiflora.* Ixia flowers are charming in every stage of development. At first the flowers are erect and cup-shaped. They close at might and remain closed on dark days. As they grow older they open wider and become more star-shaped. Fig. 2001 shows the flowers in their drooping stage. The plants remain in flower for three weeks, although the faded flowers at the bottom of the spike should be taken off toward the end of the period. As cut-flowers, they are presentable for a week or two.

2001. Ixia flowers in their drooping stage. (×½)

For greenhouse bloom, ixia bulbs can be planted any time from September 15 to October 30, the sooner the better. In general, tender bulbs of small size tend to lose vitality when kept a long time in the dry air of warehouses. They should be planted an inch deep, five or six in a 5-inch pot, or eight to ten in a 6-inch pot. They like a compound of sandy soil and leaf-mold. It is probable that most of the failures with ixias are due to hasty forcing. The pots should be stored under a bench or in a rather dark cellar, at a temperature of 45°. The object is to hold back the tops while the roots are growing, in order to get stocky, well-colored, slowly started shoots. They need no water until growth has started. Then water carefully until the flowers come, as the young plants are liable to rot at the surface of the ground. While flowering, water freely. After flowering, some gardeners give the plants no water. Others keep the soil moist until the leaves turn yellow, and then gradually withhold water. As to temperature, the plants may be brought into a cool greenhouse (50°) when well started, and toward the end of January may be given 5° more heat if flowers are desired as early as the middle of March. Ixias have to be staked and tied. The old bulbs, from which the offsets have been removed, may be used again. Ixia bulbs, which are really fibrous-coated corms about ½inch thick, keep as well as freesias. Seedlings flower the third year.

In coldframes ixias give good results. Choose for the frame an open place, sheltered from north and west winds. In its construction give especial care to providing good drainage, to close-fitting and snug banking, so that frost, mice and moles can be kept out. A sandy soil, without manures, is safest and best for ixias. If fertilizers are used, they must be placed several inches below the bulbs, never in contact with them. As in outdoor culture, the bulbs must be planted late and in soil well dried by placing the sashes over the frame some time beforehand. Plant about 3 inches deep, as far apart, and treat afterward much as in greenhouse culture. Take off the sashes in early May to show the mass of rich, odd flowers which, ordinarily, will open about that time and last for several weeks. If the frame is to have other tenants through the summer, the ixias may be taken up after their tops are dead and stored in dry sand till planting time comes around again. Otherwise, merely cease watering as the tops of the ixias die down, and put on the sashes again, tilting them so that they will give air and shed rain. (L. Greenlee.)

Outdoor culture of ixia is likely to be more satisfactory than indoor culture, if one meets the few simple requirements. The planting of the bulbs should be delayed until the last moment, because ixias are more inclined than most things to make an autumnal growth. They should be planted 3 inches deep as late as November 30. In planting bulbs it is always well to sprinkle a handful of sand on the spot where they are to lie. This helps the drainage, especially on heavy lands, and prevents rotting. The bulbs should then be covered with about 3 inches of leaves, hay, or better still, pine-needles. In the latitude of Boston, ixia beds can be uncovered during the first week of April. However, there will still be sharp frosts to nip the tender shoots that have started beneath the winter covering. Consequently a little hay or other covering material should be left nearby, where it can be easily secured when a chilly evening threatens. In ten days the young sprouts will become sufficiently hardened to withstand any subsequent cold. Even such hardy things as alliums, when first uncovered, can hardly withstand any frost at all. It is, however, a mistake to wait two weeks longer and then permanently uncover the bulb beds, for by that time the early-starting things are likely to be so lank and long that they never attain ideal sturdiness. It is better to uncover too early than too late. The secret of success with ixias outdoors is largely in hardening the plants in early spring and in never allowing them to grow too fast under cover, where they become yellow and sickly. In winter, shutters may be placed over the bulb beds to shed the rain; but the bulbs do as well without this protection, though they may be later in starting. Of course, ixia bulbs cannot stand any freezing, and they must, therefore, be planted in unfrozen soil.—After flowering, let the bulbs remain in the earth until the end of July; then take them up, and store them, not in dry earth, but in boxes without any packing. Let them remain in a dry place until they are wanted for November planting. In the southern part of England, ixias can be planted 6 inches deep in hardy borders as late as December, and Krelage, perhaps thinking of still warmer regions, considers ixias as summer-blooming bulbs, and advises planting from October to December.—In the writer's experience, the flowers from the old bulbs are not at all inferior in succeeding years: indeed, the contrary has been the case, and the bulbs raised at home have been superior to the ones purchased. Amateurs are commonly advised to throw away the offsets because fresh bulbs are cheap. Yet the writer finds that many of the offsets bloom the first year and nearly all of them the second. Ixias have been raised commercially near Boston with every prospect of success. Ixias are amongst the most pleasing of all bulbs. With thousands in bloom in the month of June, they make a braver show even than tulips, and they are less known to the public. (W. E. Endicott.)

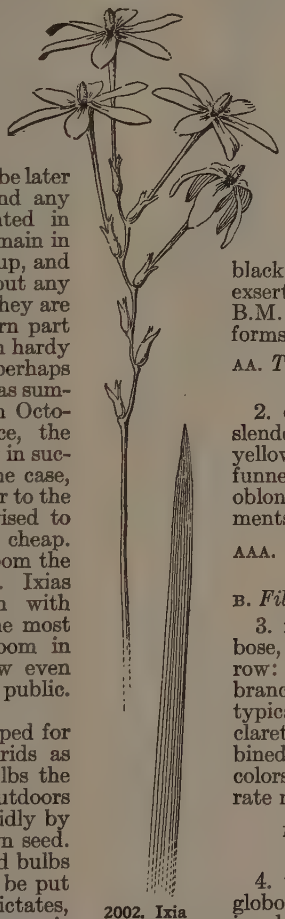
In California, ixias, with which may be grouped for cultural purposes such other South African irids as sparaxis, babianas, and tritonias, are of all bulbs the best adapted to California conditions, thriving outdoors with the minimum of care, increasing very rapidly by offsets, and even forming colonies from self-sown seed. Planting should be done as soon as the imported bulbs are available, usually in October. They should be put about 2 inches deep and as far apart as taste dictates,—say 3 inches, if space is valuable. Good drainage is essential and a sandy loam much better than heavy adobe, although the writer has grown them successfully in both. Divide every alternate year to prevent crowding. Pick the brightest place in the garden, as the flowers require strong sunlight to open them up well. This is especially true of the green kind, *I. viridiflora*.—To raise new varieties, sow seed in autumn, the resultant bulbs blooming the second season. Some of the best varieties in California are self-sown seedlings, the result of crosses between good named varieties in neighboring beds. After a start has been made, there is no reason why the American supply of these bulbs should not be grown in California, as they ripen very well and are of greater vigor than the imported ones.—Where space is limited, ixias may be planted among daffodils, thus renewing the show a month after the latter are over. As both bulbs ripen together, in harvesting this is no drawback. For garden effect, large plantings of separate, clear-colored, named varieties are much better than mixtures. The flowering season covers about six weeks, the pretty cerise *I. speciosa*, (*I. crateroides*) blooming in March, while the brilliant brick-red Vulcan is sometimes as late as May. (Sidney B. Mitchell.)

INDEX.

aristata, 8.
bicolorata, 9.
cæsia, 4.
cana, 4.
columellaris, 6.
crateroides, 13.
elegans, 8.
flavescens, 9.
flexuosa, 11.
longiflora, 1.
lutea, 10.
maculata, 5.
monadelpha, 3.
nigro-albida, 5.
ochroleuca, 5.
odorata, 2.
ornata, 5, 9.
ovata, 7.
paniculata, 1.
patens, 12.
polystachya, 9.
speciosa, 13.
stellata, 7.
viridiflora, 4.

A. *Tube of perianth long, and somewhat dilated below the limb.*

1. **paniculàta,** Delaroche (*I. longiflòra*, Berger). Fig. 2002. Corm ¾in. or less diam., with brown tunics: basal lvs. 2–3, linear and glabrous, to 1½ ft. long: st. 1–3 ft., sometimes branched: fls. many, in lax erect spikes, the tube to 3 in. long and straight, the limb cream-white, the segms. obtuse, often tinged red and sometimes with a blackish base; anthers wholly or partially exserted, about as long as the filaments. B.M. 256; 1502.—There are two botanical forms or varieties.



2002. Ixia paniculata. (×⅓)

AA. *Tube of perianth short, and dilated below limb into a distinct funnelform.*

2. **odoràta,** Ker. Lvs. very narrow: st. slender, distantly branched: fls. bright yellow, fragrant, in a short spike; tube funnel-shaped, ½in. long, the segms. oblong; anthers equaling the free filaments. B.M. 1173.

AAA. *Tube of perianth short and cylindrical (not dilated upward).*

B. *Filaments more or less connate or joined.*

3. **monadélpha,** Delaroche. Corm globose, with fibrous coverings: lvs. very narrow: st. slender, simple or somewhat branched: fls. few, in a short spike; segms. typically lilac, but there are forms with claret-red, blue or pale yellow segms. combined with eyes and markings of various colors, some of which have received separate names. B.M. 607; 1378.

BB. *Filaments all free at the base.*

C. *Fls. green.*

4. **viridiflòra,** Lam. Corm depressed-globose, ½in. diam., with fibrous covering: lvs. narrow, strongly ribbed: fls. many, in a long loose erect spike, typically with

pale green segms. and black throat. B.M. 549. L.B.C. 16:1548. F.S. 2:124. Var. **càna,** Eckl. Segms. pale blue; throat black. B.M. 789 (as *I. maculata amethystina*). Var. **cæsia,** Ker. Segms. pale lilac; eye greenish. B.R. 530.

CC. *Fls. in other colors.*

D. *Throat of fl. (eye) differently marked from the segms.*

5. **maculàta,** Linn. Fig. 2003. Corm globular, 1 in. or less diam., covered with parallel fibers: lvs. about 4, linear, ribbed, 6–12 in. long: sts. slender, 1–2 ft., simple or branched: fls. many, in dense and erect spikes, typically yellow; tube slender; limb bell-shaped, with a dark purple or black mark at throat, the segms. oblong, obtuse. B.M. 539 (orange, as *I. conìca*). The natural varieties show the range of color: Var. **ochroleùca,** Ker. Segms. sulfur-yellow; eye brown. B.M. 1285. Var. **nìgro-álbida,** Klatt. Segms. white; eye black. Var. **ornàta,** Baker. Fls. flushed bright red or purple outside.

6. **columellàris,** Ker. Like *I. maculata,* but fls. typically with bright mauve-purple segms. and blue throat. B.M. 630.

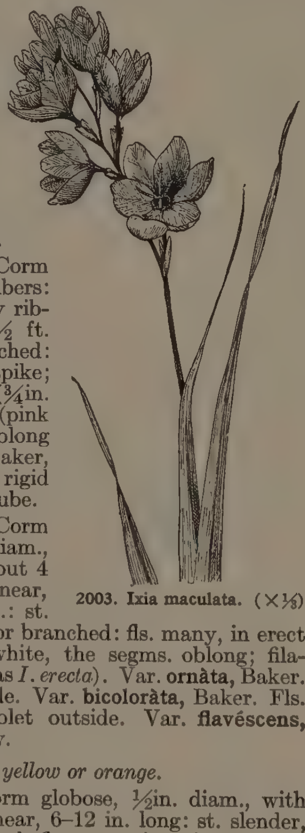
7. **ovàta,** Klatt. Like *I. maculata,* but has bright red fls. with purple-black throat. Var. **stellàta,** Klatt, has the throat yellow.

DD. *Throat not differently marked.*

E. *Color white or whitish (varying to tinted shades and colors).*

8. **aristàta,** Ker. Corm globose, with strong fibers: lvs. 3–4, linear, strongly ribbed: st. slender, to 1½ ft. high, simple or branched: fls. many, in a loose spike; perianth-tube slender (¾in. or less); limb whitish (pink in B.M. 589), with oblong segms. Var. **élegans,** Baker, has narrower and less rigid lvs., and much shorter tube.

9. **polystàchya,** Linn. Corm globose, ¾in. or less diam., with fine fibers: lvs. about 4 at base and 2 on st., linear, strongly ribbed, 6–12 in.: st. slender, 1–2 ft., simple or branched: fls. many, in erect spikes; perianth-limb white, the segms. oblong; filaments short. B.M. 623 (as *I. erecta*). Var. **ornàta,** Baker. Segms. tinged red outside. Var. **bicoloràta,** Baker. Fls. pale yellow, tinged violet outside. Var. **flavéscens,** Baker. Fls. pale yellow.



2003. Ixia maculata. (×⅓)

EE. *Color yellow or orange.*

10. **lùtea,** Baker. Corm globose, ½in. diam., with fibrous covering: lvs. linear, 6–12 in. long: st. slender, 1–2 ft., simple or branched: fls. many, in a dense spike, deep bright yellow. B.M. 846.

EEE. *Color shades of red or lilac.*

11. **flexuòsa,** Linn. Very like *I. polystachya,* except that fls. are in shades of red or lilac or lilac-tinged outside. B.M. 624.

12. **pàtens,** Ait. Corm globose, to ¾in. diam., with fine fibers: lvs. about 4, linear, 6–12 in.: st. erect, 12–18 in., sometimes branched: fls. several, in a somewhat dense erect spike, pale red.

13. **speciòsa,** Andr. (*I. crateroìdes,* Ker.). Corm globose, small, with matted fibers: lvs. from base about 6, linear: st. slender, usually simple: fls. few, in a short and erect spike, the oblong segms. dark crimson; limb campanulate. B.M. 594. Gn.W. 21:648.

WILHELM MILLER.
L. H. B.†

IXIOLÍRION (Greek, an *ixia-like lily*). *Amaryllidàceæ.* Three or four species of hardy bulbs from western and central Asia, with umbels of deep blue or violet six-lobed flowers, borne in spring.

Perianth regular, without tube above the ovary; segms., oblanceolate, acute; stamens shorter than the segms., attached to their claws; ovary club-shaped, 3-celled, becoming a 3-valved caps.: lvs. very narrow, mostly at base of the st. The nearest cult. allies are Alstrœmeria and Bomarea, which have no distinct rootstock, while Ixiolirion has a bulbous rootstock. The bulbs should be lifted in autumn and stored.

montànum, Herb. (*I. Pállasii,* Fisch. & Mey.). Bulb ovoid, 1 in. thick, with a neck 2–3 in. below the basal tuft of lvs.: st. about 1 ft. long: lvs. about 4, persistent, and a few smaller ones above: fls. on long unequal pedicels, about 4, and often 1 or 2 fls. below; perianth bright lilac according to Baker, 1½ in. or less long. Syria to Siberia. B.R. 30:66. F.S. 22:2270. R.H. 1880:310. J.H. III. 31:583.

Var. **tatàricum,** Herb. (*I. tatáricum,* Hort. *I. Lédebourii,* Fisch. & Mey.). Sts. more slender: lvs. awl-shaped: fls. all in a terminal umbel, smaller than the type. Altai Mts. G.C. II. 19:757. Gn. 75, p. 188. Gn. W. 21:685. J.H. III. 42:532.

I. Kolpakowskiànum, Regel (Kolpakowskia ixiolirioides, Regel), is perhaps a form of above, but has a smaller bulb, fls. 2–4 in a terminal umbel, and the perianth-segms. ¾–1 in. long: lvs. about 4 in a basal tuft and 1 or 2 small ones above. Turkestan. Gt. 1878:953.

L. H. B.

IXÒRA (a Malabar deity). *Rubiàceæ.* Warmhouse woody plants with showy flowers in clusters and evergreen foliage; handsome and desirable.

Shrubs or small trees with opposite or verticillate lvs. and terminal or axillary usually dense corymbs of very showy white, rose or scarlet fls. on bracteate pedicels: corolla very long and slender-tubed, the throat sometimes barbed, the limb 4- or 5-lobed and wide-spreading; stamens 4 or 5, inserted on the throat, the filaments short or none; ovary on a fleshy disk, 2-loculed, the style filiform and exserted, 2-branched; ovules solitary: fr. a hard or fleshy 2-pyrenous berry.—Species upward of 150, in the tropical parts well around the globe.

There are many garden forms of Ixora under Latin names, and these complicate a botanical account of the genus. Some of the named garden ixoras are the following: *Amabilis,* pinkish, suffused orange. *Aurantiaca,* orange-red; compact. *Chelsonii,* fls. brilliant salmon-orange. *Colei.* fls. pure white: cross of *I. coccinea* and *I. stricta* var. *alba.* *Conspicua,* fls. yellow, becoming orange. *Decora,* yellow. *Dixiana,* fls. deep orange; G. 27:363. F. S. R. 3, p. 275. *Fraseri,* fls. scarlet in the tube, and brilliant salmon above; G 7:529. *Illustris,* orange. *Incarnata,* flesh-color. *Insignis,* rose. *Ornata,* salmon-orange. *Pilgrimii,* orange-scarlet. *Princeps,* fls. whitish, becoming orange; said to have come from Java. *Profusa,* rose. *Regina,* fls. shaded violet-salmon, in large dense clusters. J.H. III. 42:159. *Sanguinea,* fls. crimson, shaded with violet. *Speciosa,* yellow. *Splendens,* orange. G.Z. 23:193. *Splendida,* crimson-orange. G.Z. 26, p. 217. I.H. 29:463. *Venusta,* orange. *Westii,* fls. pale rose, becoming brilliant; hybrid. Gn. 42:496. G.M. 36:35. G. 25:457. *Williamsii,* fls. reddish salmon.

The ixoras are perhaps the best tropical warmhouse plants that combine the showiest of flowers with fine evergreen foliage. They are of easy culture, and should be far oftener seen in tropical plant-houses.—They may be propagated at any season, but early spring is probably best. Take good strong cuttings, with four pairs of leaves on them, and pot them singly, in 2-inch pots, in two parts clean sharp sand, and one of peat. Plunge the small pots in a cutting-bed, where the bottom-heat is about 70°. Be sure they are shaded from the strong sun. In a few weeks the small pots will be filled with roots, and the plants may be shifted into a pot two sizes larger, and removed from the propagating-bed, and placed in a light position in a house where the night-temperature is about 65°.—The compost in which they are potted may be equal parts of fibrous loam, peat, and sand, adding about a sixth part of broken charcoal. When they grip the soil in this pot, cut them back, leaving two joints above the earth. If desired, the plants may be flowered in the smallest size of pot, and for decorative work they are then very useful; but if large plants are wanted quickly, keep them growing right along, never allowing the ball of the plant to get into a mat of roots until the desired size of pot is reached. After they have reached a 6-inch pot, they give the best satisfaction, if they are potted entirely in the fiber of a good loam, all the fine material being shaken out of it. Pot them rather firmly and keep up a night temperature of 65°. In winter it may be 5° less. —From March until the end of September, a very light shade over them is necessary, to keep the foliage in a perfect condition. After flowering is the best time to trim these plants into shape. Cut them back to one joint, unless some of the shoots are required longer, to preserve the symmetry of the plant. Before pruning ixoras, it is a good plan, after flowering, to keep them on the dry side for about a month. Never, however, allow the plants to suffer for lack of water. Just let them get to the wilting point, then water. This treatment firms up the wood equally, and when they are cut back, the young growths start all at the same time. By following this method the plant will flower more equally all over. Large plants of some of the varieties will give three crops of flowers a year; the variety *Fraseri* is an example. Plants in large pots will do well for several years without repotting, if fed liberally with manure-water. Green cow-manure, fertilizers such as Clay's soft-coal soot, an ordinary handful to a two-and-a-half-gallon watering-pot, or, for a further change, horse-urine, a 3-inch potful to the same amount of water, agrees well with ixoras, when they are well rooted. Water twice between applications with clean water. Insects that affect ixoras may be kept in check by a judicious use of the syringe, and fumigations with hydrocyanic gas as advised for other plants. (George F. Stewart.)

INDEX OF BOTANICAL SPECIES.

(For horticultural names, consult a preceding paragraph.)

acuminata, 2.
amboinica, 13.
Bandhuca, 7.
barbata, 3.
blanda, 6.
chinensis, 6.
coccinea, 6, 7, 12.
congesta, 10.
crocata, 6.
Duffii, 8.
fulgens, 9.
grandiflora, 7.
Griffithii, 10.
javanica, 11.
laxiflora, 5.
lutea, 12.
macrothyrsa, 8.
odorata, 4.
parviflora, 1.
rosea, 6.
salicifolia, 9.
stricta, 6.

A. *Fls. white (sometimes tinged pink).*

1. **parviflòra,** Vahl. Evergreen tree, with subsessile oblong or elliptic-obtuse lvs. 3–6 in. long: cymes sessile, with 3–5 pairs of short branches, the fls. in subglobose clusters; corolla white, glabrous, the tube only ⅓in. long, and the lobes oblong. India.

2. **acuminàta,** Roxbg. Glabrous shrub: lvs. various, from elliptic to linear-oblong, or the floral sometimes rounded or obovate and sessile while the others are petioled: cymes corymb-like, contracted and densely fld. sometimes as if almost capitate, 2–4 in. across; corolla pure white and fragrant, ⅔in. across, the lobes narrow and obtuse. India.

3. **barbàta,** Roxbg. Large glabrous shrub: lvs. stalked, elliptic, somewhat acute, thin, the upper pair usually small and sessile and cordate: cymes much broader than high, short-stalked, sometimes 1 ft. across, the branches being long, slender and spreading; corolla white, woolly at the mouth, the tube 1–1½ in. long and lobes narrow. India. B.M. 2505; 4513. J.F. 1:26.

4. **odoràta,** Hook. Small shrub: lvs. large, broad-ovate or obovate-lanceolate, acute or acuminate, thick, to 1 ft. long, the lower ones attenuate to a petiole: cymes or panicles much divided, 1 ft. or more across, with purplish branches; corolla very long (4–5 in.), white changing to yellowish brown; stamens somewhat protruding; fls. very fragrant. Madagascar. B.M. 4191.

5. **laxiflòra,** Smith. Shrub, slender, 3–4 ft.: lvs. oblong-lanceolate, acuminate, short-petioled: cymes or panicles trichotomous and very open, large, terminal; corolla white tinged pink, the tube 1½ in. long, limb cut to the base and the lobes very distinct; calyx red; fls. very fragrant. Guinea. B.M. 4482. J.F. 1:21.

2004. Ixora congesta.
(×⅓)

AA. *Fls. usually in shades of red (sometimes varying to rose and to orange-scarlet).*

6. **chinénsis,** Lam. (*I. stricta*, Roxbg. *I. coccínea*, Hort., not Linn. *I. blánda*, Ker. *I. crocàta*, Lindl. *I. ròsea*, Sims). Apparently the common species, known in greenhouses as *I. coccinea:* glabrous shrub, with sessile or subsessile lvs. which are obovate or obovate-oblong, and slender-tubed fls. in dense corymbs, the corolla-lobes short and rounded and the tube ¾–1 in. long. Malayan archipelago and China. B.M. 169 (as *I. coccinea*); 2428. B.R. 100; 782.—Runs into nearly pure white forms. There are said to be yellowish fld. forms. Prince of Orange, a popular variety, is said to be a form of this species.

7. **coccínea,** Linn. (*I. grandiflòra*, Bot. Reg. *I. Bandhùca*, Roxbg.). Much like the last, but lvs. oblong with mostly rounded or cordate base and sometimes an

apiculate tip, and corolla-lobes broad and acute, and the tube 1–1¾ in. long. E. Indies. B.R. 154; 513.

8. **macrothýrsa,** Teijsm. & Binn. (*I. Dúffii,* Moore). Very large, glabrous: lvs. a foot long, linear-oblong to oblong-lanceolate: cluster very large, 8 in. across, bearing very many deep red tinged crimson fls., with lanceolate obtuse lobes about ½in. long. E. Indies. B.M. 6853. G.M. 50:582. F.E. 19:115.—One of the finest of the genus.

AAA. *Fls. in shades of yellow or orange.*

9. **fúlgens,** Roxbg. (*I. salicifòlia,* DC.). Shrub with erect slender polished branches: lvs. petioled, linear-oblong to obovate-oblong, more or less acute or acuminate, shining above and with 20–30 pairs of sunken nerves: cymes sessile or short-peduncled, corymb-like, large, with spreading slender branches, the fls. short-pedicelled; fls. orange-scarlet or orange becoming scarlet; calyx-teeth very short and obtuse; corolla-tube 1¾ in. or less long, the lobes ovate and acute. India. B.M. 4523. J.F. 1:38.

10. **congésta,** Roxbg. (*I. Gríffithii,* Hook.). Fig. 2004. Evergreen tree in its native haunts, glabrous except the cymes: lvs. very large (6–12 in. long), stalked, elliptic or elliptic-oblong, acute or acuminate: cymes sessile or nearly so; fls. orange-yellow, changing to reddish, the segms. rounded. India. B.M. 4325. J.F. 1:50.—Much like *I. fulgens,* differing in stouter habit, very large and usually coriaceous broader lvs., stout not spreading branches in the cyme, and the fls. sometimes sessile.

11. **javánica,** DC. Glabrous shrub with lvs. 4–7 in. long, ovate-oblong, acute or acuminate: corymb terminal, long-peduncled with forking coral-red branches; fls. deep orange-red, the lobes rounded, the corolla-tube 1½ in. long, slender, red. Java. B.M. 4586. J.F. 2:156.

12. **lùtea,** Hutchinson (*I. coccínea* var. *lùtea,* Hort.). Differs from *I. coccinea* by laxer infl. and pale yellow fls. with larger ovate-rhomboid corolla-lobes. Of garden origin. B.M. 8439.

13. **amboínica,** DC. Shrub: lvs. large, short-petioled, ovate-oblong, acuminate, undulate, glabrous: cyme (or corymb) trichotomously divaricately compound; corolla-lobes acute. Amboyna (Moluccas).—Apparently in the trade as *I. amboina,* with long-lasting "showy orange-yellow flowers." L. H. B.

J

JABOTICÁBA. This name is applied in southeastern Brazil to the fruits of several species of Myrciaria, notably *M. cauliflora*, and *M. jaboticaba*, of the family Myrtaceæ. See *Myrciaria*.

The jaboticabeira, or jaboticaba tree, occurs not only in the wild state in various parts of Minas Geraes, São Paulo, Rio de Janeiro and adjoining states, but is commonly planted in gardens, and the fruit, which does not differ much in character among the various species, is held in the highest esteem by Brazilians of all classes. When well grown the tree is extremely handsome, reaching a height of 35 or 40 feet, with an umbrageous, dome-shaped head of light green foliage, the new growth pink. The persistent entire leaves are opposite, ovate-elliptical to lanceolate, acute or acuminate at the apex, generally glabrous, varying from ¾ inch to over 3 inches in length. The flowers are small, white, with four petals and a prominent cluster of stamens. They are produced singly or in clusters directly upon the bark of the trunk and limbs. The season of flowering and fruiting varies with the different species and in different localities; sometimes two or more crops a year are produced.

The fruit is nearly sessile or with a slender peduncle about 1 inch long, and is round or slightly oblate in form. It is ½ inch to 1–1½ inches in diameter, glossy, maroon-purple in color, and crowned with a small disk at the apex. The skin is thicker than that of a grape, and considerably tougher. The translucent, juicy pulp, white or tinged with rose, is of a most agreeable vinous flavor, remarkably suggestive of the grape, to which the jaboticaba is frequently compared. The seeds, one to four in number, are oval to round in outline, compressed laterally, ¼ to ⅜ inch long. When heavily laden with fruit, the tree is a curious sight. Not only is the trunk covered with glistening jaboticabas, but the fruiting extends out to the ends of the small branches as well.

The fruit is usually consumed when fresh, but in former days was used by the Indians for the manufacture of wine. It is sometimes made into jelly or jam. In the markets of Rio de Janeiro, jaboticabas sell for about 25 cents a pound, and considerable quantities are shipped in from Minas Geraes and São Paulo.

The tree prefers a soil that is rich and deep. Its growth is slow, six to eight years being required for it to come into bearing. Propagation in Brazil is almost always by seed, but inarching or some other vegetative means is necessary to perpetuate good varieties. There is much variation among seedlings. In California the jaboticaba makes very slow growth, and is adapted only to the most protected locations. It has been planted in Florida very recently, and may prove adapted to some sections of that state. When young the trees are very susceptible to frost, but when they have attained a few years' growth they will withstand slight frosts without serious injury. For a more complete account, see "Journal of Heredity," Vol. V, No. 7, 1914.

F. W. Popenoe.

JACARÁNDA (Brazilian name). *Bignoniàceæ.* Handsome tubular-flowered trees and shrubs, grown far South and also under glass.

Leaves opposite, 2-pinnate, rarely 1-pinnate; lfts. usually numerous, entire or dentate: fls. showy blue or violet, mostly in terminal or axillary panicles, often very freely produced; calyx small, 5-toothed; corolla-tube straight or curved, regular at the base or somewhat constricted above the ovary and broadened above; corolla-limb somewhat 2-lipped, the 5 lobes rounded and spreading and nearly equal; disk thick and cushion-like; perfect stamens 4, didynamous; staminode about as long as the stamens, club-shaped at the apex and often bearded at the top: fr. an oblong, ovate or broad dehiscent caps.—Species about 50, in the American tropics. Prop. by cuttings of half-ripened wood. Under glass they are considered to be warmhouse subjects.

ovalifòlia, R. Br. (*J. mimosæfòlia,* D. Don). Tree, 50 ft. and more: lvs. distant, spreading, oblong, villous: fls. blue (and a white variety) more or less horizontal. Brazil. B.R. 631. B.M. 2327. R.H. 1897:132. G.C. III. 36:224. G.M. 49:71.—*J. ovalifolia* perhaps ranks among the best flowering trees or shrubs for subtropical regions. It is now much recommended as a street tree in S. Calif., it being deciduous only in early spring. The foliage is as finely cut as a fern, symmetrical and elegant. The lvs. are decussate, distant, each one with 16 or more pairs of pinnæ, each pinna having 14–24 pairs of lfts. The plant bears loose, pyramidal panicles, 8 in. high, of 40–90 blue fls., each 2 in. long and 1½ in. wide, which have a long, bent, swelling tube and the 2 lobes of 1 lip smaller than the 3 other lobes. It is one of the best of foliage plants for the S., valuable alike for florists' decorations, conservatory, subtropical bedding in the N., or for lawn specimens in Fla., where, if cut back by frost, it rapidly recovers its beauty. It stands pruning well, and can be kept in regular form. There is some confusion between the names, *J. ovalifolia* and *J. mimosæfolia,* both being made in the year 1822.

cuspidifòlia, Mart. As compared with *J. ovalifolia,* lvs. said to attain a larger size and to have more lfts., fls. larger and in larger panicles, and brighter blue, tree more vigorous. Lvs. glabrous, with 8–10 pairs of lfts. and the lfts. again divided into 10–15 pairs, the ultimate lfts. entire, lanceolate, cuspidate at apex, the secondary rachis winged: fls. in large terminal thyrse, blue-violet, the corolla nearly 1½ in. long. Brazil, Argentina; advertised in S. Calif.

chelònia, Griseb. Tree, 30–90 ft., of globular shape: foliage fern-like, very ornamental: fls. large, blue, in strict terminal panicles 1 ft. long; calyx-lobes lance-linear and narrowly acuminate; corolla glandular-puberulent. Paraguay, Argentina.—Wood said to be veined with rose, and valued in S. Amer. for cabinet work.

acutifòlia, Humb. & Bonpl. Tree, glabrous: lvs. 2-pinnate, the lfts. 6–8 pairs and ultimate lfts. many and acuminate, entire, the petiole canaliculate and rachis winged: corolla silky, the tube straight, violet: panicle terminal and axillary. Peru.—Offered abroad.

L. H. B.†

JACK BEAN: *Canavalia.*

JACK-FRUIT: *Artocarpus integrifolia.*

JACK-IN-A-BOX: *Hernandia.*

JACK-IN-THE-PULPIT: *Arisæma.*

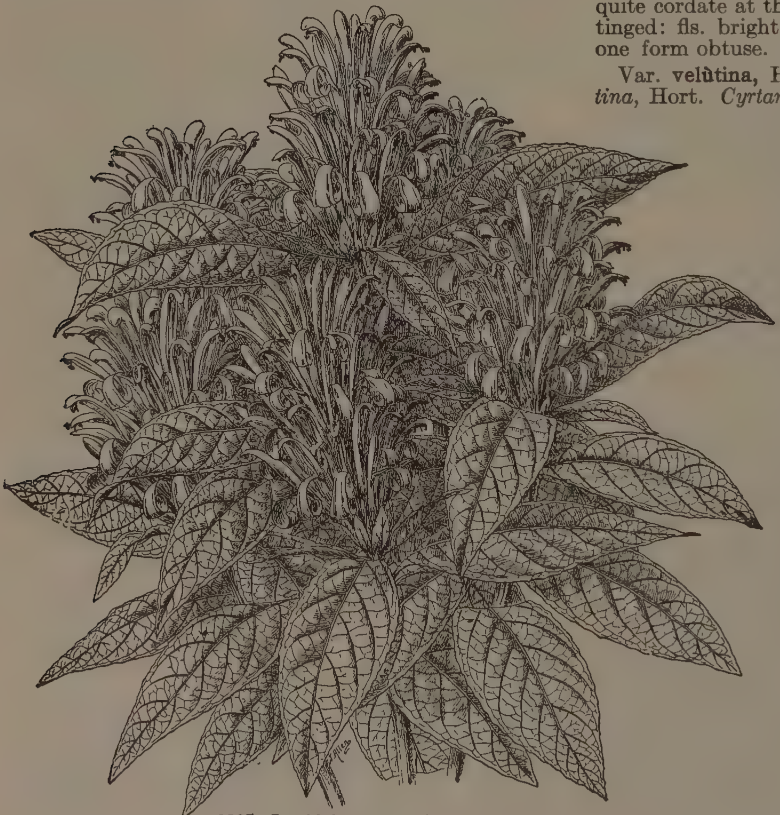
JACKSÒNIA (named for George Jackson, a Scotch botanist). Syn. *Piptómeris. Leguminòsæ.* Stiff, leafless shrubs or subshrubs, sometimes grown as greenhouse subjects: branchlets often phyllodineous or lf.-like, very much branched and spinescent: lvs. replaced by very minute scales at the nodes: fls. yellow, or yellow and purple, in terminal or lateral racemes or spikes, or scattered along the branches: bracts small, scale-like. —About 40 species, principally in W. Austral. Jacksonias are rarely seen in cult. They thrive in loam and peat soil. Prop. by cuttings from half-ripened shoots, rooted in sand, during April. *J. sericea,* Benth. A large shrub, decumbent, ascending or tall, with pendulous branches: fls. solitary or in irregular, terminal, loose racemes; calyx-lobes linear, about as long as the corolla. W. Austral. L. H. B.

JACOBÆA: *Senecio.*

JACOBÍNIA (probably a personal name). Including *Cyrtanthèra, Libònia, Sericógraphis, Sericobònia. Acanthàceæ.* Plants cultivated under glass for their narrow-tubular red, orange or yellow flowers.

Glabrous herbs, or sometimes shrubs: lvs. opposite and entire: fls. variously disposed, sometimes solitary, sometimes fascicled or spicate; calyx deeply 5-parted, with linear or awl-shaped segms.; corolla more or less 2-lipped, 1 lip 2-lobed and the other 3-lobed; stamens 2; staminodia represented by 2 hairy elevations on the corolla-tube; disk ring-like or cupulate; pistil ripening into an oblong or ovate caps., the style filiform.—Species 20–40, depending in part on the definition of the genus, from Mex. to Bolivia and Brazil.

Jacobinias, in common with other acanthads, are much confused as to species. A closely allied genus is Justicia, which, among other characters, is distinguished by having spurs or appendages at the base of the anther-lobes, whereas Jacobinia has no such appendages. Most of the garden plants called Justicias are Jacobinias. Other allied genera are Aphelandra, Dianthera, Adhatoda, Thyrsacanthus, Eranthemum, Barleria, Dædalacanthus.



2005. Jacobinia carnea. (×⅓)

In their native places, jacobinias are mostly subshrubs, but they are usually treated as herbs under cultivation. They are showy greenhouse or conservatory subjects. When well grown they are attractive plants, but they soon become weedy under neglect. They propagate very readily from cuttings, after the manner of fuchsias, and the most satisfactory plants are usually those that are allowed to bloom but once. Most of them thrive well under conditions suited to begonias.

A. *Fls. in a more or less dense terminal panicle or thryse; corolla long, more or less curved. (Subgenera Cyrtanthera, Pachystachys.)*

cárnea, Nichols. (*Justícia cárnea,* Hook. *Cyrtanthèra magnífica,* Nees. *Justícia magnífica,* Pohl. *Jacobínia magnífica,* Benth. & Hook.). Fig. 2005. Strong forking herb or subshrub, blooming when 1 or 2 ft. high, but becoming several feet high if allowed to grow: sts. 4-angled: lvs. opposite, lanceolate to ovate-lanceolate to oval-oblong, narrow or broad at base, attenuate to apex, wavy-margined, veiny, downy, sometimes a foot long: fls. rose-purple (varying to flesh-colored), ascending, arched at the top and the lower lip recurving, borne in dense terminal spike-like thyrses. Brazil. B.M. 3383. B.R. 1397. G.F. 5:317 (reduced in Fig. 2005). G. 24:238. G.W. 3, p. 439; 15, p. 704. F.E. 22:320.—A handsome old plant, of comparatively easy cult. in a conservatory temperature. Cuttings made in Feb. or March should bloom early the following winter. Young plants are usually most satisfactory, the old ones being kept over only for cutting stock. Give rich soil, and plenty of water in the growing season. This plant is said to have been distributed as *Whitfieldia lateritia.*

Pohliàna, Benth. & Hook. (*Cyrtanthèra Pohliàna,* Nees). Much like *J. magnifica,* but more robust and leafy: lvs. ovate-acuminate and rounded or nearly or quite cordate at the base, more glabrous, often purple-tinged: fls. bright crimson: bracts short-acute, or in one form obtuse. Brazil. G. 27:677. F.S.R. 3, p. 49.

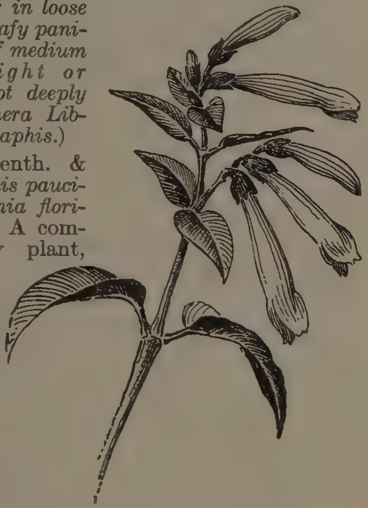
Var. **velùtina,** Hort. (*J. velùtina* and *Justícia velùtina,* Hort. *Cyrtanthèra Pohliàna* var. *velùtina,* Nees). Dwarf: bracts obtuse: lvs. villous-pubescent on both surfaces: fls. 2 in. long, rose-color. Brazil. Gng. 7:212; 16:24. A.F. 14:998.—A worthy plant of comparatively recent intro. in commerce. It is an excellent pot subject and has been considerably advertised as the "new dwarf *Justicia velutina.*" A profuse and continuous bloomer. Cultural remarks under *J. carnea* apply also to this.

coccínea, Hiern. (*Justícia coccínea,* Aubl.). Erect herb or subshrub, usually grown from cuttings each year and treated as a pot subject: 2–5 ft. high: branches terete: lvs. elliptic or ovate-lanceolate, entire, glabrous or nearly so: fls. crimson, in a dense terminal spike, pubescent, the long upper lip more or less arched and the lower one reflexed. Brazil. B.M. 432. G.W. 15, p. 704. Gn.W. 21:57.—Blooms in summer. Said to be known sometimes as *Aphelandra cristata.*

chrysostéphana, Benth. & Hook. (*Cyrtanthèra chrysostéphana,* Hook. f.) Herbaceous, glabrous or very nearly so, obtusely 4-angled: lvs. 5–6 in. long, petioled, ovate or ovate-lanceolate, acuminate, with red ribs: fls. in an erect terminal dense corymb, 2 in. long, golden yellow, on very short pedicels, the bracts linear-lanceolate and dark green; calyx ⅓in. long, with long subulate lobes; corolla glabrous, slightly curved, the upper lip oblong-lanceolate and vaulted, the lower lip oblong and reflexed and 3-lobed. Mex. B.M. 5887. Gn. 71, p. 563. J.H. III. 45:543. G. 27:678. G.M. 45:849. Gn.W. 21:51.—An attractive winter-flowering warmhouse subject.

AA. *Fls. scattered or in loose more or less leafy panicles; corolla of medium length, straight or nearly so, not deeply cleft.* (*Subgenera Libonia, Sericographis.*)

pauciflòra, Benth. & Hook. (*Sericógraphis pauciflòra,* Nees. *Libònia floribúnda,* C. Koch). A common conservatory plant, subshrubby, but usually treated as a pot-plant, with terete, short-jointed, close-pubescent branches: lvs. elliptic or elliptic-oblong, short and rather small, entire, very short-stalked: fls. 1 in. long, tubular, drooping, or nearly horizontal, scarlet with yellow at the end, the lips short. Brazil. —A most floriferous plant, almost as easy to grow as a fuchsia, and to be handled in essentially the same way.



2006. Jacobinia penrhosiensis. (×½)

Ghiesbreghtiàna, Benth. & Hook. (*Cyrtanthèra Ghiesbreghtiàna,* Decne. *Sericógraphis Ghiesbreghtiàna,* Nees. *Justícia Ghiesbreghtiàna,* Lem. *Aphelándra Ghiesbreghtiàna,* Hort.). Lvs. narrower (lance-ovate) and longer, acuminate: fls. in a terminal, very loose panicle, tubular, scarlet, appearing at the same season as those of *J. penrhosiensis.* Mex. F.S. 4:339. Gt. 98. —Intro. by Ghiesbreght; but when the plant was transferred to the genus Jacobinia the name was mispelled *Ghiesbrechtiana.* A good winter bloomer.

penrhosiénsis (*Libònia penrhosiénsis,* Carr.). Fig. 2006. Much like *J. pauciflora,* but lvs. more pointed and fls. larger and more showy. R.H. 1876:50. Gng. 2:131.—It is an excellent plant, and is taking the place of *J. pauciflora.* It is a hybrid of *J. pauciflora* and *J. Ghiesbreghtiana.* Another and very similar hybrid of the same parentage is *Sericobònia ígnea,* Lindl. & André. I.H. 22:198. *J. penrhosiensis* is a winter bloomer, a little earlier than *J. pauciflora.* Cuttings struck in spring make full blooming subjects by fall and early winter. This and *J. pauciflora* are common conservatory plants.

spicígera (*Justícia spicígera,* Schlecht. *Justícia atramentària,* Benth. *Justícia Mohíntli,* Moc. & Sesse. *Sericógraphis Mohíntli,* Nees. *Jacobínia Mohíntli,* Benth. & Hook. *Drejèra Willdenowiàna,* Nees). Undershrub, erect, pubescent: lvs. long-ovate to lanceolate, thick: fls. 1 in. long, axillary, secund, orange-yellow; corolla-tube elongated, inflated above, the upper lip somewhat arched, and entire, the lower lip spiral and 3-toothed. Mex.—Fls. said by some to be pale purple.

suberécta, André. Herb, velvety pubescent: sts. prostrate, with erect flowering branches: lvs. opposite, petioled, ovate, obtuse, to 2½ in. long: fls. in 1–10-fld. peduncled cymes, the bracts spatulate-obovate and obtuse; calyx-tube short and nearly hemispheric; corolla bright scarlet, the slightly curved tube about 1¼ in. long, pubescent outside; upper lip slightly emarginate and ovate, the lower 3-toothed and oblong. Uruguay. B.M. 8350. R.H. 1900:210.—Handsome warmhouse plant, suitable for baskets.

J. Líndenii, Nichols. (Justicia Lindenii, Houll.), is a Mexican subshrub, with long-ovate opposite decussate lvs., and a dense fascicled head of orange-yellow fls.: divisions of calyx linear; corolla long-tubular, 2 in. or more; 2 stamens attached in lower part of corolla. Does not appear to be in the trade. R.H. 1870:250.

L. H. B.

JACQUEMÓNTIA (after Victor Jacquemont, a French naturalist; died 1832). *Convolvulàceæ.* Subtropical and tropical mostly climbing herbs, grown for the convolvulus-like bloom.

Allied to Ipomœa and Convolvulus, to which they are probably inferior for garden cult. They are distinguished from Ipomœa by having 2 stigmas instead of 1; and from Convolvulus by having the stigmas ovate or oblong instead of linear-filiform to subulate. Lvs. entire, or rarely toothed or lobed: fls. not large, blue, white or violet, in either dense clusters or loose racemes, sometimes even solitary; corolla more or less campanulate, the plicate limb 5-angled or obscurely 5-lobed.—Species 60–70 in Trop. Amer. and as far north as S. C., also 1 in Trop. Afr. and 1 in Hawaii.

Jacquemontia pentantha makes an attractive greenhouse climber for summer and autumn flowering, but is not so desirable for this purpose as several species of Ipomœa. It is likely to become leggy. Propagated readily by seeds or cuttings. For cultural directions, see *Ipomœa.*

pentántha, G. Don (*J. violàcea,* Choisy. *Convólvulus pentánthus,* Jacq.). St. perennial, somewhat shrubby at base, twining 6–8 ft., pubescent or nearly glabrous: lvs. cordate to ovate-lanceolate, acuminate: peduncles slender, bearing 5–12 fls. in a loose cymose cluster; corolla about 1¼ in. wide, short-funnelform, sharply 5-angled, rich violet-blue. June-Sept. Trop. Amer., and as far north as Fla. B.M. 2151. B. 4:197. P.M. 6:219. In var. **canéscens,** Hort. (*J. canéscens,* Benth.), the whole plant is covered with short, brownish down. B.R. 33:27.

tamnifòlia, Griseb. Plant annual, usually low and erect, at length twining if support is near, covered with tawny yellow hairs: lvs. cordate-ovate, long-petioled: peduncles bearing many fls. in dense involucrate clusters; fls. less than ½in. long, violet. Cult. and waste ground, S. C. to Ark., and southward.

S. W. Fletcher.
L. H. B.†

JACQUÍNIA (Nicholas Joseph de Jacquin, 1727–1817, collector and painter of West Indian plants). *Myrsinàceæ;* by some separated, with Clavija and Theophrasta, in *Theophrastàceæ.* Tropical American trees and shrubs, seldom cultivated far South for ornament.

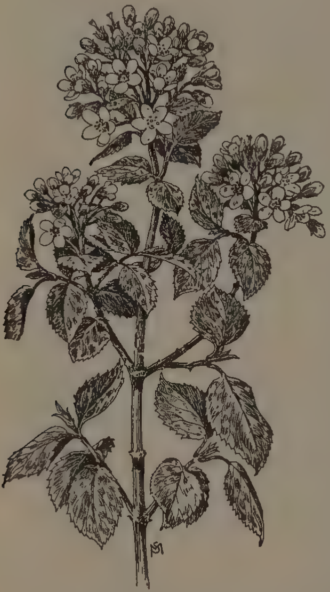
Leaves opposite or somewhat verticillate, rigid, margined, entire: fls. white, purple or orange, borne in racemes, umbels or singly; corolla 5-fid, wheel- to salver-shaped, crowned at the throat and between the lobes with 5 roundish appendages (staminodia); stamens 5, inserted far down in corolla-tube, the filaments subulate: berry leathery, few to several-seeded. In the allied genus Theophrasta the corolla is cylindrical, shortly 5-lobed, the appendages are fastened at the base of the corolla instead of the throat, and the berry is many-seeded.—By the latest monographer (Mez, Engler's Pflanzenreich, hft. 15, 1903), 33 species are described, of the warm parts of Amer.

keyénsis, Mez (*J. armillàris,* Chapm., not Jacq.). Lvs. cuneate-spatulate or obovate, blunt, revolute at the margin, usually whorled, 4 in. long, 1½ in. wide: berry ¼in. thick. S. Fla. and Bahamas. It is a low tree (about 15 ft.), with evergreen lvs. somewhat like box but obovate, and racemes of small white honey-scented fls., which appear in winter. It appears to be cult. only in S. Fla. and S. Calif. It is possible that the plant sometimes cult. is the *J. armillaris* of Jacquin, which Mez now calls *J. barbasco*, and which occurs in W. Indies. L. H. B.

JAMBÒSA: *Eugenia.*

JAMÈSIA (after its discoverer, Dr. Edwin James, 1797–1861, botanical explorer of the Rocky Mountains). Syn., *Edwínia. Saxifragàceæ.* Low hardy shrub of upright habit, with deciduous, opposite leaves, and white flowers in terminal, short panicles.

Leaves without stipules, petioled, serrate: calyx-lobes and petals 5; stamens 10; styles usually 3, rarely 4 or 5, slender; ovary superior, 1-celled: fr. a 3–5-valved, many-seeded, dehiscent caps.—One species in the Rocky Mts. from Utah to New Mex. Handsome shrub for borders of shrubberies or rocky slopes in sunny situations, thriving in any well-drained garden soil, best in a peaty and sandy one. Prop. by seeds or by cuttings of ripened wood.


2007. Jamesia americana. (×½)

americàna, Torr. & Gray (*Edwínia americàna,* Heller). Fig. 2007. Shrub, to 4 ft.: lvs. broadly ovate to oblong-ovate, acute, serrate, dentate, pubescent or almost glabrous above, whitish tomentose beneath, ½–2 in. long: fls. about ½in. across, white, sometimes pinkish outside. June. B.M. 6142. J.H. III. 32:37. Gn. 32, p. 522; 33, p. 606; 63, p. 105. Gt. 38, p. 103; 53, pp. 231, 232. L.I. 6. G.M. 52:85. Var. **ròsea,** Purpus. Fls. pink. ALFRED REHDER.

JÁNKÆA: *Ramondia.*

JANÙSIA (after Janus, the old Roman god with 2 faces). *Malpighiàceæ.* Twining or trailing plants, with 2 forms of yellow fls. in axillary clusters, the normal fls. having a gland-bearing calyx, a 3-angled style and 3 ovaries, and conspicuous clawed petals; abnormal fls. with an eglandular calyx, no style and 2 ovaries, and often rudimentary petals.—Ten to 15 species. **J. grácilis,** Gray, is offered in S. Calif. Sts. and branches very slender, twining or trailing: lvs. lanceolate-linear, both surfaces silky: peduncles mostly dichotomously 2-fld.; bracts linear, as long as the pedicels. Common throughout Texas, south of the Colorado, and west to New Mex. L. H. B.

JAPARÁNDIBA (probably a vernacular name). *Lecythidàceæ. Gustàvia,* which is retained by the "nomina conservanda" of the Vienna code. Upward of 20 trees and shrubs of Trop. Amer., little known in cult. Lvs. large, ovate or spatulate, alternate, serrate: fls. showy on 1-fld. somewhat umbelled peduncles; calyx-tube turbinate, the border entire or 4–6-lobed; petals 6–8, nearly equal; stamens many, in many series, annulate or cupulate; ovary 4–6-celled: fr. a fibrous few-seeded berry.—Some of the species may be found in choice collections of warmhouse plants, but only **J. speciòsa,** Kuntze (*Gustàvia speciòsa,* DC.), from Colombia, seems to be offered in this country (S. Calif.). Tree: lvs. thick, oblong-lanceolate, acuminate, narrowed at base, entire, punctulate above, reticulate beneath, about 3½ in. long: fls. fascicled, fragrant, 6-petaled, white, 2–3 in. long; calyx nearly entire and with the pedicel tomentose. Colombia.

J. gracíllima, Niedz. (Gustavia gracillima, Miers). Slender tree, glabrous: fls. 4 in. diam., rose-red, solitary or in pairs, from the lf.-axils on young plants and on the wood in old plants: lvs. close together, recurved, to 18 in. long, oblanceolate or much narrower, serrate. Colombia. B.M. 6151. G.Z. 21, p. 49.—*J. pterocárpa,* Niedz. (G. pterocarpa, Poit.). Fls. with 6 large obtuse white petals; calyx deeply 5–6-lobed; ovary 5-winged: lvs. thick, long-petioled, obovate-lanceolate, entire or very nearly so, acuminate: style elongated. Guiana. B.M. 5239.—*J. supérba,* Kuntze (G. superba, Berg. G. insignis, Lind.). Shrub or small tree: corolla 5–6 in. diam., cream-white, outside tinged rose: lvs. dark green and glossy, obovate-lanceolate, acuminate, much attentuate at base, sessile or nearly so, spinulose-toothed. B.M. 5069. L. H. B.

JASIÒNE (ancient name of no application to this plant). *Campanulàceæ.* Small blue-flowered or rarely white-flowered plants for the border or the rock-garden.

Jasione is easily distinguished from its allies by the fls. being borne in a head with an involucre, the calyx reduced to 5 very slender lobes, the corolla cut into 5 awl-shaped strips, and the anthers somewhat united at their bases; these characters make the infl. to resemble the Compositæ, but it is readily distinguished by the many-seeded caps.—Species 5 or 6, in Cent. and W. Eu. and the Medit. region. They differ widely in duration and habit. Prop. by division and seed. This includes the shepherd's scabious, a hardy herbaceous perennial plant of compact habit, about a foot high, and bearing globose heads 2 in. diam. composed of very many light blue fls. It is of easy cult. in any garden soil, grows either in full sunlight or partial shade, and is equally adapted for borders, edgings, or the rockery. The common annual scabious (Scabiosa) belongs to the teasel family, and has 4 stamens, while the shepherd's scabious has 5 stamens.

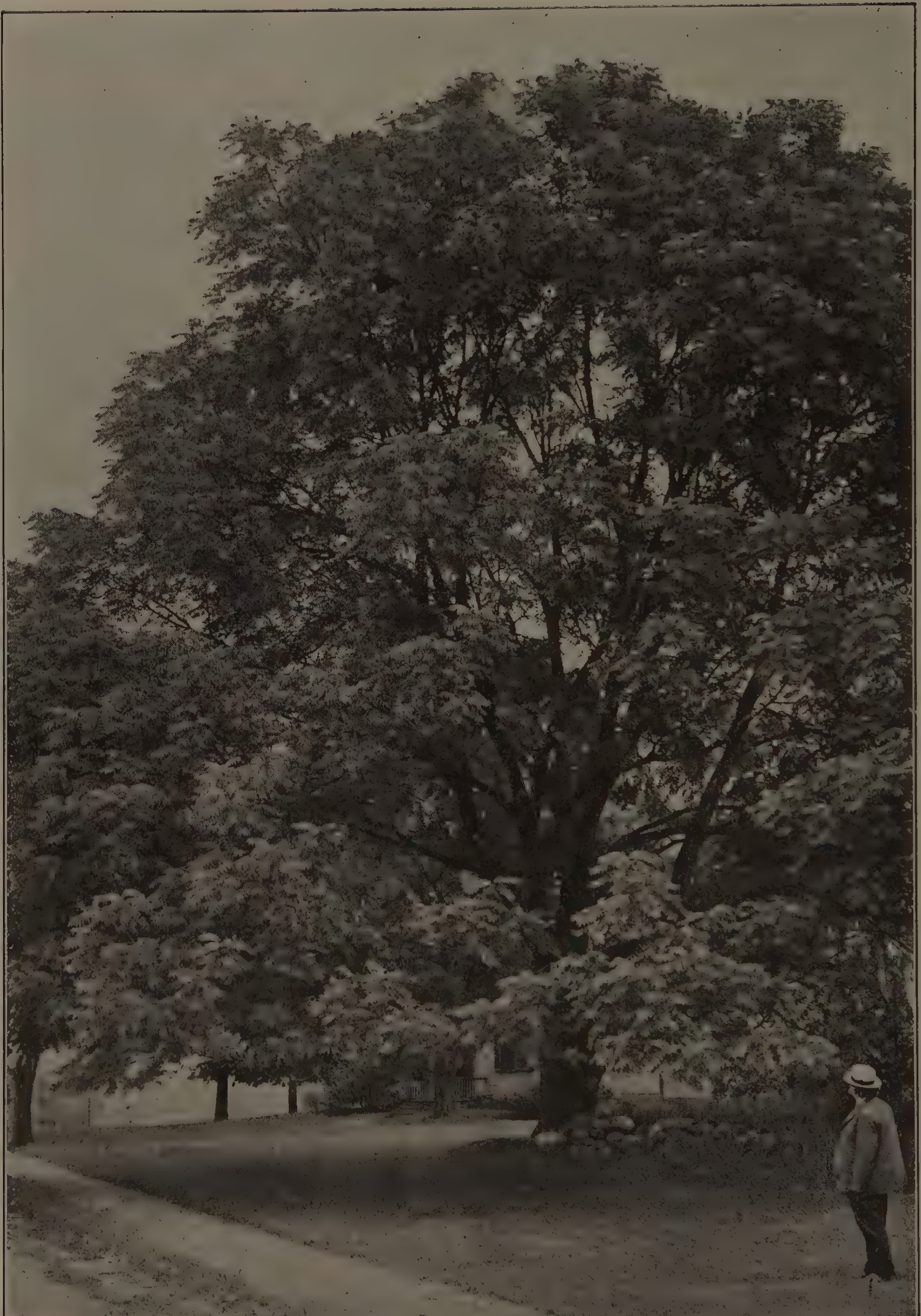
perénnis, Lam. SHEPHERD'S SCABIOUS. SHEEP SCABIOUS. SHEEP'S-BIT. Perennial: st. erect, sparingly if at all branched: root-lvs. obovate, in the non-floriferous plants forming a tufted rosette; st.-lvs. oblong-linear, entire; peduncles long, leafless; bracts ovate, serrate-dentate; fls. blue. S. Eu. July, Aug. B.R. 505. B.M. 2198.

montàna, Linn. Annual or biennial (if biennial, bearing a winter tuft or rosette of radical lvs.): sts. erect, 1 ft. high, sometimes short and more or less decumbent: lvs. linear or lanceolate, undulate, somewhat hairy: fls. pale blue, on long terminal peduncles; involucral bracts ovate. Great Britain to Caucasus.—The seaside form, (var. *littoràlis*) is said to be usually biennial. This species is also called sheep's-bit.

hùmilis, Lois. Dwarf, about 6–9 in. high, perennial: sts. simple, ascending: lvs. flat and entire, linear-obovate: fls. blue on short peduncles. Pyrenees; useful in rock-gardens. July, Aug. L. H. B.†

JÁSMINUM (Arabic name, from which have come Jessamine, Jasmin and Jasminum). *Oleàceæ.* JASMINE. JESSAMINE. Climbing or erect shrubs, with attractive flowers, mostly very fragrant, prized for planting in mild climates and frequently grown under glass.

Leaves opposite or alternate, pinnate but sometimes reduced to 1 lft. (petiole jointed): fls. on the ends of the branchlets, or twin, or in dichotomous cymes; corolla yellow or white, sometimes reddish, salver-shaped, the 4–9 or more lobes convolute in the bud, much exceeding the calyx; stamens 2, included in the corolla-tube; ovary 2-loculed, with 1–4 erect ovules: fr. a 2-lobed berry, or sometimes the carpels separate, the carpels mostly 2-seeded.—Probably upwards of 200 species, widely distributed in warm parts of Eu., Asia, Afr., and the Pacific region; nearly absent from Amer. The genus is closely allied to Ligustrum, but differs in the compound lvs. and twin-carpeled frs. Olea is also a related genus.



LX. Juglans nigra.—The black walnut.

Jasmines are of diverse horticultural groups. Some of them are hardy in the middle and southern states, whereas others are winter-flowering warmhouse plants. Most of them are known as coolhouse or temperate-house shrubs, of half-climbing habit. They are all of easy culture. They propagate readily by cuttings of nearly mature wood and by layers. The species are usually called jasmines although the word jessamine is really the same. *J. officinale* is the jessamine of poetry. Some of them (particularly *J. grandiflorum*) are grown for perfume-making. The Cape jessamine is Gardenia, although there is a *Jasminum capense.* Yellow or Carolina jessamine is Gelsemium. The hardiest kinds are *J. humile*, *J. fruticans*, *J. floridum*, *J. nudiflorum*, *J. primulinum*, *J. officinale*, but none of them is reliable north of Washington without protection, and even then only seldom north of Philadelphia.

INDEX.

affine, 13.
anastomosans, 2.
angulare, 15.
aureum, 17.
azoricum, 12.
Beesianum, 11.
capense, 15.
flavum, 20.
floribundum, 14.
floridum, 23.
fruticans, 19.
glabratum, 15.
gracile, 1.
gracillimum, 8.
grandiflorum, 16.
hirsutum, 7.
humile, 20.
ligustrifolium, 3.
lucidum, 1.
luteum, 19.
Maingayi, 10.
multiflorum, 7.
multipartitum, 4.
nitidum, 9.
nudiflorum, 17.
odoratissimum, 22.
officinale, 13.
poeticum, 13.
primulinum, 18.
pubescens, 7.
pubigerum, 21.
Reevesii, 20.
revolutum, 20.
rigidum, 3.
Sambac, 5.
Sieboldianum, 17.
simplicifolium, 1.
subulatum, 23.
syriacum, 19.
trifoliatum, 5.
trinerve, 2.
triumphans, 20.
undulatum, 6.
Wallichianum, 20.

A. *Lvs. apparently simple (reduced to 1 lft.).*

B. *Fls. white.*

C. *Calyx glabrous (No. 4 not considered).*

1. **simplicifòlium,** Forst. (*J. lùcidum*, Banks. *J. grácile*, Andr.). Climber, or sometimes a tree in its native place, glabrous or pubescent: lvs. opposite, mostly short-stalked, shining, varying from oblong-elliptic to ovate-lanceolate to cordate-ovate, acute or obtuse, usually less than 3 in. long: fls. white, in terminal forking, many-fld. clusters; calyx-teeth short and sometimes scarcely any; corolla-tube ⅓–½in. long, the acute lobes somewhat shorter. Austral. B.M. 980. B.R. 606.—Summer bloomer.

2. **trinérve,** Vahl. Tall-climbing, with terete glabrous branches: lvs. opposite, short-stalked, ample, ovate-oblong and acuminate, strongly 3-nerved from the base: fls. white, in small clusters; calyx-teeth narrow but much shorter than the long corolla-tube; corolla-lobes only half as long as the tube, acute. India. B.R. 918.—Perhaps only a form of *J. anastomosans*, Wall.

3. **rígidum,** Zenker (*J. ligustrifòlium*, Wall.). Compact dense rigid glabrous shrub, scarcely climbing: lvs. opposite, 2 in. long, ovate or elliptic, shining green, more or less acute at both ends but not acuminate, coriaceous, with reticulating nerves: fls. white, fragrant, in few-fld. dense sessile cymes; calyx-teeth linear, erect; corolla-tube 1 in. long, exceeding the lobes. India.

4. **multipartìtum,** Hochst. Erect bushy shrub, to 10 ft., the branches minutely puberulent: lvs. simple, ovate-lanceolate, less than 2 in. long, acute, somewhat undulate: fls. probably white, fragrant, solitary on the ends of branches; calyx 10-parted, the lobes setaceous; corolla-tube to 1½ in. long, the limb of several or many ovate-elliptic or linear-oblong acute lobes. S. Afr.

CC. *Calyx pubescent or pilose.*

D. *Teeth of calyx subulate.*

5. **Sámbac,** Soland. ARABIAN JASMINE. Climbing, the angular branchlets pubescent: lvs. opposite or in 3's (the ternate-lvd. specimens giving rise to the name *J. trifoliàtum*, Hort.), firm in texture, shining, nearly or quite glabrous, the petiole short and abruptly curved upward, elliptic-ovate or broad-ovate, either prominently acute or completely rounded on the end, entire, prominently veined: clusters 3–12-fld.; calyx-lobes linear and prominent, hirsute on the edges (sometimes almost glabrous); corolla-tube ½in. long; lobes oblong or orbicular. India. B.R. 1.—Much cult. in the tropics. Fls. white, but turning purple as they die. A full double button-fld. group is in cult., one form of which is the Grand Duke of Tuscany (or Grand Duke). The double form is shown in B.M. 1785. This double form sometimes passes as *J. trifoliatum*. *J. Sambac* is a perpetual bloomer, particularly in frostless countries, where it can stand in the open.

6. **undulàtum,** Ker. Climbing, with hairy branches, slender: lvs. opposite, short-petioled, rather small (about 2 in. long), ovate-lanceolate and acuminate, somewhat pubescent beneath, somewhat undulate: fls. 6–10, in terminal cymes, white, long-tubed; calyx-teeth short; corolla-tube ¾in. long, and slender; lobes half or less as long, acute. India. B.R. 436.—Lvs. sometimes ternate. Little known in cult. in this country.

7. **pubéscens,** Willd. (*J. hirsùtum*, Willd. *J. multiflòrum*, Andr.). Climbing, rusty-hairy: lvs. opposite, very short-petioled, rather thick, ovate-acute: calyx-teeth usually ⅔in. long (nearly or quite twice as long as in *J. undulatum*), with spreading yellow hairs: fls. white, much like those of *J. undulatum*, the lobes broad; often half-double. India. B.M. 1991. B.R. 15. J.H. III. 43:322.—Will stand some frost. Said to be a good dwarf glasshouse subject.

8. **gracíllimum,** Hook. f. Climbing or scrambling, soft-pubescent or hairy: lvs. opposite, very short-petioled, ovate-lanceolate, acuminate, the base cordate or truncate, bright green above and pubescent beneath, 1½ in. or less long: fls. white, in very large, dense hanging heads, an inch or more across, fragrant; calyx-teeth long and awl-like, half as long as the slender corolla-tube; corolla-lobes many (usually about 9), acute. N. Borneo. G.C. II. 15:9. B.M. 6559. J.H. III. 52:281. G.Z. 26, p. 97. G. 4:471; 7:233. F.S.R. 3, p. 15.—Long, lithe branches spring from near the ground and bear heavy clusters at their ends. Handsome floriferous winter bloomer. Nearly hardy in eastern part of N. C.

DD. *Teeth of calyx linear.*

9. **nítidum,** Skan. Slender-branched, somewhat pubescent, half-twining: lvs. opposite, shining, 2–3 in. long, elliptic-lanceolate, short-acuminate, the base somewhat cuneate, green above and pale beneath, lightly pilose along the rib, primary veins 3, the petiole less than ¼in. long and very pilose: fls. white, in small cymes, very fragrant, the pedicels about ⅓in. long; calyx pilose, the teeth linear and recurved and about ⅙in. long; corolla-tube narrow, ¾in. long; lobes of corolla 9–12, linear-lanceolate, spreading, 1½ in. broad. Admiralty Isls. (Bismarck Archipelago). R.B. 32, p. 182. R.H. 1907, pp. 110, 111. J.H. III. 60:237. Gn. 63, p. 61. A.F. 15:1237.—An excellent warmhouse climber.

10. **Màingayi,** Clarke. Scandent shrub with pilose branches: lvs. opposite, long-petioled, elliptic-lanceolate, 5 in. long, glabrous, acute at apex and rhomboid at base, coriaceous, the nerves 6–8 pairs and conspicuous and oblique and not inarched: fls. white, star-shaped, fragrant, in dense pubescent panicled cymes, on very short pedicels; calyx-tube ⅛in. long, campanulate, the teeth ⅓in. or less long, linear; corolla-tube ¾–1 in. long. the elliptic lobes acute, the limb 1½ in. diam. Penang (India). B.M. 7823.—Named for Dr. A. C. Maingay, the discoverer.

BB. *Fls. pink or red.*

11. **Beesiànum,** Forrest & Diels. Shrub, 1–3 ft.: lvs. simple and small, short-petioled, ovate or lanceolate,

1 in. or less long: fls. pink or deep rose, very fragrant; calyx-lobes linear, less than ¼in. long; corolla-tube short (less than ½in. long); lobes of corolla erect or spreading, broad-elliptic or suborbicular, short. W. China, altitude 8,000–9,000 ft. (Bees, Ltd., Liverpool.)

AA. *Lvs. of 3 or more lfts. (sometimes only 1 in No. 19).*

B. *The lvs. opposite.*

C. *Fls. white.*

12. **azòricum,** Linn. Climbing, glabrous or nearly so, the branches terete: lvs. evergreen, opposite, the lfts. 3, ovate-acuminate, the 2 side ones often smaller: calyx-teeth very small; oblong corolla-lobes about as long as the tube. Canary Isls. B.M. 1889.—A good white-fld. temperate-house species blooming in summer and winter.

13. **officinàle,** Linn. (*J. poéticum*, Hort.). Jessamine. Fig. 2008. Long, slender grower requiring support, but scarcely self-climbing, glabrous or very nearly so: lvs. opposite, odd-pinnate, the lateral lfts. 2–3 pairs and rhomboid-oblong-acute, the terminal one longer: fls. white, 2–10 in terminal more or less leafy clusters; calyx-teeth linear, ¼–⅔in. long, or sometimes as long as the rather short corolla-tube; corolla-lobes 4 or 5, oblong, more or less involute on the margins. Kashmir, 3,000–9,000 ft., Persia, and now widely distributed. B.M. 31. R.H. 1878, p. 428.—Long cult. The glossy foliage and fragrant white summer-blooming fls. render the plant very attractive in the S., where it is hardy. With protection it will stand as far N. as Philadelphia. Var. **affìne,** Nichols. (*J. affìne*, Hort.), is a form with larger fls. R.H. 1878, p. 428. There are double-fld. forms; also with yellow- and silver-edged lvs.

2008. Jasminum officinale. (×½)

14. **floribúndum,** R. Br. Much like *J. officinale*, but differs in calyx-teeth, and corolla-lobes wider and more obtuse and only half length of the tube: branches glabrous: lvs. opposite; lfts. 5, ovate, apiculate, the terminal one largest: fls. fragrant, white, in dichotomous axillary and terminal clusters; calyx-lobes subulate, longer than the bell-shaped calyx-tube; corolla-tube exceeding the calyx, to ¾in. long; segms. 5, ½in. long, oblong. Nile Land.

15. **angulàre,** Vahl. Climber with long 4-angled branches: lvs. opposite, hirsute; lfts. 3, orbicular, ovate to lanceolate, mucronate: fls. white, about 1½in. across, odorless, in 3's on axillary trifid peduncles; calyx glabrous, 5-toothed, the teeth equaling or shorter than the tube; corolla-tube many times longer than calyx, 1–1½ in., very slender; lobes of corolla 5–7, oval-lanceolate, somewhat obtuse or subacute. S. Afr. B.M. 6865. G.C. III. 28:360, 361. Var. **glabràtum,** Mey. (*J. capénse*, Thunb.). St. scarcely puberulent, the lvs. glabrous.

16. **grandiflòrum,** Linn. Catalonian, Italian, Royal or Spanish Jasmine. Nearly erect-growing, the branches drooping and angular, glabrous or very nearly so: lvs. opposite, the rachis flattened or winged, the lfts. 5–7, elliptic or round-elliptic or oval, mostly ending in a very small point or cusp, the terminal lft. mostly ovate-lanceolate and acuminate: calyx-teeth ¼in. long or rarely half as long as the corolla-tube; corolla star-shaped, larger than in *J. officinale*. India; naturalized in Fla. B.R. 91. G. 2:451.—Probably the best white-fld. species. Summer and fall, or nearly perpetual in warm countries. Much grown in Eu. for perfumery, and also a good greenhouse subject; young stock may be planted out in spring; will stand sun. Stands 10–12° of frost.

CC. *Fls. yellow.*

17. **nudiflòrum,** Lindl. (*J. Sieboldiànum*, Blume). Twiggy nearly erect shrub with 4-angled glabrous stiff branchlets: lvs. opposite, small, with 3 little ovate ciliate lfts., the entire foliage falling in autumn or when the growth is completed: fls. solitary, in early spring (or winter), from long, scaly buds, subtended by several or many small lf.-like bracts, yellow; calyx-lobes leafy and spreading or reflexed, shorter than the corolla-tube; corolla-segms. obovate, often wavy. China. B.R. 32:48. B.M. 4649. R.H. 1852:201. G.C. III. 11:181. G.W. 15, p. 300. H.F. 2:64. J.F. 3:320. Var. **aùreum,** Hort., has yellow-variegated foliage.—A most interesting species, reminding one of forsythia when in bloom. Hardy south of Washington, and blooming nearly all winter. With protection, it will stand as far north as Hudson River valley, and bloom very early in spring. In northern glasshouses, used mostly as a late winter and early spring bloomer. Strong-growing specimens need support.

18. **primúlinum,** Hemsl. Very like *J. nudiflorum*, botanically, but with larger lvs. which are sometimes well developed at flowering-time, and with much larger fls., the limb of the corolla exceeding the tube; a rambling very free-flowering evergreen glabrous shrub, with slender green 4-angled branches: lvs. petioled, of 3 lfts. which are almost sessile and 1 or 2 in. long, entire, oblong-lanceolate, shining above and paler beneath: fls. primrose-yellow with a darker eye, 1½–2 in. across, solitary on axillary bracted peduncles or branchlets; calyx-lobes lanceolate, slightly hairy; corolla-lobes usually 6, obovate-spatulate; stamens exserted. Yunnan, China, apparently as an escape from cult.; sometimes partially double. B.M. 7981. G.C. III. 33:197. R.H. 1904, p. 182; 1906:472. R.B. 35, p. 266. Gn. 69, p. 71; 71:270. J.H. III. 46:295. G.M. 46:163; 49:141. F.S.R. 2:168.—One of the best introductions of recent years; stands some frost. It blooms in early spring, the season lasting two months or more. Not hardy north of Washington, but nearly evergreen in the S.

BB. *The lvs. alternate: fls. yellow.*

19. **frùticans,** Linn. (*J. lùteum*, Gueld. *J. syrìacum*, Boiss. & Gaill.). Glabrous bush, to 12 ft., not climbing,

but with slender and weak branches which are angled: lvs. alternate; lfts. 3 (rarely 1), somewhat curved, obovate to spatulate or oblong, obtuse: fls. yellow, not fragrant, few in subterminal clusters; calyx-lobes subulate; corolla-tube twice length of calyx, about ½in. long; lobes of corolla 5, obtuse: berries black at maturity. S. Eu., N. Afr. B.M. 461.—Evergreen.

20. **hùmile,** Linn. (*J. revolùtum,* Sims. *J. Wallichiànum* Lindl. *J. flàvum,* Sieb. *J. triúmphans,* Hort.). Fig. 2009. A diffuse shrub, in the open ground in the S. reaching 20 ft. and requiring support, but in glasshouses usually grown as a pot-bush: branches glabrous, angled: lvs. alternate, odd-pinnate (rarely reduced to 1 lft.), the lateral lfts. 1–3 pairs, all lfts. thickish and acuminate, and more or less revolute on the edges, varying from oblong to oblong-lanceolate to oblong-rotund: fls. bright yellow, in open clusters; calyx-teeth very short; corolla-tube ¾–1 in. long, usually considerably exceeding the mostly obtuse and reflexing lobes. Trop. Asia. B.M. 1731. B.R. 178; 350; 1409. L.B.C. 10:966.—Apparently the commonest jasmine in American glasshouses, usually known as *J. revolutum.* It is hardy in the open as far north as Maryland. Lvs. thick and evergreen. Needs a cool house if grown under glass. Summer and fall bloomer. *J. Reèvesii,* Hort., probably belongs to this species. Some horticulturists distinguish a *J. humile* from *J. revolutum,* the former said to be of smaller size, less floriferous, and fls. smaller and scarcely fragrant.

2009. **Jasminum humile.** (×⅓)

21. **pubígerum,** D. Don. Erect shrub, much like *J. humile* and perhaps a form of it, but softly and densely villous: lvs. alternate; lfts. 3–7, to 2 in. long, suborbicular to ovate or oblong, villous on both surfaces: fls. yellow, in dense nearly sessile, very villous, about 15-fld. cymes; calyx-teeth linear, longer than in *J. humile;* corolla-tube ⅔in. long. India.

22. **odoratíssimum,** Linn. Much like No. 20, but more erect and less leafy when in flower: lvs. alternate, the lfts. 3 or 5, shining, oval or broad-oval and obtuse: fls. yellow, in a terminal cluster; calyx-teeth very short; corolla-lobes oblong-obtuse, mostly shorter than the tube. Summer. Madeira. B.M. 285.—It is an erect, glabrous shrub with straight, stiff, terete or slightly angular branches.

23. **flóridum,** Bunge (*J. subulàtum,* Lindl.). Shrub, glabrous, erect but with flexuous branches: lvs. alternate, 3-foliolate (rarely 5-foliolate), the lfts. coriaceous, ovate-oblong or oval and acute: fls. golden yellow, ½in. diam. in open cymes or panicles; calyx-teeth long-subulate, as long as the tube, the calyx-tube turbinate and 5-angled; corolla-tube 4 times length of calyx; segms. ovate, acute, spreading to 1¾ in. across; stamens included. China. B.M. 6719.—Hardy as far north as Washington. Apparently very little planted.

J. auriculàtum, Vahl. Scandent, pubescent or nearly glabrous: lvs. mostly simple but sometimes 3-foliolate and the lateral lfts. reduced to auricles: fls. white, in compound many-fld. cymes; corolla-tube ½in. or less long, the lobes elliptic and ¼in. long. India. B.R. 264.—*J. calcàreum,* Muell., is a spring- and summer-blooming Australian twining quite glabrous species with white fls. and simple, opposite, thick, 3- or 5-nerved lvs.—*J. dídymum,* Forst. Climber: fls. small, white, in narrow axillary cymes which exceed the lvs.: lvs. opposite, ternate; lfts. often retuse. Austral. B.M. 6349. Said to be an excellent warmhouse species.—*J. Giráldii,* Diels. Branches angled, hairy: lvs. alternate, 3–5-foliolate; lfts. lanceolate, somewhat obtuse or apiculate, the terminal one longer: corymb terminal, about 3–5-fld.; calyx-segms, subulate, hispid; corolla yellow, the tube 6–8 times longer than calyx, the lobes apiculate. China. Allied to J. humile and J. pubigerum.—*J. paniculàtum,* Roxbg. Evergreen climber, suitable for warmhouse: lvs. opposite, 3 foliolate; lfts. elliptic, obtuse: fls. white, in cymes; corolla-tube ½in. long. China. B.R. 690. L.B.C. 5: 469.—*J. polyánthum,* Franch., a Chinese species in the way of J. grandiflorum, may be expected to appear in cult. in greenhouses. Fls. white inside, reddish outside, long-tubed, very fragrant: lvs. opposite, with about 5 long-acuminate lfts: sts. long and sarmentose. R.H. 1891, p. 270.

L. H. B.

JATEORHÌZA (name alludes to healing qualities of the root). Also spelled *Jatrorrhiza. Menispermàceæ.* Tropical twiners.

Herbaceous perennials or suffrutescent, with rough or setose sts.: lvs. large, palmately lobed: diœcious; male fls. in long and slender racemose panicles in the axils; female fls. in racemes that are simple or nearly so; sepals 6 in 2 series; petals 6, shorter than the sepals; stamens (in male fl.) 6, the filaments free or connate; carpels (in female fl.) 3, with divided stigmas: fr. an ovoid drupe.—Species apparently 2, in Trop. Afr. *J. palmàta,* Miers (*Cócculus palmàtus,* DC. *Menispérmum palmàtum,* Lam. *M. Colúmba,* Roxbg. *J. Colúmba,* Miers). Probably not in the trade in our territory, but the fascicled fusiform fleshy roots are the source of the drug calumba: st. herbaceous: lvs. 6–16 in. across, 3–5-lobed, deeply cordate, the lateral lobes broad-ovate or roundish triangular, the central lobe often broadly obovate: male panicles very slender, 6–12 in. or more long: drupes ovoid, setose, in clusters of 4–6. Mozambique; the name calumba or columba is said to have come from Columbo, Ceylon, whence the supply of roots was once supposed to have come. B.M. 2970, 2971.

L. H. B.

JÁTROPHA (Greek, referring to its medicinal use). *Euphorbiàceæ.* A varied group of tropical herbs, shrubs or trees; several species cultivated in the greenhouse for their ornamental or curious leaves and flowers; and some grown in the tropics for their economic uses.

Juice milky: lvs. alternate, simple, usually palmately lobed, sometimes pinnate and entire: fls. monœcious, rarely diœcious, usually with petals; sepals 5, more or less connate at base, imbricate; stamens about 10, in 2 or more whorls, some, at least, with the filaments connate; ovary 2–5-celled, 1 ovule in each cell: fr. a caps.—About 150 species, chiefly in the tropics of Amer. and Afr. Related to Hevea and Aleurites.

Most of the species of Jatropha are tropical shrubs, but several low or herbaceous species extend into the southern United States. One, the spurge nettle, *J. stimulosa,* Michx. (*Cnidoscolus stimulosus,* Gray), is a stinging weed of sandy soil in the South, with white tubular calyx. A related species *J. aconitifolia,* is planted for hedges in Central America. Many species have found use in medicine chiefly as local or popular remedies. The oil of *J. Curcas,* for which the plant is cultivated in tropical America, is used as a purgative and also for cooking, soap-making and the like. In Mexico the seeds are reported to be eaten like peanuts. A few years ago *J. gossypifolia* attracted some attention as a remedy for leprosy.

Most of the species are adapted to sandy loam soil. They grow readily from seeds, and cuttings from hard young branches can be rooted in sand with bottom heat if dried somewhat before bedding.

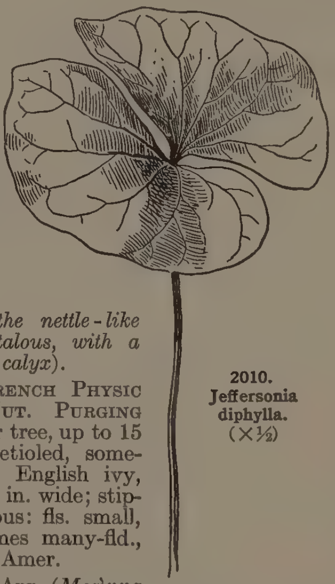
A. *Petals free, or nearly so: lvs. long-petioled; stipules usually dissected and persistent.*

gossypifòlia, Linn. BELLYACHE BUSH. Subshrub, 2–6 ft. high: lvs. 5-lobed, nearly glabrous, 4–6 in. wide, with prominent gland-tipped hairs on the margin, stipules and petioles, those of the latter branched: petals dark purple; ovary pubescent: fr. globular-oblong, warty. Trop. Amer., Key West; Trop. Afr. L.B.C. 2:117. B.R. 746.

glandulífera, Roxbg. (*J. glaùca,* Vahl). Shrub, 3–4 ft. high: lvs. 3–5-lobed, almost glabrous, glaucous, glandular dentate; stipules nearly 1 in. long; petiole not glandular: fls. yellowish green; ovary glabrous. India.

multífida, Linn. Coral Plant. Physic Nut. Shrub, 5–15 ft. high: lvs. deeply palmately 7–11-parted, glabrous, glaucous below, the lobes narrow, 4–7 in. long, pinnately incised to entire; stipules about ½in. long; petiole not glandular: fls. scarlet. Texas to Brazil.

podágrica, Hook. Guatemala Rhubarb. Physic Nut. Tartago. Shrub, 1–2 ft. high: lvs. peltate, 3–5-lobed, 4–8 in. wide, glabrous and glaucous, lobes entire; stipules about ¼in. long; petiole not glandular: petals scarlet; ovary glabrous. Cent. Amer. H.F. 8:146. B.M. 4376.



2010. Jeffersonia diphylla. (×½)

pandurifòlia, Andr. (*J. acuminàta,* Desv. *J. hastàta,* Griseb. *Mánihot diversifòlia,* Sweet). Large shrub: lvs. ovate to oblong or panduriform, entire except the dentate base, 2–3 in. wide, glabrous or puberulent; petiole 2 in. or less long; stipules small, entire, not glandular: petals over ½in. long, scarlet; cyme many-fld. W. Indies. B.M. 604. L. B. C. 17: 1604.

AA. *Petals united (the nettle-like species are apetalous, with a tubular petaloid calyx).*

Cúrcas, Linn. French Physic Nut. Barbados Nut. Purging Nut. Large shrub or tree, up to 15 ft. high: lvs. long-petioled, somewhat 3–5-lobed like English ivy, almost glabrous, 3–6 in. wide; stipules minute; deciduous: fls. small, yellowish green; cymes many-fld., corymbiform. Trop. Amer.

spathulàta, Muell. Arg. (*Mozìnna spathulàta,* Ort.). Tocote Prieto. Shrub, 1–15 ft. high, stoloniferous: branches fleshy: lvs. sessile, nearly glabrous, spatulate, entire or 3-lobed: fls. in fascicles, diœcious, pale rose-color; ovary 1–3-celled: caps. usually 1-seeded. Texas to Cent. Amer.—Sometimes seen in succulent collections.

J. aconitifòlia, Mill., var. *Papàya,* Pax. Tree, apetalous, stinging, spiny. Cent. Amer.—*J. canéscens,* Muell. Arg. Shrub: petals united. Calif. to Cent. Amer.—*J. fràgrans,* HBK. Tree, stinging, spiny, apetalous: fls. aromatic. Cuba.—*J. integérrima,* Jacq.= J. diversifolia, Muell. Arg. Small tree or shrub: petals free, stipules entire; fls. red. B.M. 1464. W. Indies.—*J. Kunthiàna,* Muell. Arg. Shrub, apetalous, stinging, spiny. Trop. Amer.—*J. Mánihot*= Manihot.—*J. Pohliàna,* Muell. Arg. Shrub or small tree: petals free: stipules dissected. S. Brazil.—*J. ùrens,* Linn. Shrub, stinging, spiny, apetalous. G.C. II. 14:753. Trop. Amer.

J. B. S. Norton.

JEFFERSÒNIA (Thomas Jefferson, third president of the United States). *Berberidàceæ.* Attractive hardy perennial herbs.

Rhizomatous: lvs. radical, palmately nerved, 2-lobed or 2-parted: fl. solitary on a naked scape; sepals 4, petaloid but fugacious; petals 8, flat, larger than sepals; stamens 8, free, with slender filaments; ovary single, the style 2-lobed at apex: fr. a caps., partially circumscissile near summit.—Two species, 1 in E. N. Amer. and 1 in Manchuria. The oriental species, *J. dubia,* Benth. & Hook., seems not to be in cult.

diphýlla, Pers. (*Podophýllum diphýllum,* Linn. *J. binàta,* Bart.). Fig. 2010. Twin-leaf. Rheumatism-root. Lvs. glaucous beneath, 3–6 in. long, 2–4 in. wide, the petioles 6–12 in. high: fls. about 1 in. across, white. N. Y. and Ont. to Wis. and Iowa, and to Tenn. G. 35:113.—A very attractive woods plant. Sometimes has parts of fls. in 3's or 5's. L. H. B.

JERUSALEM ARTICHOKE: *Artichoke, Jerusalem.* **J. Cherry:** *Solanum Pseudo-capsicum.* **J. Cross:** *Lychnis chalcedonica.* **J. Oak:** *Chenopodium Botrys.* **J. Sage:** *Phlomis fruticosa.* **J. Thorn:** *Parkinsonia aculeata.*

JESSAMINE: *Jasminum officinale* and others. **Cape J.:** *Gardenia jasminoides.* **Malayan J.:** *Rhyncospermum jasminoides.*

JEWEL WEED: *Impatiens aurea* and *I. biflora.*

JIMPSON or JIMSON WEED: *Datura.*

JOANNÈSIA (from Johannes). *Euphorbiàceæ.* A tree cult. in many tropical lands for ornament, for the wood, and the seeds used in medicine. Juice milky: lvs. alternate, long-petioled, digitately 3–7-foliate; lfts. stalked, entire: fls. monœcious, with petals; calyx 5-toothed, valvate; stamens 7–10, more or less united; ovary 2-celled, ovules 1 to each cell: fr. a large drupe.—One species, related to Aleurites and Jatropha. It grows easily on poor soil and stands long droughts well. It is hardy in S. Calif.

prínceps, Vell. (*Ánda Gomèsii,* Juss.). Anda Assu and various other native names. A large tree: lfts. ovate, 3–4 in. long: infl. a paniculate cyme, terminal and axillary; fls. inconspicuous: fr. 4–5 in. thick, coconut-like, with 4 large oily seeds. S. Brazil.

J. B. S. Norton.

JOB'S TEARS: *Coix Lacryma-Jobi.*

JOE-PYE WEED: *Eupatorium purpureum.*

JOHNSON-GRASS: *Holcus halepensis.*

JONQUIL: *Narcissus.*

JOVELLÀNA (*Jovellanos,* Spanish personal name). *Scrophulariàceæ.* A half-dozen South American and New Zealand plants that sometimes are included with Calceolaria, are referred to this genus. None of them is apparently in cultivation in this country, but *J. violàcea,* Don (see *Calceolaria violacea,* supplementary list) is sometimes cultivated as a greenhouse plant in the Old World. They differ from Calceolaria in having a ringent corolla without a saccate lip.

JUANULLÒA (George Juan and Antonio Ulloa, Spanish naturalists who traveled in Chile and Peru). *Solanàceæ.* About 10 species of shrubby plants, more or less epiphytic, from Cent. Amer. to Peru, sometimes mentioned in horticultural literature as suitable for growing in the warmhouse. Erect or diffuse and producing runners or decumbent branches, glabrous or tomentose: lvs. thick and entire: fls. yellow or red, solitary or in clusters; calyx colored, large; corolla tubular, sometimes ventricose and contracted at the throat, with small broad lobes; stamens inserted in lower part of corolla-tube: fr. an indehiscent succulent or dry berry. *J. aurantìaca,* Otto & Dietr. (*J. parasítica,* Hook.), is the species most likely to occur in cult. It is a glabrous shrub with herbaceous young branches: lvs. alternate, sometimes 2 together and very unequal, 2–5 in. long, oval or obovate, obtuse, short-petioled: fls. terminal on drooping branches in a sort of leafy raceme, showy, orange; calyx fleshy and large, 5-angled, loose on the corolla, the latter about a third longer and tubular, enlarging upward, and with a limb of 5 short rounded segms. Peru, where it is said to be epiphytic; but said to thrive well in a warmhouse in earth. B.M. 4118. H.U. 2, p. 321. L. H. B.

JUBÆA (after Juba, king of Numidia). *Palmàceæ.* The wine palm of Chile, *J. spectabilis*, which in this country is cultivated outdoors in southern California and in the North under glass.

Jubæa has only 1 species, a tall, unarmed S. American palm: caudex thick, covered with the bases of the sheaths: lvs. terminal, pinnatisect; segms. spreading, linear-lanceolate, rigid; margins recurved; rachis laterally compressed, convex on the back, acute beneath; sheath short, open. Allied genera in cult. are Attalea, Cocos, Maximiliana and Scheelea, which are distinguished chiefly by the staminate fls. In Jubæa the petals are lanceolate; stamens numerous, included, the anther-cells connate: fr. 1-seeded. In Attalea the petals are lanceolate; stamens 10–24, included, anther-cells connate: fr. 2–6-seeded. For distinctions from other genera consult also *Cocos, Maximiliana* and *Scheelea.*

Jubæa spectabilis is a handsome and satisfactory palm for the cool palm-house, where it would be treated in common with such plants as *Chamærops humilis*, the sabals and *Euterpe montana*, which may be grown well in a night temperature of 50°, providing the plants are properly established. In general appearance, *J. spectabilis* reminds one of some kinds of Phœnix, and, like them, does not show the true character of its foliage in a very small state, the seedling jubea producing several simple leaves before developing foliage of the pinnate type. In Jubæa, however, the lower pinnæ do not revert to spines, as is usually the case with Phœnix and the pinnæ are also arranged irregularly on the midrib, thus giving the fronds a feathery effect. The culture of jubea is by no means difficult, propagation being effected by means of imported seeds, which usually give a fair percentage of germination, providing they are started in a warmhouse and kept moist. The seedlings should be potted as soon as the second leaf appears, and kept in a warmhouse until they are large enough for a 4-inch pot, and from this time forward cooler treatment will give the best results, always remembering the fact that while many palms (and jubea among the number) will bear much neglect, yet the best results are to be had only by giving plenty of nourishment. (W. H. Taplin.)

spectàbilis, HBK. Height 40–60 ft. but much lower in cult.: lvs. 6–12 ft. long. G.C. II. 18:401; III. 18:516. Gn. 5, p. 413. V. 8:340. A.F. 22:696. C.L.A. 2:19. Gng. 12:658.—The southernmost American palm. "It is one of the hardiest palms," says Franceschi, "and can endure drought and many degrees of cold. If liberally treated, it makes a large tree in a few years." A full-sized trunk yields about 90 gallons of sugary sap, which is boiled by the Chileans and called "Miel de Palma" or palm honey, which is extensively used on ships and hotels on the west coast of S. Amer. There is some danger of the species being exterminated in Chile. The frs. look like diminutive coconuts, and are called Coquitos, or by the trade "monkey's coconuts." In Europe, it is cult. under glass, and also used for subtropical bedding. N. TAYLOR.†

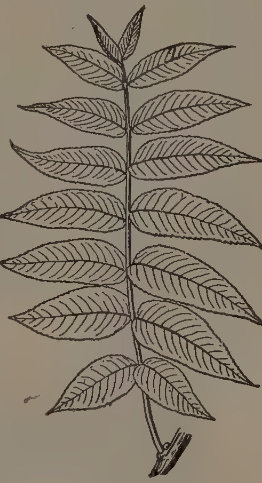
JUBÙBA, Jujuba: *Zizyphus.*

JUDAS TREE: *Cercis.*

JÙGLANS (ancient Latin name from *Jovis glans*, nut of Jupiter). *Juglandàceæ.* WALNUT. BUTTERNUT. Plate LX. Woody plants grown for their handsome foliage and some species for their edible nuts.

Deciduous trees, rarely shrubs: branches with lamellate pith: lvs. alternate, without stipules, odd-pinnate, of aromatic fragrance when bruised: staminate fls. with a 2–5-lobed perianth and 6–30 stamens, in slender catkins; pistillate fls. in few- to many-fld. racemes; ovary inferior, 1-celled, with 4 calyx-lobes and included in a 3-lobed involucre: fr. a large drupe with a thick, indehiscent husk; nut 2- or 4-celled at the base, indehiscent or separating at last into 2 valves.—About 15 species in N. and S. Amer. and from S. E. Eu. to E. Asia; 44 species have been distinguished and described in a monograph by Dode (B.S.D. 1906: 67–97; 1909: 22–50, 165–215, with many illustrations).

The walnuts are usually tall broad-headed trees with large leaves, and with small greenish flowers, the staminate in pendulous slender often conspicuous catkins, the pistillate inconspicuous followed by a greenish large drupe containing an edible nut. Most of the species are hardy, and are very valuable park trees, with a massive, straight trunk, and a light and airy broad top, the best being probably *J. nigra*, one of the noblest trees of the American forest. *J. regia, J. rupestris*, and *J. cathayensis* are hardy as far north as Massachusetts, while *J. californica* is tender in the North. Though many fungi and insects prey on the walnut, none of them does very serious damage, the worst being, perhaps, the hickory-borer. The wood of the walnut, which is easily worked and susceptible of receiving a beautiful polish, is much used for cabinet making and the interior finish of houses, especially that of *J. nigra* and *J. regia*, which is heavy, strong and durable, and of dark brown color, while that of *J. cinerea* and *J. Sieboldiana* is light and soft. The husks of the nuts are sometimes used for dyeing yellow, and the bark for tanning leather. The husk of *J. cinerea* has some medicinal properties. The nuts of all species are edible, and are an article of commercial importance, especially those of *J. regia*, which are the best. This species is extensively grown in the warmer parts of Europe, in California and in the East from Pennsylvania to Georgia. The nuts of the native species are also sold on the market, but mostly gathered in the woods, though a number of improved varieties are in cultivation. *J. Sieboldiana* and var. *cordiformis*, with nuts superior to those of the native species, and much valued in Japan, will probably become valuable nut trees where *J. regia* is too tender; also *J. regia* var. *sinensis* is hardier than the type.



2011. Leaf of Juglans nigra.

The walnut grows best in moderately moist, rich soil, but *J. cinerea* is more moisture-loving and *J. regia* prefers well-drained hillsides. They are not easily transplanted when older, and therefore the nuts are often planted where the trees are to stand, but they may be safely transplanted when two or three years old, or even later when they have been transplanted in the nursery. Propagation is by seeds, which should be stratified and not allowed to become dry. A light, sandy soil is to be preferred, as the young plants produce more fibrous roots, while in stiff soil they are liable to make a long taproot. The young seedlings are transplanted when about two years old; sometimes the taproot is cut by a long knife. Varieties are often grafted on potted stock in the greenhouse in early spring or are budded in summer, either shield- or flute-budding being employed; even top-grafting of old trees is sometimes practised. For culture and further information, see United States Department of Agriculture, "Nut Culture in the United States," quoted below as U. S. N. C.; see, also, *Walnut.*

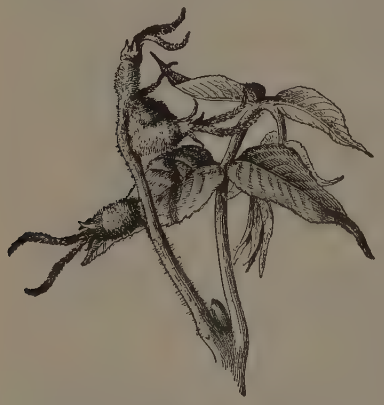
INDEX.

ailantifolia, 10.
alata, 12.
Allardiana, 10.
aspleniifolia, 1.
Bartheriana, 1.
californica, 4, 5.
cathayensis, 8.
cinerea, 7.
coarctata, 10.
corcyrensis, 1.
cordiformis, 10.
draconis, 8.
Duclouxiana, 1.
elongata, 1.
fertilis, 1.
filicifolia, 1.
fruticosa, 1.
gibbosa, 11.
Hindsii, 5.
intermedia, 11, 12.
laciniata, 1.
Lavallei, 10.
major, 2.
mandshurica, 9.
monophylla, 1.
nigra, 6.
ovoidea, 6.
pendula, 1.
præparturiens, 1.
pyriformis, 11.
quadrangulata, 12.
quercina, 5.
quercifolia, 5.
regia, 1.
rupestris, 2, 3.
Sieboldiana, 10.
sinensis, 1.
subcordiformis, 10.
Torreyi, 2.
Vilmoreana, 11.
Vilmoriniana, 11.

A. *Fr. glabrous or finely pubescent, 1–3; nut 4-celled at the base.*

B. *Lfts. usually 7–9, almost entire.*

1. **règia,** Linn. PERSIAN OR ENGLISH WALNUT. Round-headed tree, to 70 ft.: lfts. 5–13, oblong or oblong-ovate, acute or acuminate, almost glabrous, bright green, 2–5 in. long: fr. almost globular, green; nut usually oval, reticulate and rather smooth, rather thin-shelled. S. E. Eu. Himalayas, China. U. S. N. C. pl. 6. H.W. 2:36, pp. 87–9. M.D. 1911, p. 197 (habit). Many varieties are cult. as fr. trees, for which see *Walnut.* Var. **sinénsis,** DC. (*J. sinénsis,* Dode). Lfts. usually 5, larger, pubescent on the veins below: nut globose-ovoid, very rugose. China, Japan. S.I.F. 2:5. Of the ornamental varieties the most distinct and decorative is var. **laciniàta,** Loud. (var. *filicifòlia,* Hort. var. *asplenifòlia,* Hort.), with narrow, pinnately cut lfts.; very effective as a single specimen on the lawn; remains usually shrubby. M.D.G. 1908:617. Var. **monophýlla,** DC., has the lvs. simple or 3-foliolate. Var. **péndula,** Kirchn., has pendulous branches. Var. **fértilis,** Kirchn. (var. *fruticòsa,* Dipp. var. *præpartùriens,* Hort.), is a shrubby variety producing rather small, thin-shelled nuts on very young plants. Var. **Bartheriàna,** Carr. (var. *elongàta,* Hort.). Nut elongated, narrow-oblong. R.H. 1859, p. 147; 1861, p. 427. Gn. 50, p. 478. Var. **corcyrénsis,** Sprenger. Lvs. large, to 2 ft. long; lfts. 9, the lowest pair very small, the upper pairs broadly ovate, about 8 in. long and 5 in. broad: nut rather thick-shelled. *J. Duclouxiàna,* Dode, from the Himalayas and W. China with more elliptic and more acuminate lfts. and nuts with thin fragile shell, is probably only a variety of *J. regia.*



2012. Pistillate flowers of Juglans cinerea. (Natural size.)

BB. *Lfts. 9–25.*

C. *Width of lfts. usually less than 1 in.*

D. *Nuts deeply grooved.*

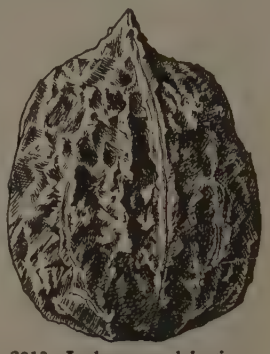
E. *Diam. of nut up to 1½ in.: lfts. 9–13.*

2. **màjor,** Heller (*J. rupéstris* var. *màjor,* Torr. *J. Tórreyi,* Dode). Tree, to 50 ft., with narrow head: branchlets pubescent while young: lfts. 9–13, rarely to 19, oblong-lanceolate to ovate, acuminate, cuneate or rounded at the base, coarsely serrate, soon glabrous or slightly pubescent on the midrib beneath, 3–4 in. long, the lowest lfts. 1½–2 in. long: stamens 30–40: fr. subglobose or ovoid, 1–1½ in. across, covered with a close rufous tomentum; nut dark brown or black, slightly compressed, with broad deep longitudinal grooves, with a thick shell and small sweet kernel. New Mex., Ariz., Colo. S.S. 7:336.

EE. *Diam. of nut not more than ¾in.: lfts. 11–23.*

3. **rupéstris,** Engelm. Shrub or small tree, rarely to 30 ft.: branchlets pubescent when young: lfts. 17–23, narrow-lanceolate, acuminate, finely serrate or nearly entire, puberulous or pubescent when young, at maturity quite glabrous or pubescent on the midrib beneath, 2–3 in. long: stamens about 20; ovary pubescent or tomentose: fr. globular, rarely ovoid, often pointed, usually pubescent, ½–¾in. across; nut with deep longitudinal grooves, thick-shelled, with small kernel. Texas and N. Mex. S.S. 7:335. G.W. 11, p. 399.

4. **califórnica,** Walt. Shrub or tree, 12–20, rarely 40–50 ft. high: branchlets puberulous: petioles glandular-pubescent; lfts. 11–15, rarely to 19, oblong-lanceolate, usually acute, or acuminate, cuneate or rounded at the base, glabrous, 1–2½ in. long: stamens 30–40: fr. globose, ⅓–¾in. across, puberulous, husk thin; nut nearly globose with deep longitudinal grooves. S. Calif. S.S. 7:337, figs. 1–4.



2013. Juglans mandshurica. (Natural size.)

DD. *Nut obscurely or not at all grooved, up to 2 in. across.*

5. **Hìndsii,** Sarg. (*J. califórnica* var. *Hìndsii,* Jepson). Rounded-headed tree, 30–40, occasionally to 75 ft. high, with tall trunk: branchlets densely pubescent at first: petioles villous; lfts. 15–19, usually 19, ovate-lanceolate to lanceolate, long-acuminate, usually rounded at the base, coarsely serrate, pubescent beneath on the midrib and veins, 2½–4 in. long: stamens 30–40: fr. globose, 1¼–2 in. across, soft-pubescent; nut nearly globose, faintly grooved, with thick walls. Cent. Calif. S.S. 7:337, figs. 5–8. Gn. 49, p. 278.—A graceful ornamental tree often planted as a street tree in Calif. and used as stock for grafting varieties of the English walnut. The nut is of good quality, but rather small. Var. **quércina,** Sarg. (*J. califórnica quércina,* Babcock. *J. quercifòlia,* Pierce). An abnormal form with 1–5 lfts., usually 3, short-stalked or sessile, broadly ovate to oblong, obtuse or emarginate, serrate or entire, ½–2 in. long. Jepson, Silv. Calif., pp. 51–3.

CC. *Width of lfts. 1 in. or more: nut prominently and irregularly ridged.*

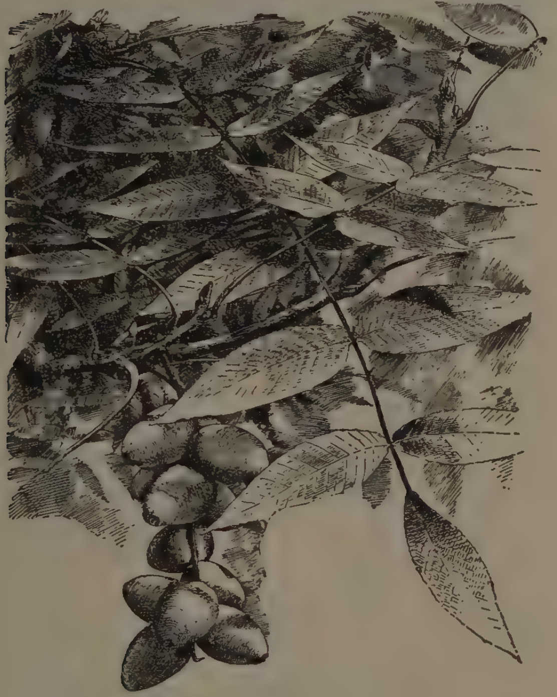
6. **nìgra,** Linn. BLACK WALNUT. Fig. 2011. Lofty tree, to 150 ft., with rough brown bark and pubescent branchlets: lfts. 15–23, oblong-lanceolate, acuminate, appressed-serrate, glabrous and somewhat shining above at length, pubescent beneath, 3–5 in. long: fr. usually 1–3 on a short stalk, 1½–3 in. across, with papillose surface; nut thick-shelled, globular or somewhat depressed, strongly ridged. Mass. to Fla., west to Minn. and Texas. S.S. 7:333, 334. Em. 211. G.C. II. 11:373; 26:617; III. 30:303. F.S.R. 3:210. H.W. 2, p. 182. U. S. N. C. 7, pp. 1–3. Gn. 27, pp. 269, 270. —*J. ovoìdea,* Dode, is a form with ovoid pointed nuts.

AA. *Fr. coated with viscid hairs, racemose; nut 2-celled at the base: lfts. with stellate and glandular pubescence beneath, serrate.*

B. *Nut strongly 6–8-ridged.*

7. **cinèrea,** Linn. BUTTERNUT. WHITE WALNUT. Fig. 2012. Large tree, occasionally to 100 ft., with

gray bark: young branchlets villous and glandular: lfts. 11–19, oblong-lanceolate, acuminate, appressed-serrate, usually pubescent on both sides, more densely below: 3–5 in. long: fr. in short racemes, 2–5, oblong, pointed, 3–5 in. long; nut oblong, with 4 more and 4 less prominent irregular ribs and many broken sharp ridges between. New Bruns. to Ga., west to Dak. and Ark. S.S. 7:331, 332. Em. 207. U. S. N. C. 7, p. 4. Gn. 22, p. 251.



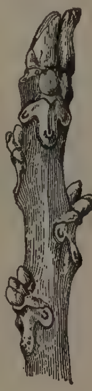
2014. Juglans Sieboldiana. (×⅕)

8. **cathayénsis,** Dode (*J. dracònis,* Dode). Tree, to 70 ft.: branchlets glandular-hairy: lvs. up to 3 ft. long; lfts. 9–17, obovate-oblong, acuminate, obliquely rounded or subcordate at the base, serrulate, sparingly hairy above, more densely below, midrib glandular, 3–9 in. long: fr. 6–10 in pendulous racemes, ovate, pointed, 1¼–1¾ in. long; nuts ovoid, pointed, 6–8-angled, with sharp and broken, nearly spiny ridges. Cent. and W. China. G.C. III. 50:189.—Has proved hardy at the Arnold Arboretum.

9. **mandshùrica,** Maxim. Fig. 2013. Broad-headed tree, to 60 ft.: branchlets glabrescent: lfts. 11–19, oblong, acute, obtusely serrate, at length almost glabrous above, pubescent beneath, rarely almost glabrous at length, 3–8 in. long: fr. in short racemes, globular-ovate to oblong; nut with 8 prominent obtusish ridges. Mandshuria, Amurland. G.C. III. 4:384; 30:302. A.G. 1891:178. R.H. 1861, p. 429 (as *J. regia octogona*). Gn. 50, p. 478 (by error as *J. regia cordata*). U.S.N.C. 7, p. 5.

BB. *Nut rugose or nearly smooth.*

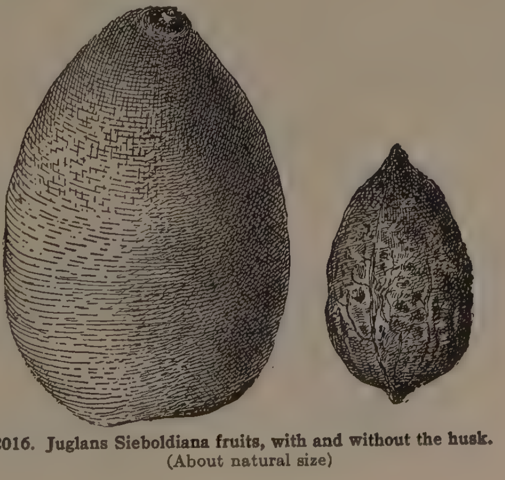
10. **Sieboldiàna,** Maxim. (*J. ailantifòlia,* Carr.). Figs. 2014–2016. Broad-headed tree, to 50 ft.: branchlets pubescent: lfts. 11–17, oval to oval-oblong, short-acuminate, densely serrate, glabrous above, pubescent and usually glandular beneath, 3–6 in. long: frs. in long racemes, sometimes 20, globose to ovate-oblong; nut more or less globose, with thick, wing-like sutures and pointed apex, the surface rather smooth, slightly rugose and pitted, 1–1½ in. long, rather thick-shelled. Japan. Gn. 47, p. 442. A.G. 1890:701; 1891:179. R.H. 1878, pp. 414, 415. U.S.N.C. 7, p. 7. S.I.F. 2:5. Var. **cordifórmis,** Makino (*J. cordifórmis,* Maxim.). Fig. 2017. Nut heart-shaped or ovoid, much flattened, sharply 2-edged, smooth and with a shallow longitudinal groove in the middle of the flat sides, rather thin-shelled. G.C. III. 30:292. S.I.F. 1:17. U.S.N.C. 7, p. 6.—Though this form is very different in its fr. from the true *J. Sieboldiana* there are no other reliable characters to distinguish it, and seedlings raised from nuts of var. *cordiformis* have always produced, at least to a large percentage, trees bearing nuts like those of *J. Sieboldiana* or of intermediate character. Probably *J. Lavállei,* Dode (L.I. 1, 2), is such an intermediate form. *J. coarctàta,* Dode, is another of these intermediate forms with a somewhat longer nut slightly constricted about the middle. *J. subcordifórmis,* Dode, is hardly different from the variety except in its shorter and broader nuts. *J. Allardiàna,* Dode, is probably only a form of the species; it differs little from it except in the gray or blackish dull color of the nut, which is yellowish and lustrous in typical *J. Sieboldiana.*



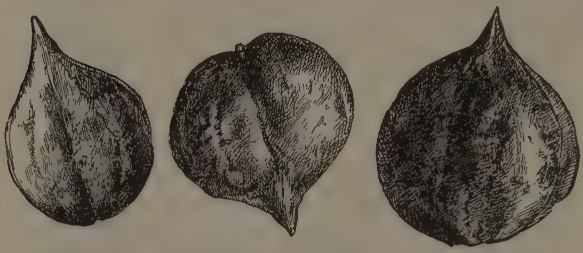
2015. Winter twig of Juglans Sieboldiana.

11. **intermèdia,** Carr. (*J. nìgra* × *J. règia*). Intermediate between the parents, but in general appearance more like *J. regia.* Lfts. usually 11, ovate or elliptic-ovate, remotely denticulate, glabrous dark green. In regard to the fr. 2 forms have been distinguished. Var. **pyrifórmis,** Carr., with an obovoid fr. more resembling that of *J. regia.* R.H. 1863, p. 30. Gn. 50, p. 478. Var. **Vilmoreàna,** Carr. (*J. Vilmorinidàna,* Vilm.). Fig. 2018, with a fr. more like that of *J. nigra.* G.F. 4:52, 53 (adapted in Fig. 2018). M.D. 1911:197.—Probably also *J. regia gibbosa,* Carr., with a large, thick-shelled deeply rugose nut belongs here. R.H. 1861, p. 428. Gn. 50, p. 478. Of the same parentage is without doubt the so-called James River hybrid (Forest Leaves 2:133, 134).

12. **quadrangulàta,** Rehd. (*J. alàta,* Schelle. *J. intermèdia quadrangulàta,* Carr. *J. intermèdia alàta,* Carr. *J. cinèrea* × *J. règia*). Fig. 2019. Tall tree, in its bark, winter-buds and foliage much resembling *J. regia:* lfts. usually 9, oval to oblong, obscurely and remotely serrate, slightly pubescent beneath: fr. sparingly produced, subglobose, about 2 in. long; nut ovoid-oblong, acute at the apex, 1¾ in. long, with deeply sculptured walls thinner than those of the butternut



2016. Juglans Sieboldiana fruits, with and without the husk. (About natural size) and broad ridges at the sutures. Originated in France and in several places near Boston and probably elsewhere. G.F. 7:435 (adapted in Fig. 2019). R.H. 1870, p. 494. Gn. 50, p. 478.—The form figured by Carriere seems much nearer to *J. cinerea*, while the form originated near Boston is more similar to *J. regia*.

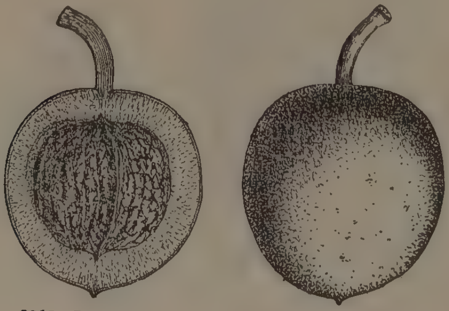

2017. Juglans Sieboldiana var. cordiformis. (Natural size)

Besides these described above, several other hybrids have been reported. Luther Burbank raised a hybrid between J. Hindsii and J. nigra, named "Royal," with large nuts of excellent flavor, and one between J. Hindsii and J. regia, named "Paradox," a very vigorous grower, but a shy bearer. There are supposed hybrids between J. mandschurica × J. regia, J. cinerea × J. nigra and J. cinerea × J. rupestris; J. longirostris, Carr. (R. H. 1878, p. 53), may be a hybrid between J. regia and J. major, which often has a fr. similar in shape to the one figured.—*J. austràlis*, Griseb. Allied to J. rupestris. Lfts. 13–21, large, ovate-oblong, abruptly acuminate, serrate, viscid-pubescent: nut ovoid, acute, small, slightly grooved. Argentina.—*J. collápsa*, Dode. Allied to J. mandschurica and probably only a variety, but nut less rugose, less sharply angled, with ovoid depressions. Probably from N. China.—*J. kamaònia*, Dode (J. regia var. kamaonia, DC.). Allied to J. regia. Lfts. 5–11, oblong-elliptic to oblong-lanceolate, puberulous on both sides, rufous-pubescent on the veins beneath: nut globose, rather hard-shelled. Himalayas. —*J. stenocárpa*, Maxim. Closely allied to J. mandschurica. Lfts. narrower, more coarsely serrate, more pubescent, the terminal lft. very large: fr. more oblong, less strongly ridged. Manchuria.

Alfred Rehder.

JUJÚBE: *Zizyphus Jujuba.*

JULIÀNIA (Julian Cervantes). Doubtfully associated with the *Anacardiàceæ*, but now made the type of the family *Julianiàceæ*. Tortuously branched resinous diœcious shrubs or small trees of Mex., perhaps not in cult.: lvs. alternate, unequally pinnate, the lfts. 3–11: fls. small, green; male fls. and infl. much like those of the oak, "a single, hairy, thin perianth, divided nearly to the base into 5 or 7 acute segms., with as many stamens alternating with the segms."; female fls. 2–4 in an involucre, the whole having the appearance of a single fl., of curious structure: fr. composite, dry, with an exceedingly hard involucre, indehiscent, germination taking place through the apex. The known species are 4, one of which, *J. adstríngens*, Schlecht., is figured in G.C. III. 43:99, by Hemsley (adapted from Trans. Roy. Soc. of London). Aspect somewhat like some species of Rhus: lfts. 5–7, sessile or the terminal very short-stalked, 1–1½ in. long, obovate or oval, dentate: fr. 2 in. long, enlarging upward. *J. Huaucùi*, Gray, of Peru, is referred to Orthopterygium; probably not in cult.

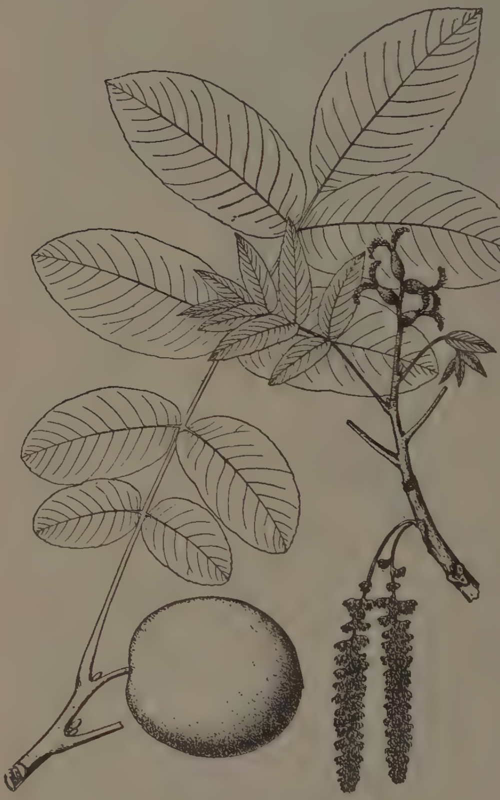

2018. Juglans intermedia var. Vilmoreana. (×½)

JÚNCUS (classical name, *to join*). *Juncàceæ*. Rushes. Grass-like plants growing in wet, rarely in dry, places and used for planting in bogs and around aquatic gardens.

Plants send up from the rootstock several unbranched cylindrical sts. which bear a terminal, or sometimes apparently lateral, cyme of greenish or brownish very small fls.: lvs. grass-like terete or flat: perianth of 6 rigid chaffy parts in 2 whorls; stamens short, either 3 or 6: caps. 3-celled or rarely 1-celled, many-seeded. Rushes differ from the true grasses and sedges in having a true perianth and a many-seeded pod.—The genus includes a host of species distributed throughout the temperate regions, but most of these are not in cult. Rushes are sold by dealers in native and aquatic plants. The kind used in making mats in Japan is procurable from dealers in Japanese plants.

A. *St. without lvs.: cymes apparently lateral.*

effùsus, Linn. (*J. commùnis*, Hort.). Common Rush. Fig. 2020. St. soft, 1–4 ft. high: cyme diffuse, 1–2 in. long, the fls. separate; sepals acute, equaling the short retuse and pointless or mucronate greenish brown caps.; stamens 3: seeds not tailed. North Temperate Zone. Used also for weaving into mats, and the like. Var. **compáctus**, Lej. & Coutt. (var. *congéstus*, Hort.). Fls. small, ¾–1½ lines long: cyme congested into a spherical head: culms rather stout, finely many striate. Much of the *J. conglomeratus* of the trade is probably this variety. Var. **conglomeràtus**, Engelm., is similar to the last, but the culm coarsely few (12–15) striate, and perianth very dark. Var. **solùtus**, Fern. & Wiegand. Fls. medium, 1½–2½ lines long; perianth semi-appressed: cyme open: culms coarse with usually pale basal sheaths, at least when dry. Var. **Pỳlæi**, Fern. & Wiegand. Fls. medium; perianth spreading:


2019. Juglans quadrangulata. (×⅓)

cyme open: culm medium, usually coarsely striate at least when dry: basal sheaths usually dark. Var. **vittàtus**, Buch. (*J. effùsus* var. *aùreo-striàtus*, Hort. *J. conglomeràtus* var. *variegàtus*, Hort.). Foliage striped with yellow. Var. **spirâlis**, Hort. Fig. 2021. A curious form with sts. spirally twisted like a corkscrew. Gt. 54, p. 406.

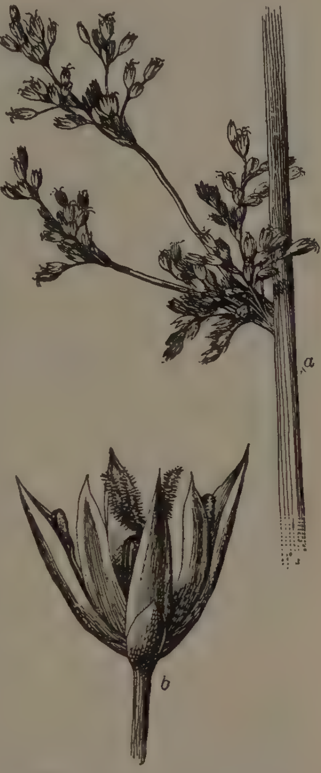
AA. *St. bearing terete lvs.: cyme terminal, open, but fls. borne in heads at end of branches.*

canadénsis, Gay. Sts. 1½–3 ft. high, tall and coarse: heads numerous; stamens 3: seeds long-tailed at each end. N. Amer.

nodòsus, Linn. Sts. lower, ½–1½ ft. high: heads few; stamens 6: seeds without tails. N. Amer.—May be used for gravelly borders of pools.

J. acuminàtus, Michx., and other species may be used for water-gardens.—*J. zebrinus*, Hort.=Scirpus Tabernæmontanus var. zebrinus.

K. M. Wiegand.



2020. Common rush, Juncus effusus. The flower-cluster, *a*, is natural size. The single flower, *b*, is enlarged.

JUNEBERRY. Fig. 2022. Fruits of species of Amelanchier.

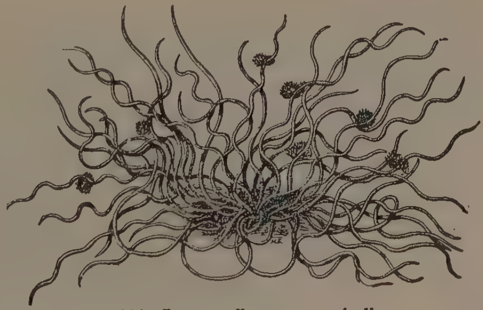
The fruits of some twenty-five or thirty species of Amelanchier are edible, those of several species being especially juicy, sweet and refreshing. Under the names juneberry, shad-bush, service-berry, sugar-pear and grape-pear, or their equivalents in other languages, the wild fruits are used for food in all parts of the North Temperate Zone. The product of one or another of the species plays an important part in the diet of North American Indians, who make use of the berries both fresh and dried. So, also, juneberries have been a source of food-supply to explorers, prospectors and pioneers, who testify to their value as nourishing esculents and pleasing dessert fruits. Juneberries are as yet little used where they must compete with other fruits, although they have many qualities to commend them for domestication.

The fruit of the juneberry is a small pome or apple, usually with five cells each more or less completely divided into two parts so that there appear to be ten cells. The seeds are small and thin-shelled, varying in number from five to ten. The pomes of some species are no larger than a pea, while in the best strains of other species they attain the size of a small crab-apple. They vary in color from dark red to a purplish blue or black and all have more or less bloom. The fruits resemble somewhat the pomes of the hawthorn, for which they are often mistaken. The juneberry, however, is superior to the more common hawthorn as a food product because the flesh is greater in quantity and is not so dry and mealy, the flavor is sprightlier and the seeds are fewer, smaller and thinner-shelled. The several juneberries are quite as variable in the character of their fruits, either within or between species, as are other members of the rose family to which Amelanchier belongs—sufficiently variable to suggest high potentialities in the domestication of the best of the wild species.

Juneberries differ much in the character of the plants. Some species are dwarf shrubs with many stems, while others are small trees with straight, slender trunks, the largest of which attain a height of 40 feet and a diameter of 8 or 10 inches. All of the species are vigorous and the American juneberries are hardy, at least two of them giving promise of making most desirable domesticated plants in regions too cold for any or but few other fruits. Juneberries are easily transplanted and respond to culture as readily as any other species of the rose family. In the garden, they thrive under the same care as that given the apple or pear. Insects and fungous troubles are not particularly apparent in wild species but it is probable that under artificial conditions juneberries would suffer from about the same insects and fungi that attack other pomes. Birds, especially the robin, take heavy toll and would prove troublesome to cultivated plants. The genus shows wide adaptation to soils and moisture conditions, there being few localities in temperate regions where other fruits are grown upon which some one or several of the juneberries would not thrive.

All of the plants in this genus, whether shrubs or trees, have value as ornamentals. The common juneberry of eastern America is a particularly beautiful plant in early spring, bearing large white flowers in profusion, which are well set off by the opening foliage and bright silky bud-scales and bracts. The trees are attractive ornamentals in fruit though the eastern juneberry is often infertile and sets few or no pomes. Trained as a tree or as a many-stemmed shrub, the several juneberries are all desirable lawn and park ornamentals.

From time to time strains of wild species have been brought under cultivation, some of which have been named and sparingly disseminated by nurserymen. So far all of the cultivated varieties have come from the bush-like species, most of them said to be from *A. alnifolia*. One of the first named varieties was Success, a dwarf strain probably of *A. canadensis*, introduced by H. E. Van Deman, then of Kansas, about 1878; this variety seems to be no longer cultivated. Several western nurserymen now offer strains of dwarfs under the names Improved Dwarf Juneberry, Dwarf Mountain Juneberry, and Western Huckleberry. So far as their history can be learned, all these named varieties are selected strains from wild plants, no one as yet having set out to breed and improve juneberries. There are many distinct forms in the wild, some of them supposed to be natural hybrids, offering opportunities for selection in the amelioration of the species for the garden. There is no reason to believe that the species will not hybridize as freely as other members of the rose family. All looks to be favorable for the domestica-



2021. Juncus effusus var. spiralis.

tion of juneberries,—opportunities awaiting a man to do the work.

Juneberries are readily propagated from seeds and no doubt all would yield to budding, grafting and to the same treatment in the nursery given to apples and pears. Some of the species would, no doubt, vex the souls of cultivators by throwing up many suckers, but in garden culture this could be remedied by working on a non-suckering stock. Juneberries are said to be easily budded on the hawthorn. The suckers are commonly used in propagating the species used as ornamentals.

2022. Juneberry. A cultivated form, probably a hybrid between Amelanchier lævis and some other species.

The eleven species described under Amelanchier all have horticultural possibilities well indicated in the descriptions. The species giving greatest promise for their fruits are *A. alnifolia*, *A. lævis*, *A. sanguinea*, *A. stolonifera* and *A. humilis*. To these should be added *A. canadensis* as the most desirable juneberries for ornamentals.

U. P. Hedrick.

JUNÍPERUS (ancient Latin name). *Pinàceæ*. Juniper. Ornamental trees and shrubs grown for their foliage and habit.

Evergreen, with the branchlets spreading in all directions: lvs. either all needle-shaped and in 3's, or needle-shaped and scale-like, and usually opposite, often found on the same plant, the needle-shaped lvs. prevailing on younger plants and vigorous branches, the scale-like ones on older plants: fls. diœcious, rarely monœcious; staminate yellow, consisting of numerous anthers united into an ovoid or oblong catkin; pistillate greenish, minutely globular, with several bracts, each or some bearing 1 or 2 ovules; the bracts become fleshy and unite into a berry-like cone, usually wholly inclosing the 1–6, rarely 12, seeds. The fr. ripens either the first year, as in *J. virginiana*, or the second, as in *J. Sabina* and most species, or in the third, as in *J. communis*.—About 40 species distributed throughout the extra-tropical regions of the northern hemisphere, in Amer. south to Mex. and W. India. Juniperus is closely allied to Cupressus, and sometimes hard to distinguish without fr.; but young plants with needle-shaped lvs. can be almost always told apart, since Juniperus has whitish lines or marks on the upper surface of the lvs., while the similar juvenile forms of allied genera have the whitish marks beneath. Most species are very variable, as well in habit as in the shape of the lvs., which renders the determination of an unknown form, at least without fr., a rather difficult task.

The junipers vary greatly in habit from tall pyramidal trees to low prostrate or trailing shrubs, and have small needle-shaped or scale-like foliage, insignificant flowers and small berry-like fruits usually bluish black and often glaucous, less often brown or orange. Many of the species are hardy North, as *J. virginiana*, *J. scopulorum*, *J. communis*, *J. rigida*, *J. Sabina*, *J. chinensis*, *J. Pseudo-sabina*, *J. sphærica*, *J. squamata;* others are half-hardy, as *J. Oxycedrus*, *J. macrocarpa*, *J. recurva*, *J. excelsa*, *J. occidentalis*, while some, as *J. procera*, *J. Lucayana*, *J. thurifera* and the Mexican species, can only be grown South. All are valuable ornamental plants, and the erect-growing species, mostly of pyramidal or columnar habit, are decorative as single specimens on the lawn or if planted in groups. Some varieties form a very narrow column, and are valuable for formal gardens; the columnar form of *J. virginiana* is a good substitute in the North for the classical cypress. The low prostrate junipers, as *J. communis* var. *montana*, *J. horizontalis*, *J. Sabina*, and *J. squamata*, are well adapted for covering rocky slopes or sandy banks. The close-grained, fragrant wood is much used for the interior finish of houses and in the manufacture of small articles, also for posts, since it is very durable in the soil; that of *J. virginiana* and *J. Lucayana* is in great demand for pencil-making. The fruits and also the young branchlets of some species contain an aromatic oil used in medicine. The fruit of *J. drupacea* is edible.

The junipers thrive best in sandy and loamy, moderately moist soil, but grow well even in rather dry, rocky and gravelly ground. They prefer sunny, open situations. They are well adapted for hedges and for planting as shelter or windbreaks; also for seaside planting. Propagation is by seeds, which germinate usually the second and sometimes the third year; to hasten their germination, they may be plunged for 3 to 6 seconds in boiling water, but this should be regarded as an experiment and tried only with a portion of seed. They are also increased by cuttings of nearly ripened wood in fall under glass, either outdoors or in the greenhouse. As a rule, those with needle-shaped leaves root much more easily than those with scale-like leaves, and the latter are therefore mostly increased by side-grafting during the winter in the greenhouse on young potted plants of the typical form or an allied species. The shrubby species, especially *J. Sabina*, are also propagated by layers.

INDEX.

albo-spicata, 16.
albo-variegata, 14, 16.
alpina, 6.
argentea, 14.
aurea, 6, 14.
aureo-variegata, 6, 14, 16.
australis, 18.
barbadensis, 18, 19.
Bedfordiana, 18.
bermudiana, 19.
californica, 10.
canadensis, 6.
Cannartii, 16.
Cedrus, 3.
Chamberlaynii, 16.
chinensis, 14.
communis, 6.
cupressifolia, 20.
densa, 7.
depressa, 6.
Douglasii, 21.
drupacea, 1.
dumosa, 16.
elegantissima, 16.
excelsa, 12.
Fargesii. 8.
fastigiata, 6, 20.
femina, 14.
Fortunei, 15.
glauca, 15, 16.
globosa, 16.
hemisphærica, 6.
hibernica, 6.
horizontalis, 21.
humilis, 20.
Jackii, 6.
japonica, 14.
Lucayana, 18.
macrocarpa, 2.
mascula, 14.
montana, 6.
nana, 6.
neaboriensis, 2.
oblonga, 6.
oblongo-pendula, 6, and suppl.
occidentalis, 11.
Oxycedrus, 4.
pendula, 3, 6, 14, 16.
Pfitzeriana, 14.
phœnicea, 9.
plumosa, 16.
procera, 13.
procumbens, 14, 21.
prostrata, 21.
pyramidalis, 14, 16.
recurva, 7, 8.
Reevesii, 14.
reflexa, 6.
repanda, 7.
repens, 21.
reptans, 16.
rigida, 5.
Sabina, 20.
sabinoides, 20 and suppl.
Schottii, 16.
scopulorum, 17.
Shephardii, 15.
sibirica, 6.
sinensis, 14.
sphærica, 15.
squamata, 8.
stricta, 6, 12.
suecica, 6.
tamariscifolia, 20.
tripartita, 16.
variegata, 12, 20.
venusta, 16.
virginiana, 16, 18.

A. *Foliage always needle-shaped and in 3's, rigid, jointed at the base: fls. axillary, diœcious: winter-buds with scale-like lvs. (See also Nos. 7 and 8.)*

B. *Fr. large, ¾–1 in. across, with the seeds connate into a usually 3-celled bony stone. (Caryocedrus.)*

1. **drupàcea,** Labill. Pyramidal tree with narrow head, to 45 ft.: lvs. lanceolate, spiny-pointed, ½–¾in. long and ⅛–⅙in. broad (the broadest of all species), with 2 white lines above: fr. bluish black, edible. S. E. Eu., W. Asia. G.C. 1854:455; III. 19:519. R.H. 1854, p. 165; 1904, pp. 357, 358.

BB. *Fr. smaller; seeds not connate, usually 3. (Oxycedrus.)*

C. *Lvs. with 2 white lines above.*

2. **macrocárpa,** Sibth. (*J. neaboriénsis,* Gord.). Shrub or small tree, to 12 ft., of dense pyramidal habit: lvs. crowded, linear-lanceolate, spiny-pointed, spreading, ½–¾in. long: fr. to ½in. across, dark brown, glaucous. Medit. region.

3. **Cèdrus,** Webb & Berth. (*J. péndula,* Loud.). Tree, to 12 ft., with pendulous branches; the trunk to 3 ft. diam.: branchlets bluish green, angled: lvs. very crowded, curved or straight, spreading, linear-lanceolate, acute or obtusish, scarcely spiny, ¼–½in. long: fr. subglobose, ⅓–½in. long, bluish at first, finally orange-brown, 1-seeded. Canary Isls. Antoine, Cupressineen Gatt. 19.—Cult. in Calif. The abnormal development of thickness in comparison to height is one of the peculiarities of the species.

4. **Oxycèdrus,** Linn. Bushy shrub or small tree, to 12 ft., with rather slender branches: lvs. linear, spiny-pointed, spreading, ½–¾in.: fr. globose, ¼–⅓in. across, brown, shining, not or slightly glaucous. Medit. region. H.W. 1, p. 193.

CC. *Lvs. with 1 white line above.*

5. **rígida,** Sieb. & Zucc. Small, pyramidal tree, to 30 ft., or spreading shrub with the slender branches pendulous at the extremities: lvs. in closely set whorls, narrow-linear, stiff, yellowish green, ½–1 in. long: fr. about ¼in. across, dark violet. Japan. S.Z. 125. S.I.F. 1:12.—Graceful, hardy shrub, somewhat similar to *J. communis* var. *oblonga,* but the lvs. more crowded and stiffer.

6. **commùnis,** Linn. Common Juniper. Upright shrub or tree, sometimes attaining to 40 ft.: lvs. linear or linear-lanceolate, concave and with a broad white band above, spiny-pointed, ½–¾in. long: fr. almost sessile, dark blue, glaucous, ¼–⅓in. across. Arctic N. Amer. south to Pa., Ill., and in the Rocky Mts. to N. Mex., N. and Cent. Eu. and N. Asia. H.W. 1:10.—A very variable species; some of the most important varieties are the following: Var. **aùreo-variegàta,** Hort. Upright form, with the tips of the branchlets golden yellow. Var. **depréssa,** Pursh (*J. commùnis* var. *canadénsis,* Loud. *J. canadénsis,* Burgsd. *J. nàna canadénsis,* Carr.). Fig. 2023. Forming broad patches, the sts. ascending from a procumbent base, rarely exceeding 4 ft. in height. The lvs. somewhat shorter and broader. Var. **aùrea,** Hort. (*J. nàna* var. *canadénsis aùrea,* Beissn. *J. canadénsis aùrea,* Hort.). Like the former, but tips of branchlets golden yellow. Gng. 5:67. Var. **hemisphærica,** Parl. (*J. hemisphærica,* Presl). A low, dense, rounded bush, rarely more than 3 ft. high: lvs. straight and stiff, short. Mountains of S. Eu. and N. Afr. Var. **hibérnica,** Gord. (var. *strícta,* Carr.). Narrow, columnar form, with upright branches, deep green, tips of branchlets erect. G. 4:521. Gng. 1:355. Var. **montàna,** Ait. (*J. commùnis nàna,* Loud. *J. nàna,* Willd. *J. alpìna,* S. F. Gray. *J. sibírica,* Burgsd.). Low, spreading or procumbent shrub, seldom over 2 ft. high: lvs. oblong-linear, abruptly pointed, usually incurved, densely clothing the branches, with a broad silvery white line above, ¼–½in. long. Arctic and mountainous regions. H.W. 1:10. M.D.G. 1910:123. Var. **Jáckii,** Rehd. Prostrate, with flagelliform trailing branches often to 3 ft. long, and almost unbranched except for occasional clusters of short lateral branchlets 1–2 in. long: lvs. linear-lanceolate, incurved. Ore., N. Calif. Var. **oblónga,** Loud. (*J. oblónga,* Bieb.). Upright shrub, with slender, diverging and recurving branches: lvs. thin, long-attenuate, horizontally spreading, bright green. Transcaucasia. Var. **oblóngo-péndula,** Carr. (var. *refléxa,* Parl.). Similar to the preceding, but more decidedly pendulous. A very graceful form. C.L.A. 11:308. Var. **péndula,** Carr. Shrub, with spreading, recurving branches and pendulous branchlets. Var. **suècica,** Loud. (var. *fastigiàta,* Hort.). Narrow, columnar form, growing sometimes into a tree to 40 ft. high, with rather long, spreading lvs., the branchlets with drooping tips: of lighter and more bluish color than the similar var. *hibernica.*

2023. Juniperus communis var. depressa.

AA. *Foliage usually of 2 kinds of lvs. (Fig. 2025) usually opposite, decurrent: fls. terminal: no distinct winter-buds. (Sabina.)*

B. *Lvs. in 3's, lanceolate, short, loosely appressed: fr. oblong.*

7. **recúrva,** Ham. (*J. repánda,* Hort.). Shrub or small tree, to 30 ft., with spreading and usually recurving branches: branchlets slender: lvs. crowded, curved, appressed, linear-lanceolate, pointed, grayish or glaucous green with a whitish band above, ⅙–¼in. long: fr. olive-brown or blackish purple, when fully ripe, about ¼in. long, 1-seeded. Himalayas. G.C. II. 19:468. Gn. 22, p. 107; 36, p. 215. Var. **dénsa,** Carr. Dwarf, with short, crowded branchlets: lvs. curved, grayish green.

8. **squamàta,** Lamb. (*J. recúrva* var. *squamàta,* Parl. *J. recúrva* var. *dénsa,* Hort.). Decumbent shrub, sometimes ascending: branchlets thick, ascending at the apex: lvs. crowded, loosely appressed, linear-lanceolate or lanceolate, straight or slightly curved, grayish or bluish green, with 2 grayish white bands above: fr. bluish black, globose-ovoid, ¼–⅓in. across. Himalayas, W. China. Var. **Fárgesii,** Rehd. & Wilson. Tree, to 70 ft.: lvs. longer and narrower, linear-lanceolate, more spreading, usually about ⅓in. long, acuminate: fr. ovoid, ¼in. long. W. China. It has proved hardy at the Arnold Arboretum.

BB. *Lvs. mostly opposite, scale-like or of 2 kinds, usually with a gland on the back: fr. mostly globular.*

C. *Fr. erect or nodding: mostly trees.*

D. *Color of fr. reddish brown, with rather dry, fibrous flesh: lvs. minutely denticulate.*

9. **phœnícea,** Linn. Shrub or small tree, to 20 ft., with ovate-pyramidal head and upright branches: branchlets slender: lvs. acicular and spreading or scale-like, imbricate, rhombic, obtuse, opposite, often bluish green: fr. ⅓–½in. across, shining, with 3–6 seeds. S. Eu., N. Afr. Canary Isls. H.W. 1, p. 194. M.D. 1911, pp. 286, 287 (habit).

10. **califórnica,** Carr. Fig. 2024. Pyramidal tree, to 40 ft., or shrub with many erect branches: branchlets rather stout: lvs. usually in 3's, imbricate, rhombic, obtuse, thick, yellowish green, with conspicuous gland, only on vigorous branches acicular: fr. ¼–⅓in. long, with bluish bloom and with 1–2 large seeds. Calif. S.S. 10:517. R.H. 1854, p. 353. A.G. 1890:10.

DD. *Color of fr. bluish black or blue, with juicy, resinous flesh.*

E. *Imbricate lvs. usually in 3's, minutely denticulate.*

11. **occidentàlis,** Hook. Tree, to 40 feet, rarely to 60 ft., with spreading branches forming a broad, low head, or shrub with several upright sts.: branchlets stout and thick, imbricate, ovate, acute, grayish green, rarely acicular: fr. subglobose or ovoid, ¼–⅓in. long, with 2–3 seeds. Wash. to Calif. S.S. 10:521.

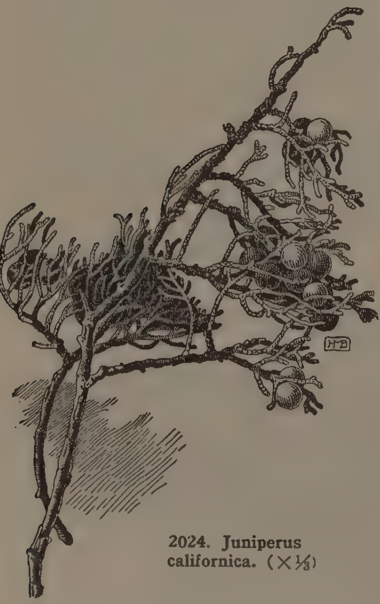
EE. *Imbricate lvs. opposite, entire or nearly so.*

F. *Seeds of fr. 2–6.*

G. *Point of imbricate lvs. acute: branchlets slender.*

12. **excélsa,** Bieb. Tree, to 60 feet, with pyramidal head and upright or spreading branches: lvs. ovate, spreading, mostly opposite, but in 3's on the lower branches, rhombic, bluish green: fr. bluish black, bloomy, globular, about ⅓in. across, with 3–6 seeds. Greece, W. Asia to Himalayas. Gt. 46, p. 209. Var. **stricta,** Hort. Of upright, columnar habit, with very glaucous foliage. Var. **variegàta,** Carr. Foliage variegated with yellowish white.

13. **pròcera,** Hochst. Tree, to 100 or 150 ft., similar to the preceding: lvs. in 3's, or opposite, lanceolate and spreading or loosely appressed and ovate-lanceolate: fr. globose, small, about ¼in. across, 2–3-seeded. Mountains of E. Afr.—Probably the tallest species of the genus.



2024. Juniperus californica. (×⅓)

GG. *Point of imbricate lvs. obtuse.*

14. **chinénsis,** Linn. (*J. sinénsis,* Hort.). Tree, to 60 ft., or shrub, sometimes procumbent: branches rather slender: lvs. opposite or whorled, linear, pointed and spreading, with a white band above or scale-like, appressed, rhombic, obtuse: fr. globular, brownish violet, bloomy, ⅕–⅓in. across, with 2 or 3 seeds. Himalayas, China, Japan. S.Z. 126, 127. S.I.F. 1:12. G.C. III. 42:163. C.L.A. 11:308. G.W. 1, p. 305.—Very variable in habit: the staminate plant usually forms a much-branched, upright, pyramidal bush, often almost columnar, while the pistillate has slender, spreading branches. They are therefore often distinguished as var. **máscula** and var. **fémina** (var. *Reèvesii,* Hort.). The first one is the most desirable as an ornamental plant. Var. **álbo-variegàta,** Beissn. (var. *argéntea,* Hort.). Dwarf, dense form, with dimorphic lvs.: tips of branchlets mostly white. Gn.M. 6:292. Var. **aùrea,** Beissn. (var. *máscula aùrea,* Hort.). Upright form, with the young branchlets golden yellow, the color becoming more brilliant in the full sun. Var. **péndula,** Hort. With spreading branches, pendulous at the extremities. Var. **Pfitzeriàna,** Spaeth. Forming a broad pyramid with horizontally spreading branches and nodding branchlets, grayish green. G.W. 5, p. 403. Var. **pyramidàlis,** Carr. Narrow, pyramidal form, with bluish green, mostly needle-shaped foliage. Var. **procúmbens,** Endl. (*J. procúmbens,* Sieb. *J. japónica,* Carr.). Dense, low shrub with spreading, sometimes procumbent branches and mostly acicular lvs. in whorls, with 2 white lines above, longer and stouter than in the type. S.Z. 127, fig. 3. G.W. 13, p. 618. Var. **procúmbens aùrea,** Beissn. Branches robust and long, decumbent, with rather few branchlets, young growth golden yellow at first, changing to light green. Var. **procúmbens aùreo-variegàta,** Beissn. Dwarf, dense form, variegated with golden yellow.

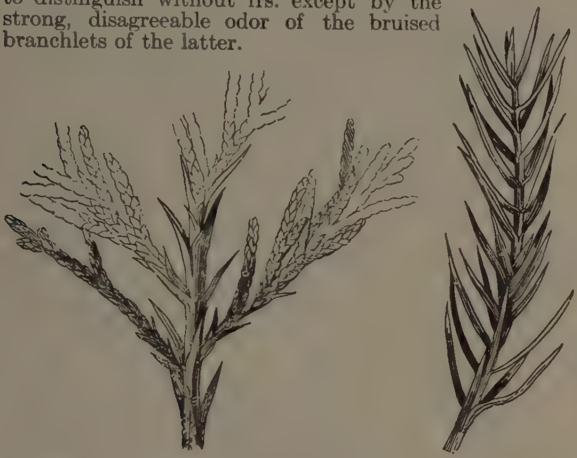
15. **sphærica,** Lindl. (*J. Fórtunei,* Van Houtte). Similar to the former. Densely branched shrub or tree, to 30 ft., with upright branches: branchlets short, rather thick, quadrangular: lvs. acicular and whorled, but less rigid than those of the former, or scale-like, rhombic-oblong, somewhat spreading: fr. globular, about ⅓in. across, not bloomy, 3-seeded. N. China. Probably not specifically different from the preceding species. Var. **glaùca,** Gord. (*J. Shéphardii,* Hort.). Dense form, with usually needle-shaped glaucous foliage.

FF. *Seeds of fr. 1–2; fr. small, ⅙–⅓in. across.*

G. *Trees hardy, sometimes shrubby.*

16. **virginiàna,** Linn. RED CEDAR. SAVIN. Fig. 2025. Tree, to 100 ft., with conical head and spreading or upright branches: lvs. acicular, spiny-pointed, spreading or scale-like, rhombic, acute or subacute, imbricate, very small: fr. brownish violet, bloomy, globular or ovoid. Canada to Fla., east of the Rocky Mts. S.S. 10:524. G.F. 8:65; 10:145. F.E. 27:147. G.W. 16, p. 540.—A very variable species. Some of the most important varieties are the following: Var. **álbo-spicàta,** Beissn. Tips of branchlets white. Var. **álbo-variegàta,** Beissn. Branchlets variegated with white; a very similar more constant form is "Triomphe d' Angers." Var. **aùreo-variegàta,** Hort. With golden yellow variegation. Var. **Cannártii,** Beissn. A compact, ovate-pyramidal form, dark green, with bloomy bluish fr. Var. **Chamberlàynii,** Carr. With spreading branches and elongated, pendulous branchlets: lvs. dimorphic, grayish green. Var. **dumòsa,** Carr. Dense shrub, forming a rounded pyramid, with mostly needle-shaped, bright green lvs. Var. **elegantíssima,** Hort. Tips of young branchlets golden yellow. Var. **glaùca,** Carr. Vigorous-growing form, with glaucous foliage. Var. **globòsa,** Beissn. Compact globose form with bright green scale-like foliage. Var. **péndula,** Carr. With spreading limbs and slender, pendulous branches: lvs. usually scale-like. Var. **plumòsa,** Hort. A graceful pyramidal form with needle-shaped lvs., the tips whitish (var. *plumòsa álba* or *plumòsa argéntea,* Hort.), or pure white (var. *plumòsa nívea,* Schwendt.). Var. **pyramidàlis,** Carr. Dense, columnar form, with the foliage glaucous (var. *pyramidàlis glaùca*) or bright green (var.

pyramidàlis víridis). Var. **réptans,** Beissn. Low shrub, with horizontally spreading, procumbent branches and slender, curving branchlets: bright green. M.D.G. 1896:296. Probably the same as var. *horizontalis,* Arb. Kew. Var. **Schóttii,** Beissn. A dwarfish, dense, pyramidal form, with bright green and rather light foliage. Var. **tripartìta,** Beissn. A dwarf, spreading form of irregular habit, densely branched, with acicular, glaucous lvs. F.E. 33:15. Var. **venústa,** Hort. (*J. venústa,* Ellwanger & Barry). A columnar form with glossy dark green, scale-like foliage.—The dwarf forms are often very similar to *J. Sabina* and hard to distinguish without frs. except by the strong, disagreeable odor of the bruised branchlets of the latter.



2025. The two kinds of red cedar leaves. (Natural size)

17. **scopulòrum,** Sarg. Closely allied to the preceding; chiefly distinguished by the somewhat larger fr., ripening not until the second year; by its habit, forming a broad head with stout, spreading branches and often dividing into several sts. near the base, and by its shredding bark. The branchlets are somewhat shorter and stouter, and the foliage usually glaucous or yellowish green. Brit. Col. to Calif. in the Rocky Mts. G.F. 10:423. S.S. 14:739.

GG. *Trees tender.*

18. **Lucayàna,** Brit. (*J. austràlis,* Pilger. *J. barbadénsis,* Auth. *J. virginiàna* var. *Bedfordiàna,* Veitch, not Linn. *J. virginiàna* var. *barbadénsis,* Gord.). Tree, to 50 ft., with spreading branches and slender pendulous 4-angled branchlets: lvs. light green, closely appressed, ovate, sharp-pointed, glandular: fr. globose, about ⅙in. thick, dark blue, bloomy, 1–2-seeded. S. Ga. to Fla., Jamaica, Cuba, Bahamas, Haiti. S.S. 14:738.—One of the most beautiful of the junipers, often planted for ornament in the Gulf States, and in the W. Indies.

19. **barbadénsis,** Linn. (*J. bermudiàna,* Linn.). Tree, to 40 ft., in habit much like *J. virginiana,* but branches much stouter and foliage pale bluish green: branchlets thickly set, quadrangular, stout and short: lvs. mostly imbricate, thick or acicular, spiny-pointed, rigid, erect-spreading: staminate catkins larger: fr. usually 2-seeded and depressed-globular. Bermuda, Barbadoes, Antigua. G.C. II. 19:657. G.F. 4:295.

CC. *Fr. pendulous, on curved peduncles, small: shrubs, usually spreading or procumbent.*

20. **Sabìna,** Linn. Spreading or procumbent shrub, rarely with erect st. to 10 ft.: branchlets rather slender, of a very strong, disagreeable odor when bruised: lvs. needle-shaped, acute and slightly spreading or imbricate, oblong-rhombic, obtuse or subacute, usually dark green: fr. ⅕–¼in. thick, globular, 1–3-seeded. Mountains of Cent. and S. Eu., W. Asia, Siberia, N. Amer.—Very variable. The most remarkable varieties are the following: Var. **fastigiàta,** Beissn. Erect shrub of columnar habit, with dark green, mostly imbricate lvs. Var. **cupressifòlia,** Ait. (var. *hùmilis,* Endl.). Procumbent, with ascending thickish branchlets: lvs. usually imbricate, scale-like, often bluish green. Var. **tamariscifòlia,** Ait. (*J. sabinoìdes,* Griseb.). Procumbent or ascending, rarely erect: lvs. usually all needle-shaped and often in 3's, slightly incurved, dark and bright green, with a white line above. Mountains of S. Eu. G.W. 1, p. 304. Var. **variegàta,** Beissn. Branchlets variegated with creamy white: lvs. mostly imbricate.

21. **horizontàlis,** Moench (*J. prostràta,* Pers. *J. Sabìna* var. *procùmbens,* Pursh. *J. rèpens,* Nutt.). Procumbent, usually with long trailing branches furnished with numerous short branchlets, sometimes to 4 ft. high and with spreading branches: lvs. of young plants subulate, mature foliage imbricate, scale-like, acute or acutely cuspidate, bluish green or steel-blue: fr. about ⅓in. across, blue, slightly glaucous, on a pedicel shorter than its length. Nova Scotia to Brit. Col., south to Mass., N. Y., Minn. and Mont. B.B. (ed. 2) 1:67. Var. **Doúglasii,** Hort., is a distinctly trailing form with steel-blue foliage, turning purple in autumn with glaucous bloom; also called Waukegan juniper.

J. conférta, Parl.=J. litoralis.—*J. davùrica,* Pall. Allied to J. Sabina. Procumbent, with slender, spreading or drooping branchlets: fr. 1–4-seeded, small. Siberia.—*J. fláccida,* Schlecht. Graceful tree, to 30 ft., with spreading branches and slender, remote, pendulous branchlets: lvs. acute, with spreading tips: fr. globular, 5–10-seeded. Texas, Mex. S. S. 10:519.—*J. fœtidíssima,* Willd. Allied to J. excelsa. To 12 ft. high: branchlets thicker: lvs. with spreading apex, mucronate, usually eglandular: fr. larger, 1–2-seeded. Greece, W. Asia.—*J. formosàna,* Hayata (J. taxifolia Parl., not Hook. & Arn. J. oblongo-pendula, Hort.). Allied to J. rigida. Tree, to 40 ft.: lvs. rigid, spiny-pointed, with 2 white bands above, ½–1 in. long: fr. ovoid, orange, ⅓in. across. Formosa, Cent. & W. China. Has proved hardy at the Arnold Arboretum; the true J. taxifolia, Hook. & Arn. is not in cult.—*J. litoràlis,* Max. (J. conferta, Parl.). Allied to J. rigida, but prostrate, with long, trailing branches: fr. larger. Japan.—*J. macrópoda,* Boiss. Allied to J. excelsa. Shrub or small tree, to 30 ft., sometimes procumbent: lvs. closely appressed: fr. nodding, globular, 4-seeded. Persia to Himalayas.—*J. megalocárpa,* Sudworth. Allied to J. californica. Tree 30–50 ft. with a single trunk: lvs. in 3's, acute: fr. ½in. across or slightly more, 1–2-seeded. Ariz.—*J. mexicàna,* Schiede. Pyramidal tree: branchlets numerous, short and rather stout: lvs. acute, loosely appressed: fr. 2–4-seeded. Mex.—*J. mexicàna,* Schlecht.=J. tetragona.—*J. monospérma,* Sarg. (J. occidentalis var. monosperma, Engelm.). Closely allied to J. occidentalis. Branchlets more slender: lvs. usually opposite and eglandular: fr. smaller and usually 1-seeded. Rocky Mts., from Colo. to New Mex. S.S. 10:522.—*J. oblóngo-péndula,* Hort.=J. formosana.—*J. pachyphlæa,* Torr. Tree, to 60 ft. allied to J. occidentalis, with broad, pyramidal or round-topped head: lvs. usually opposite, glandular, bluish green: fr. dark reddish brown, bloomy, with 3–4 seeds. Has a checkered bark like a black-jack oak. Colo. to Texas and New Mex. S.S. 10:520.—*J. Pínchotii,* Sudworth. Allied to J. californica. Small tree to 20 ft., usually with several sts.: branchlets rather slender: lvs. usually in 3's, appressed, sharply pointed, yellowish green: fr. globose or ovoid, ⅓in. long, red, 1–2-seeded. Texas. B.T. 110.—*J. Pseùdo-sabìna,* Fisch. & Mey. Allied to J. Sabina. Erect shrub, with thick, dense and short branchlets: lvs. usually dimorphic: fr. ovate, blackish, glossy, 1-seeded. Siberia.—*J. sabinoìdes,* Endl.=J. thurifera.—*J. sabinoìdes,* Nees=J. tetragona.—*J. sabinoìdes,* Griseb.=J. Sabina var. tamariscifolia.—*J. saltuària,* Rehd. & Wilson. Allied to J. Pseudo-sabina. Tree to 40 ft.: lvs. dark green, dimorphic, those of the lateral branches scale-like, obtusish, of the shoots in 3's, acute: fr. erect, ovoid, ¼in. long, 1-seeded. N. W. China.—*J. Sánderi,* Hort.=Chamæcyparis obtusa var. ericoides.—*J. taxifòlia,* Parl.=J. formosana.—*J. tetrágona,* Schlecht. Allied to J. occidentalis. Small tree, to 20 ft., rarely to 40 ft., with round-topped or pyramidal head and slender, quadrangular branchlets: lvs. obtuse, usually eglandular: fr. subglobose, mostly 1-seeded. Texas to Mex. S.S. 10:523.—*J. thurífera,* Linn. Shrub or tree, to 40 ft., with round-topped head and spreading branches: branchlets slender: fr. globular, 2–3-seeded. Spain, Algeria.—*J. utahénsis,* Lemm. (J. californica var. utahensis, Engelm.). Bushy tree, rarely more than 20 ft., with broad, open head: branchlets slender: lvs. obtuse, light yellowish green: fr. usually 1-seeded. Colo. to Calif., west to Utah. S.S. 10:518.

ALFRED REHDER.

JURÌNEA (named for Louis Jurine, 1751–1819, professor of medicine). *Compósitæ.* Herbs or subshrubs, one of which is offered for the wild garden: lvs. gray or white-tomentose beneath or on both sides, pinnate or entire, unarmed: fls. purple: achenes 4–5-sided, seldom compressed, crowned with a pappus of unequal rough hairs.—Over 50 species from Cent. and

S. Eu., N. W. Afr., to Cent. Asia. None of the species is of great horticultural value, although sometimes cult. They thrive in any ordinary garden soil and are prop. by seeds or division of the roots in spring. **J. alàta,** Cass. Height 3–4 ft.: perennial, or according to Boissier, biennial: st. erect, winged below, 1–1½ ft. high: radical lvs. 6 in. long, oblong and lyrate, nearly glabrous above and canescent beneath: st.-lvs. lanceolate, sinuate-dentate, decurrent: heads hemispherical, long-peduncled, the involucre-bracts narrow-linear and the outer ones short-mucronulate and the apex spreading; florets purplish blue: achene 4-angled and muricate, the pappus exceeding it. Caucasus. J.H. III. 66:442. While *J. alata* is definitely described as biennial and as reaching a height of 18 in. in cult., the plant grown under this name, and which is apparently correctly determined, is said to be perennial and to grow 3–4 ft. high, having a silvery aspect in the foliage. L. H. B.

JUSSIÆA (Bernard de Jussieu, 1699–1777, who laid the foundations of a modern natural system of the vegetable kingdom). Also written *Jussieua. Onagràceæ.* Primrose Willow. This genus includes one or two herbs that are more or less cultivated, one at least as a water plant.

Herbs, shrubs or even tree-like plants, with alternate usually entire but sometimes serrate mostly narrow lvs., and sometimes more or less showy axillary or solitary white or yellow fls.: calyx tubular with 4–6 acute persistent lobes; petals 4–6, spreading, inserted on margin of the disk; stamens 8–12 in 2 rows, inserted with the petals; ovary 4–5-celled, style simple, stigma 4–6-lobed: fr. a terete, angled or costate, dehiscent, many-seeded caps.—Species about 50, widely distributed in temperate and warm regions, but most abundant in S. Amer.; some are native in the U. S.

The horticultural interest in this genus, in this country, centers about the plant known in the trade as *J. longifolia*, a summer-flowering aquatic herb, and differing somewhat from the botanical description given below. The stems of young seedlings are four-winged, and a specimen before the writer of a plant of the previous season is five-winged. The main root of these old plants may be tuber-like, 3 inches long, ½inch thick, or 8 to 10 inches long and more slender. Also the lower leaves, at least, are opposite.—*J. longifolia* is best treated as a tender annual. The seed may be sown in fall or spring in shallow water, using seed-pans or pots, as with other flower seeds. Cover the seed, which is very fine, with finely sifted soil, place the pot or seed-pan in water, but do not submerge until the second day, when the seed will be thoroughly soaked and will not float on the surface of the water. When the plants attain a few leaves they should be potted, singly, into thumb-pots, and later into 3-inch pots, and from these planted into their summer quarters. It is not absolutely necessary to keep these plants always submerged in water after potting. The plants will do well on a bench, which should be covered with sand or ashes and the plants kept well watered. (Wm. Tricker.)

longifòlia, DC. Erect, glabrous: st. 3-angled: lvs. sessile, lanceolate-linear, acuminate at both ends, glandular beneath at the margins: pedicels 1-fld., longer than the ovary, and bearing 2 bractlets at the apex: petals 4, obovate, scarcely notched at the apex; stamens 8. Brazil.—It is not clear whether this is the plant that is listed as *J. longifolia.*

Sprèngeri, Hort. Evergreen prostrate perennial, somewhat soft-hairy, much branched, the st. winged: lvs. opposite, crowded, ovate and acute: fls. very large, canary-yellow. Argentina.—Offered abroad (Sprenger, Naples); said to be one of the most beautiful aquatic plants and that it grows equally well if grown as a terrestrial subject. L. H. B.†

JUSTÍCIA (James Justice, a Scotch gardener and author of the eighteenth century). *Acanthàceæ.* Greenhouse plants, grown for the showy fascicles, spikes or panicles of white, violet or red bracted flowers.

Mostly herbs of various habit, with opposite entire lvs: calyx deeply divided into 4 or 5 narrow lobes; corolla 2-lipped, the straight or curved tube very short and dilated above, the upper lip erect or incurved and concave and the summit entire or somewhat 2-toothed, the lower lip 3-lobed and spreading; stamens 2 attached in the throat; staminodia none; disk ring-like or cupulate: caps. ovate or oblong, with seeds 4 or less.—Species 250–300, widely distributed in many warm regions, in Amer. reaching as far north as Texas. From Jacobinia, close garden ally, the genus is distinguished by the spurred or appendaged anthers. Justicia is variously understood. Lindau (in Engler & Prantl, Pflanzenfamilien) refers no less than 30 genera to it, among others being Adhatoda and Dianthera. Most of the garden plants known as justicias are jacobinias. Consult Jacobinia, for example, for *Justicia magnifica, J. carnea, J. Pohliana, J. velutina, J. Mohintlii, J. coccinea, J. Ghiesbreghtiana* and *J. Lindenii.* Others may belong to Thyrsacanthus, Dædalacanthus and Schaueria; and there has been confusion even with Whitfieldia.

The remarks on culture under the different species of jacobinias will apply here. Plants are secured readily from cuttings made in late winter or spring, and these should bloom the coming fall or winter. After blooming, discard the plants, except such as are to be kept for furnishing cuttings. Unless well headed back, old plants become loose and weedy, and they take up too much room.

The *Justicia quadrifida* now offered in S. Calif., is probably **Anisacánthus virgulàris,** Nees (*Justícia virgulàris*, Salisb. *J. coccínea,* Cav., not Aubl. *J. quadrífida,* Vahl. *Drejèra pubérula,* Torr.). Plant vigorous, rather straggling, with long erect branches, glabrous: lvs. deciduous, light green, opposite and decussate, elliptic-lanceolate, spreading, rigid: fls. scarlet-red (or orange-scarlet), usually solitary, axillary in one of the 2 opposite axils, thus making a long leafy unilateral spike; corolla-tube long and slender, deeply lobed into 4 spreading or recurved parts. Mex. R.H. 1872:50. Autumn and winter in S. Calif., Aug. and Sept. in France. Var. **compácta,** Franceschi, is a very compact low bush of emerald-green color and covered all summer with orange-scarlet fls.; comes true from seed.—Not to be confounded with *Justicia quadrifaria,* Wall.

Of the justicias appearing in American lists, only **J. furcàta,** Jacq. (*Adhátoda furcàta,* DC.) seems now to be retained in the genus. Herbaceous, pubescent, the st. erect and terete: lvs. oblong-oval, attenuate to petiole: fls. small, in short aggregated axillary spikes which are often geminate, the bracts linear-lanceolate; color of fls. purple and white; upper lip 2-fid, the lower 3-fid and broad-convex. S. Mex.—Said to seed itself freely in S. Calif., but to be of little value.

J. callètricha and *J. calycótricha,* Hort., see Schaueria.—*J. flàva,* Hort., and *J. flavícoma,* Lindl.=Schaueria. L. H. B.

JUTE is a fiber plant, of easy culture in warm climates. It has been successfully grown in the Gulf States, but the want of suitable machines for separating the fiber is the great obstacle which prevents the growth of the jute-fiber industry in America. See *Corchorus;* also "Cyclopedia American Agriculture," Vol. II.

K

KADSÙRA (Japanese name). *Magnoliàceæ.* Tropical Asian woody climbers. Kadsuras have leathery or rarely membranous foliage: fls. axillary, solitary, whitish or rosy, unisexual; sepals and petals 9–15, gradually changing from the outermost and smallest to the innermost and petaloid; staminate fls. with an indefinite number of stamens, which are separate or coalesced into a globe: carpels indefinite in number, 2–3-ovuled: mature berries in globular heads.—About 8 species, of one of which Charles S. Sargent writes (G.F. 6:75): "The flowers are not at all showy, but it is a plant of extraordinary beauty in the autumn when the clusters of scarlet fruit are ripe, their brilliancy being heightened by contrast with the dark green, lustrous, persistent leaves. . . . It might well be grown wherever the climate is sufficiently mild, as in the autumn no plant is more beautiful."

japónica, Linn. Small, procumbent, warty shrub: lvs. oval or oblong-oval, thick, serrate: peduncles 1-fld., solitary. Japan, as far as 35° north latitude.—The type is advertised by Japanese dealers; also a variety with foliage blotched with white, and another with foliage margined white.

2026. Kalanchoe carnea. (Plant × ¼)

KAEMPFÈRIA (Engelbert Kaempfer, 1631–1716, traveled in the Orient, and wrote on Japan). *Zingiberàceæ.* Tuberous- or fleshy-rooted plants, grown for foliage and flowers.

Often stemless or apparently so, the few lvs. aggregated at the base and sometimes distichous on the st.: lvs. mostly broader than lanceolate: fls. in a bracted tuft or small cluster in the center of the lf.-clump, or in a peduncled raceme, often large and showy, white, yellow, violet or purple; calyx cylindrical or funnelform, toothed; corolla tubular, exserted, with narrow lobes; staminodia petal-like and the showy parts, one of them being a broad lip; fertile stamen 1.—More than 50 species in Trop. Asia and Afr. Schumann, Engler's Pflanzenreich, hft. 20 (1904). For cult. see *Hedychium* and *Zingiber.*

A. *Foliage margined with white.*

Gílbertii, Bull. Stemless, fleshy-rooted: lvs. oblong-lanceolate, deep green, bordered white, wavy at the margin: fls. purple and white. E. Indies. G.C. II. 17:713. R.B. 21:169. S.H. 2:131. G.Z. 27, p. 217.—Intro. by W. Bull, 1882. Reasoner Bros. cult. this outdoors in S. Fla., and say, "The fls. are borne on ornamental crimson heads rising from the ground on separate stalks, and resembling in outline small pineapple frs. These heads retain their beauty all summer."

AA. *Foliage not margined with white.*

B. *Lvs. tinged purple beneath.*

rotúnda, Linn. Stemless, tuberous: lvs. not produced until after the fls., oblong, erect, petioled: corolla-segms. long-linear; staminodes oblong, acute, white, 1½–2 in. long; lip lilac or reddish, deeply cut into 2 suborbicular lobes; anther-crest deeply 2-fid: petiole short, channelled; blade 12 in. long, 3–4 in. wide, usually variegated with darker and lighter green above and tinged purple beneath: spikes 4–6-fld., produced in March and April. India. B.M. 920 and 6054. R.B. 25:181.

BB. *Lvs. not tinged purple beneath.*

Kírkii, Schumann (*Cienkówskya Kirkii,* Hook. f.). Lf.-st. 3–4 in. long: lvs. about 4, crowded at the apex of the st., oblong, acute, 8–9 in. long, 2½–3 in. wide at the middle: flowering sts. short, slender, 1-fld.; corolla-lobes oblong-lanceolate, 1 in. long; staminodes more than twice as long as the corolla-lobes, pale rose-purple; lip rounded at the apex, slightly notched, 2 in. broad, with a yellow mark at the throat. Trop. Afr. B.M. 5994. I.H. 30:495. G.W. 2, p. 253. Var. **elàtior,** Stapf. Taller: lvs. longer, the base long-attenuate, the petiole longer: lip bright rose, with a yellow blotch bordered by purple marking. Rhodesia. B.M. 8188.

K. lùtea, C. H. Wright. Stemless: lvs. 3 or 4, about 9 in. long, oblong, green and glabrous above but paler and pilose beneath: scape 3½ in. high; bracts about 8, rounded and green; fls. yellow, the lip entire and orange-yellow. Penang (India).—*K. ròsea,* Schweinf. Much like K. Kirkii, but said to be more beautiful: rootstock short and fleshy, with many cord-like roots: lvs. about 18 in. long, the blade bright green and plaited: scape 18 in. high, bearing about 6 fls. to many, which are above 2 in. across, brilliant rose-red and open one at a time, with an orange-blotched throat. Cent. Afr.

Wilhelm Miller.
L. H. B.†

KAFIR or **K. CORN:** *Sorghum.*

KAGENÉCKIA (F. v. Kageneck, an Austrian minister to Spain). *Rosàceæ.* Very few species of tender small evergreen trees from Chile and Peru, one of which has been grown in S. Calif. but now is probably lost to cult. in this country. The fls. are white, 5-petaled, about ¾in. across, and unisexual. The male fls. are borne in racemes or corymbs; the females are solitary; all are terminal: lvs. leathery, serrate, stalked: stamens 16–20, inserted on the mouth of the calyx, in 1 series: carpels 5, free: ovules numerous.

oblónga, Ruiz & Pav. Lvs. oblong, acuminate at both ends, the serrations obtuse and rather callous. Chile. B.R. 1836 (as *K. cratægifolia*). L. H. B.

KAKI: *Diospyros* and *Persimmon.*

KALÁNCHOË (from Chinese name). *Crassulàceæ.* Sometimes spelled *Calanchoë.* Succulent glasshouse herbs or subshrubs, with interesting foliage and flowers.

Usually robust erect plants: lvs. opposite, fleshy, sessile or stalked, varying from entire to crenate and pinnatifid: fls. yellow, purple or scarlet, in many-fld.

terminal paniculate cymes, rather large and often showy; calyx 4-parted, the narrow lobes shorter than the corolla-tube, usually falling early; corolla 4-parted and mostly spreading, the tube usually urn-shaped; stamens 8: carpels, 4.—More than 100 species, in the Old World tropics and in S. Afr., and 1 reported from Brazil. A few species are prized by amateurs. The fls. are lasting in bouquets. For the general handling of this class of plants, see *Succulents;* also *Cotyledon* and *Crassula.* They prop. readily by seeds and cuttings.

A. *Fls. of the red, scarlet, orange, yellow series.*

coccínea, Welw. Somewhat hairy above, 2–4 ft. tall: lower lvs. ovate, obtuse, coarsely crenate-dentate, stalked; upper lvs. linear-lanceolate, obtuse, sessile: fls. scarlet or orange, on short pedicels, in broad forking panicles which have stalks about 1 ft. long; calyx pubescent, the segms. lanceolate, acute; corolla-tube ½in. long, the limb ½in. across, and the segms. deltoid-ovate, acuminate and glabrous or pubescent. Trop. Afr.

Kírkii, N. E. Br. St. 2–4 ft., simple or branched, more or less glandular-pubescent: lower lvs. soft-fleshy, pubescent, oblong to lanceolate, about 4 in. or less long, the petioles to 2 in. long, irregularly crenate-dentate; uppermost lvs. linear-cuneate, nearly or quite entire: fls. brilliant orange-scarlet, in large corymbose cymes; calyx-lobes or sepals (free to base) oblong, acute, green, glandular-pubescent; corolla-tube ⅓in. long, yellowish green, thinly glandular-pubescent; lobes about ¼in. long, elliptic, scarlet-orange, red on the back. Trop. Afr. R.H. 1914, p. 21. M.D.G. 1908:521.

flámmea, Stapf. A foot to 18 in. high, glabrous, little branching: lvs. ovate-oblong, obtuse, narrowed into a short petiole (blade about 2 in. long and 1¼–1½ in. wide), fleshy, obscurely crenate-dentate or almost entire: fls. yellow and orange-scarlet, ½in. across; calyx parted to the base, the segms. linear-lanceolate and somewhat acute; corolla-tube 4-angled, less than ½in. long, yellowish; lobes ovate-acute, orange-red. Trop. Afr. B.M.7595. G.C. III. 26:47.—Thrives in a comparatively cool greenhouse.

glaucéscens, Brit. St. glabrous, terete, 2 ft. or more, sometimes with long ascending pubescent branches which are nearly leafless below: lower lvs. narrow-ovate, obtuse and irregularly crenate, 5 in. long, narrowed to clasping petioles: infl. glaucous, being a di- or trichotomous panicle; fls. red or dark yellow, sometimes on few-fld. peduncles from the upper nodes; calyx-lobes lanceolate, acute or nearly so, short; corolla-tube ½in. long, bearing short narrow-ovate acute segms. Trop. Afr.

crenàta, Haw. St. glabrous, or somewhat hispid in the upper part, 2–6 ft. high from a thick fibrous root: lvs. oblong or roundish ovate or spatulate, 2–3 in. long, coarsely crenate, obtuse: infl. of many-fld. axillary and terminal cymes; fls. bright yellow or orange; calyx-lobes glabrous or hispid-viscid, lanceolate and acute, only slightly joined at base; corolla-tube ½in. long, glabrous or pubescent; lobes acute, oblong-lanceolate. Trop. Afr. B.M. 1436 (as *Cotyledon crenata*).—*K. crenàta,* Hamet=*Bryophyllum crenatum.*

2027. A Norfolk kale field at the Christmas harvest time.

rotundifòlia, Haw. St. glabrous, slender, 1–3 ft., leafy below: lvs. roundish obovate, obovate or spatulate, nearly entire or crenulate, somewhat petioled, the lower ones 1–2 in. long: infl. of panicled trichotomous flat-topped cymes; fls. orange or deep yellow; calyx small; corolla small (less than ½in. long), the lobes narrow-lanceolate and acute. S. Afr.

AA. *Fls. pink.*

cárnea, Mast. Fig. 2026. Sts. simple, 2 ft. or less, glabrous: lvs. oval or obovate, obtuse, crenate-dentate, narrowed into a short petiole, the upper ones nearly linear and sessile: fls. light rose or pink, very fragrant, nearly ½in. across; calyx parted to the base, the segms linear-pointed; corolla-tube swollen at base and 2–3 times longer than calyx: corolla-lobes broad-oval, acute. S. Afr. G.C. III. 1:211. G.F. 3:53 (reduced in Fig. 2026).—Good winter bloomer, prop. by seeds or cuttings. Seeds sown in spring give blooming plants for following Christmas.

AAA. *Fls. white or white-yellow, very long.*

marmoràta, Baker (*K. grandiflòra,* Rich., not Wight). St. stout and branching: lvs. large (6–8 in. long), obovate, narrowed to a short broad petiole, crenate, blotched with purple: fls. long and tubular (3 in. or more long), creamy white or yellowish, the lobes ovate-acuminate. Abyssinia. B.M. 7333. I.H. 43, p. 45.—Interesting pot-plant, with large trusses of erect fls.

Any number of kalanchoës may appear in the collections of fanciers. Following are some of the more recent kinds, which may not be found in the regular manuals: *K. angolénsis,* N. E. Br. Lvs. fleshy, to 4 in. long and half as broad: fls. bright yellow and numerous, variable in the number of its corolla-lobes. Trop. Afr.—*K. Béntii,* C. H. Wright. St. 3 ft., unbranched, nearly 1 in. diam.: lvs. about 6 pairs near top of st., rigid and subcylindrical, 3–6 in. long: fls. white, in a loose erect panicle; calyx-lobes fleshy and spreading; corolla 1½ in. long, 4-angled, inflated at base, the limb nearly 1 in. across. Arabia. B.M. 7765.—*K. divérsa,* N. E. Br. St. 1½–2 ft. high: lvs. lanceolate to elliptic-ovate, to 5 in. long, toothed, glabrous: fls. with a green tube ½in. long and vermilion-orange shorter lobes. Somaliland.—*K. Dỳeri,* N. E. Br. A fine species, 2–2½ ft. high, glabrous: lvs. elliptic and spreading, 4–7 in. long, coarsely toothed, petiole to 3 in. long: infl. corymbose-cymose, to 1 ft. long; fls. with a pale green tube 1½ in. long, and a pure white spreading limb of lanceolate-acute lobes 1 in. long. Trop. Afr. B.M. 7987.—*K. Elìzæ,* Berger. St. simple, about 8 in.: lvs. oblong, nearly 4 in. long, entire: fls. red, in axillary thyrse-like panicles; corolla almost 2-lipped, the tube nearly 1 in. long, the lobes linear and acute and about ½in. long. Trop. Afr.—*K. felthaménsis,* Hort., is a hybrid of K. flammea and K. Kirkii.—*K. kewénsis,* Hort., is a hybrid of *K.* Bentii and K. flammea.—*K. latisépala,* N. E. Br. Related to K. Dyeri, but lvs. sessile and fls. about half the size: st. about 2 ft.: lvs. obovate, 4–5 in. long: fls. white, in many-fld. terminal cymes; corolla-tube 1¼ in. long; lobes ½in. long, ovate or elliptic-ovate. Trop. Afr.—*K. Lùciæ,* Hamet. St. stout, simple, erect: lvs. sessile, obovate or obovate-spatulate, 1–3 in. long: fls. (color not given) in a panicle-like cluster, the corolla urn-shaped and the segms. shorter than tube. Transvaal.—*K. mágnidens,* N. E. Br. St. 2½ ft. or more, glabrous, green and with no bloom: lvs. petioled, 3½ in. or less long, the lower elliptic-ovate and with 3 or 4 large teeth on either side: infl. loosely branched, the ultimate cymes compact, 9–25-fld.; corolla light salmon, the tube somewhat less than ½ in. long. Uganda (Trop. Afr.).—*K. prasìna,* N. E. Br. Small, with small and not attractive fls.: sts. leafy, about 1½ in. long: lvs. obovate or spatulate-obovate, 2–3 in. long, entire, or obscurely crenate: fls. with a green tube less than ¼in. long, and short white lobes with greenish center. Trop. Afr.—*K. somaliénsis,* Baker. Erect, shrubby: lvs. obovate or oblong-obovate, 4–6 in. long, toothed: fls. in a loose cyme to 10 in. long, white faintly tinged yellow; corolla-tube 2½ in. long; lobes ovate-lanceolate. Somaliland.—*K. sexangulàris,* N. E. Br. St. 6-angled, simple and straight, about 3 ft. high: lvs. stalked, the lower ones elliptic or suborbicular, about 3 in. long: fls. small, yellow, in a panicle about 8 in. long. Probably Transvaal.

L. H. B.

KALE (*Brassica oleracea* var. *acephala*). Figs. 2027, 2028. This plant and the so-called Georgia collard are without doubt more closely akin to the wild cabbage of Europe than any of the other cultivated forms of Brassica. Kale is really a non-heading cabbage. It is hardy and enjoys the cool portion of autumn and early spring for its growth. It ranks low in quality, but because it is hardy and will stand the winters of the Atlantic seaboard states south of New York, it supplies a cheap and palatable pot-herb during the winter season.

2028. Kale.—Leaf of Scotch Curled.

Commercially kale is extensively grown in only two districts, namely, in the vicinity of Norfolk, Virginia, and on Long Island, New York. This restricted commercial area is undoubtedly due to economic rather than soil or climatic conditions. The fact that it is a coarse, light, low-priced commodity in greatest demand from December to April restricts its profitable extensive culture to regions possessing peculiar climatic and transportation conditions,—that is, mild winters, a relatively short haul, and reasonable transportation rates.

There are several forms of kale, but only two are extensively grown for market,—Scotch kale and blue kale. Scotch kale forms by far the greater bulk of the plantings in the Norfolk area, but because the blue kale is considered hardier it is often used for late plantings and by those who have been delayed in seeding their crop.

While kale can be started under cover and transplanted with as great ease and certainty as cabbage, it is seldom handled in this way outside the kitchen-garden. Under field conditions the land is prepared the same as for cabbage, by liberal fertilizing and thorough plowing and harrowing. The seed is usually planted in drills 3 feet apart and later thinned, by chopping out, to a stand of individual plants about 6 inches apart in the row. In the Norfolk area, the seeding is done between August 15 and 20 and if the plants grow vigorously they are often harvested to meet early market demands in such a way as to accomplish the work of further thinning. The main crop is harvested by cutting the thick whorl of leaves that forms the crown of the plant. These are packed for market either in barrel-high Delaware baskets or in veneer barrels. The kale is pressed firmly as it is filled into the receptacle. The barrels are then covered by a clean burlap drawn over the mass piled on top of the barrel and held in place by driving down the loose top hoop.

Kale requires somewhat less fertilizer than cabbage, is less expensive to produce, usually produces an abundant crop which can be harvested at small cost and with a fairly satisfactory net profit an acre. The yields vary from 200 to 400 barrels to the acre with an average of about 250 barrels. The price ranges all the way from 50 cents to $2 a barrel. As usually handled, kale is not at its best. It is not economically possible to produce high-grade kale. Good kale is young tender kale which yields only a small crop to the acre. For the amateur, however, high-quality kale is possible, for he can handle it so as to secure the quick growth of young tender plants, which insures quality. The commercial grower must fill barrels if he is to find profit.

L. C. Corbett.

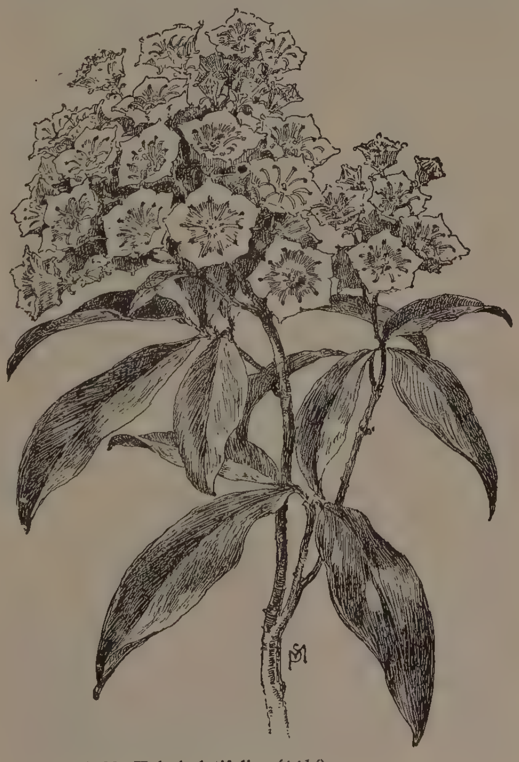
KALE, SEA: *Crambe maritima*, treated under *Sea-Kale*.

KÁLMIA (after Peter Kalm, Swedish botanist, traveled from 1748 to 1751 in North America). *Ericàceæ.* American Laurel. Ornamental shrubs grown for their handsome flowers and foliage.

Evergreen, rarely deciduous: lvs. alternate or opposite, short-petioled, entire: fls. in terminal or lateral corymbs or umbels, rarely solitary; calyx 5-parted; corolla saucer-shaped or broadly campanulate, 5-lobed; stamens 10, with slender filaments, the anthers held back in little pouches of the corolla, springing up suddenly and discharging the pollen if touched; ovary 5-celled, superior: caps. globular, parting into 5 valves, with numerous minute seeds.—Seven species in E. N. Amer. and Cuba. The lvs. of the kalmias are said to be poisonous to animals, especially those of *K. angustifolia*. The fl. of Kalmia is one of those proposed as a national floral emblem, especially on account of the exquisite symmetrical beauty of the single blossom. Kalmia is a purely American genus, but unfortunately it is popularly known only in the eastern states.

The kalmias are medium-sized or low shrubs, very rarely small trees with purple, pink or nearly white, cup-shaped flowers in showy terminal corymbs or in axillary umbels, rarely solitary, followed by small capsular fruits. *Kalmia angustifolia* and *K. polifolia* are hardy North, and also the most ornamental member of the genus, *K. latifolia*, which next to rhododendron is the most beautiful flowering hardy evergreen. Massed in groups or as single specimen on the lawn, it is one of the most decorative plants when covered with its abundant pink flowers. Even small plants produce flowers. The foliage is very decorative, contrasting well with the red and yellowish branches. The species is easily forced and makes a very handsome pot-plant. The other species are pretty border plants for evergreen shrubberies.

The kalmias thrive well in a sandy, peaty or loamy soil, but dislike clay and limestone. They grow almost as well in swamps as in drier locations and prefer partly shaded situations, but thrive well also in sunny places, provided there be sufficient moisture. They require generally almost the same treatment as the hardy rhododendron, but are less particular about soil and


2029. Kalmia latifolia. (×½)

position. Transplanting, if carefully done either early in fall or in spring, is not difficult; a mulching the first season after planting will be of much advantage to keep the roots from drying in summer and from frost in winter. Propagation is usually by seeds sown in sandy, peaty soil in pans or boxes in early spring and kept in a coldframe or greenhouse. The seedlings should be pricked off as soon as they can be handled, and after they are again established gradually hardened off and the following year transplanted in frames or beds outdoors. Varieties of *K. latifolia* are usually increased by side-grafting on seedlings in the greenhouse or by layers, since it grows less readily from cuttings, while the other species may be propagated by cuttings of half-ripened wood under glass.

2030. Kalmia latifolia var. myrtifolia. (×½)

A. *Fls. in umbels or corymbs.*

B. *Lvs. evergreen.*

C. *Branchlets terete: lvs. pale green beneath.*

D. *The lvs. alternate, pointed.*

latifòlia, Linn. MOUNTAIN OR AMERICAN LAUREL. CALICO BUSH. Fig. 2029. Shrub, 4–10 ft. high, rarely tree to 30 ft., with dense, round-topped head: lvs. petioled, alternate or irregularly whorled, oblong or elliptic-lanceolate, acute at both ends, dark green above, yellowish green below, 3–4 in. long: fls. in large, terminal compound corymbs on viscid peduncles; corolla rose-colored to white, with purple markings within, about ¾in. across. May, June. New Bruns. to Fla., west to Ohio and Tenn. B.M. 175. Em. 443. S.S. 5:236, 237. A.F. 13:32. Gng. 1:306; 3:1; 7:289. Gn. 22:6; 27, p. 549; 33, p. 607; 52, p. 77; 61, p. 9. G.M. 51:551. G. 19:708; 21:664; 35:33, 497. F.E. 9:401. C.L.A. 3:181. A.G. 19:465. M.D.G. 1903:576–79. G.F. 3:453. Mn. 3:183. J.H. III. 51:361. Var. **álba,** Bosse. Fls. almost white. Var. **fuscàta,** Rehd. Corolla inside with a broad dark purpish brown band. Var. **myrtifòlia,** Bosse (var. *nàna* or var. *mìnor*, Hort.). Fig. 2030. Lvs. small, 1–2 in. long, deep green, of slow growth, forming a low, dense bush. G.F. 8:317 (adapted in Fig. 2030). R.H. 1883, p. 11. Gn. 29, p. 379; 33, p. 603. Var. **obtusàta,** Rehd. Of compact habit and slow growth: lvs. elliptic or oval, obtuse at both ends, 2–3 in. long. Var. **polypétala,** Nichols. (var. *monstruòsa*, Mouillef.). Fig. 2031. Corolla divided into 5 narrow petals which gives to the fls. a feathery appearance. G.F. 3:453 (adapted in Fig. 2031). Var. **rùbra,** Sweet (var. *Pavártii*, André). Fls. deep pink. R.H. 1888:540.

DD. *The lvs. mostly opposite or in 3's, obtuse.*

E. *Under side of lvs. glabrous.*

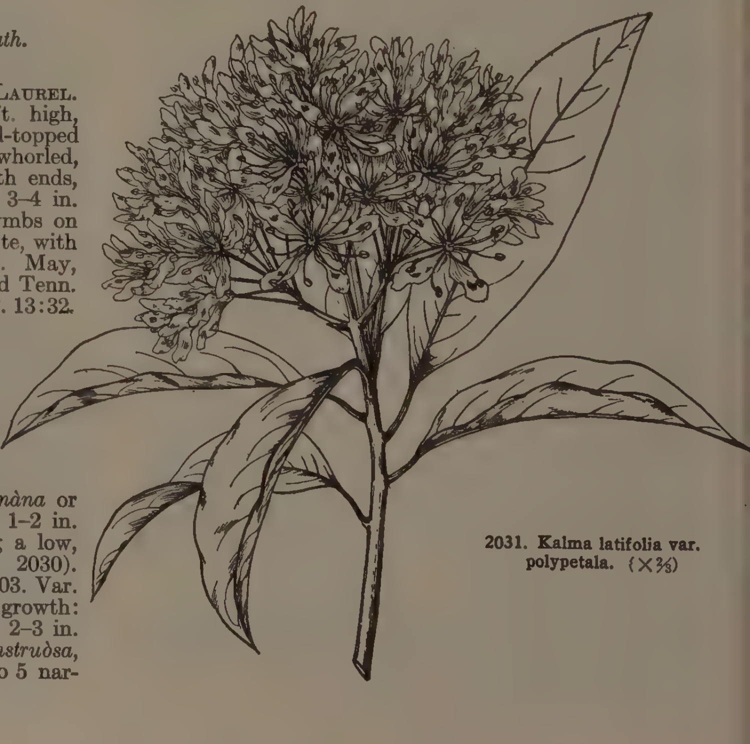
angustifòlia, Linn. SHEEP-LAUREL. LAMBKILL. WICKY. Shrub, to 3 ft.: lvs. petioled, usually oblong, obtuse, light green above, pale beneath, 1–2½ in. long: corymb lateral, many-fld., compound or simple; fls. ⅛–½in. across, purple or crimson; sepals ovate, glandular. June, July. From Newfoundland and Hudson Bay to Ga. B.M. 331. Em. 445.—There are varieties with light purple fls., var. **ròsea,** Hort.; with crimson fls., var. **rùbra,** Lodd. (var. *hirsùta*, Voss). L.B.C. 6:502; with white fls., var. **cándida,** Fern.; with ovate or oval lvs., var. **ovàta,** Pursh, and of dwarf habit, var. **pùmila,** Bosse (var. *nàna*, Hort.).

EE. *Under side of lvs. pubescent.*

carolìna, Small (*K. caroliniàna*, Day). Similar to the preceding, but the young parts finely pubescent: lvs. oval to oblong, obtuse, grayish pubescent below, ⅔–1¾ in. long: fls. purplish, ⅓in. across, in small corymbs; sepals oblong-lanceolate, puberulous. June, July. Va. to N. C. B.B. (ed. 2) 2:684.—Has proved hardy at the Arnold Arboretum.

CC. *Branchlets 2-edged: lvs. glaucous-white beneath, all opposite or in 3's.*

polifòlia, Wang. (*K. glaùca*, Ait.). Low, straggling shrub, to 2 ft.: lvs. almost sessile, oval to linear-oblong, obtuse, revolute at the margins, ½–1½ in. long: fls. in simple terminal umbels, slender-pedicelled, ½–¾in. across, rose-colored or purplish. May, June. Newfoundland to Pa. and in the Rocky Mts. from Sitka to Calif. B.M. 177. L.B.C. 16:1508. Em. 441. Var. **microphýlla,** Rehd. (*K. microphýlla*, Heller), is the alpine form of the Rocky Mts., growing only a few inches high, and with very small lvs., ½in. or less long. Var. **rosmarinifòlia,** Rehd. (*K. glaùca* var. *rosmarinifòlia*, Pursh), has narrow, linear-oblong, strongly revolute lvs.



2031. Kalma latifolia var. polypetala. (×⅗)

BB. *Lvs. deciduous, alternate.*

cuneàta, Michx. Fig. 2032. Erect shrub, with slender, straggling sts. to 3 ft.: lvs. petioled, cuneate, obovate-oblong, acute or obtuse, pubescent beneath when young, ¾–1½ in. long: fls. slender-pedicelled, in few-fld. lateral umbels, creamy white with a red band within, ½–¾in. across. June. N. C. and S. C. G.F. 8:435 (adapted in Fig. 2032). B.M. 8319.—Tender.

AA. *Fls. solitary, axillary: plant hirsute.*

hirsùta, Walt. (*Kalmiélla hirsùta,* Small). Low shrub, with many erect or ascending sts. to 1 ft.: lvs. alternate, almost sessile, oblong to lanceolate, ¼–½in. long: fls. slender-pedicelled, ½in. across, rose-purple; sepals oblong-lanceolate, hirsute, longer than the caps. June. S. Va. to Fla. B.M. 138. L.B.C. 11:1058.—Tender.

ALFRED REHDER.

KALOPÀNAX: *Acanthopanax.*

KALOSÁNTHES: *Rochea.*

KARÀTAS: *Aregelia.*

KAULFÚSSIA: *Charieis.*

KENDRÍCKIA (personal commemorative name). *Melastomàceæ.* A warmhouse root-climber from S. India and Ceylon, where the sts. "in their lower part creep up trees like ivy, hence flattened with the lvs. distichous." Species one, **K. Wálkeri,** Hook. f., offered abroad: lvs. opposite, fleshy, stalked, oblong or obovate, obtuse, about 1½ in. long, the margins glandular-hairy and the surface dotted white: fls. "tinging the forest red" when the plants ascend to the tops of the tallest trees, borne in few-fld. umbels or solitary; calyx rose-purple, urn-shaped; corolla bright red, the 4 fleshy petals about 1 in. long; stamens 8, equal, the anthers opening at the apex by a pore and somewhat produced or extended at the base: fr. a globose caps. opening by 4–6 valves at the apex. Probably requires the treatment given other warm melastomaceous plants. See *Melastoma.*

L. H. B.

KENNÉDYA (Kennedy, of the nursery firm of Kennedy & Lee, important English nurserymen of the latter part of eighteenth century). *Leguminòsæ.* Woody trailers or twiners, making excellent plants for the intermediate house or conservatory.

Perennials, usually pubescent or villous, prostrate and trailing or climbing, the st. more or less woody: lvs. mostly pinnately 3-foliolate, sometimes with 5 lfts. or even reduced to 1, the lfts. stipellate, entire or somewhat 3-lobed: fls. papilionaceous, red to almost black, disposed in pairs, umbels or racemes, or sometimes solitary; calyx 2-lipped by the cohesion of 2 upper lobes; standard orbicular or obovate, narrowed to a claw, and bearing minute auricles; wings falcate, joined to the incurved keel; stamens 9 and 1: pod linear, flattened or cylindrical, 2-valved with pithy divisions between the seeds.—Species about a dozen, in Austral. Closely allied to Hardenbergia, but differs in the larger red or red-black rather than white or blue fls., and characters of keel and infl. These genera belong to the Phaseolus tribe.

The species are known mostly as glasshouse subjects. They propagate with ease from seeds, and also from cuttings of firm green wood; they require an intermediate temperature. Insects are likely to trouble them. They are mostly spring and summer bloomers, and should rest in winter. Give plenty of water during summer. They should be given support; they grow from 3 to 10 feet high, making stiff, woody stems. They may be trimmed back freely when at rest. The taller kinds, like *K. rubicunda* and *K. coccinea,* are excellent for rafters. *K. nigricans* is an old garden plant, still grown in this country under the name of *Lotus nigricans.* Well-rooted plants may be planted permanently in the greenhouse border.

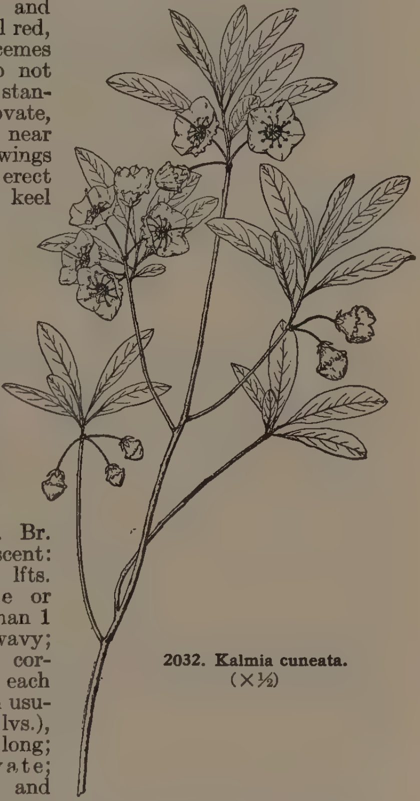
A. *Fls. nearly black.*

nígricans, Lindl. Twining, robust, somewhat pubescent: lfts. (sometimes reduced to 1) broad-ovate or rhomboid, entire, obtuse or emarginate, 2–3 in. long; stipules small and reflexed: fls. slender, 1 in. or more long, in short 1-sided axillary racemes, deep violet-purple or almost black, green-blotched on the standard which is narrowly obovate and reflexed; wings about as long as keel, and narrow: pod flattened. W. Austral. B. R. 1715. B.M. 3652.—An immense grower in S. Calif.

AA. *Fls. red or scarlet.*

B. *Standard narrow-obovate.*

rubicúnda, Vent. Pubescent, twining: lvs. 3-foliolate; lfts. 3–4 in. or more long, ovate to orbicular or ovate-lanceolate, entire; stipules small and reflexed: fls. dull red, drooping in racemes that usually do not exceed the lvs.; standard narrow-obovate, reflexed from near the middle; wings narrow and erect adhering to keel above the middle: pod flat or nearly so. L.B.C. 10:954. B.M. 268 (as *Glycine rubicunda*). B.R. 1191 (as *Amphodus ovatus*). H.F. II. 4:166.



2032. Kalmia cuneata. (×½)

BB. *Standard broad-ovate or orbicular.*

prostràta, R. Br. Prostrate, pubescent: lvs. 3-foliolate; lfts. broad-obovate or orbicular, less than 1 in. long, often wavy; stipules leafy, cordate: fls. 2–4 on each peduncle (which usually exceeds the lvs.), scarlet, ¾in. long; standard obovate; keel incurved and obtuse; wings narrow and short: pod nearly cylindrical, pubescent. B.M. 270 (as *Glycine coccinea*). J.H. III. 44:65.

Var. **màjor,** DC. (*K. Márryattæ,* Lindl. *K. Marryattiàna,* Hort.). Larger and more hairy, twining: lfts. larger, strongly undulate; stipules sometimes 1 in. across: fls. large, deep scarlet. B.R. 1790. Gn. 28:60. Gn.W. 4:505. H.U. 5, p. 139. A.F. 3:547.—A very handsome winter-flowering twiner.

coccínea, Vent. Prominently pubescent, trailing or twining: lfts. 3 or 5, ovate or oblong, very obtuse, often somewhat 3-lobed; stipules very small: fl. ½in. long, scarlet, in long-peduncled clusters of 15–20; standard orbicular; keel very obtuse, short: pod flattened. B.M. 2664. L.B.C. 12:1126.—Known under several names, as *K. inophýlla,* Lindl., B.R. 1421; *K. dilatàta,* Cunn., B.R. 1526; *Zíchya trícolor,* Lindl., B.R. 25:52; *Z. villòsa,* Lindl., B.R. 28:68, and others. Handsome slender twiner or trailer.

K. audomariénsis, Hort., is probably a form of Hardenbergia monophylla, although reputed to be a hybrid between that species and K. prostrata var. major (K. Marryatæ). Fls. rosy red, in racemes: lvs. ovate-lanceolate, acuminate, petioled: handsome. R.B. 27:25.—*K. Beckxiàna*, F. Muell. Much like K. rubicunda, but peduncles 2-fld.: twining: lvs. 3-foliolate, the lfts. obovate to elliptic, to 3 in. long: fls. red with a green-yellow dark-margined blotch at base of standard, about 1½ in. long. S.W. Austral. B.M. 8358. A showy and striking plant.—*K. cærùlea*, Hort., is probably Hardenbergia Comptoniana.—*K. Comptoniàna*, Link.=Hardenbergia Comptoniana.—*K. exímia*, Lindl. Twining or prostrate, silky or becoming glabrous: lfts. 3, ovate, or obovate, not exceeding 1 in. long, very obtuse. fls. scarlet, not large, 2 or 3 more on a peduncle; standard very broadly obovate or nearly orbicular: pod usually curved. W. Austral. P.M. 16:35. H.F. 4:166.—*K. longiracemòsa*, Lindl.=Hardenbergia monophylla.—*K. macrophýlla*, Lindl.=Hardenbergia Comptoniana.—*K. ovàta*, Sims=Hardenbergia monophylla.—*K. retrórsa*, Hemsl. Twining, reddish hairy on the young growths: lvs. 3–6 in. long, 3-foliolate, petioled; lfts. oval to sub-orbicular: fls. rose-purple with white spot on standard, about ⅗in. across, borne in a peduncled raceme: pod retrorsely pilose. E. Austral. B.M. 8144.—*K. Stírlingii*, Lindl. Hairy, trailing or twining: lvs. 3-foliolate, ovate to orbicular, very obtuse; stipules broadly cordate: fls. scarlet, in 1–3 pairs on axillary peduncles: pod very turgid. W. Austral. B.R. 1845.

L. H. B.

KÉNTIA (after William Kent, horticulturist, companion of Reinwardt in journeys through the Indian archipelago). *Palmàceæ*, tribe *Arèceæ*. Ornamental spineless palms grown in the greenhouse.

Leaves pinnate, sharp-pointed or 2-toothed; lfts. linear-lanceolate, midnerves scaly beneath, and rachis angled above; petiole channelled above, rounded on the back. It differs from Areca in the sharply 4-angled branchlets of the spadices; and from Hedyscepe and Kentiopsis in having only 6 stamens.—Species at most 6 or 7, from the Moluccas to N. Austral. The type is *K. procera*, Blume, from New Guinea, which is not cult. It is probable that none of the kentias known to the American trade belongs properly in this genus.

K. austràlis, Hort., from Lord Howe's Island, is probably one of the four following palms which, according to Maiden in Proc. Linn. Soc. N. S. W. 1898, are the only palms on that island: Clinostigma Mooreanum, Howea Belmoreana and H. Forsteriana, and Hedyscepe Canterburyana. K. australis was intro. 1873 and advertised 1893. —*K. Baùeri*, Seem.=Rhopalostylis Baueri.—*K. Belmoreàna*, C. Moore=Howea Belmoreana.—*K. Belmoreàna*, F. Muell.=Howea Belmoreana.—*K. Brównii*, Hort. Dedicated to D. S. Brown, of St. Louis, Mo. Resembles K. Macarthuri. Lvs. pinnate, arching; lfts. truncate and premorse. Very graceful. A.G. 15:266. This is, perhaps, Nenga or Hydriastele.—*K. Canterburyàna*, F. Muell.=Hedyscepe Canterburyana.—*K. divaricàta*, Planch.=Kentiopsis divaricata.—*K. Dumoniàna*, Hort. Adv. 1895. F.R. 1:379.—*K. élegans*, Brongn. & Gris.=Cyphophœnix elegans.—*K. exhorrhìza*, Wendl.=Exhorrhiza Wendlandiana.—*K. Forsteriàna*, F. Muell.=Howea Forsteriana, considered by Bentham to be only a form of Howea Belmoreana, although horticulturists do not accept this.—*K. frutéscens*, Hort. Cult. by Siebrecht & Son.—*K. fulcìta*, Brong.=Cyphophœnix fulcita.—*K. grácilis*, Hort.=Microkentia gracilis.—*K. Kersteniàna*, Hort. Lvs. very slender, dark green, arching, ascending, widely pinnated; lfts. broadly cuneate, shaped like a shark's fin, the truncate apex curiously erose, ragged, the upper margin extending into a long, sharp tip; petioles covered with light grayish brown pubescence. New Ireland. A.G. 20:223 (1899). G.C. III. 24:391. This is probably a Nenga.—*K. Líndenii*, Hort.=Kentiopsis macrocarpa.—*K. Luciàni*, Lind.=Kentiopsis macrocarpa.—*K. Macárthuri*, Hort.=Ptychosperma Macarthuri, which see.—*K. Mooreàna*, F. Muell.=Clinostigma Mooreanum.—*K. Mòrei*, Hort. Dreer. Possibly same as K. Mooreana.—*K. rubricaùlis*, Hort. Lvs. pinnate, ovate, with red petioles. Adv. 1895.—*K. rupícola*, Hort. Adv. 1895.—*K. Sanderiàna*, Hort. Very slender in habit, very hard foliage, spreading: lfts. very narrow, arranged on an arching rachis similar to Cocos Weddelliana. A graceful plant for jardinieres or conservatories. A.G. 20:223. A.F. 20:603. Gn.M. 2:226. G. W. 2:399.—*K. sápida*, Mart.=Rhopalostylis sapida.—*K. Van Hoùttei*, Hort.=Veitchia, sp. (?). Adv. 1895.—*K. Vèitchii*, Hort. probably = Hedyscepe Canterburyana.—*K. Wendlandiàna*, F. Muell.=Hydriastele Wendlandiana.

N. Taylor.†

KENTIÓPSIS (Greek: *like Kentia*). *Palmàceæ*. A small but very handsome group of palms with tall unarmed stems.

Leaves equally pinnate; pinnæ sub-opposite, very coriaceous, narrow, sword-shaped, narrowed to the obtuse or toothed apex, with strong mid-nerve, prominent veins and thickened margins: spadix large, thick, the branches stout and long; fls. monœcious, spirally disposed; ovary globose-ovoid followed by a thick-walled fr.—There are 3 species, all Australian. G.C. II. 25:75. Kentiopsis belongs to a large group of genera mentioned under Hedyscepe, which differ from Kentia in having the ovule fastened on the side of the locule, and more or less pendulous, instead of fastened at the base and erect, as in Kentia. Kentiopsis is distinguished from Hydriastele by having its fls. arranged spirally instead of in 4 ranks. From numerous other cult. allies it is distinguished by the following characters: stamens numerous, 20–25: lf.-segms. narrowed, obtuse or dentate: sepals of the staminate fls. triangular-orbicular, broadly overlapping. Cult. as in Kentia.

macrocárpa, Brongn. (*Kéntia Líndenii*, Hort., Lind. *Kéntia Luciàni*, Lind.). About 20 ft., usually less in cult.: rachis flat above, convex below. The form known as *Kéntia Luciàni*, has bright green lvs., tinged with brown on the under surface, the young petiole yellowish, later becoming brown. I.H. 24:276; 29:451. R.H. 1881:372. F. 1884, p. 71. S.H. 2:117.—The species is distinguished by the reddish tinge of the young lvs.

K. divaricàta, Brongn. (Kentia divaricata, Planch.), is referred by Drude in Engler & Prantl, to Drymophlœus. It may be distinguished from the preceding by the alternate pinnæ and triangular rachis, keeled above. I.H. 28:409. This has been confused in the trade with Kentia gracilis, which is referred by Index Kewensis to Microkentia gracilis. See I.H. 23:245. Advertised 1895.—*K. olivæfórmis*, Brongn., is characterized by the 4-angled rachis. Not cult.

N. Taylor.†

KENTUCKY BLUE GRASS: *Poa pratensis.*

KENTUCKY COFFEE TREE: *Gymnocladus canadensis.*

KERNÈRA (Johann Simon von Kerner, 1755–1830, professor of botany at Stuttgart). *Crucíferæ*. Under this name amateurs cult. a rock-plant growing about 4 in. high, which blooms profusely all summer, its fls. being small, white, and borne in elongated umbels. Bentham & Hooker regard Kernera as a subgenus of Cochlearia, in which the stamens are longer and bowed at the apex: pods turgid; valves very convex: cotyledons accumbent or incumbent. Prantl (in Engler & Prantl, Pflanzenfamilien), however, keeps the genus distinct, comprising 5 species in the mountains of Cent. and S. Eu. They are perennial herbs, with simple or pinnately parted lvs.

The species grown in rock-gardens is a compact branching, neat-habited plant thriving in any light soil that is moderately rich. It requires a sunny but not too dry situation. Prop. by cuttings, division or seed. *K. saxátilis*, Reichb. (*Cochleària saxátilis*, Linn.). Root-lvs. oblong, dentate, pilose; st.-lvs. linear-oblong: petals 4, obovate, 2–3 times as long as the calyx: seeds numerous, not margined. Pyrenees to Carpathians.

Wilhelm Miller.

KÉRRIA (after William Kerr, a gardener who introduced this and many other plants from China; d. 1814; not J. Bellenden Ker or M. Kerr, as often stated). *Rosàceæ*. A monotypic genus, one of the first shrubs brought from Japan, best known by its weak, slender green branches, slender irregularly toothed leaves and large yellow flowers.

From Rhodotypus, a close relative, it differs in its 5 rather than 4 petals, 5–8 rather than 4 carpels, and in the dry achene rather than drupe. The related genus Neviusa lacks petals, and has 2–4 carpels. **K. japónica**, DC. (*Córchorus japónicus*, Thunb.), is a very common bush in yards under the name of Japanese Rose, Corchorus and the prevailing double form as Globe-flower. (Fig. 2033): lvs. simple, alternate, ovate-lanceolate, acuminate, largely unequally serrate, 1–2 in. long, clear green above, pale below, thin, slightly pubescent: fls. abundant, solitary, terminal, peduncled, 1–2 in. diam. appearing in June and more or less throughout the year; calyx persistent, 5-lobed; petals 5, large, yellow, ovate; stamens numerous: carpels 5–8, globose, distinct. A.G. 18:425. F.E. 9:593. R.H. 1869, p. 293. Gn. 21, p. 275. Var. **flore-plèno**, double, more vigorous and more frequent in cult. than the single. B.M. 1296. G. 26:345; 27:146. G.M. 50:210. G.Z. 9:48. Var. **grandiflòra**, a vigorous form with large fls. Var.

vittato-ramòsa, Zabel (*K. ramùlis variegàtis aùreis*), a dwarf form, the branches striped with yellow and green. Var. **argénteo-variegàta,** 2–3 ft. high, with small green lvs. edged with white.

Kerria japonica grows 4 to 8 feet high and as broad as high, with numerous short-branched, spreading stems, attractive in winter from its light green branches; in early June, when its blossoms appear in greatest abundance; in November, when the leaves are of a clear yellow; and is not unattractive throughout the whole year. It is a refined plant and deserves free use in ornamental planting, either in simple masses or at the front of a shrubby group or border. It is not thoroughly hardy in all situations in the northern states, the tips of its branches often winter-killing, which causes it to demand a well-drained and partially sheltered position. It grows in any good garden soil. Although enduring sunlight, it is best in partial shade, since the intensity of full sunlight partially bleaches the flowers. It is propagated by cuttings, layers and root-divisions.

2033. Kerria japonica, the single-flowered form. (×½)

A. Phelps Wyman.

KERSTINGIÉLLA (Dr. Kersting, of Togoland). *Leguminòsæ*. A very recently described African plant that produces a bean underground, much after the manner of peanut. It is widely cult. by the natives of Trop. Afr. for food, *K. geocárpa*, Harms (*Voandzèia Poìssonii*, Chev.). It is a prostrate herb, the main st. creeping, 2–3 in. long, and rooting at the nodes: lvs. 3-foliolate, rising on slender petioles, the lfts. broadly ovate or obovate, obtuse: fls. small, in pairs or solitary, subsessile in the axils (on the ground); corolla papilionaceous, greenish white but the standard pale violet at tip: pod maturing underground, indehiscent, usually divided by 1 or 2 constrictions into 2 or 3 joints; seeds oblong or oblong-ovoid, about ¼in. long, white, red or mottled: "after fertilization, the solid base or stipe of the pistil, which in the fl. is very short, lengthens into a carpopodium and at the same time turns toward the ground; then the corolla and the style are thrown off. The ovary, still very small, is pushed out of the calyx, and by the root-like carpopodium gradually driven into the ground, where finally the growth and the maturation of the ovary into the seed-bearing pod take place."—Kew Bull., 1912, p. 209, with fig. See *Voandzeia*.

L. H. B.

KETELEÈRIA (after Jean Baptiste Keteleer, a French nurseryman, born in Belgium). *Pinàceæ*. Ornamental trees, grown for their handsome fir-like foliage and distinct habit.

Evergreen, of regular pyramidal habit while young, in old age with a broad flat-topped head: winter-buds globose or ovoid, not resinous: lvs. linear, flat or keeled, not grooved above, pale green below, appearing 2-ranked: staminate fls. arranged in clusters: cones upright, with persistent woody scales; bracts inclosed, about half as long as the scales; wings of seeds as long as the scales.—Three or possibly only 2 species in China. Closely allied to Pseudotsuga and chiefly distinguished by the clustered staminate fls. and the upright fir-like cones. In foliage most similar to Abies but easily distinguished by the flat lvs. being keeled, not grooved above and pale green, not marked with white or whitish lines beneath.

The keteleerias are little known in this country and are not hardy North, though the recently introduced *K. Davidiana* is probably hardier than the better known *K. Fortunei*. They are handsome trees, of fir-like habit while young, but old trees become flat-topped with wide-spreading branches resembling somewhat the cedar of Lebanon in habit. Propagation is by seeds and by cuttings.

Fórtunei, Carr. (*Àbies Fórtunei*, Murr. *Pseudotsùga jezoénsis*, Bertrand. *Pìnus Fórtunei*, Parl. *Abiètia Fórtunei*, Kent). Tall tree, to 100 ft.: branchlets glabrous, orange-red: lvs. twisted so as to form 1 plane, linear, rigid, mucronate or spiny-pointed, flat, with the midrib prominent on both sides, glossy dark green above, paler below, 1–1¼ in. long: cones ovoid or cylindric-ovoid, 3–7 in. long; scales suborbicular, purple while young, later reddish brown. S. E. China. R.H. 1866:449; 1887, pp. 208–211; 1900, p. 202; 1904, p. 130. G.C. II. 21:348, 349. F.S. 7, p. 223; 9:858. J.F. 4, p. 29. G.W. 3, p. 125.

Davidiàna, Beissn. (*Àbies Davidiàna*, Franch. *Pseudotsùga Davidiàna*, Bertrand. *Àbies sàcra*, David). Tall tree, to 120 ft.: young branchlets puberulous: lvs. twisted into 1 plane, linear rounded or notched at the apex, midrib raised on both sides, glossy green above, paler below, 1–1½ in. long: cones cylindric-oblong, 6–8 in. long, with orbicular-ovate scales, erose at the margin and recurved at the apex. W. China. R.H. 1873, pp. 37, 38; 1904, p. 131. G.C. III. 33:85. M.D.G. 1912:9 (habit of an old tree).

K. Evelyniàna, Mast. Closely allied to K. Davidiana and probably only variety of it. Lvs. 1½–2 in. long, obtuse or acutish: cones 2–3 in. long, with oblong-ovate scales. S. W. China. G.C. III. 33: 194.—*K. Fàbri*, Mast.=Abies Delavayi, Franch., a recently intro. Chinese species.

Alfred Rehder.

KIDNEY BEAN. Common name in England for the garden beans in distinction from the lima bean, the former being *Phaseolus vulgaris*, the latter *P. lunatus*.

KIDNEY VETCH; *Anthyllis*.

KIGÈLIA (from a native name). *Bignoniàceæ*. About a dozen trees of Trop. Afr. (one extending into S. Afr.), remarkable for the long-hanging fls. and frs. Lvs. odd-pinnate: fls. orange or red, on long-peduncled lax panicles; calyx 2–5-lobed, campanulate; corolla broadly campanulate and narrowing below into a straight cylindrical or constricted tube, the limb 2-lipped; upper lip 2-lobed and nearly erect; lower lip deeply 3-lobed and deflexed; stamens 4, didynamous, somewhat or partially exserted; disk ring-like: fr. a cylindrical, indehiscent rough body, with a thick exterior and a fibrous pulp holding the seeds. **K. pinnàta,** DC. (Fig. 2034), the "fetish-tree" and "sausage-tree," is offered in S. Calif., and specimens may be expected in botanical collections in the W. Indies. It is native of the Mozambique district in Afr., where it makes a tree 20–50 ft. high, according to Sprague: lvs. ternate, the lfts. 7–9, elliptic-oblong or obovate and 3–6 in. long, serrate or entire, usually glabrous above but sometimes more or less pubescent beneath, the lateral lfts. sessile but the terminal one with a stalk several inches or a foot long: fls. claret-colored, with a corolla-tube to 3 in. long dilated at the mouth, and lobes to 2½ in. long: fr. 12–18 in. long, blunt, 5 in. diam., hanging on a peduncle or cord often several ft. long, making very striking objects. In parts of Afr. this tree, or possibly a related species, is said to be held sacred; and the fr., when cut and slightly roasted, is said to be used as outward applications in certain diseases. The tree is practically unknown in the U. S. G.C. III. 50, suppl. Aug. 12 (1911).

L. H. B.

KIN-KAN: *Kumquat.*

KINNIKINNICK: Dry bark of *Cornus Amomum*, smoked by western Indians.

KINO. A dark red or blackish plant product, usually of a resinous nature, rich in tannin. There are numerous kinds of kino obtained from plants of different families; some are used in medicine as an astringent, others are employed in dyeing and tanning. The Australian or Botany Bay kino is derived from various species of Eucalyptus. *E. resinifera* is known as the kino eucalypt.

KIRENGESHÒMA (Japanese words meaning *yellow Anemonopsis macrophylla*). *Saxifragàceæ.* One perennial yellow-flowered herb from Japan, *K. palmàta*, Yatabe, which has lately received attention in England where it has proved hardy and appears to be adapted to the shady border or rock-garden; prop. by division. The plant grows at an elevation of over 5,000 ft. in Japan, on Mt. Ishizuchi. Two to 4 ft., upright, the sts. slender and glabrous: lvs. large and papery, all the lower ones petioled, round-cordate and palmately 7–10-lobed, hairy on both surfaces, the lobes acute and coarsely toothed: fls. overtopping the lvs., on usually 3-fld. peduncles, nodding; corolla bell-shaped, to 1¾ in. long, the 5 petals oblong-lanceolate and recurved above the middle: fr. a loculicidally dehiscing caps. B.M. 7944. Gn. 64, p. 246; 74, p. 573. G. 27:421. R.H. 1908, p. 153.

L. H. B.

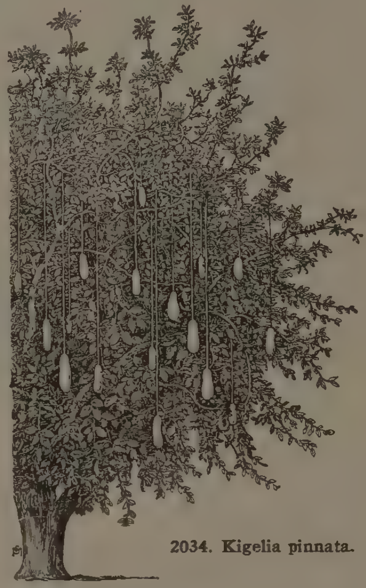
KITAIBÈLIA (Paul Kitaibel, 1757–1817, of the botanic gardens at Pesth). *Malvàceæ.* One garden species from the S. Danube region, planted in the open, **K. vitifòlia,** Willd. Hardy robust perennial herb, to 8 ft., allied to Malope: lvs. angled or 5-lobed, toothed: fls. white or rose, showy, sometimes many and sometimes solitary in the axils; involucre surpassing the calyx, the bracts connate at base and 6–9-parted; calyx 5-parted; petals 5, obovate, narrowed almost to a claw; staminal column divided at apex into many filaments; ovary many-celled, the carpels becoming congested into a head, dehiscent. It is a plant somewhat on the order of abutilon, with vine-like or maple-like lvs. It thrives in any usual garden soil, and is said to be good for naturalizing in the shrub plantations and elsewhere; prop. by division or by seeds. B.M. 821.

K. Balánsæ, Boiss., is a second species very like K. vitifolia, but the lvs. deeply 5-lobed, stipules ovate, the bracts of involucre much exceeding calyx and oblong-lanceolate and cohering or grown together at base. Cilicia.—*K. Líndemuthii*, Hort., is a graft-hybrid, produced by grafting K. vitifolia on Abutilon Thompsonii. Lvs. variegated or marbled as in the abutilon stock: plant 6–8 ft. Named for H. Lindemuth, of Berlin, its raiser.

L. H. B.

KITCHEN - GARDEN and FLOWER - GARDEN. The kitchen-garden is for the kitchen,—to grow the supplies that are used in cookery and on the table as food. We ordinarily think of it only as a vegetable-garden, yet it may grow strawberries and other small fruits; and in England the melons are classed with fruits even if grown in the kitchen-garden. It is in the kitchen-garden, also, that the sweet herbs and the garnishing plants may be grown; and flowers need be no strangers to it. In fact, some of the best and most attractive kitchen-gardens may be comprised of vegetables, fruit bushes and flowers,—all grown for the table and the home.

The essential idea is the home-gardening idea; and therefore it is difficult to separate the home vegetable-garden and the home flower-garden by any hard-and-fast or arbitrary line.



2034. Kigelia pinnata.

If the place is large enough to have been laid out in a landscape treatment, the home-garden area has been set aside in its place, proper both for exposure and convenience. With this landscape plan we have nothing to do at the moment except to insist that the home-garden idea shall not have been overlooked and that it shall form one essential part in an artistic subdivision of the property.

The kitchen-garden of vegetables.

Human diet consists chiefly of three classes of foods. first, meats, high in protein, useful for structural purposes; second, cereals and other starchy or carbohydrate foods, useful for their high fuel-value; and third, vegetables and fruits. The last mentioned contain but little material for building body or for supplying energy; but they offer other substances seemingly less important, but which are absolutely essential. Most notable among these are the mineral elements. The flavoring and appetizing qualities are scarcely less important, and the requirement for comparatively bulky foods is no more to be neglected in human than in animal nutrition. The truth of these assertions is evident in the fact that no meal is regarded as complete without its vegetarian dishes, and more especially is it emphasized in the intense craving for this sort of food which is experienced in the spring months by those who enjoy but little of it during the winter. Indeed, one can hardly avoid tracing a connection between the meat and cereal diet of the old-time winter and the once accepted notion that one must necessarily be in poor physical condition as spring approaches, and resort to the use of "spring bitters." In fact, certain definite disorders are clearly traced to the lack of vegetable food.

More appealing than the nutritional value of the vegetable food is its value as a contribution to good living. No diner is satisfied unless vegetables appear on the menu, and the products of the garden add widest variety in the form of condiment and salad, as well as in the main part of the meal. Paragraph after paragraph might be written in praise of the endless array of delicacies which are offered by the skilful housewife who is in league with the skilful gardener.

Vegetable food is procured in two ways,—by purchase and by culture. The former method is not available to many who dwell in the open country. To the townsmen it is open to very serious objection. The cost is usually high, often exorbitant and prohibitive. The varieties are more often selected for resistance to the rigors of shipment and sale than for excellence of table quality. For example, the leading commercial sort of celery is far surpassed by others, and the most widely grown winter cabbage—the best keeper of all—lacks tenderness and flavor. The market watermelon of long experience in freight cars sadly lacks in quality. Even though a product be good when it leaves the farm, the delays in handling to which it is subjected rob it of its freshness and its delicacy of flavor. Lettuce cannot be made to retain its garden crispness, and the sweetness of sugar corn speedily departs. Moreover, market-bought vegetables are often in thoroughly unclean condition.

The second source of supply is the kitchen-garden. By this means are the shortcomings of the urban vegetable supply avoided by many townsmen, and a notable contribution to the farm income is afforded. An experiment continued for five years at the Illinois Experiment Station showed an average return of $105 from a half-acre garden. The average cost was $30. Under intensive culture on small areas, each square foot of ground may be brought to yield, for example, lettuce to the value of 10 or 12 cents, followed by tomatoes worth 6 to 12 cents. These figures are offered merely to suggest possibilities and not to form a basis for calculating the value of back-yard gold mines. Perhaps the gold mine is there, but many factors must be considered in figuring its profits. It is safe to say that in the hands of a skilful gardener a city back yard may mean as much to the family budget as a 5 per cent increase in an ordinary "middle class" salary, and a suburban garden offers far greater possibilities. In the dooryards and vacant lots of our cities lie locked up one of the great economic resources of the state. The value of products of the kitchen-gardens in New York alone already runs into the millions of dollars and should be many times doubled. So much for the material gain. No less to be prized are the dividends which are paid in the joys of a variously laden table and in the satisfaction and pleasure of production. The city dweller can find no better means of recreation and exercise. A garden is an ideal hobby.

It is impossible to tell in detail how to make a garden. It is possible only to offer certain generalities and suggestions which may be helpful to one who is learning how to cope with a given set of conditions. Circumstances vary so widely that almost any statement may be wrong in some cases, and rule-making is always unsafe. Experience is the best teacher, and one who loves plants and the soil and who is willing to see and to think and to do the best that one knows may be confident of increasing success from year to year.

Location.

It often happens that no choice is offered as to the location of the vegetable-garden, but when this is not the case, an outline of desirable points may be of service. While one whose domain is measured in feet and inches rather than in rods is forced to utilize the plot which is at hand, the garden factor should certainly be considered in choosing a place for a home.

On the farm the garden should be near the buildings, for convenience in working. The distant garden is almost invariably neglected, while the nearby plot offers useful employment for odds and ends of the time of farm-hands which might otherwise be wasted. For example, the cultivation of a corn-field is finished an hour before noon. It is too late to go to a distant field, and the horse is turned into the home half-acre not to browse but to loosen the crusted soil. The garden should be near the home for convenience in gathering the products. If possible, a liberal water-supply should be available.

A gentle slope is desirable to insure good drainage. Exposure to the southeast affords the maximum advantage from the sun's rays and consequent maximum earliness of maturity. Protection from severe winds may be gained by placing the garden near farm buildings, wood-lot or hill. At the same time, the roots of trees, greedy for moisture, should be avoided.

Three points are to be borne in mind in the choice of soil. The most important is its physical character, for this is least readily modified. Heavy clay soils are plastic, sticky, and unworkable when wet and are lumpy when dry. They are retentive though not readily receptive of moisture and of plant-food. They are cold and late in the spring. Very light sandy soils are loose and friable and are workable even when wet. They are readily receptive though not retentive of water and nutrients, and are warm and early. The ideal is a well-drained sandy loam of moderate fineness.

The second point is that plant-food should be abundant and available. Dark, loose, friable soils are usually, though not always, as in the prairie states, of relatively high fertility, while light-colored soils usually lack humus and will require heavy additions of various amendments.

Thirdly, soil that is free of weed-seeds and of disease is to be preferred, and land that has been well cultivated is more likely to offer favorable bacterial relations.

Soil management.

A good garden cannot be expected on badly drained soil. Artificial drainage is often of great advantage even on soils that are not swampy. It makes for better physical character and earlier crops. If no outlet is available, a pit filled with stone or old brick may be used.

City lots frequently offer soils that are very unfavorable for gardening operations. It is seldom that the case is hopeless, even though excavated material, brickbats and tin-cans abound. In some cases it is profitable to haul in good soil bodily, although this material is expensive. Coarse soil should be removed, and improvement brought about, if the soil is heavy, by the use of such materials as ashes, sand, other soil, manure, and lime. A stiff clay which is being broken in for garden purposes should be spaded or plowed in the fall and left in clods, in order that the frost of winter may have its full effect in rendering it workable. A sterile sand may be rendered productive by the liberal use of manure and by applications of lime.

In any garden, the main reliance for maintenance of soil fertility should be on stable manure. In this material are added nitrogen, phosphorus, and potash, the only chemical elements which are often lacking, together with large quantities of humus. Manure that has rotted for some months is better than new manure, especially if it is to be worked into the soil in the spring. However, a heavy coat of fresh material may be plowed under or spaded under each fall. It will be fairly well decayed and ready to aid the plants by spring.

In Europe, the process of trenching is frequently practised in intensive gardening. The plot is divided lengthwise, and a trench 2 or 3 feet wide and 1 to 2½ feet deep is dug across the end of one of these parts, throwing the soil outside the area to be trenched. In the bottom of this ditch is placed a heavy layer of fresh manure. The soil from the next adjoining block in the same division is turned over upon this, and a layer of manure placed in the bottom of the new ditch. Thus the work progresses to the other end of the division. Here the soil from the adjacent block of the second division is thrown into the last ditch of the first division, and then the work proceeds as before to the starting-point. The last trench is filled with the soil from the first. One or two years later the process is repeated. The layer of manure at the bottom is now well rotted and is thoroughly incorporated with the soil as the work progresses. The soil may be gradually deepened from year to year. This is a very desirable method of soil preparation, when the necessary hand labor is available.

Lime at the rate of perhaps a ton to the acre should be added every two to four years. It is useful in making clay soils more friable and in binding together very sandy soils, in correcting acidity, in freeing plant-food, and in rendering conditions unfavorable for certain diseases, although it is favorable to others. It makes little difference which form of lime is used, although quicklime is not conveniently handled. Either ground limestone rock or hydrated lime may be applied. About one-third more of the latter must be used than of the former.

The term tillage is often applied to the working of land previous to the planting of crops, and the working of soil after planting is spoken of as cultivation, although tillage properly includes all these operations. Tillage, as used to denote preparation of the land, improves the physical condition of the soil, rendering it more granular; it is useful for the improvement of the moisture relation as regards reception, retention, and transmission of moisture, it makes aëration possible, it assists in the incorporation and freeing of plant-food and in the destruction of weeds. If a soil is shallow, it should not be worked too deeply at first, but each year a bit of the subsoil may be incorporated in the surface soil, thus gradually deepening the root pasturage. The utmost care is necessary to avoid handling soils, especially the heavier sorts, when they are wet. The clayey types may be spaded or plowed with good results only at a certain stage of dryness. Experience only can teach this stage for a given soil. The work should be performed when the lumps crumble readily, as they are turned over. They should be neither plastic nor hard-baked.

When the ground is plowed or spaded in autumn, it should, as suggested above, be left rough over winter. In the spring it may be gone over with the disc-harrow or with the hoe. If plowed in the spring, the lumps should be worked down with plank drag, harrow, or rake, according to the circumstances, and a loose soil-mulch should be maintained until planting-time. If this is neglected, moisture may be lost so rapidly as to waste the equivalent of a half inch of rain a week. In very small areas, where these horse tools cannot be used, the hand implements that accomplish the same results on the soil may be employed.

For very early plantings it is well to prepare a few raised beds or ridges in autumn. These should have a southern or southeastern exposure. They will thaw out, drain and become warm much earlier in the spring than soil at the ordinary level, although they will dry out more rapidly in midsummer.

Planning.

The first task in each year's garden operations is the preparation of a good plan. This first phase of the garden work is often neglected. It should receive careful attention long before the season opens, in order that space and effort may be economized and that seed, fertilizer and other supplies may be provided. The materials for the work consist of a few good garden books and bulletins, a few catalogues of reliable seedsmen, together with paper, pencil, and ruler. A fund of experience in home-gardening is an asset of incalculable value. The aim should be to produce an abundance of vegetables of high quality, in wide variety, and as evenly distributed as possible throughout the year with a minimum of unprofitable labor and expense.

The first step is to decide what is wanted. Make a list of crops, bearing in mind the likes and dislikes of the family, even distribution through the season, adaptation to climate and soil, and the space available. List too few rather than too many, especially if the garden is small.

Avoid an over-large garden. An area 40 by 50 feet, well kept, will give greater satisfaction than a half acre neglected through press of other work. A half acre will yield a full summer and autumn supply for a large family, together with ample quantities for canning and storage. The beginner should avoid allowing his enthusiasm to lead him into deeper water than that in which he can swim. Better begin simply and let experience teach the best lines of development than to suffer failure and discouragement on account of an over-complex plan.

No area is too small to be utilized. A plot 2 feet wide and 12 feet long will yield, if well tended, as many as twenty bunches of radishes, thirty heads of early lettuce, and forty to sixty pounds of tomatoes. A fall crop of lettuce and radishes may even be matured in addition.

The larger garden should be longer than wide, in order to make the care easier. A ratio of two to one is frequently used. The rows of most crops should be far enough apart for horse cultivation. In a garden of limited area, where small amounts of many vegetables are sought, crosswise rows may be desirable. In such plots rows may be closer together, dependence being placed upon the wheel-hoe and hand-hoe for cultivation. Permanent crops, as asparagus and rhubarb, should be placed at one side to avoid interference with tillage. The hotbeds and coldframes should be in this same part of the garden. Early crops should be kept together, in order that a considerable area may be cleared up at once for later plantings. The same plants should not appear in the same part of the garden year after year. Good taste will suggest a neat arrangement, and some attention should be paid to symmetry and balance of appearance.

Three good garden plans are shown herewith, in Figs. 2035, 2036, 2037. They are by Albert E. Wilkinson, Cornell Reading-Course Bulletins. They are intensive plans,—made to utilize the land to the utmost and assuming good care, liberal fertilizing, and other close attention. With larger areas and horse labor, the distances may be greater.

The seed.

With the general plan completed, the next step is the choice of varieties and the preparation of the seed order. Only experience will offer a satisfactory knowledge of the sorts to be planted under a particular set of conditions. In the meantime, it is well to consult neighboring gardeners on this as well as on many other matters. Seed orders should be placed early to avoid disappointment as to varieties and to allow time for testing. The well-known seed firms are striving to supply good seeds, clean, viable, and true to type. Packet seeds found in grocery stores are sometimes uncertain. Many local seed-houses are thoroughly reliable.

The only true test for seed is to grow a crop from it. However, seed that will not establish in the soil a strong, healthy plant will certainly not grow a crop. It is accordingly well to test seed before it is planted. For this purpose, twenty-five, fifty, or one hundred seeds should be counted out and planted in a little box of garden soil in the house. This should be kept moist and at ordinary room temperature. Other methods of testing, by means of blotters, layers of cloth, porous dishes, and the like, afford knowledge only of the ability of the seed to sprout, not of its ability to complete the process of germination, that is, to establish itself in the soil so that it may make progress independently of the supply of food material that was stored within the seed coats.

No phase of gardening affords a more fascinating hobby than the selection and saving of seed from one's own plants. Some individuals are always superior to others, and this superiority is inherited to a greater or less degree. In the course of a series of years, remarkable progress may be made in increasing the returns from a given area. The first necessity is to establish in the mind a clear notion of the ideals to be secured. This must be very carefully worked out, for if it is necessary to modify it from year to year no progress will be made. Selections should be made on the basis of individual plants rather than of individual fruits. Every home-garden should be to some degree a plant-breeder.

Planting.

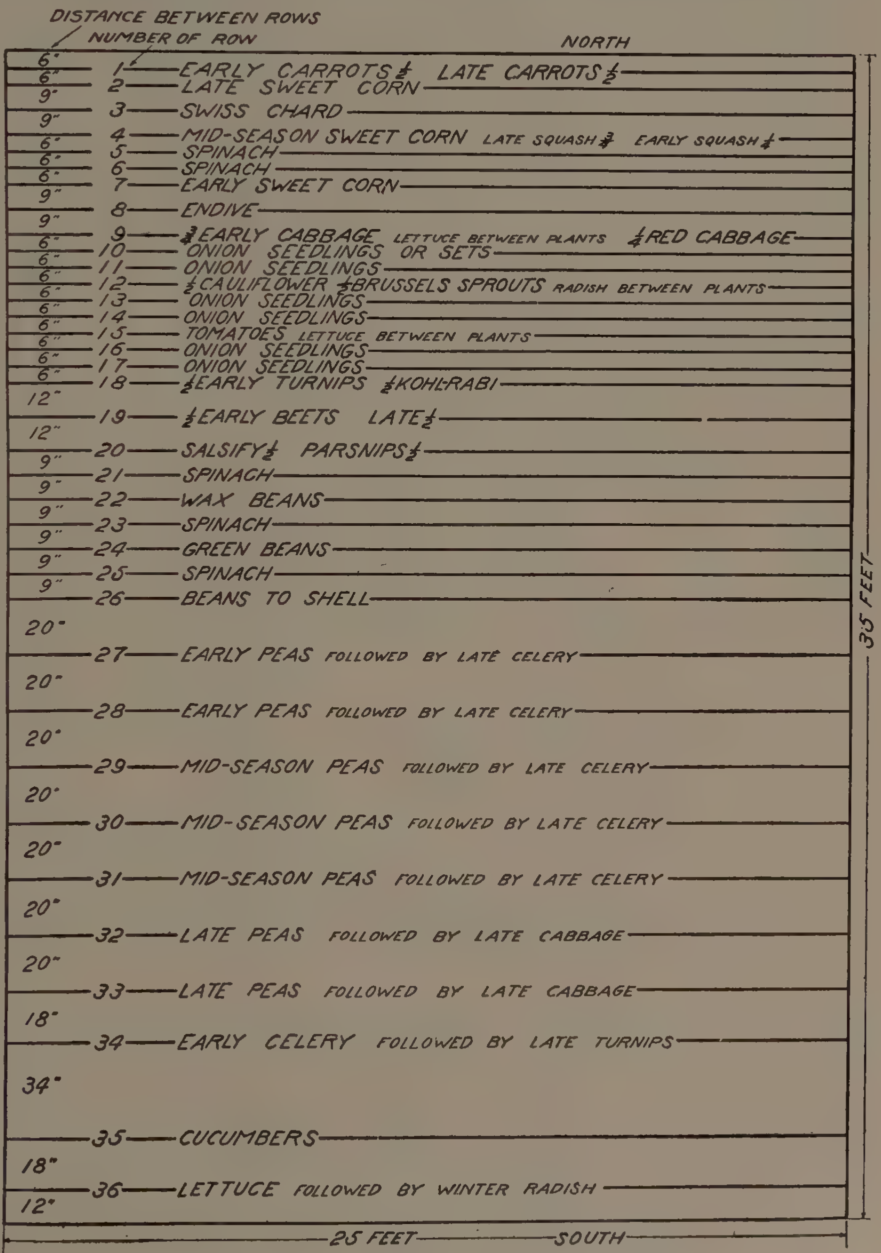
Each vegetable has its own peculiarities as to time and manner of planting. These characteristics are considered under each of the various crops.

The essentials for germination are moisture, warmth, and aëration. Light is not necessary, although, of course, it is required immediately after seedlings break ground. No general rules may be laid down for the sowing of seed. It is necessary that the soil be in good physical condition if the best results are to be attained, especially for the smaller and more delicate seeds. Seed must be sown more thickly in the case of the smaller and more delicate seeds, as celery and lettuce, in case the percentage of germination is not high, when the planting is made in very early spring, when soil conditions are unfavorable, as in a heavy soil or in time of drought, and in case serious devastation by insects or diseases is feared.

Commercial men try to know their soil and their seed and to sow just right. Until one has gained considerable experience, it is better in the home-garden to sow rather thickly, and thin after the plants have come up. Extreme thickness of sowing results in weak seedlings and a very large amount of tedious work to be done afterward.

Rules as to depth of sowing may have slight virtue, but they may also be rather seriously misleading. Seed should be sown more deeply in dry or sandy soils than in wet or heavy soils. Soaking seed before sowing is not ordinarily of very great value, although it is practised by some gardeners.

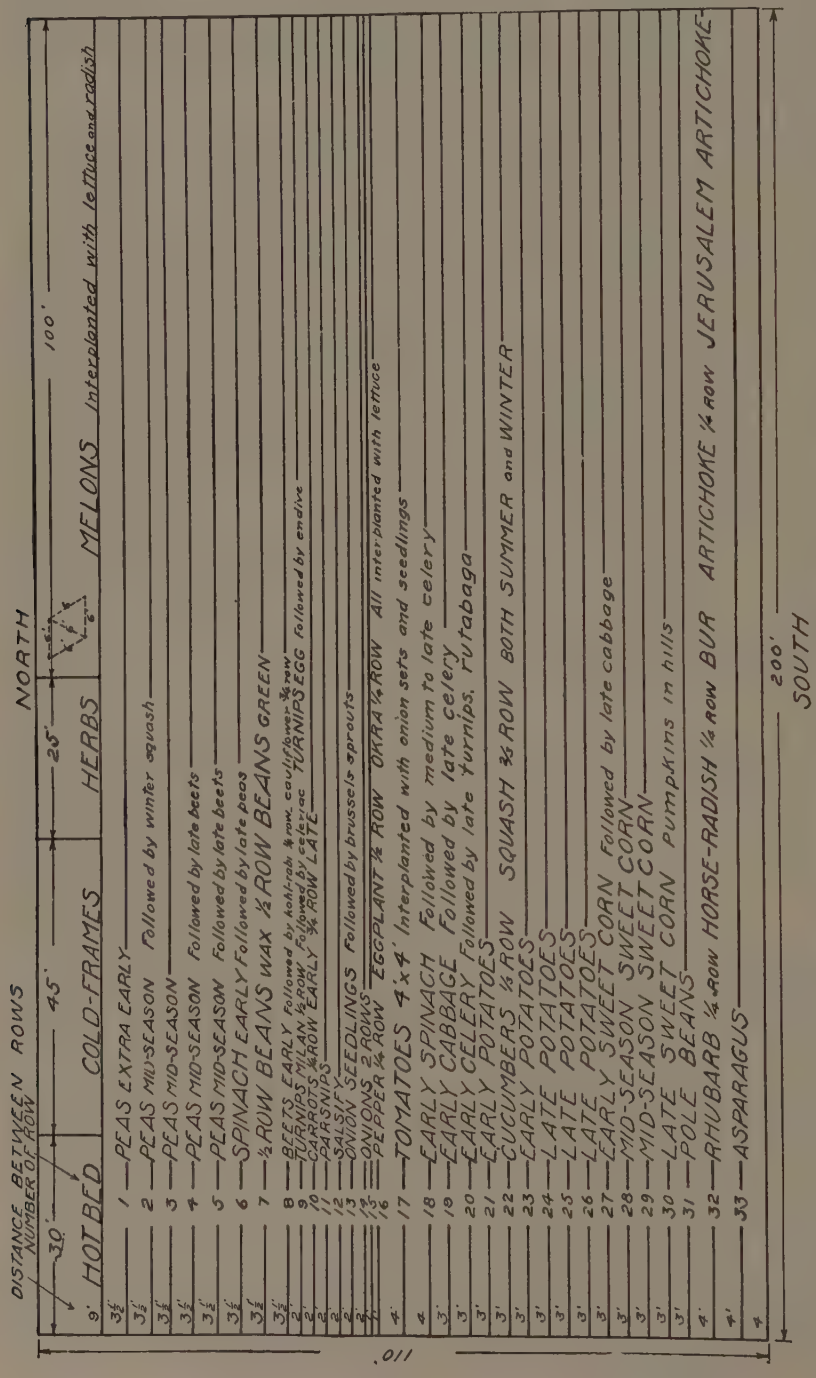
Seeds do not germinate until moisture has been imparted to them by the soil. The movement of moisture from soil to seed is a capillary movement and is more complete when there is very close contact between soil and seed. Accordingly, the soil should be carefully firmed in covering. This can hardly be overdone in


DISTANCE BETWEEN ROWS
NUMBER OF ROW
NORTH
1—EARLY CARROTS ½ LATE CARROTS ½
2—LATE SWEET CORN
3—SWISS CHARD
4—MID-SEASON SWEET CORN LATE SQUASH ¾ EARLY SQUASH ¼
5—SPINACH
6—SPINACH
7—EARLY SWEET CORN
8—ENDIVE
9—¾ EARLY CABBAGE LETTUCE BETWEEN PLANTS ¼ RED CABBAGE
10—ONION SEEDLINGS OR SETS
11—ONION SEEDLINGS
12—½ CAULIFLOWER ½ BRUSSELS SPROUTS RADISH BETWEEN PLANTS
13—ONION SEEDLINGS
14—ONION SEEDLINGS
15—TOMATOES LETTUCE BETWEEN PLANTS
16—ONION SEEDLINGS
17—ONION SEEDLINGS
18—½ EARLY TURNIPS ½ KOHL-RABI
19—½ EARLY BEETS LATE ½
20—SALSIFY ½ PARSNIPS ½
21—SPINACH
22—WAX BEANS
23—SPINACH
24—GREEN BEANS
25—SPINACH
26—BEANS TO SHELL
27—EARLY PEAS FOLLOWED BY LATE CELERY
28—EARLY PEAS FOLLOWED BY LATE CELERY
29—MID-SEASON PEAS FOLLOWED BY LATE CELERY
30—MID-SEASON PEAS FOLLOWED BY LATE CELERY
31—MID-SEASON PEAS FOLLOWED BY LATE CELERY
32—LATE PEAS FOLLOWED BY LATE CABBAGE
33—LATE PEAS FOLLOWED BY LATE CABBAGE
34—EARLY CELERY FOLLOWED BY LATE TURNIPS
35—CUCUMBERS
36—LETTUCE FOLLOWED BY WINTER RADISH
6" 6" 9" 9" 6" 6" 6" 9" 9" 6" 6" 6" 6" 6" 6" 6" 6" 6" 12" 12" 9" 9" 9" 9" 9" 9" 20" 20" 20" 20" 20" 20" 20" 18" 34" 18" 12"
35 FEET
25 FEET
SOUTH

2035. Intensive plan for a fertile space 25 x 35 feet (Wilkinson) sandy soils or in those that are rather dry. Clay soils should not be packed so hard. Sowing in drills is usually regarded as better than broad-casting, because it is easier to sow the seed at uniform depth, the seedlings are of mutual assistance to one another in breaking ground, it is easier to thin and to do other work, and the plants can be more easily cultivated.

In the small garden most sowing is by hand. Many methods are practised. When the fingers are used, the seed should be worked out by means of the thumb over the second joint of the first finger. Many gardeners like to use an envelope which has been sealed at the side and cut off squarely at the end. A small quantity of seed is placed in this envelope, which is held the flat way, the opening only very slightly spread. It is held with the opening parallel to the rows and is shaken with a motion in the same direction.

Mechanical drills are now widely used and are almost indispensable in the larger gardens, the chief advantages being uniformity of work and rapidity of action. A seed-drill is not a cure-all for planting troubles. It requires as much skill as any other method. Since there is such great variation in the size of seed of a given kind, the scales on the machines can be used only as a general guide, and the machine should be tried on the bare road or on a floor before beginning work.


NORTH
SOUTH
DISTANCE BETWEEN ROWS
NUMBER OF ROW
30'
45'
25'
100'
200'
110'
9'
3½'
2'
3'
4'
HOT BED
COLD-FRAMES
HERBS
MELONS Interplanted with lettuce and radish
1 PEAS EXTRA EARLY
2 PEAS MID-SEASON Followed by winter squash
3 PEAS MID-SEASON
4 PEAS MID-SEASON Followed by late beets
5 PEAS MID-SEASON Followed by late beets
6 SPINACH EARLY Followed by late peas
7 ½ ROW BEANS WAX ½ ROW BEANS GREEN
8 BEETS EARLY Followed by kohl-rabi ¾ row, cauliflower ¼ row
9 TURNIPS MILAN ½ ROW Followed by celeriac TURNIPS EGG Followed by endive
10 CARROTS ¼ ROW EARLY ¾ ROW LATE
11 PARSNIPS
12 SALSIFY
13 ONION SEEDLINGS Followed by brussels sprouts
14 15 ONIONS 2 ROWS
16 PEPPER ¼ ROW EGGPLANT ¼ ROW OKRA ¼ ROW All interplanted with lettuce
17 TOMATOES 4'x4' Interplanted with onion sets and seedlings
18 EARLY SPINACH Followed by medium to late celery
19 EARLY CABBAGE Followed by late celery
20 EARLY CELERY Followed by late turnips, rutabaga
21 EARLY POTATOES
22 CUCUMBERS ⅓ ROW SQUASH ⅔ ROW BOTH SUMMER and WINTER
23 EARLY POTATOES
24 LATE POTATOES
25 LATE POTATOES
26 LATE POTATOES
27 EARLY SWEET CORN Followed by late cabbage
28 MID-SEASON SWEET CORN
29 MID-SEASON SWEET CORN
30 LATE SWEET CORN Pumpkins in hills
31 POLE BEANS
32 RHUBARB ¼ ROW HORSE-RADISH ¼ ROW BUR ARTICHOKE ¼ ROW JERUSALEM ARTICHOKE
33 ASPARAGUS

2036. Close-planting plan for a space 110 x 200 feet. (Wilkinson)

Growing early plants.

One of the most dearly cherished ambitions of the amateur gardener is to begin the harvest of his products very early in the season. To accomplish this, it is necessary to sow seed long before outdoor planting is possible. Plants for setting outdoors should possess such vigor and hardiness that they will make steady growth in spite of possible unfavorable conditions which they may encounter. Other advantages of starting plants in the seed-bed, either indoors or outdoors, are fuller utilization of space in the garden, greater ease in caring for both the soil of the garden and the plants themselves, better root-systems, and in some cases even greater yield. The specific methods of plant-growing are considered under the various vegetables in this Cyclopedia.

There are three ways in which this work for earliness may be managed. Seed may be sown for outdoor transplanting in small plant-boxes in the house. If plenty of window room is available and temperature within the house is under fair control, seed may be started very early and the seedlings transplanted once before they go to the garden. Another possibility is sowing seed indoors, transplanting the seedlings to the coldframe, where they are under protection for some weeks, and then placing in the garden. The next step would be the use of hotbeds and greenhouses (see *Hotbed*). The gradation in construction from hotbed to greenhouse is very simple, some houses being constructed with two rows of hotbed sash for a roof and using manure for heat. Other types may be built in all degrees of complexity. Fig. 2037 (p. 1747) shows how completely a hotbed space may be utilized.

In plant-growing, relatively low temperatures, free ventilation, sparse watering and abundant sunshine make for stockiness, hardiness, good root-systems, vigor and freedom from disease. Plants should be carefully hardened before they are placed outdoors by increasing the ventilation, lowering the temperature, and keeping them relatively dry.

Transplanting.

Soil should be in excellent physical condition if plants are to be set in it. A good degree of moisture should be present, and if possible, the work should be performed in cloudy weather or in the evening, in order that the plants may have opportunity to recover before being exposed to strong sunshine. It is not wise to undertake setting warm-blooded plants like the tomato exceedingly early, as they may be severely stunted by cold weather, even though there be no frost. Some gardeners, however, like to set out a few plants very early, expecting to replace them if necessary.

Most plants ought to be moved with a good-sized ball of earth. If the soil is in proper state of moisture and is compacted firmly about this earth ball, the plants will hardly be disturbed. Plants should ordinarily be set just a little deeper than they stood in their previous place.

Cultivation.

By cultivation is here meant the maintenance of a loose mulch of dry soil on the entire surface of the garden throughout as much as possible of the growing season. The maintenance of this mulch is of great value in retaining moisture, in keeping the soil in good physical condition, and in destroying weeds. In the small gardens, the hand-hoe and hand-weeder will meet every requirement without undue labor. A man-power wheel-hoe is useful in medium-sized gardens, usually when the rows are 40 feet or more long. The farm garden should be cultivated as far as possible by means of the horse-cultivator. When wheel-hoe and horse-cultivator are used, it is necessary to go through afterward and loosen the earth and destroy the weeds in the rows themselves. There are many types of weeders, hoes, and cultivators. Selection must be made according to the character of the soil, of the crops, and the individual fancy of the gardener himself.

Mulching.

The general effects of cultivation may be attained, in the case of thoroughly well-prepared soils, by mulching. A coat of comparatively coarse manure is spread on the soil between rows of vegetables. This practice has proved very satisfactory with celery and tomatoes. It is especially desirable with the latter crop, because it keeps down the weeds and conserves the moisture after cultivation is no longer possible.

Watering.

Hardly a summer passes in which the garden does not suffer from lack of water, in some month or other, in spite of the utmost care in cultivation. Water may be applied to small gardens by means of hose or by allowing it to flow into the furrows between the rows. Hose irrigation is usually superficial. Gardeners often think that they have watered the garden when they have merely moistened the surface. It is better to water thoroughly and less frequently than to water lightly every day. Of recent years, overhead sprinkler systems of irrigation have been devised. Those that are equipped with whirling sprays are not thoroughly satisfactory because they do not water evenly. Another type consists of pipes supported over the garden in which are inserted tiny nozzles at distances of about 3 feet. With forty pounds pressure, these nozzles will throw water for about 25 feet. The pipe is supported in such a way that it may be turned to throw a spray far to the side or directly overhead. Thus a belt 50 feet wide will be covered by a single line. The question is raised as to whether this type of irrigation would be as successful in home gardens with their many crops as it is in large commercial plantings of single crops. There seems to be little definite knowledge at present on this point, but the plan would seem to be thoroughly feasible. Nature does not water one crop at a time. Practice in the handling of garden irrigation has not been studied as fully as it should be. See *Irrigation*, p. 1682.

In warm summer weather, it is usually best to water in the evening so that the foliage will be well dried off by morning. It is not likely that watering in midday in the summer does as much harm as is ordinarily supposed.

Other work.

The summer work of training, pruning, blanching, pest control, and the like, is considered under the different entries in the Cyclopedia and under *Diseases and Insects* in Vol. II.

The last task of autumn is one of the most important,—cleaning up the garden completely. Many of the diseases and insects are wintered over in the refuse that is left on the soil.

The garden-lover who is interested in making the greatest possible progress from year to year will keep careful record of his operations. He will preserve the plan that he has drawn up for each season's operations, and, while avoiding an elaborate or cumbersome scheme, he will jot frequent notes as to dates of frost and other weather conditions, dates of planting, transplanting, and maturity of crops, behavior of plants from seed from different sources, and countless other points that will occur to him. Such a record requires but little time and is of almost incalculable advantage in future operations.

Books and bulletins.

There are many good bulletins and books on vegetable-gardening, some of them specially adaptable to the needs of the home gardener. The reader should consult the list on page 1553. The following are useful for the beginner:

"Home Vegetable Gardening," by F. F. Rockwell.
"The Home Garden," by Eben E. Rexford.
"The Vegetable Garden," by Ida D. Bennett.
"How to Make a Vegetable Garden," by Edith Loring Fullerton.
"Book of Vegetables," by Allen French.
"Manual of Gardening," by L. H. Bailey.
"The Home Vegetable Garden," Farmers' Bulletin No. 255.
"Hotbeds and Coldframes," Cornell Reading-Course Bulletin No. 30.
"Home-Garden Planning," Cornell Reading-Course Bulletin No. 34.
"Planting the Home Vegetable Garden," Cornell Reading-Course Bulletin No. 58.
"Summer Work in the Home Garden," Cornell Reading-Course Bulletin No. 92; and others.
"The Home Vegetable Garden," Illinois Circular No. 154.
"The Farmer's Vegetable Garden," Illinois Bulletin No. 105.
"Farmers' Home Garden," West Virginia Bulletin No. 122.

Tables and lists.

The home-gardener will soon acquire sufficient experience to be independent of rules and lists; and yet even the oldest gardeners like to have such lists and tables at hand to refresh the memory. The beginner is likely to follow these tables and lists slavishly and without imagination; but if he uses them as suggestions to be modified and applied in his own work, he should find them much worth the while. The remainder of this article comprises tabular material from Albert E. Wilkinson, Cornell Reading-Course Bulletin No. 34. The suggestions are for the state of New York; the consultant should know how to apply them elsewhere.

PLANTING-PLAN FOR A VEGETABLE-GARDEN 25 x 35 FEET. (See Fig. 2035.)—Wilkinson

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed or plant (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Beans, green snap	24	1 pt.	$0.20	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	July 1–15	Sept. 1	
Beans, wax snap	22	1 pt.	.20	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	July 1–15	Sept. 1	
Beans, shell	26	1 pt.	.15	May 1–15	Drills	1	1–2	June 15	3–4	Destroy	Aug. 1	Sept. 30	
Beets, early	½ of 19	1 pkg.	.05	April 15	Drills	½–¾	¼–½	June 15–30		Greens	June 15–30	Aug. 1	
Beets, late	½ of 19	1 pkg.	.05	May 15	Drills	½–¾	¼–½	July 1–15	4	Greens	July 15–30	Oct. 15	Winter
Brussels sprouts	½ of 12	1 pkg.	.10	Mar. 15	Hotbed	½	12	......	......	......	Aug. 1	Oct. 1–15	
Cabbage, early	¾ of 9	1 pkg.	.10	Mar. 15	Hotbed	......	18	......	......	......	July 15–30	Sept. 1–15	
Cabbage, late	32, 33	1 pkg.	.05	May 15	Hotbed	......	24	......	......	......	Aug. 1–15	Nov. 1	Winter
Cabbage, red	¼ of 9	1 pkg.	.05	April 15	Hotbed	......	24	......	......	......	July 30	Oct. 30	
Carrots, half-long	½ of 1	1 pkg.	.05	April 15–30	Drills	½	¼–½	June 1–15	2	Destroy	July 1–15	Aug. 15	
Carrots, long	½ of 1	1 pkg.	.05	April 15–30	Drills	½	¼–½	June 1–15	3	Destroy	July 15–30	Oct. 1–30	Winter
Cauliflower	½ of 12	1 pkg.	.20	April 15	Hotbed	......	18	......	......	......	July 1–15	Oct. 15.	
Celery, early	34	1 pkg.	.10	Mar. 15	Hotbed	......	4	......	......	......	June 1–15	July 15	
Celery, late	27, 28, 29, 30, 31	1 pkg.	.10	May 1	Hotbed	......	5	......	......	......	Sept. 15	Nov. 15	Winter
Chard, Swiss	3	1 pkg.	.05	April 15	Drills	½–¾	¼–½	June 15	12	Greens	June 15–30	July 15	
Corn, early	7	½pt.	.10	May 15	Hills	1	3	July 1	Hills 18	Destroy	July 30	Sept. 1	
Corn, midseason	4	½pt.	.10	June 1	Hills	1	3	July 15	Hills 18	Destroy	Aug. 15	Sept. 15	
Corn, late	2	½pt.	.10	June 15	Hills	1	3	July 30	Hills 18	Destroy	Sept. 1–15	Sept. 30	
Cucumbers	35	1 pkg.	.05	May 15	Drills	½–¾	1	July 1–15	6	Destroy	Aug. 15–30	Sept. 15–30	
Endive	8	1 pkg.	.05	May 1	Drills	½	½	June 15	12	Greens	July 15	July 30	
Kohlrabi	½ of 18	1 pkg.	.05	Mar. 15	Hotbed	......	6	......	......	......	May 30	June 15–30	
Leek	16, 17	2 pkgs.	.10	April 1	Hotbed	......	3	......	......	......	June 1–15	July 1–15	
Lettuce	Part of 36	2 pkgs.	.20	April 1 on	Hotbed	¼–½	10	......	......	......	May 20–30	All seasons	Plant wherever space allows
Onions	10, 11, 13, 14	3 pkgs.	.30	April 7	Hotbed	......	3	......	......	......	June 1–15	Aug. 15–30	Plant wherever space allows
Parsnips	½ of 20	1 pkg.	.05	April 15	Drills	¼–½	¼–½	June 1–15	4	Destroy	Sept. 1–15	Oct. 30	Winter
Peas, early	27, 28	1 qt.	.65	April 1–15	Drills	1½–2	Close	......	......	......	June 15–20	July 1–10	
Peas, midseason	29, 30, 31	1½ qts.	1.00	April 15–30	Drills	1½–2	Close	......	......	......	June 30	July 15–20	
Peas, late	32, 33	1 qt.	.45	May 1–15	Drills	1½–2	Close	......	......	......	July 15	Aug. 1–10	
Radishes, early	Part of 12	2 pkgs.	.10	April 1 on	Drills	½	½	1 week after planting	1–1½	Destroy	May 1	All seasons	Plant wherever space allows
Radishes, winter	36	2 pkgs.	.10	June 1	Drills	½	½	June 15–20	6	Destroy	Sept. 1	Oct. 15–30	Winter
Salsify	½ of 20	1 pkg.	.10	April 15–30	Drills	½	½	June 1–15	4	Destroy	Sept. 1–15	Oct. 30	Winter
Spinach	5, 6, 21, 23, 25	¼lb.	.25	April 1–30	Drills	½	½	May 30	3	Greens	May 15–30	June 30	Plant wherever space allows
Squash, early	¼ of 4	1 pkg.	.05	May 1	Corn hills	¾	Corn hills	......	......	......	June 15–30	July 15	
Squash, late	¾ of 4	1 pkg.	.10	May 15	Corn hills	¾	Corn hills	......	......	......	Sept. 1–15	Oct. 15	Winter
Tomatoes	15	1 pkg.	.05	April 1	Hotbed	......	36	......	......	......	June 15–30	Sept. 15–30	
Turnips, early	½ of 18	1 pkg.	.05	April 1–15	Drills	½	½	May 15–30	6	Destroy	June 1–15	Aug. 1	
Turnips, late	34	2 pkgs.	.10	May 15	Drills	½	½	June 15–30	10	Destroy	Aug. 15	Oct. 1–15	Winter
			$5.60										

PLANTING-PLAN FOR A VEGETABLE-GARDEN 110 x 200 FEET. (See Fig. 2036.)—Wilkinson

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Transplanting		Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed (inches)	Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Artichokes, bur.	¼ of 32	18 roots	$2.25	......	......	......	......	April 15	36	......	......	......	Sept. 30	Oct. 30–Nov. 30	
Artichokes, Jerusalem	¼ of 32	48 roots or 1 qt.	.25	......	......	......	......	April 15	12	......	......	......	Sept. 30	Nov. and next spring	
Asparagus	33	200 two-yr. roots	2.00	......	......	......	......	April 15	12	......	......	......	Two years after planting	May to June 1 after three yrs.	On to July 4
Beans, green	½ of 7	1 qt.	.35	May 1–15	Drills	1	1 to 2	......	......	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
Beans, wax	½ of 7	1 qt.	.40	May 1–15	Drills	1	1 to 2	......	......	June 15	3 to 4	Destroy	July 1–15	Sept. 1–15	
Beans, pole	31	1 qt.	.35	May 1–15	Hills, 6 to 8 seeds	1	1 to 2	......	......	......	......	......	Aug. 1–15	Sept. 30 on	
Beets, early	8	¼lb.	.50	April 15	Drills	½–¾	¼–½	......	......	June 15	3	Greens	June 15–30	Aug. 1	
Beets, late	4, 5	½lb.	.75	July 15–30	Drills	½–¾	¼–½	......	......	July 1–15	4	Greens	Sept. 15–30	Oct. 15	
Brussels sprouts	13	1 pkg.	.10	Mar. 15	Hotbed	½	½	April 15–30	18	......	......	......	Aug. 1–15	Oct. 15 on	
Cabbage, early	19	1 pkg.	.10	Mar. 15	Hotbed	½	¼–½	April 15–30	18	......	......	......	July 1–15	Sept. 1	
Cabbage, late	½ of 27	1 pkg.	.05	May 15	Coldframes	½	¼–½	June 15–30	24	......	......	......	Aug. 15–30	Nov. 1 on	All winter
Cabbage, red	¼ of 27	1 pkg.	.05	April 15	Hotbed	¼	¼–½	May 20–30	24	......	......	......	July 30	Oct. 30 on	All winter
Cabbage, Savoy	¼ of 27	1 pkg.	.05	April 15	Hotbed	½	¼–½	May 20–30	24	......	......	......	July 30	Oct. 30 on	All winter
Carrots, half-long	¼ of 10	1 oz.	.25	April 15–30	Drills	¼–½	¼–½	......	......	June 1–15	2	Destroy	July 1–15	Aug. 15	
Carrots, long	¾ of 10	2 oz.	.40	April 30	Drills	¼–½	¼–½	......	......	June 1–15	3	Destroy	July 15–30	Oct. 1–15	
Cauliflower	¾ of 8	1 pkg.	.20	April 15 and later	Hotbed	½	¼–½	June 20–30	18	......	......	......	Aug. 1–15	Oct. 15	To store for winter
Celeriac	½ of 9	1 pkg.	.05	May 1	Hotbed	¼ or less	Thick	June 10–20	10 to 12	......	......	......	Sept. 15	Nov. 1 on	Winter
Celery, early	20	1 pkg.	.10	Mar. 15	Hotbed	¼ or less	Thick	May 1–10	4	......	......	......	June 1–15	July 15	
Celery, late	18, 19	1 pkg.	.10	May 1	Hotbed	¼ or less	Thick	June 10–20	5 to 6	......	......	......	Sept. 15	Nov. 1 on	Winter
Chard, Swiss	Herb bed	1 pkg.	.10	April 15	Drills	½–¾	¼–½	......	......	June 15	12	Greens	June 15–30	July 15	
Corn, early	27	1 pt.	.20	May 15 or earlier	Hills	1	3	......	......	July 1–4 plants	Hills 18	Destroy	July 20–30	Aug. 5	
Corn, midseason	28, 29	1 qt.	.30	June 1	Hills 18 in. apart	1	3	......	......	July 15	To4plants in hill	Destroy	Aug. 1–15	Sept. 1	
Corn, late	30	1 pt.	.15	June 15	Hills 24 in. apart	1	3	......	......	July 30	To3plants in hill	Destroy	Sept. 1–15	Sept. 30	
Cucumbers	⅓ of 22	1 pkg.	.10	May 15	Drills	½–¾	1	......	......	July 1–15	6	Destroy	Aug. 15–30	Sept. 15–30	
Eggplant	½ of 16	1 pkg.	.10	April 15	Hotbed	½	½	May 20–30	15	......	......	......	Sept. 1	Sept. 15	
Endive	½ of 9	1 pkg.	.05	July 1	Drills	½	½	......	......	June 15	12	Greens	Sept. 15	Oct. 30	
Horse-radish	¼ of 32	50 roots	.50	......	......	......	......	Apr. 15	12	......	......	......	Nov. 1 on	Fall and next spring	Winter
Kohlrabi	¼ of 8	1 pkg.	.05	April 15	Hotbed	½	½	June 15–30	9	......	......	......	July 30	Aug. 15–30	
Leek	Between tomatoes	2 pkgs.	.10	April 1	Hotbed	½	¼–½	May 1–10	3	......	......	......	June 1	July 15	
Lettuce	In melons and elsewhere	6 pkgs.	.50	Apr.–Sept.	Hotbed and field	¼–½	¼–½	Apr.–Aug.	7x7 in. hotbed, 10 outside	......	......	......	May 20–30	All seasons	
Carried forw'd	....	....	$10.45												

PLANTING-PLAN FOR A VEGETABLE-GARDEN 110 x 200 FEET, continued.

Vegetable	Number of row	Amount of seed	Cost of seed	Planting				Transplanting		Thinning			Harvesting		Remarks
				Time	Method	Depth (inches)	Distance apart of seed (inches)	Time	Distance apart of plants (inches)	Time	Space between plants (inches)	Method of disposal	First	Final	
Brought forw'd	....	....	$10.45												
Muskmelons	Bed	3 pkgs.	.40	May 15	Hills, plow	½–¾	1	......	......	June 15	6	Destroy	Aug. 15–30	Oct. 15	
Okra	¼ of 16	1 pkg.	.05	Mar. 15	Hotbed	½–¾	¼–½	May 15–30	12	......	......	......	July 15–30	Sept. 30	
Onions	13, 14, 15, and between	3 ozs.	.45	April 1 or later	Hotbed and outside	½	¼–½	April 1–30	3	......	......	......	June 1–15	Aug. 15–30	
Parsnips	11	2 ozs.	.25	April 15	Drills	¼–½	¼–½	......	......	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Again in spring
Peas, early	1	2 qts.	1.30	April 1	Drills	1½–2	Thick	......	......	......	......	......	June 15–20	July 1	
Peas, midseason	2, 3, 4, 5	1 pk.	4.00	April 15	Drills	1½–2	Thick	......	......	......	......	......	July 1–15	July 30	
Peas, late	6	2 qts.	1.00	May 30	Drills	1½–2	Thick	......	......	......	......	......	July 30	Aug. 15–30	
Peppers	¼ of 16	1 pkg.	.05	April 1	Hotbed	½	½	May 20–30	12	......	......	......	Aug. 15	Oct. 1–15	
Potatoes, early	21, 23	4 pks.	2.00	May 1	Drills	4	10	......	......	......	......	......	June 15	Aug. 1	
Potatoes, late	24, 25, 26	1½ bu.	3.00	May 15	Drills	4	10	......	......	......	......	......	Aug. 15–30	Oct. 15	For winter
Pumpkins	In sweet corn	2 ozs.	.20	May 15	Corn hills	¾–1	2 or 3 in every third corn hill	......	......	June 15	2 in hill	Destroy	Oct. 1	Oct. 15	For winter
Radishes, early	In melons and vacant places	3 ozs. in pkgs.	.30	Apr.–Aug.	Drills and hotbed	½	¼–½	......	......	......	......	......	May 1	All seasons	
Radishes, winter	Herb bed	2 pkgs.	.10	June 1	Drills	½	½	......	......	June 15	2 to 6	Destroy	Sept. 1	Oct. 15	Winter
Rhubarb	¼ of 32	16 roots	2.50	......	......	......	......	Apr. 15	36	......	......	......	May 15	July 15	
Salsify	12	¼lb.	.50	April 15	Drills	½	½	......	......	June 1–15	4	Destroy	Sept. 1	Oct. 30 on	Winter
Spinach	Early, 6, 18, late anywhere	½lb.	.25	April 1 on	Drills	½	¼–½	......	......	May 30 on	3	Destroy or greens	May 15–30	June 30 on	
Squash, early	⅓ of 22	2 pkgs.	.10	May 1–15	Hills 6 to 8 seeds	¾	3 to 6	......	......	June 15	3 or 4 in hill 3 ft.	Destroy	June 15	July 15	
Squash, late	2, ⅓ of 22	¼lb.	.40	May 15 July 1	Hills	¾	3–4	......	......	June 15 on	2 or 3 in hill 6 ft.	Destroy	Sept. 1	Oct. 15	Winter
Tomatoes	17	3 pkgs.	.25	April 1	Hotbed	¼–½	¼–½	May 20–30	36	......	......	......	June 15–30	Sept. 15–30	
Turnips, early	9	2 ozs.	.20	April 15	Drills	½	¼–½	......	......	May 15	6	Destroy	June 1–15	Aug. 1–Sept. 15	
Turnips, late	20	2 ozs.	.20	July 15–20	Drills	½	¼–½	......	......	Aug. 1	10 to 12	Destroy	Sept. 15	Oct. 15	
Balm	Herb bed	1 pkg. each	.05	May 1–15	Hotbed	¼–½	¼–½								
Basil, sweet			.05												
Caraway			.05												
Catnip			.10												
Dill			.05												
Horehound			.05												
Mint			.25												
Sage			.05												
Savory, summer			.05												
Thyme			.05												
Total	....	....	$28.70												

Time for planting seeds or transplanting plants in the garden (Wilkinson).

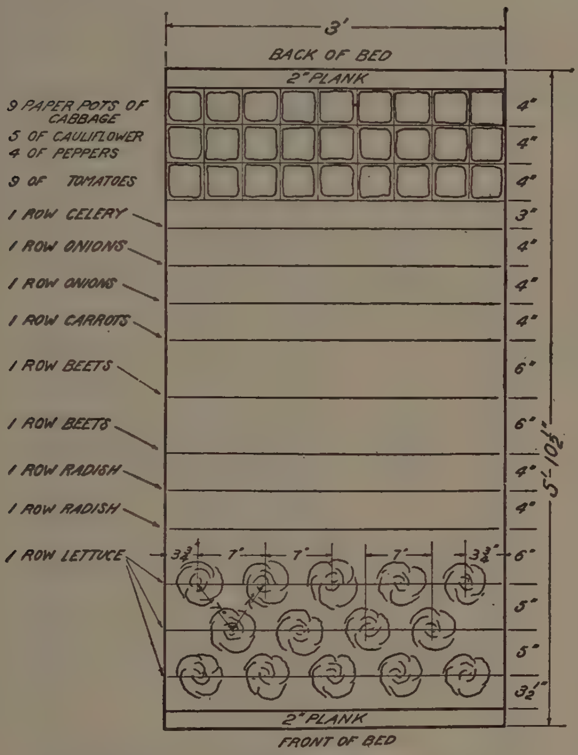
April 1–15.—Early peas (seeds).

April 15 (all seeds).—Early beets, Swiss chard, early carrots, midseason peas, radishes, parsnips, salsify, early turnips.

April 15–30 (all plants).—Early brussels sprouts, early cabbage, early kohlrabi.

May 1–10.—Early corn (seeds), lettuce (plants), endive (seeds), radishes (seeds), early celery (plants), leek (plants), onions (plants).

May 10–20 (all seeds).—Beans, green and wax; late carrots, cucumbers, late peas, early squash.



2037. Plan for the utilizing of hotbed space. (Wilkinson)

May 20–30.—Beans, shell (seeds); late beets (seeds), late squash (seeds), late turnips (seeds), cauliflower (plants), red cabbage (plants), tomatoes (plants).

June 1–10 (all seeds).—Midseason corn, lettuce, winter radishes.

June 10–20.—Late corn (seeds), late celery (plants), lettuce (seeds).

June 30.—Late cabbage (plants), late cauliflower (plants), late brussels sprouts (plants), late kohlrabi (plants), lettuce, and radishes in vacant places (seeds).

The yearly supply of vegetables (Wilkinson).

The family should plan to have for consumption, on the dates named, the following vegetables:

March 15–20 (from hotbeds).—Radishes, lettuce (leaves).

March 20–30 (from hotbeds).—Radishes, lettuce (leaves), spinach.

April 1–15 (from hotbeds).—Radishes, lettuce (head), spinach, beet greens.

April 15–30 (from hotbeds).—Radishes, lettuce, spinach, beets (small), cress, endive, parsley.

May 1–15 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce (head), spinach, beets, carrots, cress, endive, parsley, rhubarb.

May 15–30 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce, spinach, beets, carrots, cress, endive, parsley, rhubarb, asparagus, cauliflower, turnips.

June 1–15 (from hotbeds and coldframes, and from the garden).—Radishes, lettuce, spinach, beets, carrots, cabbage, parsley, rhubarb, asparagus, cauliflower, turnips, beans, celery, leek, onions, peas.

June 15–30 (from the garden).—The vegetables named above; Swiss chard, potatoes, squash (crookneck and white), tomatoes.

July 1–15 (from the garden).—The vegetables named above; beans (wax and green), cabbage, carrots (half-long), midseason peas.

July 15–30.—The new vegetables ready between these dates are: Carrots (long), early sweet corn (outside-grown), kohlrabi, okra.

August 1–15.—The new vegetables ready between these dates are: Beans (shell), brussels sprouts, red cabbage, savoy cabbage, cauliflower (from outside), midseason sweet corn, late peas.

August 15–30.—The new vegetables ready between these dates are: Late cabbage, cucumbers (outside-grown), muskmelons, peppers, late potatoes.

September 1–15.—The new vegetables ready between these dates are: Bur, or globe, artichokes, late corn, eggplant, parsnips, winter radishes, salsify, late squash.

September 15–30.—The new vegetables ready between these dates are: Jerusalem artichokes, late beets, late celery, celeriac, turnips.

October 1–15.—Pumpkins.

October 15–30.—Herbs harvested.

The following should be supplied for storage and winter consumption: Jerusalem artichokes, beets, carrots, celery, cabbage, celeriac, potatoes, pumpkins, parsnips, winter radishes, horse-radish, salsify, squash, turnips, onions.

Paul Work.

The home flower-garden.

The flower-garden differentiates itself from the formal plantings which comprise the main landscape gardening features. The landscape design is for general effect; the flower-garden a more intimate, homely affair, the outgrowth of a real love of flowers and their associations.

Usually it will lie within the province of the housewife to plant and cultivate the flower-garden and, for this reason, its location is of first importance. It should be convenient of access, secluded in a measure, that one may work in odd moments and odd habiliments, if convenient, and should be considered from the standpoint of convenience and personal preference. Nothing should be planted merely for show or ornament, although nothing need be left out because it is ornamental, but the flowers which most appeal to one, either from certain qualities they possess or from sentiment or association, should be much in evidence.

The platting of the garden should be on a practical working basis, with ample beds of straight outlines, with broad well-constructed paths that do not end in cul-de-sacs but afford ample room at their angles for the turning of a hand barrow or cart, for paths are not intended merely to separate the parts of the garden or to facilitate strolling in the cool of the evening, but they serve the very utilitarian purpose of a working basis for the beds. Gravel, cinders or earth paths which have been treated with a good herbicide, are preferable; if they are properly treated they will practically take care of themselves from season to season.

While the form of the plat and individual preference will usually determine the outlines of the garden, no form is more satisfactory and ample than that of beds

Planting-list of Annuals.—(A. C. Hottes, New York).

Name, Botanical and Common	Height	Color	Distance apart	Season	Remarks.
Ageratum Houstonianum, Floss Flower	8 in.	Purplish blue, white	6–9 in.	July, Aug.	Best blue hardy annual for edging.
Alyssum maritimum, Sweet Alyssum	8 in.	White	5 in.	July to frost	One of the best white, hardy annuals for edging.
Amarantus caudatus, Love-Lies-Bleeding	3 ft. +	Scarlet to yellow	15 in.	June	Tender; rather gaudy.
Antirrhinum majus, Snapdragon	1–4 ft.	Various	1–1½ ft.	July–Sept.	Sow in February for early bloom; cut-flower; hardy.
Arctotis grandis, African Daisy	1½ ft.	White, lilac	12–18 in.	June to frost	Hardy; petals white above, lilac beneath; blue center; daisylike.
Brachycome iberidifolia, Swan River Daisy	½–1 ft.	Pale blue or white	9–12 in.	July	Half-hardy; plant in heat for early bloom; pretty little plant.
Browallia demissa, Amethyst	1 ft.	Blue, white	9 in.	All summer	Tender; excellent planted among other annuals.
Calendula officinalis, Pot Marigold	12–18 in.	Orange, yellow, sulfur	12–18 in.	May to frost	Hardy; masses or borders.
Callistephus chinensis, China Aster	2 ft.	Various	9–12 in.	July to frost	Half-hardy; start indoors; partial shade or sun; cut-flower.
Celosia cristata, or Cockscomb	1 ft.	Various	9–12 in.	June to frost	Tender; cutting; border; moisture-loving.
Centaurea Cyanus, Bachelor's Button	1½–2 ft.	Blue-white, pink	12 in.	May to frost	Hardy; water and pick flowers, to prolong season of bloom.
Centaurea moschata, Sweet Sultan	2 ft.	White, yellow, purple	6–10 in.	June, through Aug.	Hardy; cut-flower; have bloom before hot weather.
Clarkia elegans, Clarkia	1–3 ft.	White, lilac, pink	8–12 in.	June–Sept.	Hardy; warm light soil; sun or partial shade.
Coreopsis tinctoria, Calliopsis	2 ft. +	Yellow, brown	8–10 in.	May to frost	Hardy; self-sows; good for cutting; sun.
Cosmos bipinnatus, Early Cosmos	4 ft. +	White, pink, crimson	12–15 in.	Late July to frost	Hardy; choose earliest varieties; not too rich soil.
Delphinium Ajacis, Annual Larkspur	1½ ft.	Various	6–12 in.	June, July	Hardy; sun; good for cut-flowers.
Dianthus chinensis, Chinese Pink	10–16 in.	Pinks, reds, combin	6–8 in.	July to frost	Hardy; scentless; really a biennial.
Eschscholtzia californica, California Poppy	15 in.	Yellow, pink, white	6–8 in.	July	Sun; sow early; do not transplant; tender.
Gaillardia pulchella, Blanket Flower	1–2 ft.	Crimson, red, yellow	10–12 in.	July to frost	var. picta, free-blooming; hardy; cutting.
Godetia amœna, Satin Flower	1–2 ft.	Red, white combin	8–12 in.	July–Oct.	Hardy; satiny luster.
Gomphrena globosa, Globe Amaranth	1–1½ ft.	Pink, purple, White, orange	1 ft.	July, Aug.	Hardy, cutting; masses; an everlasting.
Gypsophila elegans, Baby's Breath	1–1½ ft.	White	12 in.	July	Hardy; sow for succession of bloom; cut to combine with other flowers.
Helianthus annuus, Sunflower	2–10 ft.	Golden yellow	2–4 ft.	Aug. to frost	Hardy; background screen.
Helichrysum bracteatum, Everlasting	3 ft.	Deep red, white, yellow	10–12 in.	July to frost	Hardy; sun; gather flowers at night to preserve form.
Iberis amara, Candytuft	6–18 in.	White, crimson, carmine	6–9 in.	July to frost	Hardy; successive sowings two weeks apart prolongs season; sun.
Impatiens Balsamina, Lady Slipper	1–2½ ft.	Various	9–12 in.	July to frost	Half-hardy; sun; sandy loam.
Lavatera trimestris, Annual Mallow	2 ft.	Pink, white	12 in.	July	Hardy; sow early, May, where they are to grow.
Linum grandiflorum var. coccineum, Scarlet Flax	1–1½ ft.	Scarlet	8–10 in.	July	Half-hardy; glossy red; is attractive; not good when cut.
Lupinus hirsutus, Hairy Lupine	2–3 ft.	Blue, pink, white	6–8 in.	July–Aug.	Hardy; massing; cut-flowers; hairy.
Matthiola incana var. annua, Stock	1½ ft.	Various	6–12 in.	July–Sept.	Half-hardy; for early bloom start indoors; fragrant.
Nicotiana alata, Ornamental Tobacco	3–5 ft.	White	12–18 in.	July to frost	Hardy; start indoors; fragrant in evening; massing.
Nigella damascena, Love-in-a-Mist	1–2 ft.	Blue, white	10–12 in.	June–Sept.	Hardy; flowers surrounded by attractive foliage.
Papaver Rhœas, Shirley Poppy	2 ft.	Various	4 in.	June–Sept.	Hardy; sow very thinly September or April.
Papaver somniferum, Opium Poppy	2½ ft.	Various	4–5 in.	June–Sept.	Hardy; massing.
Petunia hybrida, Petunia	1 ft.	Various	1 ft.	June to frost	One of the most freely blooming annuals; half hardy.
Phlox Drummondii, Annual Phlox	1 ft.	Various	6–8 in.	June	Hardy; benefited by starting inside; massing in beds.
Portulaca grandiflora, Rose Moss	6 in.	Various	6–8 in.	July–Oct.	Hardy; sun; will thrive in dry soil.
Reseda odorata, Mignonette	1–1½ ft.	Reddish yellow	9 in.	July–Sept.	Hardy; fragrant; cutting; sandy soil.
Ricinus communis, Castor Bean	5–7 ft.	Green and bronze foliage	2½–ft.	July to frost	Half-hardy; tropical; screening; foliage plant.
Salpiglossis sinuata, Painted Tongue	1½ ft. +	Various	9–12 in.	July–Aug.	Half-hardy; sow indoors for early bloom; sun; rich soil.
Salvia splendens, Scarlet Sage	3 ft. +	Scarlet	8–12 in.	July to frost	Half-hardy; sun or half shade; start indoors, March; not too rich soil.
Scabiosa atropurpurea, Mourning Bride	2½ ft. +	Various	12–15 in.	Aug. to frost	Hardy; sow indoors for earlier bloom; sun; cut-flowers.
Schizanthus pinnatus, Butterfly Flower	2 ft. +	Yellow, lilac, rose, etc.	12 in.	July, Aug.	Hardy; masses; borders; cut-flowers.
Tagetes erecta, African Marigold	3 ft.	Golden yellow to sulfur	12–18 in.	July	Hardy; scented foliage; massing.
Tagetes patula, French Marigold	1–1½ ft.	Golden yellow to maroon	6–10 in.	July	Hardy; excellent edger.
Tagetes signata var. pumila, Dwarf Marigold	9–11 in.	Golden yellow	8–10 in.	Aug. to frost	Hardy; excellent edger.
Torenia Fournieri, Wishbone Flower	8 in.	Blue, white	8–12 in.	July–Sept.	Tender; urns and hanging-baskets.
Tropæolum minus, Tom Thumb Nasturtium	6 in.	Various	9 in.	July to frost	Half-hardy; cut-flowers; massing; sun.
Verbena hybrida, Verbena	1 ft.	Various	10–12 in.	July to frost	Hardy; sow indoors for early bloom; from cuttings less fragrant.
Zinnia elegans, Youth and Old Age	3 ft.	Red, yellow, magenta and combin	1 ft.	July to frost	Hardy; stiff but easily grown.

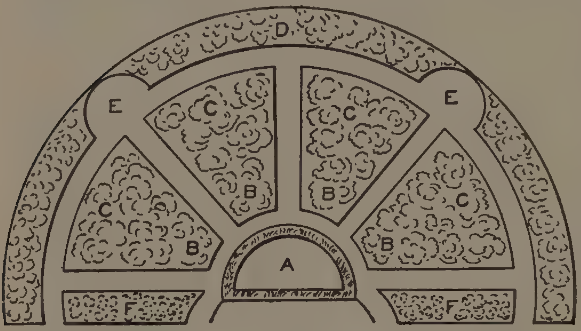
Planting-list of Hardy Herbaceous Perennials.—(A. C. Hottes, New York).

Name, Botanical and Common	Height	Color	Distance apart	Season	Remarks
Achillea Ptarmica, The Pearl	2 ft.	White	18 in.	June	Var. Pearl, double; confine, else it overruns garden.
Aconitum Napellus, Monkshood	3–4 ft.	Blue, white	10–15 in.	July, Aug.	Borders; root poisonous; partial shade; seeds difficult to germinate.
Adonis vernalis, Spring Adonis	6–9 in.	Yellow	12 in.	March	Do not disturb often; propagated by seed or division.
Althæa rosea, Hollyhock	4–6 ft.	Various	3 ft.	July–Sept.	Sun; plant in spring; single and double; standard background.
Anemone japonica, Japanese Anemone.	3–6 ft.	Rose, white	18 in.	Sept., Oct.	Excellent; one of best; sun or shade; standard fall border perennial.
Anthemis tinctoria, Golden Marguerite.	1 ft.	Yellow	12 in.	June to frost	Sun; divide annually; var. Kelwayi best.
Aquilegia chrysantha, Long-spurred Columbine	2–2½ ft.	Yellow	8–15 in.	June, July	Dainty and graceful; border; sun.
Boltonia latisquama	4–5 ft.	Blue, pink, violet	3–4 ft.	Late Aug.	Sun; remains in bloom several weeks; spreads rapidly.
Campanula carpatica, Harebell	6–9 in.	Deep blue	9–12 in.	July–Oct.	Edging border; sun; little bloom in fall.
Campanula Medium, Canterbury Bell.		Blue, white, pink.	1–1½ ft.	June.	Biennial; requires protection.
Campanula persicifolia, Peach-leaved Campanula	2–3 ft.	Blue or white	1–1½ ft.	June	Border; sun; rich soil.
Chrysanthemum coccineum, Pyrethrum	1–2 ft.	Various	12 in.	Aug. to frost	Needs protection in U. S.; light soil; sun; leave undisturbed two or three years.
Clematis recta, White Bush Clematis.	3–4 ft.	White	2½–3 ft.	June–Aug.	Border; dig deeply; give roots plenty of room.
Coreopsis grandiflora	1½–2 ft.	Golden yellow	15 in.	July	Cut-flower; border; keep seeds picked.
Delphinium formosum, Larkspur	4–5 ft.	Blue	2½ ft.	June–Sept.	Sun; rich, well-drained, rather heavy soil; if cut down after blooming will bloom again.
Dianthus barbatus, Sweet William	12–18 in.	Various	8–12 in.	June	Old-fashioned; still charming.
Dianthus plumarius, Grass Pink	8–12 in.	White to purple	8–12 in.	June	Rock-garden; beds; sun; rich soil.
Dicentra spectabilis, Bleeding Heart	15–24 in.	Rosy purple	15–18 in.	May, June	Warm soil; sun or shade; graceful; border; an old favorite.
Dictamnus albus, Gas Plant	12–15 in.	Purple, pink, white	12 in.	June	Remains a permanent border feature; will grow in partial shade.
Digitalis purpurea, Foxglove	1½–3 ft.	Pink and white	15 in.	June	Good foliage; sun or shade; var. gloxiniæflora best.
Eryngium amethystinum, Globe Thistle	3–4 ft.	Slate-blue	12–15 in.	July–Sept.	Attractive foliage and thistle-like heads; often dried for winter bouquets.
Filipendula hexapetala, Meadow Sweet.	12–18 in.	White	18 in.	June	Large clumps; fine foliage.
Gaillardia aristata, Blanket Flower	1 ft.	Yellow, maroon center	12–18 in.	June to frost	Keep flowers picked; sun.
Gypsophila paniculata, Baby's Breath.	2 ft.	White	18 in.	Aug.	Sun; fine flowers; excellent in bouquets.
Helenium autumnale, Sneezewort	4–6 ft.	Yellow	18–24 in.	Late Aug.	Border; sun.
Helianthus decapetalus var. multiflorus, Sunflower	4–6 ft.	Yellow	18–24 in.	Late Aug. Sept.	Good clumps; border; screening.
Hesperis matronalis, Sweet Rocket	3 ft.	White, magenta, purple	12–18 in.	July	Border; showy
Heuchera sanguinea, Coral Bells	12–15 in.	Crimson, white	12 in.	June	Sun; edging; resembles bishop's cap; long graceful spikes of bloom.
Iris germanica, German Iris	12–18 in.	Various	6 in.	June	Sun or half shade; wide range of adaptability.
Iris lævigata, Japanese Iris	18–30 in.	Various	6–12 in.	July	Requires abundance of water; sun.
Iris pumila, Dwarf Iris	6–8 in.	Purple	5–6 in.	June	Medium loam.
Iris sibirica, Siberian Iris	15–24 in.	Blue, white	6–12 in.	June	Moist soil.
Lobelia cardinalis, Cardinal Flower	2–3 ft.	Brilliant cardinal	12 in.	Aug.	Moist soil; sun or half shade.
Lychnis chalcedonica, Maltese Cross	3 ft.	Brilliant red	12 in.	July to frost	Showy; border; also called campion and lamp flower.
Lychnis Viscaria, German Catchfly	9 in.	Deep red, white	9–10 in.	June	Sun; long-lived.
Mertensia virginica, Virginia Cowslip	16 in.	Blue	Clumps	April	Leave undisturbed; foliage dies after flowering.
Monarda didyma, Bee Balm	3 ft.	Red, scarlet	12 in.	July	Sun; spreads rapidly.
Myosotis palustris, Forget-me-not	½–1 ft.	Blue, white	8–10 in.	May, June	Moisture; shade or sun if not dry; var. semperflorens is very good.
Œnothera missouriensis, Missouri Evening Primrose	6–9 in.	Yellow	8–10 in.	Aug.	Large flowers; showy.
Pæonia officinalis, Peony	2 ft.	Red, white	3 ft.	May	Heavy soil; sun; old-fashioned "piney."
Pæonia albiflora, Chinese Peony	3 ft.	Various	3–4 ft.	June	Sun; deep, rich soil.
Papaver nudicaule, Iceland Poppy	12–18 in.	White, yellow, orange	6–8 in.	May–Sept.	Edger; blooming intermittently through season.
Papaver orientale, Oriental Poppy	2–3 ft.	Red, scarlet	12–18 in.	June–Aug.	Mixed border; gorgeous colors; after flowering the plants rest and foliage dies down.
Pentstemon barbatus, Beard Tongue	1½–3 ft.	Light pink to carmine	9–12 in.	June, Aug.	Var. Torreyi; sun; rich; grown in masses.
Phlox paniculata, Hardy Phlox	3–4 ft.	Various	12–18 in.	June, July	Indispensable; clumps; choose good colors.
Phlox subulata, Moss Pink	12 in.	Lavender	8–12 in.	April	Excellent for rockery or border.
Platycodon grandiflorum, Chinese Balloon Flower	3–3½ ft.	Blue, white	12–18 in.	Aug.	Showy; border; cut-flower.
Polemonium cæruleum, Jacob's Ladder	1–2 ft.	Blue, white	12–18 in.	June	Likes moisture; sun or partial shade; border; finely cut foliage.
Rudbeckia laciniata, Golden Glow	4–6 ft.	Yellow	12–18 in.	Late Aug., Sept.	Excellent background; easily grown.
Sedum spectabile, Showy Sedum	15–18 in.	Pink	8–10 in.	Aug.	Showy; sun; rich soil.
Stokesia cyanea, Stokes' Aster	12–18 in.	Blue, white	12 in.	Aug.	Sun; light soil; masses; border; cut-flower.
Trollius europæus, Globe Flower	12–18 in.	Yellow	12 in.	May, June	Moist heavy loam; buttercup-like flowers; best in half shade.
Viola cornuta, Horned Violet	6–8 in.	Blue, white	12 in.	May	Masses; rich soil.
Yucca flaccida, Hardy Yucca	5 ft.	White	2 ft.	June	Transplant early spring; sun; light soil.

Note.—In the column "distance apart," the distance indicated is for first year; nearly all plants will need frequent division of clumps, placing them at greater distances apart.

radiating from a common center. Such beds provide the greatest amount of growing room with the least waste, and they bring all parts of the garden into view, without the defect of nearby beds shutting out the view of those in the rear. Such a garden is shown in Fig. 2038, with turning-places and outlooks at EE.

If the home flower-garden comprises the whole of the floral planting and no other space is devoted to shrubbery and the more robust kinds of perennials, then these radiating beds furnish the very best form in which to combine them with the landscape garden proper. Starting from a central point, A, which may be conspicuous by a pool, a bit of sod with table and seat or any garden furnishing, the beds, which may be as narrow as 1 foot at the point, widen gradually as they recede until, at the circumference, they attain considerable width; these rear parts are excellent for the planting of shrubbery and tall perennials, and shrubs may extend upward through the center of the rear parts of the beds; tall perennials may be massed at the sides and in front, lower perennials border these, and annuals and edging plants fill out the remainder of the ground, in this way furnishing a massed planting which is very attractive and also economical of space. The diagram (Fig. 2038) is a very good example of this manner of platting, and it may be adopted in its entirety or simplified by omitting the outer circle and the two short beds in front.



2038. A serviceable plan for a home flower-garden.

When economy in labor is of moment, it will be well to choose those plants whose manner of growth is clean and neat, rather than those that tend to spread and so require much cutting and restraining. Lilacs, for example, require constant grubbing out, while the lespedeza has an attractive erectness and cleanness of manner and requires no pruning or restraint; this, also, is true of the altheas and spireas in the main, while the deutzia is easily kept to the single plant if desired.

Lilies, which do their best when planted among shrubbery and perennials, should be used abundantly in the home-garden, especially the candidum and auratum lilies. For summer cut-flowers, few things equal in effectiveness and usefulness the gladiolus; and as this flower is at its best when interspersed among more generously foliaged plants, it may be worked in among tall perennials to good advantage. Perennial poppies are one of the valuable garden assets and, once established, continue to give satisfactory returns for years. They combine effectively with the Shasta daisies, and are specially effective against the green backgrounds of taller plants. The dictamnus is valuable and should find a place in the home-garden, as once established it is practically everlasting; and its manner of growth is so erect and neat, its bloom so satisfactory and attractive that it is well worth adopting.

A garden laid out as indicated and planted in the rear and central parts with permanent things, leaves abundant room in front and along the margins for annual plants and for experiments in novelties from year to year. It will have its shady and sunny spots which may be utilized for plants requiring special conditions of exposure.

Certain old garden favorites among the annuals will be much in evidence, but a study of the catalogues of the leading florists will show vast improvements in type which may be adopted without in any way detracting from the old-time sentiment of the flowers. Asters and pansies, especially, show this advancement, and petunias are much superior to the small kinds of a few years ago. In purchasing seed of these flowers it is economy to buy the most expensive, as the results well repay the extra outlay. From 25 to 50 cents a packet for pansies and petunias is none too much if one would secure notable flowers.

The home-garden should be beautiful and interesting from early spring until frost, and to secure this result one must plant freely along the margin of the beds of spring-blooming bulbs—crocus, tulips, hyacinths, narcissi and the like. These bulbs do admirably planted in long, triple rows, and the space between them may be filled in summer with candytuft, ageratum, schizanthus, Drummond phlox, verbena, petunia.

Sufficient plants that bloom late in summer and in autumn should be supplied to make the garden attractive at this time. Anemones are the most charming of autumn flowers, hardy chrysanthemums bloom well into November, tritomas or kniphofias are a blaze of color for weeks. By judicious planting there need be no dearth of color in any season.

Preparing the ground for the flower-garden.

The preparation of the ground, especially when the planting is to be of a permanent character,—that is of shrubbery, perennials and hardy bulbs,—is of great importance, as any defects in quality of mechanical condition of the soil will not be easily rectified, once the planting is accomplished.

Good drainage is the first consideration, as this must be performed before any platting or bed-making is attempted. When the lay of the land makes for a natural removal of surplus moisture, or the soil is sandy and underlaid with gravel, no artificial drainage will be required; but when the soil is cold and sour and retentive of too much moisture it will be necessary, for the best results, to lay two or more courses of porous drain-tile underneath the plot.

If the garden is large enough to admit of an initial plowing, this way of preparing the soil may put it in better mechanical condition than spading, although, of course, after the beds are laid out and paths established, spading will be the only feasable method of working the ground. When the soil is naturally good, as in breaking up a piece of sod land or in a well-fertilized garden spot, it will be necessary only to spade or work up the beds, incorporating a liberal quantity of old well-rotted manure. A very satisfactory way of working manure into beds is to begin at one side of the bed and spade one row, laying the soil one side so as to leave an open trench; fill this trench full of manure and spade the next row on top of this, and so continue till the entire area is covered. This buries the manure well beneath the surface and effectively prevents the germination of weed seeds; at the same time the manure deep in the soil holds the moisture and brings the roots well down beneath the surface where they remain cool and moist. See p. 1739, trenching.

In beds that are to be worked over but not fertilized the second summer, it is not desirable to turn the soil over in spading as this throws the manure back to the surface; but sufficiently satisfactory results are secured by thrusting the spade well down into the ground and turning it around, but not lifting it out. A bed worked over in this way will be in excellent condition and less disturbance and cutting of the roots will result.

A garden planted to shrubs and perennials may safely be left undisturbed for three years, providing a good annual stirring of the soil is given in early spring followed by sufficient tillage to establish a dust-mulch throughout the dry weather. Getting down on hands and knees and working around each individual plant with a trowel has many advantages, as it puts one more intimately in touch with the plant than is possible with hoe and spade. Many ambitious little shoots succumb to the onslaught of a too vigorous hoe, that might have been saved by a closer inspection. The presence of insect enemies about the base of the plants is likely to pass unnoticed until much damage is done, when only a standing cultivation is practised; so, one intimate acquaintance with each inmate of the garden is advised at least once a year, preferably in early spring.

For the remainder of the summer, dependence may be placed on any one of the various forms of hoes, preferably the scuffle-hoe, as by the use of this tool one can work closer to the stem of the plants, slipping beneath the leaves and recumbent foliage with little damage. It produces the most perfect dust-mulch of any tool and as it is used walking backward no footprints are left on the soil to press a weed back into the ground where it may grow again, as is the case with a wheel-hoe or most hand-hoes, and last, it is the tool best adapted to a woman's use and with it she can accomplish a large amount of labor with little fatigue. A good trowel is essential. In buying this everyday implement, the gardener should choose one in which the blade and handle are in one piece of steel, for a handle riveted or secured to the blade is always unsatisfactory and of short duration. Pruning shears that open easily and fit the hand well are also necessary when shrubs or roses are cultivated. These three articles, together with a spade and rake are about all the indispensable tools aside from a good wheelbarrow and one or more baskets of convenient size.

When the garden plat is confined with an ornamental wooden fence, painted white as is so much the custom, a good effect is gained by planting tall-growing shrubs in the rear to reach over the fence, furnishing a charming background of bloom and greenery.

Tall-growing shrubs that make their growth mostly at the crown are especially desirable, as for example, the dogwood, flowering thorns, red-buds, tree lilacs and the tamarix. Shrubs which bloom from the ground up are wasted in the flower-garden. Altheas, syringas, deutzias, spireas, symphoricarpos, Tartarian honeysuckles, weigelas, snowballs and the like need an open place in which to display their merits to the best.

As the buying of any great quantity of perennial plants calls for a considerable initial outlay, it is both economical and interesting to grow them from the seed. The seeds may be started in hotbeds in early spring and transplanted into the beds where they are to grow as soon as large enough; or, what may be the better way for many kinds, they may be sown in long rows in the vegetable-garden, where they will receive the same cultivation as the vegetables and be transplanted the following spring. Oriental poppies do especially well under this treatment. Shasta daisies and delphiniums should be planted, but physostegias, hibiscus, aquilegias, achilleas, sweet Williams, dianthus, digitalis, gauras, sunflowers, hollyhocks, may be produced by the hundreds at a very trifling expense.

Annuals that are desired merely for cutting may also be grown in the vegetable-garden to advantage. Asters, sweet peas, cosmos, arctotis, annual larkspurs, centaureas, cornflowers, gaillardias, all the everlastings, may very profitably be relegated to this economic culture and so leave room for more permanent things in the garden proper.

IDA D. BENNETT.

KITCHÍNGIA (personal name). *Crassulàceæ.* Succulent glabrous perennial herbs, allied to Bryophyllum but with small calyx and diverging carpels: sts. flexuose, bearing many opposite sessile or stalked fleshy crenate lvs.: fls. large for the plant, bright red, terminal, often in loose racemes, the parts in 4's; calyx-segms. as long as tube; corolla-tube campanulate or tubular, sometimes larger in middle, with 4 short lobes; stamens 8: carpels 4, free, making small many-seeded follicles.—Species 10, in Madagascar. *K. uniflòra,* Stapf, is an attractive prostrate sedum-like plant, rooting at the joints: lvs. obovate and obtuse, less than 1 in. long, bright green: fls. solitary or 3 together, bright red, the corolla-tube narrowed at both apex and base, about 1 in. long and half as thick; stamens polymorphic. B.M. 8286. R.H. 1913, p. 177.—A recent species, suitable for temperate conditions under glass.

L. H. B.

KLEÌNIA. Of the three genera of Compositæ of this name, two are referred to Porophyllum and Jaumea, but the trade names will be accounted for under *Senecio.*

KLÙGIA (Dr. Fr. Klug, German zoölogist). *Gesneriàceæ.* About 4 blue-fld. herbs, rooting at the base and more or less succulent, suitable for growing in the greenhouse. Lvs. alternate, or sometimes nearly opposite and one of the pair reduced to very small size, the sides of the lf. unequal, many-nerved, sinuate or nearly entire: fls. opposite the lvs. or terminal, small and pendulous, short-stalked; calyx 5-angled or 5-winged, one wing often larger than the others, the lobes of calyx 5; corolla-tube cylindrical, 2-lipped, the upper lip very small and the lower rounded or somewhat 3-lobed; stamens 4, perfect: fr. a 2-valved caps. included in the calyx. India, and 1 species in Mex. *K. Notoniàna,* A. DC. Quick-growing herbaceous annual, 12–18 in., more or less puberulent: lvs. petiolate, ovate, acuminate, 5–8 in. long: corolla-tube white, ½in. long; large lower lip blue, with yellow at the base; calyx-lobes short and triangular, and one wing larger. India, 2,000–5,000 ft. altitude; variable. Blooms under glass, Jan. to summer. G.C. III. 19:237. *K. zeylánica,* Gardn., differs in the long-acuminate calyx-lobes and the wings of calyx nearly equal. Ceylon. B.M. 4620 (as *K. Notoniana*).

L. H. B.

KNIPHÒFIA (Johann Hieronymus Kniphof, 1704–1765, professor at Erfurt). Syn., *Trítoma. Liliàceæ.* TORCH-LILY. RED-HOT-POKER PLANT. FLAME-FLOWER. Excellent showy perennial herbs grown in the open (some species under glass), with spikes or racemes of long, drooping red and yellow (rarely white) flowers.

Herbs with abundant radical lvs. and stout, simple naked scapes or peduncles, the thick roots from a short vertical rootstock, mostly stemless but a few species with a short caudex below the crown of lvs.: fls. many, in a spike-like raceme or dense head-like spike, on short articulated pedicels; perianth funnel-shaped or cylindrical, the tube long and the nearly or quite equal segms. small and mostly broad; stamens 6, in two lengths, equaling or exceeding the perianth; ovary 3-celled, bearing a filiform style and capitate stigma: fr. a short 3-valved caps.—Species probably 70, in Trop. and S. Afr. in the tropical regions mostly from high elevations. The genus is rich in good native forms, many of which are scarcely known in general cult., and it is to be expected that important horticultural developments will arise in the future. Accounts of the species described to those dates will be found in Flora Capensis (1896–7) and Flora Tropical Africa (1898) in the treatments by Baker, from which the present descriptions have been largely drawn. These descriptions are made mostly from wild plants and therefore may not apply to garden forms, which are very likely to be hybrids.

The kniphofias are among the most showy of border plants. They are essentially autumn bloomers, but some of the newer kinds are nearly continuous bloomers from midsummer. The common kinds are hardy south of Philadelphia when well covered in winter, but in the North it is usually safer to dig up the plants in November, place them in boxes with dry earth, and store them in a cellar in winter. In spring place them in a warm, sheltered, well-drained spot, perhaps with a background of shrubbery to set off the flowers. Some of the recent species from tropical Africa are treated as greenhouse or warmhouse subjects. In general cultivation the prevailing species is *K. Uvaria.* This is nearly hardy North, has sword-shaped leaves 2 to 3 feet long, and several scapes 4 or 5 feet high surmounted by a spike 4 to 8 inches long composed of perhaps 100 tubular, drooping flowers, each 1 inch or more long, and fiery red. It has perhaps a dozen varieties with Latin names and twice as many with personal names. Most other species have much the same general effect, and recent variations and apparent hybrids have greatly extended the blooming season and the range of color and form. For producing mass-effects, the torch-lilies are among the most striking subjects, the brilliant flowers producing a flame of color. Clumps in open sunny places are particularly emphatic.

The miniature-flowered torch-lilies are excellent for planting in small beds and near the front borders and also for cutting. They begin to bloom as early as June. The plants are mostly small, the racemes not so massive, and the flowers small and short. It is probable that such species as *K. Nelsonii, K. pauciflora, K. rufa, K. breviflora* have entered into them.

Under cultivation, the kniphofias appear to hybridize very freely through the agency of bees, and seedlings therefore may not be true to the parent from which they came. The result is that there is much confusion in the literature of the genus, and it is often very difficult to trace the original species-forms.

They grow readily from seeds, and novel forms are likely to be secured from the mixed garden parentage. The plants should bloom freely the second year, and often the first year. The usual method of propagation is by division; the caulescent kinds, however, may not produce offsets or divisible parts readily unless they are headed back or cut off to make them spread. Kniphofias are often classed by dealers as bulbous plants, though they have only a short rhizome and numerous, clustered, thickish root-fibers. Old but vigorous plants of the *K. Uvaria* kind divide easily, and give large strong pieces.

INDEX.

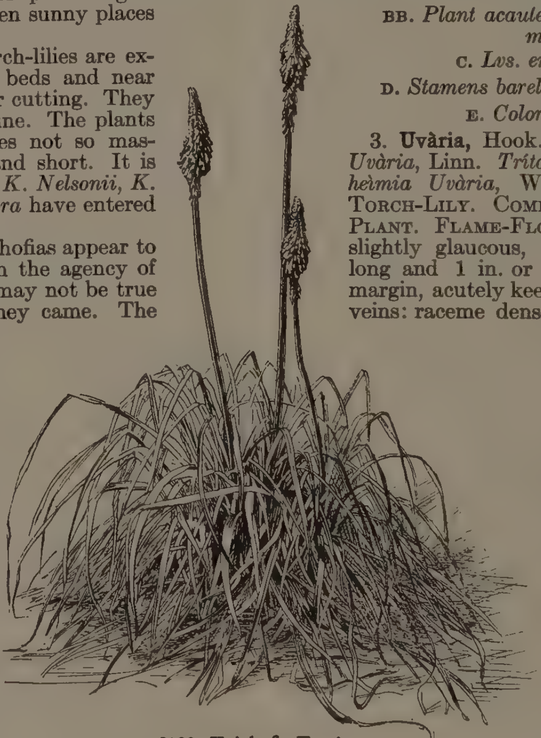
alooides, 3.
aurea, 18.
breviflora, 16.
Burchellii, 5.
carnosa, 3.
caulescens, 1.
citrina, 23.
comosa, 17.
corallina, 11.
floribunda, 3.
foliosa, 27.
glauca, 3.
glaucescens, 3.
gracilis, 22.
grandiflora, 3.
grandis, 3.
kewensis, 10.
Leichtlinii, 18.
longicollis, 6.
longiflora, 13.
Macowanii, 11.
maroccana, 11.
maxima, 3.
media, 11.
modesta, 14.
multiflora, 19.
natalensis, 12.
Nelsonii, 10.
nobilis, 3.
Northiæ, 2.
pauciflora, 20.
Pfitzeri, 3; also suppl. list.
præcox,, 3.
primulina, 8.
pumila, 21.
Quartiniana, 27.
refulgens, 3.
rigidissima, 11.
Rooperi, 4.
rufa, 24.
sarmentosa, 7.
Saundersii, 3.
serotina, 3.
sparsa, 15.
triangularis, 9.
Tuckii, 25.
Tysonii, 26.
Uvaria, 3.

A. *Perianth long, an inch or more.* (*Nos. 1–13.*)

B. *Plant caulescent* (*a st. or caudex below the lf.-crown*).

1. **cauléscens,** Baker. Plant with a thick st. below the lvs., 6–12 in. long: lvs. very glaucous, sword-shaped-acuminate, broadly channelled, not acutely keeled on the back, 2–3 ft. long, 2–3 in. wide, margin serrulate: spike about ½ ft. long, 3 in. thick; lower fls. yellow, upper ones red; segms. broad, ovate and obtuse, very short; stamens and style somewhat exserted. Cent. Cape region. B.M. 5946. G.C. III. 6:564. R.H. 1887:132 (as *Tritoma caulescens*). Gn. 41:536; 78, p. 502. G. 36:83. Gn.W. 16:443. G.M. 57:555.

2. **Nórthiæ,** Baker. St. short, 2–3 in. diam.: lvs. 30–40, in a dense rosette, 4–5 ft. long and 5–6 in. broad, lance-acuminate, channelled on the face, not sharply keeled, margins serrulate: raceme or spike 1 ft. and more long, very dense, on a peduncle shorter than the lvs.; fls. 1 in. long, the lower ones yellow and the upper ones red toward the tip; segms. small and ovate; stamens becoming much exserted. Coast region. S. Afr. B.M. 7412. G.C. III. 39:100. Gn. 73, p. 480.


2039. Kniphofia Uvaria.

BB. *Plant acaulescent* (*no caudex below the mass of lvs.*).

C. *Lvs. ensiform-acuminate.*

D. *Stamens barely exserted in full anthesis.*

E. *Color of lvs. dull green.*

3. **Uvària,** Hook. (*Alòe Uvària,* Linn. *Áletris Uvària,* Linn. *Trítoma Uvària,* Ker-Gawl. *Veltheìmia Uvària,* Willd. *K. alooìdes,* Moench). TORCH-LILY. COMMON POKER PLANT. POKER-PLANT. FLAME-FLOWER. Figs. 2039, 2040. Lvs. slightly glaucous, ensiform-acuminate, 2–3 ft. long and 1 in. or less broad, scabrous on the margin, acutely keeled, with 30–40 close vertical veins: raceme dense, often 6 in. long, 2½–3 in. thick, on a peduncle as long as the lvs.; upper fls. bright red, lower ones yellow; perianth cylindrical, to 1½ in. long; segms. ovate and obtuse; stamens in the lower fls. barely exserted. General Cape region. F.S. 13:1393. B.M. 758; 4816.—The following varieties with Latin names are in the trade and usually advertised as apparent species under Kniphofia or Tritoma. They may be all more or less distinct horticulturally. Var. **carnòsa,** in Gn. 19:548, with the fls. opening from the top instead of the bottom, and with red filaments and yellow anthers. Leichtlin intro. it about 1881 and said it grew 1½–2 ft. high, the apricot-red of the fls. toned down by a glaucous bloom. (Cf. No. 17.) Var. **floribúnda** is early-flowering. Var. **glaùca** is apparently a trade name. Var. **glaucéscens** is figured in Gn. 36:458 with a spike 9 in. long, of "vermilion-scarlet fls. changing to a more orange color; one of the freest bloomers. Intro. 1859." Foliage somewhat glaucous. Var. **grandiflòra,** one of the earliest improvements on the type: 2–3 ft. high. Var. **grándis.** Large-fld.; fls. red and yellow, 5 ft. The plant in the trade as *K. Pfitzeri* probably belongs here; see also suppl. list, p. 1755. Var. **nóbilis** is said by Carrière, R.H. 1885:252, to have shorter and stricter lvs. than var. *Saundersii,* the spikes more ovoid, the fls. uniformly red and less deflexed. Lvs. not glaucous. Gn. 55, p. 167. Var. **Saùndersii,** in R.H. 1882:504, is shown with "red-orange fls." in an elliptical spike and said to grow 6 ft. and more

high. It grows 4-6 ft. high in rich soil, the peduncles less rigid than in *K. Uvaria* (blooming late) with cylindrical spikes 18–24 in. long and fls. often ½in. across. Gn. 71, p. 492. See var. *maxima*, below.

Baker's treatment of the botanical varieties (under *K. alooides*) is as follows (Fl. Capensis, VI, p. 283):

Var. **máxima** (*Trítoma grandiflòra*, Hort. *T. Saùndersii*, Carr.). More robust: lvs. 4–5 ft. long, 1 in. wide: raceme and fls. longer; stamens more decidedly exserted. B.M. 6553 (fls. yellow, more or less tinged red). R.H. 1882:504 (colored like the type).

Var. **nóbilis** (*Trítoma nóbilis*, Guill.). Still more robust: scape including raceme sometimes 6–7 ft. long; fls. 1½ in. long. R.H. 1885:252.

Var. **serótina,** Hort. A late-flowering form with slender perianth 1¼ in. long and distinctly exserted stamens. Baker also mentions var. **carnòsa, glaucéscens** and **refúlgens** without discrimination. Other varieties with Latin names are mentioned in Gn. 36:458. *K. prǽcox*, Baker, is probably not in cult.: fls. sometimes in summer and sometimes in autumn.

4. **Roòperi,** Lem. Lvs. ensiform-acuminate, 4 ft. long, and to 1½ in. broad, scabrous on the margin, acutely keeled, glaucous: raceme to 6 in. long, very dense, on a stout stiff peduncle as long as the lvs.; fls. paler than in *K. Uvaria* and later; perianth cylindrical, to 1½ in. long, the segms. ovate and obtuse; stamens at length just exserted. Coast region, S. Afr. B.M. 6116. J.F. 4:362.—The plant grown under this name is likely not to be the true botanical species here described.

EE. *Color of lvs. bright green.*

5. **Búrchellii,** Kunth. Lvs. ensiform-acuminate, 2–3 ft. long, ½–¾in. wide, sharply keeled, 15–20 ribs each side of midrib, smooth on the margin: spike 6–12 in. long, on a stout peduncle 3 ft. high; fls. bright yellow, much tinged with red when young; perianth somewhat cylindrical, to 1½ in. long, the segms. as long as broad and ovate; stamens at length just exserted. S. Afr. B.R. 1745 (as *Tritoma Burchellii*).—Probably the true *K. Burchellii* is not now in commerce.

6. **longicóllis,** Baker. Lvs. ensiform, sharply keeled, 2 ft. long and 1 in. broad at base, smooth on margins: raceme dense and short, on a slender peduncle 1½ ft. long: fls. lemon-yellow tinged orange-yellow when young, on very short pedicels; perianth somewhat or nearly cylindrical, to 1½ in. long, constricted above the ovary, the lobes small and ovate; stamens and style at length short-exserted. Natal. Gn. 59, p. 96; 63, p. 92. Gn.W. 20:120.

DD. *Stamens prominently exserted.*

7. **sarmentòsa,** Kunth. (*Áletris sarmentòsa*, Andr.). Lvs. ensiform-acuminate, 2–3 ft. long and to 1 in. broad, glaucous-green, sharply keeled, about 12 ribs either side the midrib: raceme cylindrical, dense, 6–12 in. long, on a stout peduncle equaling the lvs.; upper fls. red, the lower yellow or yellow tinged red; perianth cylindrical, to 1 in. long, the segms. broad, ovate and obtuse; stamens and style at length exserted to about ½in. S. Afr. B.M. 744.—It produces underground shoots or offsets.

8. **primúlina,** Baker. Lvs. many, ensiform, 3–4 ft. long and ½–1 in. broad, toward base sharply keeled, smooth on margin: raceme dense, oblong, 3–4 in. long, on a stout and stiff peduncle as long as the lvs.; fls. pale yellow; perianth nearly cylindrical, 1 in. long; segms. small and ovate; stamens and style much exserted. Eastern region. S. Afr. G. 32:299.

CC. *Lvs. linear.*

9. **triangulàris,** Kunth. Lvs. narrow-linear, rather rigid, erect, 1 ft. long, nearly triquetrous, margins smooth: raceme dense, 12–18 in. long, on a slender peduncle 1–1½ ft. long; fls. all yellow; perianth 1 in. long, cylindrical; segms. ovate-oblong and obtuse, longer than broad; stamens and style not exserted. Central region, S. Afr.

10. **Nélsonii,** Mast. Lvs. narrow-linear (the old ones persisting as weak fibers), 1½–2 ft. long, with a thick midrib, rounded and 3-nerved on the back, and recurved serrulate edges: raceme dense, oblong, 2–3 in. long, on a peduncle as long as the lvs.; fls. bright scarlet sometimes tinged orange, all deflexed at expansion, on very short pedicels; perianth cylindrical, 1¼ in. long and narrow; segms. oblong and small; stamens more or less in two series, much shorter than perianth. Kalahari region, S. Afr. G.C. III 11:561; 39:82. Gn. 50, p. 400; 55:166.—It is probable that *K. Nelsonii* is not represented in the garden plants under this name. A hybrid between *K. pauciflora* and *K. Macowanii* has passed under this name, but it is now given the name *K. kewénsis*, N. E. Br.: fls. yellow.

2040. Kniphofia Uvaria.

11. **Macówanii,** Baker (*Trítoma rigidíssima* and *T. maroccàna*, Hort.). Dwarf: lvs. linear, erect and rigid, to 2 ft. long, 3–5 veins either side the midrib, with a thickened scabrous margin: raceme very dense, 2–4 in. long, on a slender peduncle 1–2 ft. long; fls. bright yellowish to orange-red; perianth cylindrical, 1 in. long; segms. ovate and obtuse, reflexed; stamens not exserted. S. Afr. B.M. 6167. R.H. 1879:390. G.C. III. 39:83.—*K. corállina*, Hort., R.B. 19:25 (1893), a hybrid between this species and *K. Uvaria* was raised by Deleuil, of Marseilles: it grows 18–24 in. high and bears ovoid spikes of coral-red fls. all summer and fall: said to be good for cutting. *K. mèdia Macówanii*, Hort.: "a hybrid between *K. aloides grandiflora* and *K. Macowanii*. This is an earlier blooming sort than either of its parents, as dwarf as *K. Macowanii* and much earlier and more brilliant."

12. **natalénsis,** Baker. Lvs. linear, 1½–2 ft. long to ⅓in. broad, with 10–12 veins either side midrib, margin thickened: raceme not very dense, 6–8 in. long, on a peduncle 2–3 ft. long; fls. mostly yellow; perianth nearly cylindrical, about 1 in. long; segms. ovate; stamens as long as perianth; style at length exserted. S. Afr.—Variable.

13. **longiflòra,** Baker. Much like *K. sarmentosa*, differing in the perianth being twice longer and the stamens scarcely exserted: lvs. linear, 2 ft. long, flaccid, green, sharply keeled, ¾in. wide toward the base: raceme dense, oblong, 3 in. long, on a stout peduncle that is 3 ft. and more tall; fls. yellow-red, strongly deflexed; perianth cylindrical, slender, curved, 1½ in. long; segms. ligulate and obtuse; stamens in two series included; style long-exserted. Natal probably

AA. *Perianth short, mostly ¾in. or less long.*

B. *Fls. (perianth) not more than ⅓in. long.*

C. *Color of fls. white, when open.*

14. **modésta,** Baker. Lvs. linear, rigid, 1½ ft. long, sharply keeled: raceme moderately dense and spike-like, secund or 1-sided, 4–7 in. long, on a slender peduncle as long as the lvs.; fls. ⅓in. long, the perianth cylindrical, and the segms. ovate; anthers at length just exserted. Griqualand, S. Afr.—Probably not in cult., the next having been confused with it. In the original description the fls. are described as yellow.

15. **spársa,** N. E. Br. A much stouter plant than *K. modesta,* with lvs. 2–2½ ft. long: peduncle 2½–3½ ft. high, bearing a spike 9–18 in. long; fls. reddish or reddish; brown in bud but white when expanded, rather laxly scattered and directed to all sides. Natal. B.M. 7293 (as *K. modesta*).

CC. *Color of fls. yellow.*

16. **breviflòra,** Harvey. Lvs. linear, not rigid, 12–18 in. long and very narrow, strong ribs about 5, margin scabrous: raceme dense, 1½ in. or less long, on a slender peduncle as long as the lvs.; fls. yellow, on very short pedicels; perianth cylindrical, ¼in. long; segms. ovate and obtuse; stamens as long as perianth. S. Afr.

BB. *Fls. (perianth) ⅓–¾ in. long.*

C. *Shape of perianth funnelform (flaring at the end).*

D. *Stamens exserted more than the length of perianth.*

17. **comòsa,** Hochst. Rootstock thick and short, with copious roots: lvs. many, linear, bright green, to 2 ft. and more long, sharply keeled, edges smooth: raceme very dense, oblong, 3–4 in. long, on a peduncle equaling the lvs.; fls. bright yellow, deflexed, ½in. long and funnel-shaped but dilated suddenly at the middle; segms. very obtuse; filaments red; anthers yellow, long-exserted. Nile Land. B.M. 6569.—This is perhaps more conspicuous by reason of its mass of stamens than the outline of the spike. It is doubtful whether the true *K. comosa* is the same as the cult. plant of that name. Perhaps *K. comosa* and *K. Leichtlinii* of gardens are forms of one species. In the true or botanical *K. comosa* and *K. Leichtlinii,* the spikes are sometimes 2 or 3 on the peduncle; when there is only 1 spike, the uppermost fls. open first, thus reversing the usual order in the kniphofias; when there are lateral spikes, they open from below upward. G.C. III. 56:410.

18. **Leìchtlinii,** Baker. Plant with many slender root-fibers: lvs. many, linear, strongly keeled, 3–4 ft. long and ½in. wide toward base, edges smooth: fls. bright yellow; perianth narrowly funnel-shaped, becoming ¾in. long; segms. ovate, very obtuse; stamens and style distinctly exserted (about 1½ times length of perianth): scape speckled with red, sometimes bearing a bract 4–5 in. long, as long as the lvs., the raceme very dense and 3–4 in. long. Nile Land. B.M. 6716. R.H. 1884, p. 556. Var. **aùrea,** Hort. Spike or raceme broad and about 1 ft. long; upper unopened fls. soft orange-red and the lower ones soft yellow.

19. **multiflòra,** Wood & Evans. Lvs. 3–6 ft. long, 1 in. broad in middle, long-acuminate, deeply channeled above, strongly keeled, with many strong nerves, margin serrulate, stiffish, bright green above and somewhat glaucous beneath: spike 2 ft. long, dense, cylindric and narrow (1½–2 in. diam.), on a stout peduncle as long as lvs. or shorter; fls. white or suffused with green (buds yellowish), numerous, erect, produced very late; perianth ⅔in. or less long, swollen at base, narrow-funnelform; segms. small and rounded, erect; filaments white, almost twice the length of the perianth. Natal, 5,000–6,000 ft. B.M. 7832. G.C. III. 45:196; 54:356. Gn. 77, p. 587.

DD. *Stamens exserted, not exceeding the length of the tube.*

20. **pauciflòra,** Baker. Lvs. few, linear and rigid, 1–1½ ft. long, margin thickened and smooth: raceme lax, 2–3 in. long, on a slender peduncle 1½–2 ft.; fls. pale yellow; perianth narrow-funnelform, ¾in. long; stamens shortly exserted. Eastern region. S Afr. B.M. 7269. G.C. III. 12:65; 39:101.

21. **pùmila,** Kunth (*Trítoma pùmila,* Ker-Gawl). Lvs. linear, to 2 ft., glaucous, sharply keeled, 10–12 veins either side of midrib: raceme very dense, 3–4 in. long, on a peduncle equaling the lvs.; fls. red, or yellow to red; perianth narrow-funnelform, to ¾in. long, suddenly dilated above base; segms. ovate and obtuse; stamens and style exserted to ⅓in. S. Afr. B.M. 764.

CC. *Shape of perianth nearly or quite cylindrical: fls. yellow or yellow-red.*

D. *Lvs. very narrow (½in. or less broad).*

22. **grácilis,** Harvey. Lvs. linear ⅙in. broad, 1½–2 ft. long, margin smooth, 5–6 veins either side the midrib: raceme dense, 2–3 in. long, on a peduncle as long as the lvs.; fls. pale yellow; perianth about ½in. long, with a very slender tube and dilated throat; segms. oblong; the longer stamens and the style exserted. Eastern region, S. Afr. R.B. 39:227.

23. **citrìna,** Baker. Lvs. many, linear, 1½–2 ft. long and ⅓in. to perhaps ½in. broad toward the base, acutely channelled down the face, slightly scabrous on the edge: raceme oblong, dense, 2–3 in. long, on a slender peduncle shorter than the lvs.; fls. pale yellow; perianth subcylindrical, about ¾in. long; segms. small and ovate; stamens and style much exserted. Coast region, S. Afr.

24. **rùfa,** Leicht. Small: lvs. few, linear, 12–18 in. long and ⅓in. broad toward base, firm and green, sharply keeled on back, tapering to a long point, margin smooth: raceme lax, 4–6 in. long, on a moderately stout peduncle as long as the lvs.; lower fls. primrose-yellow and upper ones tinged red, drooping; perianth cylindrical, ¾in. long; segms. orbicular, spreading; stamens and style at length exserted. Natal. B.M. 7706. G.M. 47:562.—Blooms early and for a long season; a good border plant.

DD. *Lvs. broader (¾–2 in., toward base).*

E. *Stamens short-exserted.*

25. **Túckii,** Baker. Lvs. ensiform, bright green, 1–1½ ft. long, ¾in. wide, margin serrate: raceme very dense, 5–6 in. long, on a peduncle shorter than the lvs.; fls. yellow, tinged bright red when young, deflexed; perianth subcylindrical, ⅝in. long; segms. short, ovate and obtuse; stamens shortly protruding. Central region, S. Afr.—One of the hardiest.

EE. *Stamens much or prominently exserted.*

26. **Tỳsonii,** Baker. In character, between *I. pumila* and *I. sarmentosa:* lvs. linear, 3–4 ft. long and at base ¾in. broad, tapering to a long point, sharply keeled: raceme very dense, 6 in. long, on a peduncle that equals the lvs.; fls. red-yellow; perianth cylindrical, ¾in. long; segms. nearly orbicular; stamens protruding to ⅓in. or less. Eastern region, S. Afr. Gn. 77, p. 538.

27. **foliòsa,** Hochst. (*K. Quartiniàna,* A. Rich.). Lvs. densely tufted, 2–3 ft. long and to 2 in. broad, ensiform, acuminate, sharply keeled: raceme dense, oblong, on a very stout peduncle equaling the lvs.; fls. yellow; perianth cylindrical, about ¾in. long; segms. small, ovate and obtuse; stamens much exserted. Transvaal. B.M. 6742.

K. elménsis, Hort. Garden hybrid (Sprenger, Naples) between K. pauciflora and K. rufa.—*K. erécta,* Hort. Remarkable hybrid: spike conical before anthesis, the buds spreading horizontally, but as the spike develops the fls., beginning with the lowermost, take an erect position, at the same time the axis of the spike elongating, finally all the fls. becoming erect: fls. brilliant orange-scarlet, fading from below upward, never expanding. G.C. III. 56:410.—*K. excélsa,* Hort. Garden hybrid, parentage not recorded: remarkable for enormous size and almost campanulate fls.—*K. Goldélse* Hort. Seedling from K. Nelsonii and K. pauciflora: fls. pure yellow. G. 32:29.—*K. hýbrida,* Hort., is a trade name used to include varieties with personal names, of miscellaneous or unknown paren tage. The new "everblooming" poker-plants are likely to be listed under this name.—*K. Pfitzerii*, Hort. (K. grandiflora multiflora, Hort.). Described as in bloom from Aug. to Oct., with spikes standing 3–4 ft. high, the fls. rich orange-scarlet.—*K. ruvària*, Hort. Garden hybrid between K. rufa and K. Uvaria (Sprenger, Naples).—*K. sulphùrea*, Hort. Free-flowering, sulfur-yellow.—*K. trícolor*, Hort. Small-fld.; buds opening cochineal-red, changing to canary-yellow and then to sulfur-white.—*K. vomerénsis*, Hort. Garden hybrid (Sprenger, Naples) between K. pauciflora and K. rufa.—*K. Woòdii*, Campbell. Resembles K. modesta, but is stouter and there are a few spines on the lvs.: peduncle 3½ ft., the raceme 9 in. long; fls. ½in. long, pale cream-color. S. Afr.

Wilhelm Miller.
L. H. B.†

KNOWLTÒNIA (Thos. Knowlton, 1692–1781, curator of the botanic garden at Eltham, England). *Ranunculàceæ.* By some referred to Anemone, but differs in having 5 sepals and numerous petals, and the carpels soft and fleshy: species 8 or so in S. Afr., sometimes mentioned as half-hardy or as greenhouse subjects, but apparently not in the trade. Stemless perennial herbs, with large ternately decompound rigid radical lvs., no involucre, numerous 1-seeded carpels which become thick and juicy at maturity, and greenish or yellowish fls. on branching cymose or umbellate scapes. *K. vesicatòria*, Sims, with lvs. 1 ft. or more across, green fls. and blackish purple berries: lf.-segms. nearly entire or only serrulate: ovaries as long as the subulate style. B.M. 775. B.R. 936. *K. rígida*, Salisb., with lvs. rather smaller, segms. sharply serrate, and ovaries shorter than the subulate style: variable. H.F. II. 7:72.

L. H. B.

KOA. A species of Acacia (*A. koa*, page 186), from the wood of which the Hawaiians make their beautiful highly polished "calabashes."

KÒCHIA (after W. D. J. Koch, 1771–1849, professor of botany at Erlangen; wrote a flora of Germany and Switzerland). *Chenopodiàceæ.* Summer Cypress. Mock Cypress. This includes two hardy annuals, called the "mock cypress" or "summer cypress," grown for the compact habit and the herbage which is green in summer and turns red in autumn.

2041. Kochia trichophylla; often grows in a more ovoid form.

Kochia is a polymorphous genus of herbs which are often woody at the base: lvs. often minute and narrow, alternate, more or less silky, rarely glabrous: fls. small or minute, sessile, solitary or clustered in the axils of the lvs.; calyx enlarging into a flask-shaped body, which incloses the fr.; perianth orbicular; lobes 5, incurved and bearing horizontal wings on the back or on the tube which are membranous or scarious, distinct or confluent; stamens 5; filaments short or long and compressed; stigmas 2, rarely 3.—Species 30–40, of which one is native in the W. U. S. and the others in the Old World and Austral.

The seed may be sown indoors in April, and the plants set out in May, or the seeds may be sown in the open ground about May 1. The plants should stand about 2 to 3 feet apart.

scopària, Schrad. Belvedere. Annual, erect, 3–5 ft., much-branched, more or less pyramidal: branches striate, slender, and close to the main st.: lvs. linear-lanceolate, 2–3 in. long, 2–4 lines wide: fls. inconspicuous, green, in elongated clusters; perianth in fr. provided with very short, triangular, pointed appendages. Cent. Eu.—A plant sometimes grown in gardens for its fastigiate or pyramidal form; used sometimes for brooms. Probably not now grown to any extent in American gardens.

trichophýlla, Stapf. Fig. 2041. The common summer cypress of gardens, although frequently grown under the name of *K. scoparia*, but differing in its ovoid, conical or nearly globular rather than narrow and fastigiate form, by its purple-red color in autumn, and other characters: annual, very much branching, 3–5 ft., making a very compact ovoid object, remarkable for the natural regularity in different plants: lvs. very abundant, alternate, straight, long and linear (2–3½ in. long), sharp-pointed, bright green, puberulent and with long white hairs on the margins near the base: infl. in few-fld. glomerules; fls. polygamous, those on the lateral branches most numerous and female, those at the summit of the principal branches perfect: foliage delicate green, becoming deep red-bronze in autumn. China, probably. R.H. 1907, p. 119. J.H. III. 66:495.—Very useful when formal regular effects are desired, and for its pronounced color in autumn, keeping its shape when most other garden vegetation is destroyed by frost. It is of the easiest cult. This species has been recognized and has come into prominence within the past ten or twelve years.

L. H. B.

KOELÈRIA (G. L. Koeler, professor at Mainz, an early writer on grasses). *Gramineæ.* Tufted perennials, with slender sts.: spikelets 2–4-fld. in dense spike-like panicles.—Species about 12, in temperate regions of both hemispheres; of little horticultural value.

cristàta, Pers. Culms 1–1½ ft., puberulent below the panicles: lvs. fine, mostly basal. Dept. Agric., Div. Agrost. 20:136. Prairies, N. Amer.—Sometimes cult. for lawn decoration in open dry ground.

A. S. Hitchcock.

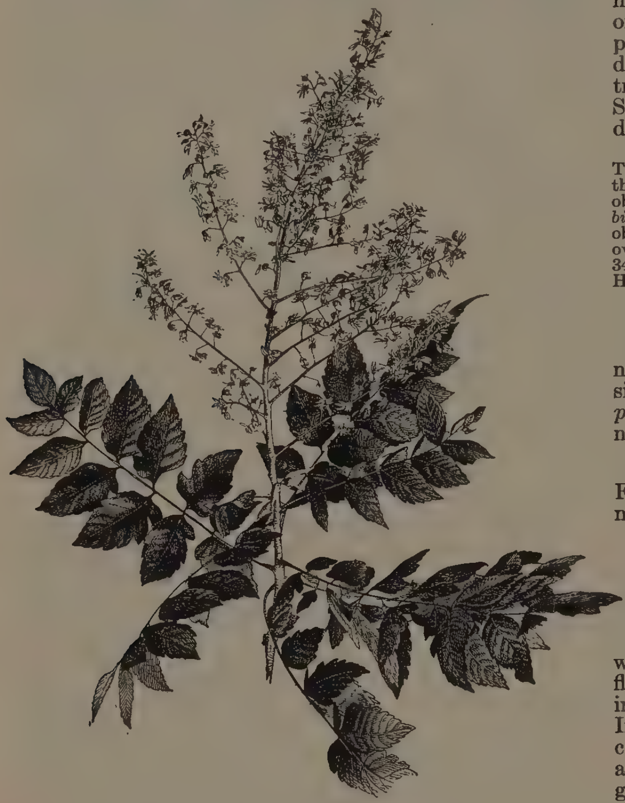
KOÈLLIA: *Pycnanthemum.*

KOELLIKÈRIA (Professor Koelliker, German botanist). *Gesneriàceæ.* One species, a small herbaceous warmhouse plant, **K. argyrostígma,** Regel, Cent. Amer. to Peru, offered abroad: in the way of achimenes, but fls. smaller in leafless racemes, the corolla-limb distinctly 2-lipped: rhizomatous or the root, creeping: lvs. opposite, soft-pubescent, elliptical and nearly or quite obtuse, velvety green and marked with white dots: fls. white or cream-color, red-spotted, in racemes standing 12 in. high; calyx-tube obovoid, the lobes 5 and narrow; corolla-tube short, broad and decurved; upper lip 2-parted and nearly erect; lower lip larger, 3-parted, spreading; stamens attached in base of corolla, somewhat exserted; style filiform, the stigma becoming 2-lobed: caps. 2-valved. B.M. 4175 (as *Achimenes argyrostigma*).—Requires treatment probably of achimenes; prop. by division.

L. H. B.

KOELREUTÈRIA (Joseph G. Koelreuter, 1733–1806, professor of natural history at Karlsruhe). *Sapindàceæ.* Ornamental trees, grown for their large panicles of yellow flowers and the handsome compound foliage.

Deciduous: winter-buds small, with 2 outer scales: lvs. alternate, petioled, estipulate, pinnate or bipinnate, with serrate lfts.: fls. in large terminal panicles, yellow, symmetrical; calyx deeply divided into 5 unequal lobes; petals 4, turned upward, lanceolate, clawed, the blade cordate at the base with 2 upturned appendages; disk crenate at the upper margins; stamens 8, sometimes less, with long filaments; ovary superior, 3-celled, style 3-fid at the apex, shorter than stamens: fr. a bladdery, loculicid caps., with papery walls; seeds usually 1 in each cell, roundish, black.—Five species in China and Japan.



2042. Koelreuteria paniculata. (×⅙)

The koelreuterias are medium-sized rather sparingly branched round-headed trees with light green pinnately divided leaves and small yellow flowers in large terminal panicles appearing in summer and followed by conspicuous bladder-like pods. *K. paniculata* is hardy as far north as Massachusetts, though occasionally killed back in severe winters; as a rule it is a short-lived tree. The other species are more tender. They are not particular as to the soil and prefer sunny positions. Propagation is by seeds, which are usually freely produced and sown in autumn or stratified, also by root-cuttings.

paniculàta, Laxm. (*Sapíndus chinénsis*, Linn.). Figs. 2042–2044. Tree, to 30 ft.: lvs. pinnate or sometimes bipinnate, to 14 in. long; lfts. 7–15, ovate to oblong-ovate, coarsely and irregularly crenate-serrate, at the base often incisely lobed, glabrous above, pubescent on the veins below or nearly glabrous, 1–3½ in. long: fls. yellow, ½in. long, in broad panicles to 18 in. long; filaments hairy: caps. ovate-oblong, gradually narrowed into the pointed apex, 1½–2 in. long. July, Aug.; fr. in Sept. China, Korea, Japan. I.T. 4:147. G.C. III. 2:561. B.R. 330. Gng. 2:353; 8:219. Gn. 32, p. 378. J.H.S. 27, p. 875. G.W. 5, p. 81; 9, p. 9; 13, p. 529.—It is often cult. in the Cent. W., Kans., Mo., and southward, as an ornamental tree, as it stands drought and hot winds well. It is there popularly known as "pride of India" or "China tree," but the first name belongs properly to *Melia Azedarach* and the second to Sapindus; it is also sometimes called "varnish tree," but the true varnish tree is *Rhus verniciflua.*—*K. japónica*, Sieb., is scarcely different; it is said to differ in its more deeply serrate lvs. and smaller fr.

K. apiculàta, Rehd. & Wilson. Closely allied to K. paniculata. Tree, to 35 ft.: lvs. bipinnate, the pinnæ pinnatifid or pinnate at the base, incisely lobed and serrate toward the apex: fr. ovate-oblong, rounded at the apex and apiculate. Cent. China.—*K. bipinnàta*, Franch. Tree, to 60 ft.: lvs. bipinnate with ovate to oblong nearly equally serrate lfts. 1½–4 in. long: fr. globose-ovoid, rounded at the apex. W. China. R.H. 1888, p. 393. Gn. 34, p. 305.—*K. Hénryi*, Dümmer, from Formosa and *K. mìnor*, Hemsl., from S. E. China, are not in cult.

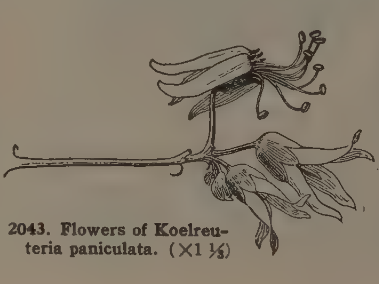
ALFRED REHDER.

KŒNIGA: *Koniga.*

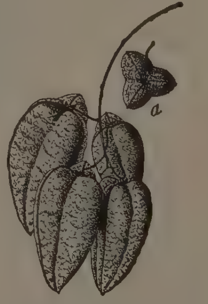
KOHLÈRIA (named for J. M. Kohler, teacher of natural history, Zurich). *Isoloma*, which see for discussion. *K. bogoténse*, Fritsch=*I. bogotense*, Nichols. *K. pícta*, Hanst.=*I. picta*, Planch. (*Gesneria picta*, Hook., not *Achimines picta*, Benth.).

KOHLRABI (*Brassica oleracea* var. *Caulo-Rapa*). Fig. 2045. As the Latin name indicates, this plant is a member of the cabbage group. This group is interesting from a horticultural standpoint because of the great variety in the parts developed to a condition suitable for human food. The kohlrabi is one of the most peculiar of the lot. It is like a turnip produced on a cabbage root, if that were possible. The flesh of the thickened stem resembles that of a turnip, but when well grown it is more delicate, both in texture and flavor. This interesting plant is deserving of a place in every home-garden as well as in the market-garden. In quality it is superior to all other members of the cabbage group save cauliflower. Kohlrabi is naturally a cool-weather plant. To have it at its best it should be grown during the cool days of either spring or autumn and gathered while still young and tender. The soil for kohlrabi should be a rich loam, well drained so as to be available for early planting. Plants may be started in a hotbed and transplanted to the open the same as early cabbage, or the seed may be sown in the open as soon as the season is far enough advanced to sow radish or cabbage seed safely. The rows should be from 15 to 30 inches apart and the young plants planted or thinned to stand 6 to 8 inches apart in the row. The cultivation that would be given early beets will suffice for the plant. The early, quick-maturing sorts should be chosen for table use. The plants should be harvested as soon as the edible portion can be induced to develop to the size of a baseball. If conditions are such as to retard or delay growth, the product is apt to be tough and strong. Quick growth means quality in this plant.

To prepare kohlrabi for market, cut the stem just above the



2043. Flowers of Koelreuteria paniculata. (×1⅙)



2044. Pods of Koelreuteria paniculata. *a*, end view. (×⅙) surface of the ground and tie three to five plants together by their leaves to form a bunch. To prepare it for the table it should be peeled and cut into dice about ½inch square and cooked the same as cauliflower. Vilmorin says that some of the large, coarse varieties are grown in Europe for stock feed. It is doubtful whether it will ever find favor in this country for this purpose for the reason that in most localities turnips, cabbage, or marrow kale will outyield it.

L. C. Corbett.

KOLKWÍTZIA (after Richard Kolkwitz, professor of botany, Berlin). *Caprifoliàceæ.* A shrub allied to Abelia, but differing in the fls. being arranged in pairs at unequal height, one above the other, in the sepals not enlarging after flowering and in the numerous ovules. Only 1 species in Cent. China, recently intro.; it has proved hardy at the Arnold Arboretum, but has not yet flowered. Prop. is by greenwood cuttings in late summer. **K. amábilis,** Graebn. Small deciduous shrub with slender, hairy branches: lvs. ovate, acute or acuminate, rounded at the base, denticulate or nearly entire, sparingly hairy above, more densely hairy below, 1–1¾ in. long: fls. in axillary slender-peduncled pairs, forming short panicles at the end of short branchlets; sepals linear; corolla tubular-campanulate, white, flushed with pink, puberulous, ½in. long; stamens 4, included: fr. a usually 1-seeded ribbed achene, crowned by the persistent stipitate calyx, in pairs. H.I. 30:2937. B.M. 8563.

Alfred Rehder.

KÒNIGA (Charles Konig, of the British Museum early in last century). Sometimes written *Kœniga. Cruciferæ.* A genus established in 1826 by Robert Brown, but now included in Alyssum. Trade-lists still contain *Koniga maritima,* R. Br., which is *Alyssum maritimum;* and *K. variegata* of lists is the variegated form of *A. maritimum. K. spinosa,* Spach =*Alyssum spinosum.*

KÓPSIA (Jan Kops, Dutch botanist, 1765–1849). *Apocynàceæ.* A few trees or shrubs (upward of a dozen species), somewhat allied to oleander, grown in warmhouses and also offered (species not given) in S. Fla. Lvs. opposite, very short-petioled: fls. white or pink, in terminal cymes; calyx 5-parted, the segms. with glandular tips; corolla salverform with a very slender tube and a hairy throat; stamens inserted near the top of the tube, not protruding; disk of 2 glands: fr. 2 carpels; 1-celled, coriaceous or fleshy. India and Malaysia to the Philippines. *K. fruticòsa,* A. DC. Large evergreen shrub, with lvs. 4–8 in. long, elliptic or elliptic-lanceolate: fls. pink, the tube 1½ in. long and limb 1–2 in. across. *K. ornàta,* Hort., shrub from Malaya, with large oblong-lanceolate glossy lvs., and white red-centered salverform fls. in corymbose panicles; apparently not botanically described under this name.

L. H. B.

KOROLKÒWIA: *Fritillaria. K. Sewerzowi,* Regel and *K. discolor,* Hort.=*F. Sewerzowi.*

KORTHÁLSIA (Peter W. Korthals, a German botanist). *Palmàceæ,* tribe *Lepidocàryeæ.* Feather-leaved palms from farther India to Borneo and New Guinea, little grown in warmhouses. Climbing and usually spiny plants with pinnatisect lvs., the lfts. mostly more or less cuneate or trapezoid and erose: fls. perfect, crowded in cylindric and catkin-like spikes; sepals orbicular or oblong, and petals ovate or lanceolate; stamens and staminodia 6 or more: fr. 1-seeded, nearly globular or ovoid: spadix axillary and loosely branched, pendulous, in sheathing tubular presistent spathes: some of the ligules of the petiole-sheath harbor ants.—About 20 species, imperfectly understood. One species is offered abroad. **K. robústa,** Blume (*K. Jùnghuhnii,* Miq.), from Java. Petiole 1 ft. long, not armed; lfts. 7–9, rhomboidal, more or less attenuated below into a stalk-like base, sharp-pointed at apex, 8–16 in. long; rachis backwardly or retrorsely hooked or armed; end of lf. terminating in a hook-like process. Java.

L. H. B.

KOSTELÉTZKYA (named for V. F. Kosteletzky, professor of medicinal botany at Prague, and author of several books). *Malvàceæ.* Perennial herbs or shrubs closely related to Hibiscus, 6 species of which are found in Amer., 1 in. Abyssinia and 1 from W. and Cent. Italy through S. Russia to Persia. Lvs. sagittate, lobed: fls. solitary or clustered in the axils of the lvs., often in terminal panicles or racemes, pink, purple or white; bractlets 7–10, often very small or obsolete; staminal column entire or 5-toothed; ovary 5-celled with 1 ovule in each cell: caps. depressed, dehiscing loculicidally along the 5 projecting angles. **K. pentacárpa,** Ledeb., is the only European species and has been described in horticultural literature abroad. An erect plant, about 3 ft. high: lvs. cordate, toothed: fls. purple-red, rather large, borne singly on peduncles a little shorter than the lvs. **K. virgínica,** Presl. Foliage pubescent, often scabrous: sts. 1–4 ft. high, branching: panicles leafy; calyx canescent; petals pink or purple: caps. hirsute at maturity. Marshes along the coast, N. Y. to Fla. and La.

2045. Kohlrabi.

KRAMÈRIA (John George Henry Kramer, of Hungary in the early part of the 18th century). *Leguminòsæ;* by some referred to *Polygalàceæ.* Woody plants, or perennial herbs, of minor horticultural value, sometimes grown in the warmhouse, from Trop. Amer., upward of a dozen species. Silky-tomentose: lvs. alternate, small, entire or of 3 lfts.: racemes terminal, carrying red or purplish fls.; sepals 4 or 5, about equal; petals 5, very unequal in sets of 3 and 2, the former long-clawed and connate or rarely free, the 2 orbicular and very much shorter; stamens 4, connate part way, the anthers opening by a pore: fr. 1-seeded, coriaceous and indehiscent. *K. triándra,* Ruiz & Pav., of Peru, is probably the most important species horticulturally: small shrub: lvs. alternate or scattered, close together, elliptic or obovate, apiculate, hairy: fls. bright scarlet. This and other species supply the rhatany root of apothecaries.

L. H. B.

KRAÙSSIA: *Tricalysia.*

KRÍGIA (David Krig or Krieg, an early collector in Maryland and Delaware). Syn. *Adopògon,* Neck. *Compósitæ.* Hardy herbaceous plants, annual and perennial, yellow-flowered and sometimes called "dwarf dandelions."

Scapose or leafy-stemmed herbs with heads about 1 in. across, usually yellow, and 15–20 pappus bristles. They differ from the common dandelion in having a pappus composed of both chaff and bristles, instead of bristles alone.—Five species natives of the Atlantic and Gulf states westward, of which three perennial species are cult. by dealers in native plants. Unlike the common dandelion these plants do not become weedy. In the southern states there are two annual species, *K. occidentalis*, Nutt. (*Cymbia occidentalis*, Stand.), and *K. virginica*, Willd. (*K. caroliniana*, Nutt.).

A. *St. a leafless scape, bearing 1 head.*

B. *Plant a tuberous perennial.*

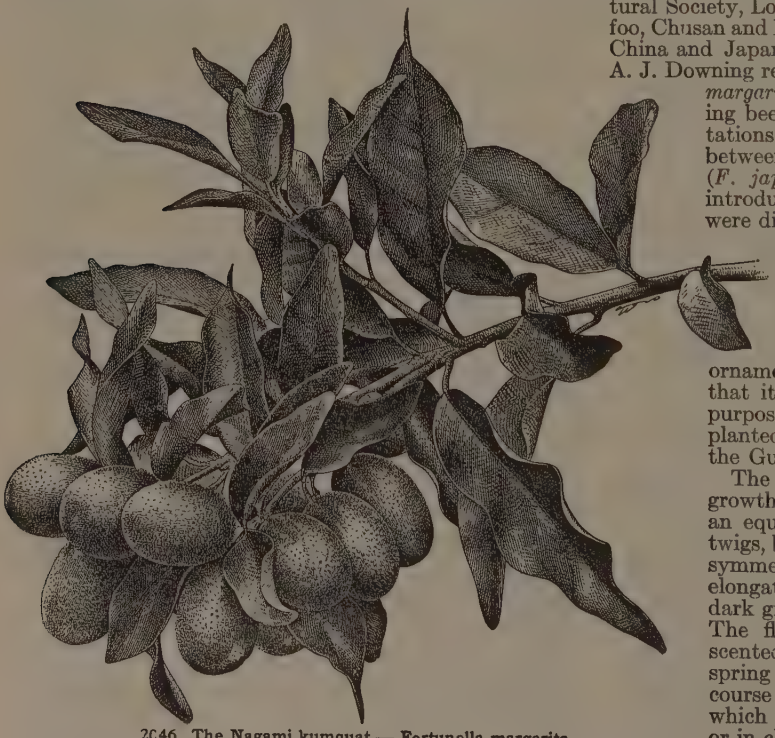
Dandèlion, Nutt. Height 6–18 in., glabrous and bluish green: lvs. lanceolate or almost linear, varying from minutely toothed to pinnatifid: head about 1 in. diam., solitary, the rays yellow. April–June. Moist ground, Md. to Fla. and Texas.—The only kind that has tubers.

BB. *Plant has no tubers, but perennial.*

montàna, Nutt. (*K. Dandèlion* var. *montàna*, Chapm.). Height 9–12 in.: lvs. oblong to linear, varying from entire to pinnatifid: head smaller than in *K. Dandelion*. Crevices of rocks, Alleghenies, N. C. and S. C. and Ga.—Harlan P. Kelsey says that this is an admirable rock-plant, thriving in any soil or situation, and blooming profusely from March to June or July. Prop. by seed or division.

AA. *St. 1–3-lvd., branched above, bearing 2–6 heads.*

amplexicaùlis, Nutt. (*Cýnthia virgínica*, Willd.). Perennial, the st. 1-lvd. and 12–24 in. in height: lvs. oblong or oval, obtuse, entire or repand and denticulate, or the root-lvs. somewhat lyrate; st.-lvs. partly clasping: heads about 2 in. diam., the rays showy, orange-yellow. May–Oct. Moist banks, Ont. to Ga., west to Manitoba.
N. TAYLOR.†



2046. The Nagami kumquat.— Fortunella margarita.

KRYNÍTZKIA (Prof. J. Krynitzki, of Cracow). *Boragináceæ*. Annual and some perennial herbs, with small flowers nearly always white, two of which have been listed for wild-gardens and borders.

Closely allied to Eritrichium, with which the genus has been united; by other writers the genus is broken up in Allocarya, Cryptanthe and Oreocarya. As defined by Gray, the characters are founded mostly on technical features of the nutlet. The species are mostly natives of the W. U. S., and of small promise horticulturally, being usually coarse herbs.

glomeràta, Gray (*Eritríchium glomeràtum*, DC.). Biennial, coarse, grayish prickly-hirsute, 1–3 ft. high: lvs. spatulate or linear-spatulate: fls. white, thyrsoid-glomerate. Plains, along eastern base of Rocky Mts. and to Wash.

barbígera, Gray (*Eritríchium barbígerum*, Gray). Hispid and hirsute, 9–12 in. high: lvs. linear: fls. white, in solitary or panicled, elongating spikes. S. Calif., Ariz., Nev. to Ore.
L. H. B.

KÙHNIA (Dr. Adam Kuhn, an early botanist of Philadelphia). *Compósitæ*. American herbs, closely allied to Eupatorium, seldom planted in the wild garden or border. Perennials, with mostly alternate resinous-dotted lvs., and small whitish or purplish heads in late summer and autumn. From Eupatorium, Kuhnia differs in having 10-angled or -costate achenes rather than 5-costate. Species perhaps 4 or 5, Atlantic U. S. to Texas and Mex. *E. eupatorioìdes*, Linn., is the species most likely to appear in cult. grounds: 2–3 ft., erect: lvs. ovate-lanceolate to oblong-lanceolate or linear, the uppermost usually entire but others usually few-toothed and sometimes short-petioled: heads of white fls. cymose-clustered. Dry places, N. J. to Dak. and S.; very variable.
L. H. B.

KUMQUAT or KINKAN. Fig. 2046. A group of dwarf evergreen citrous fruits of the genus Fortunella but formerly referred to Citrus, introduced into England by Robert Fortune, collector for the Royal Horticultural Society, London, from the provinces of Foo-chow-foo, Chusan and Ningpo, China, May 6, 1846. In both China and Japan the kumquat is grown extensively. A. J. Downing reports the variety Nagami (*Fortunella margarita*) as being in America in 1850, having been brought from England, and importations from Japan by Florida nurserymen between 1885 and 1890 included the Marumi (*F. japonica*) variety. Shortly after their introduction into America, both varieties were distributed throughout the Gulf coast and California citrous regions and soon attracted attention for their ornamental value. Later the variety Neiwa (*F. crassifolia*) was introduced but is not yet commonly known. While the kumquat was first regarded as an ornamental in America, it was soon realized that its fruit is valuable for many culinary purposes. In consequence it has been largely planted in many sections, particularly along the Gulf of Mexico.

The kumquats are distinctly shrubby in growth, reaching a height of 10 to 15 feet and an equal distance across the branches. The twigs, branches and leaves make a very dense symmetrical head. The leaves are narrow, elongated, pointed or rounded at the apex, dark green. Thorns are absent or very small. The flowers are small, white and sweet-scented. The first blooms produced in early spring are usually without pistils and of course no fruit results. Later the flowers from which the fruit is produced are borne singly or in clusters of three or four on shoots that arise from the first growth in spring. There may be one or two successive crops of bloom and settings of fruit. The ripening of the fruit is therefore usually prolonged over a period of several weeks or even months. The fruit is small, either oval or round, orange in color, and borne freely.

The kumquats are among the most hardy of the citrous fruits. In dormant condition they have withstood temperatures as low as 15° F. in the latitude of north Florida without injury, and they have been fruited in the open ground as far north as Augusta, Georgia.

While the kumquat may be budded on any of the stocks commonly used for other citrous fruits, most of them are grown on *Poncirus* (or *Citrus*) *trifoliata*, rough lemon, and sweet orange stocks. When soil and moisture conditions are suitable, *Poncirus trifoliata* is given the preference. It is a very hardy stock and well adapted to the kumquat. For pot culture, when both soil and moisture are under control, it is the best stock to use. The ordinary shield method of budding is used, and the young plants, being of shrubby growth do not require any special training such as must be given other citrous trees.

In orchard planting, the kumquats are usually placed 10 by 10 feet up to 15 by 15 feet apart. Sometimes they are grown in hedges, the plants being set 6 feet apart in the rows and the rows 15 feet apart. The same tillage and fertilizing are required as for other citrous fruits. Plant-food must be available in liberal amounts to keep the fruits up to size, and fertilizers should be applied in goodly amounts in late winter to produce a strong growth in the first spring shoots.

In the matter of pruning, kumquats are very much benefited by rather severe cutting back of the twigs of the previous season's growth in the winter months. Since the fruit is usually gathered with twigs attached, the necessary pruning is given when the crop is harvested, but if the crop is light, additional pruning will be necessary and should be directed toward thinning out the shoots as well as cutting them back. Liberal pruning well in advance of the starting of growth increases both the size and quantity of fruit.

Varieties.

Up to this time three varieties have been introduced into America, as already noted. A fourth variety, Omi, is listed in Japanese catalogues, and there are doubtless still other forms in China and Japan.

Nagami.—Oblong fruit 1¼ to 1¾ inches long, deep orange in color; juice acid; rind sweet, spicy; seeds two to five; season October and through the winter. Usually begins to ripen two or three weeks later than Marumi.

Neiwa.—Fruit 1¼ to 1¾ inches in diameter, round, orange-yellow; juice subacid; rind sweet; season earlier than Nagami; prolific. A recent introduction.

Marumi.—Round; fruit 1 to 1¼ inches in diameter, round, irregular in size; deep orange in color; juice acid; rind sweet and spicy; seeds one to three; season October and through the winter. The earliest variety to ripen.

Nagami is usually considered the most desirable variety, as it is more robust in growth and produces fruit of uniform size. Marumi is very prone to produce fruit that is small and very irregular in size. Nagami is thornless, while Marumi has very short, sharp, slender thorns. As a pot-plant, Marumi is valuable because of its very compact symmetrical growth.

Uses.

Well-grown kumquat plants make handsome ornamentals,—the combination of dark green foliage and small golden fruit being very pleasing. They may be used for hedges, planted singly or in groups.

Large quantities of fruit are shipped for the holiday trade. In gathering the fruit, it is clipped from the plants with leaves and twigs attached and packed in strawberry baskets. There is also a good demand for large sprays of fruit and leaves for decorative purposes.

When eaten raw, well-ripened kumquats have a very agreeable combination of flavors. The outer rind is spicy, the white inner rind is sweet and granular, while the juice is acid.

2047. The round kumquat.—Fortunella japonica. (×½)

The fruit is coming into very general use for the making of marmalade, jelly, preserved and crystallized fruit. Marmalade made from kumquats is esteemed by many above the product made from other citrous fruits.

H. Harold Hume.

KÚNZEA (Gustav Kunze, 1793–1851, German botanist). *Myrtàceæ.* Australian shrubs, sometimes grown in cool or temperate houses: often heath-like, the small entire lvs. mostly alternate: fls. small with extending stamens, in the upper axils or in terminal heads or in a spike below the end of the branch; calyx with 5 small lobes; petals 5, spreading, small; stamens many, free or in series, the filaments filiform; ovary 2–5-celled, 2 to many ovules in each cell. The species are 15–20, allied to Callistemon, Leptospermum, and formerly included in Metrosideros. The cult. requirements of Callistemon (p. 630) will probably suit them. *K. pomífera*, F. Muell., has been mentioned as a fruit-plant (G.C. III. 5:201; copied in A.G. 1889: 127), Mueller saying that it is one of the few really valuable fruit-plants indigenous at the south coast of Austral. "The fruits are of a peculiar acidulous aromatic taste, and very extensively collected by people settled on the coast for the purpose of jam-making." It is described by Bentham as a rigid prostrate shrub: lvs. ovate, varying from nearly orbicular and almost cordate to narrow and acute-based, mostly less than

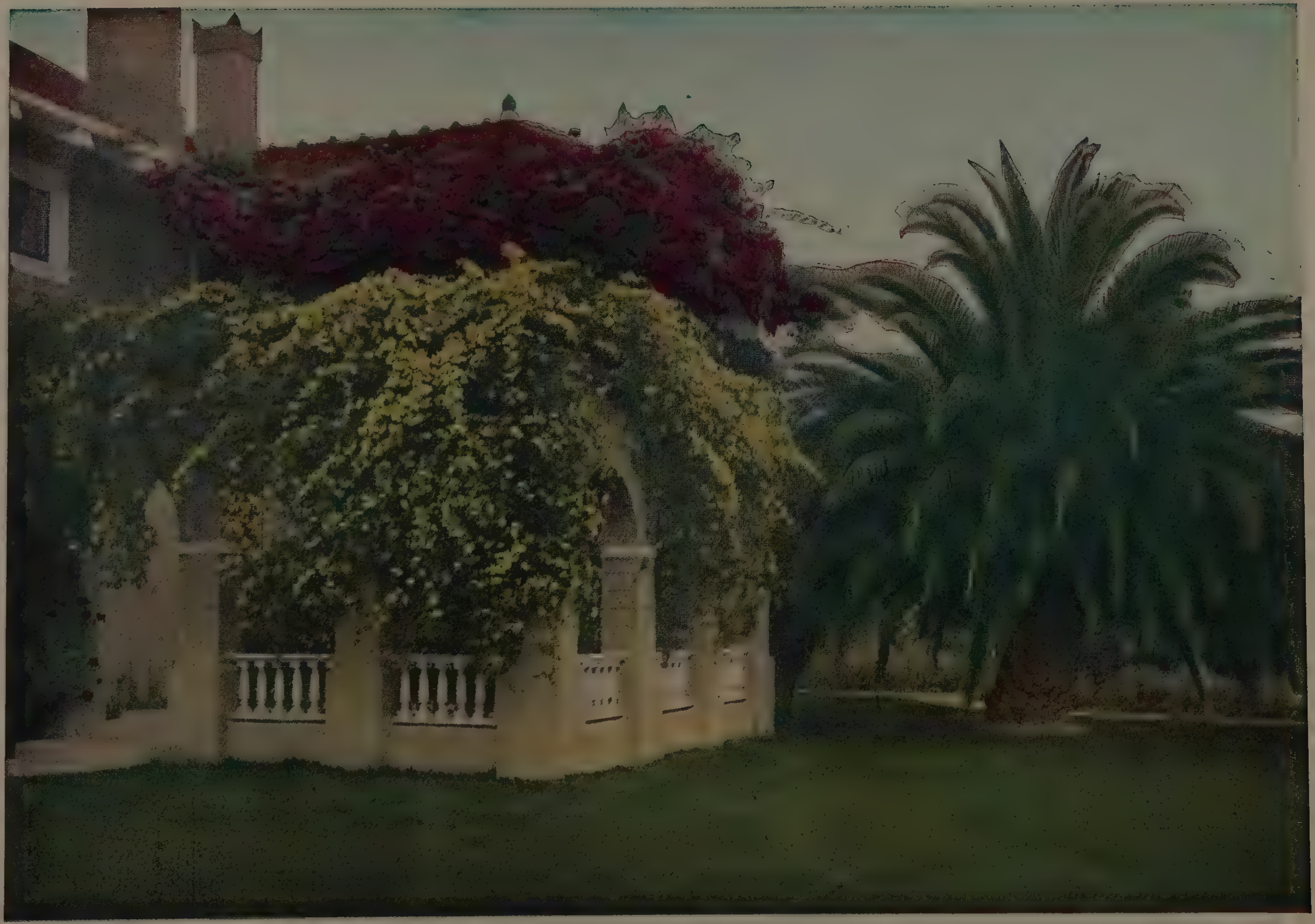
⅓in. long: fls. white or yellowish, sessile and not numerous but yet forming dense terminal heads becoming lateral by elongation of the branch; stamens numerous, 3 or 4 times as long as the small petals: berry blue, ⅓in. or less diam., crowned by the calyx-lobes. Victoria and S. Austral. L. H. B.

KÝDIA (Col. Robert Kyd, founder of the Calcutta Botanic Garden, died 1794). *Malvàceæ.* Oriental trees, one of which has been cultivated in southern Florida and southern California.

Plants with stellate pubescence: lvs. entire or lobed, palmi-nerved: fls. polygamous, in panicles, white or pink, ornamental; sepals 5, joined at the base, subtended by 4–6 leafy bracts which enlarge in fr.; petals 5, exceeding the calyx and joined to the stamen-tube; staminal tube divided about the middle into 5 divisions, each bearing 3 anthers, which are imperfect in the pistillate fls.: fr. a 3-valved caps.—Two or three species in India.

calycìna, Roxbg. Tree, attaining 25 ft.: lvs. 4–5 in. long, 3 in. wide, rounded, cordate, palmately 7-nerved, more or less lobed, midlobe longest, close-felted beneath: infl. much-branched, many-fld.; fls. white or pink, with oblong-spatulate bracts beneath. Trop. India.—Indicated as a stove evergreen abroad. It is doubtful whether the plant is still cult. to any extent. L. H. B.

KYLLÍNGA (Peder Kylling, Danish botanist, died 1696). *Cyperàceæ.* Annual and perennial herbs, of little value horticulturally although one species is sometimes mentioned in gardening literature. Grass-like or sedge-like plants of perhaps 30 species in many parts of the world, with very small fls. in spikelets which are aggregated into spikes or heads. *K. monocéphala*, Rottb., is nearly glabrous with a creeping rhizome: lvs. drooping or arched, in a graceful tuft: culms. 3-angled: spikes terminal, ovoid or cone-shaped, silky, white, the subtending lvs. 3 and spreading-deflexed. India and other warm regions of the Old World, where it is common. This species is recommended for greenhouse work, where, in 4-in. pots, it makes decorative specimens 1 ft. high, requiring a warm greenhouse temperature. G. 2:298; 25:173. Apparently not offered in this country. L. H. B.



LXI. Landscape in southern California.—Bougainvillea above; Banksian rose in yellow; Phœnix canariensis.

L

LABELS. There are two reasons for using labels,—to display the names of plants in public plantations for the information of visitors, and to enable the gardener to preserve the name of the plant for his own use. In the former use, the label should be prominent, as permanent as possible, and attractive or at least not obnoxious in itself. In the latter case, the label may be only a tag or tally, and it is often of temporary use.

The characters demanded in a good plant-label in general are legibility, convenience, durability and a reasonable cheapness. The purposes for which labels are needed by the horticulturist may be grouped as follows: (1) For pots, boxes, frames and benches; (2) for stock in storage or transit; (3) for rows, plots or beds in garden, nursery, orchard; (4) for individual trees, shrubs and plants.

Of the materials that may be used for gardeners' labels, wood holds the first place, and the soft, easily worked nature of white pine makes this the favorite species, although other more durable woods, such as cedar, spruce, cypress and mulberry, are used to some extent. Machine-made ready painted wooden labels of convenient shapes and sizes, from 4 to 12 inches in length (see No. 1, Fig. 2049), are carried in all stocks of gardeners' supplies, and are in common use in all work with plants in pots, boxes and benches, and to some extent in out-of-door gardening, but these should not be trusted where the label is expected to endure for a considerable time. In the storage of grafts and cuttings in pits or cellars, two of these labels should be written and slipped together under the tie, the outer one for immediate reference and the under and protected one for security when the other becomes defaced.

2048. A stamped aluminum label, with raised letters.

Notched or perforated labels (Nos. 2, 3, Fig. 2049), with or without wires, are also prepared for nurserymen's use, those strung with soft copper wire being the best. These are used in the shipping of nearly all trees and shrubs, and here great annoyance would be saved if all names were written distinctly and with a heavy impression. If such labels are used on stock after planting, the grower should use great care that stems and branches are not choked by the wire. The printing of any desired names may be procured on order, effecting a great saving of time and a gain in distinctness.

For marking rows, plots, and beds, stakes should be used large enough readily to attract attention and not be broken over or moved in cultivation. A very serviceable stake for nurseries, trial grounds and gardens is made by cutting 2-inch pine or cypress plank 2½ inches wide and 2 feet long, pointing and giving two good coats of paint. Inscriptions may be stenciled on these as suggested in No. 4, Fig. 2049, written with a heavy pencil, or better, where names, dates and list or plot numbers are wanted, written on a square of sheet zinc and fastened to the face of the stake with small nails. (No. 5, Fig. 2049). An annual coat of paint obliterates old lettering and preserves the wood.

A common wooden label for borders, groups or specimen plants is shown by No. 6 and a variation by No. 7 (Fig. 2049). The stakes should be of some durable wood, and the whole well painted. A paint of pure lampblack and oil is the most indestructible and letters will stand out like type after the lead paint and the very wood surface have weathered away. An effective contrast is obtained by painting the face of the label black and placing the lettering in white.

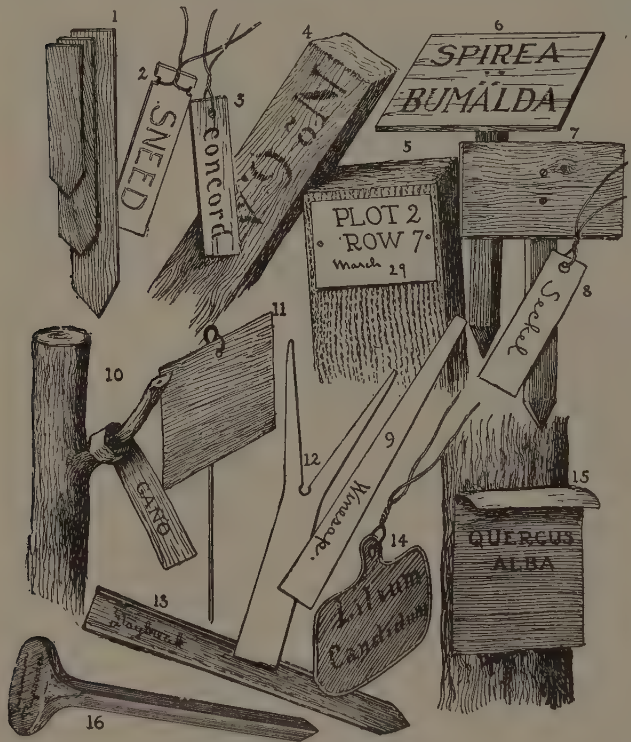
For display labels on trees and posts in parks and experiment stations, sheet aluminum is now used, with the name stamped in raised letters by a machine or by hand dies (Fig. 2048). Such labels are durable, are not injured by sprays, keep clean, and are cheap in first cost if the number to be made is enough to warrant the purchase of an equipment. We must now provide for labels that withstand spraying compounds.

Of the sheet metals, zinc has heretofore proved superior to other materials. It may be stamped with steel letter dies or written upon with a common lead pencil, but more commonly a chemical ink is used. The common formula for this in horticultural books is substantially that prepared by the French chemist, Brainnot, in 1837, and is as follows: Two parts by weight of verdigris (acetate of copper), two of sal ammoniac (ammonium chloride), one part of lampblack and thirty parts of soft water. The chemicals should be incorporated with a little of the water, and the remainder added. Keep in a glass bottle tightly corked and shake frequently while using, as the lampblack tends to separate. The zinc, cut in the desired forms, should be prepared by scouring slightly with emery dust or fine sandpaper. The ink may be applied with a quill or coarse steel pen, but a fresh one will be needed with each batch of labels. Inks of an aqueous solution of chloride of copper or of chloride of mercury are also recommended for writing on zinc, which should first be cleaned with a weak solution of muriatic acid. Bichloride of platinum is one of the blackest inks for zinc. A slightly oxidized zinc surface may be written upon with a soft lead pencil, and while the inscription will not be very distinct at first will grow more so with age, and will endure for years.

It is always best to secure a sheet-metal label to the bole or post by both ends if possible; but in many cases a hanging label must be used. A wired zinc label, as shown in No. 8, Fig. 2049, if exposed to the wind will sometimes cut the eye completely out, unless care is taken to twist the wire up tightly. If the end of the label is folded over and the hole punched just beyond the fold, it will not be so likely to pull out. Strips of zinc ⅝ inch wide and 7 inches long (No. 9, Fig. 2049), coiled loosely around a branch, as in No. 10, are a serviceable form of tree-label, but even these should be noticed every year, that they do not become fastened into the fork of a rapidly-growing tree.

For borders or beds of herbaceous perennials, bulbs, and the like, the label shown in No. 11 is excellent and inexpensive. A piece of galvanized wire Nos. 6–8 in size, is cut 1½ to 2 feet long, bent to shape and the written zinc tablet closed in. For a more conspicuous label, the zinc may be given a coat of white lead, then one of black enamel paint, and the letters be traced in white. In some European botanical gardens a zinc tablet stamped with sunken letters brought into relief by paint are used for similar purposes. A zinc label, with two wire legs to prevent it from turning around, is shown in Fig. 2050.

There are many designs of cast or enameled metal or porcelain labels, that have found little use in this country. A label of stamped zinc of English manufacture (shown in No. 16, Fig. 2049) is one of the best garden labels. For labeling specimen tree trunks, a sheet of zinc or copper with a little water-ledge bent at the top, painted, enameled black and lettered in white, is neat and useful. It should be secured with copper tacks, and given occasional attention. (See No. 15.) A series of thin sheet-copper labels, to be written on with a stylus against a soft, yielding surface, as a piece of leather, are shown in Nos. 12, 13, 14. These may be too frail for out-of-door use, but are very good for conservatory plants, although the inscription needs rather close examination. Of copper labels, the temper should be taken out and the metal folded on edges. A neat label for conservatory use is made of white sheet-celluloid with a mat surface, as pencil marks show very plainly on it.



2049. Various types of labels.

Several kinds of tree-labels are shown in Fig. 2052, as follows: Nos. 1, 2, German labels, made of glazed earthenware, with the name colored blue and sunken. Strong copper wire, coiled, to allow of the growth of the limb, holds the label to the tree. No. 3, Cornell label is made of wood. No. 4, double wooden label, consisting of two common wooden labels fastened together. The name is written upon the outside of the double label, as in any other label, but it is also written on the inside to insure permanence. When the outside writing is worn off the label is opened and the inside is still bright. The label is fastened to the tree by a tack or small nail, as shown in the cut at the right. The label is seen opened in the cut at the left. Nos. 5, 6, zinc labels, used at the New York State Experiment Station, Geneva. The wire is driven into the tree, and the name is written or printed on the zinc with black paint. No. 7, common handmade wooden tag, taken from an old tree in the test orchard of the late Charles Downing, Newburgh, New York. No. 8, thin copper label, with the name indented into the metal by the use of a hard-pointed instrument. Some metal labels are apt to tear out at the hole when exposed to winds. No. 9, common painted pine label used by nurserymen, and costing (without the copper wire) about 35 cents a thousand for the common size, which is 3½ inches long. No. 10, Lodeman's label, used somewhat at Cornell, consisting of a tag of sheet lead securely fastened to a coiled brass wire. The wire is secured to the body of the tree by a staple or screw-eye, and it is expected that the wire will become imbedded in the trunk as the tree grows. No. 11, common zinc label or talley. A good vineyard label is shown in Fig. 2051, described by Bailey as follows: The figure is Paddock's vineyard label (designed by W. Paddock, State Experiment Station, Geneva, New York). The label is a strip of heavy zinc secured to a stiff galvanized wire. This wire or shank is provided with a hook at the lower end and a half-hitch near its middle, so that it can be securely adjusted to the wires of the trellis, holding the label well above the foliage.

2050. A metal garden label.

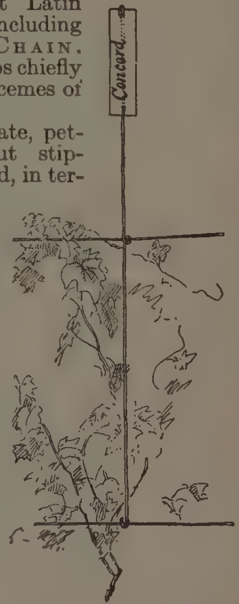
S. C. Mason.
L. H. B.†

LABLAB: *Dolichos.*

LABÚRNUM (ancient Latin name). *Leguminòsæ.* Including *Podocýtisus.* GOLDEN-CHAIN. Ornamental trees or shrubs chiefly grown for their showy racemes of yellow flowers.

Deciduous: lvs. alternate, petioled, 3-foliolate, without stipules: fls. slender-pedicelled, in terminal simple racemes, mostly pendulous; calyx 2-lipped, with obtuse, short lips; corolla papilionaceous, with the petals all distinct; stamens 10, all connate; ovary stalked: fr. a linear pod with several seeds, compressed, tardily dehiscent; seed without appendage at base.—Three species in S. Eu. and W. Asia, often included under Cytisus. All parts of the plants are poisonous, especially the young frs. The hard, tough and close-grained wood is susceptible of a very fine polish, and is manufactured into various small articles.

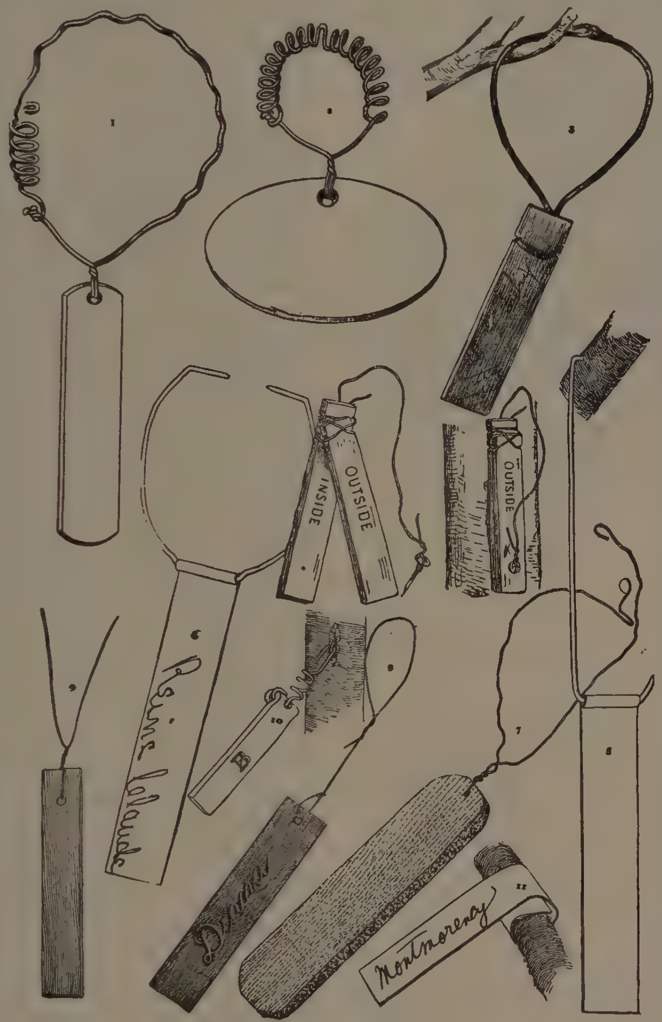
The golden-chains are handsome small trees with dark



2051. Paddock's vineyard label.

green trifoliolate leaves falling late in autumn without change of color, and with drooping racemes of bright yellow flowers in late spring, followed by long narrow pods remaining on the tree a long time. They are adapted for planting on rocky slopes or in borders of shrubberies, where they should be allowed enough space to show to the best advantage their graceful, drooping racemes of golden flowers, which contrast with the dark green foliage. They are hardly ever attacked by insects or fungi.—*Laburnum alpinum* is the hardiest species and perfectly hardy as far north as Massachusetts; *L. anagyroides* is somewhat less hardy, while *L. caramanicum* is tender. They thrive in any kind of well-drained soil, including limestone, and grow as well in partly shaded positions as in sunny ones. Propagated by seeds, sown usually in spring, and also by layers; the varieties are mostly grafted or budded on seedlings of one of the species.

anagyroìdes, Medikus (*L. vulgàre*, Griseb. *Cýtisus Labúrnum*, Linn.). GOLDEN-CHAIN. BEAN-TREE. Fig. 2053. Large shrub or small tree, to 20 ft., with erect or spreading branches: branchlets appressed-pubescent, grayish green: lvs. long-petioled; lfts. elliptic or elliptic-ovate, usually obtuse and mucronulate, glaucous-green and appressed-silky pubescent beneath when young, 1–1¾ in. long: racemes silky-pubescent, 4–8 in. long; fls. about ¾in. long: pod appressed-pubescent, with thick keel, about 2 in. long; seeds black. May, June. S. Eu. Gn. 25, p. 518; 34, p. 30, and 51, p. 302. G.C. III. 36:318. H. W. 3, p. 101.—There are many garden forms. Var. **aùreum**, Rehd. (var. *chrysophýllum*, Schneid.), with yellow foliage. F.S. 21:2242, 2243. F. M. 1875:182. G.Z. 20:129. Var. **bullàtum**, Schneid. (var. *involùtum*, Hort.), with curled lfts. Var. **Carlièri**, Schneid. (*L. vulgàre Carlièri*, Kirchn.). Lvs. smaller: fls. smaller in short upright racemes, often several from one bud. Var. **péndulum**, Rehd., with pendulous branches. Gn. 25, p. 522. G.M. 45:317. Var. **quercifòlium**, Schneid., with sinuately lobed lfts. Gn. 25, p. 520; 34, p. 30. Var. **sessilifòlium**, Schneid., with crowded, sessile lvs. Var. **Alschíngeri**, Schneid. (*L. Alschíngeri*, Koch). Racemes shorter, lower lip of calyx longer than upper lip: lvs. more silky. S. E. Eu. Var. **autumnàle**, Rehd. (*L. vulgàre autumnàle*, Kirchn. *L. vulgàre bífera*, Lavalle. *L. vulgàre semperflòrens*, Nichols.). Blooms a second time in late summer.



2052. Tree labels of many patterns.

alpìnum, Griseb. (*Cýtisus alpìnus*, Mill.). SCOTCH LABURNUM. Shrub or tree, to 30 ft., similar to the former: branchlets glabrous or hirsute when young: lfts. usually elliptic, acute, light green and glabrous beneath or sparingly hirsute, ciliate, 1–1¾ in. long: racemes long and slender, glabrous or sparingly hirsute; fls. smaller: pod thin, with the upper suture winged, glabrous; seed brown. June. Mountains, S. Eu. B.M. 176 (as *Cytisus Laburnum*). Gn. 25, p. 519; 34, p. 30. R.H. 1912, p. 446. G.M. 45:316. G. 36:477. Var. **péndulum**, Koch. With pendulous branches. Gn. 25, p. 522. A var. *aùreum* is advertised.—This species flowers about 2 weeks later than the former, and has much longer and more slender racemes; it also is of more upright and stiffer growth and hardier.

Wátereri, Dipp. (*L. Párksii*, Hort. *C. alpìnus* × C. *vulgàris*, Wittst.). Hybrid of garden origin, but found also wild. Lvs. beneath and racemes sparingly pubescent: racemes long and slender: pod with narrow wing, sparingly appressed-pubescent, few-seeded. G. 24:355. G. M. 45:313.—As hardy as *L. alpinum* and sometimes considered to be a variety of that species.

Ádamii, Kirchn. (*C. Ádamii*, Poir. *C. Labúrnum purpuráscens*, Loud. *Laburnocýtisus Ádamii*, Schneid. *L. vulgàre* × *Cýtisus purpùreus*). Originated at Vitry, near Paris, about 1826. Habit and foliage usually almost like *L. anagyroides*, but fls. dull purplish, rarely yellow; sometimes bearing a few branches with the fls. and lvs. of *Cytisus purpureus*. A very interesting form, but of less ornamental value. B.R. 1965. B.H. 21:16–18. G.C. III. 36:219; 50:162.—One of the so-called graft-hybrids which have recently been termed chimæras, as there is no fusion of cell-contents and nuclei, but only a mixture of tissues.

L. caramánicum, Benth. & Hook. (Podocytisus caramanicus, Boiss.). Erect shrub, to 4 ft., much resembling in foliage and habit the Cytisus sessilifolius, with long and slender terminal upright racemes. July–Sept. Asia Minor. R.H. 1861, p. 410. G.C. III. 48:454. B.M. 7898.—*L. fràgrans*, Griseb., *L. ramentàceum*, Koch, and *L. Wéldeni*, Lavalié.=Petteria ramentacea.

ALFRED REHDER.

LABYRINTHS or mazes are intricate and confusing networks of walks and passages within hedges of evergreen, formerly employed as a garden entertainment and conceit. They are still kept up in some Old World gardens as relics of the past. They were popular in the sixteenth and seventeenth centuries. Fig. 2054 is the plan of an English labyrinth of two centuries ago. It would be vandalism to destroy so fine an example of a style of gardening no longer fashionable, but folly to copy it in a modern garden. Mazes are made of clipped evergreens of various kinds.

2053. Laburnum anagyroides. (×⅓)

LACÆNA (one of the names of Helen, which Lindley states may be applied to this plant on account of its beauty; but he adds it may also be derived from *Lakis*, a cleft, alluding to the divisions of the lip). *Orchidàceæ.* A little-known group of epiphytic orchids inhabiting Central America and Mexico.

Pseudobulbs rather long, ovoid, smooth at first: lvs. large, elliptic-pointed and contracted into a petiole, plicate venose: raceme pendent from the base of the pseudobulbs, loose, bearing up to 10 medium-sized fls.; sepals and petals nearly equal, elliptical, half-spreading; labellum equaling the petals, articulated to the base of the column, clawed, with the lateral lobes incurved, terminal larger, spreading and narrowed at the base to a broad claw; column rather long, winged, hooded at the top; pollinia 2 on a simple stipe.—Only 2 species.

The plants should be grown in baskets or on blocks of wood like stanhopeas: if potted the racemes are likely to bury themselves in the soil. At the end of October, water should be almost entirely withheld for a few weeks. The flower-stalks appear in spring.

bícolor, Lindl. (*Lueddemánnia Sanderiàna*, Kränzl.). Racemes drooping, about 18 in. long, bearing 9 or 10 fls.; fls. greenish yellow, covered externally with short hairs; petals with 3 purple streaks; labellum hairy, spotted with purple. Discovered about 1843 in Guatemala, at an elevation of 7,000 ft. B.R. 30:50. Var. **glabràta,** Lem. Fls. everywhere nearly glabrous, creamy white. Not in the American trade. I.H. 1:33. Var. **álba,** Hort. Fls. yellowish white, without purple markings.

spectábilis, Reichb. f. Fls. about 1 in. diam., whitish, suffused with pink and speckled with purple; sepals concave orbicular; petals smaller, connivent. Costa Rica. Mex. (?). B.M. 6516.—Far more handsome than the former, but not advertised in Amer.

Heinrich Hasselbring.

LACE-BARK: *Lagetta;* also *Gaya* and *Hoheria.*

LACE-LEAF, LATTICE-LEAF· *Aponogeton.*

LACHENÀLIA (Werner de Lachenal, 1736–1800, professor of botany at Basel). Including *Scillópsis. Liliàceæ.* Cape Cowslip. Small Cape bulbs that are easily flowered in a cool greenhouse in early spring or even in winter; some of them are useful also for the window-garden.

Plant comprised of a tunicated bulb, a leafless peduncle or scape bearing a raceme or spike of fls. in shades of red and yellow, sometimes white, and usually 2 lvs. at the base of the scape: perianth tubular, persistent, the 3 outer segms. oblong and slightly swollen near the apex, the 3 inner segms. commonly longer and obtuse-spatulate; stamens 6, attached in the perianth-tube; style long and slender, with capitate stigma: caps. loculicidally 3-valved, with turgid black seeds.—Species about 50, in S. Afr. They have a remarkable range of color, and with good management may be kept in an attractive condition for 2 months or more. There are species with bell-shaped fls. and some in which the fls. are all more or less erect, but the favorite types are the long, cylindrical, pendulous fls. with the brilliant red and yellow colors. But few species are cult., the most popular being *L. tricolor*, particularly its var. *Nelsonii* and some of the recent forms with personal names. *L. pendula* is perhaps second in popularity, the others being known chiefly to bulb fanciers. Lachenalias are very distinct in coloring and general appearance. They usually have 2 lvs. (sometimes 5 in. cult.), rarely 1, and the bulbs are globose, tunicated, and about ½–1 in. thick. An exceptionally strong bulb, under the most favorable conditions sends up 3 or 4 erect fl.-stalks 9 in. high, with as many as 40 fls., each 1–1½ in. long. Under careless treatment the lvs. and fl.-stalks are weaker, and bear perhaps 6–12 fls. Lachenalias are good subjects for hanging-baskets.

It is well to make one job of it, planting freesias and lachenalias together. Six are planted in a 6-inch pot, in good rich loam. They probably do as well without leaf-soil, if the drainage is good. They are stored in a well-protected coldframe until late in November, but might be kept longer, as a pinch of frost will not hurt them. After they are brought into the greenhouse, and make good growth, plenty of water may be given, and, occasionally, liquid manure. A night temperature of 50° F. will be found about right, but they scarcely bear forcing until the flowering scapes show. If forced before the bulbs show, the flowers are often malformed. They last in bloom from six to eight weeks, after which follows the same routine.—After blooming, the plants should be set on a shelf in a light position and watered as carefully as before the blooming season, less water being given as signs of maturity appear; viz., discolored leaves and withered flower-stems. When thoroughly ripened, they are stored in the pots they have grown in and kept quite dry until the month of August. They must be repotted then. If by chance drip should strike the soil, the plants may be found starting into growth. The bulbs multiply rapidly, more than doubling in a season. Fully one-third of the extra bulbs will be serviceable, and still more would make bloom of less decorative value. There are many more—bulblets—which can be sown on the borders of carnation or violet benches, a large number making good-sized bulbs in one season. Seeds of lachenalias germinate readily in a few weeks, and with good treatment many seedlings will bloom before going to rest. In the opinion of the writer, *L. Nelsonii*, is still the most satisfactory kind to grow. (T. D. Hatfield.)

INDEX.

atroviolacea, 5.
aurea, 4.
aureliana, 3.
Cammii, 4.
convallarioides, 10.
d'Anconæ, 4.
glaucina, 6.
liliflora, 7.
lucida, 11.
luteola, 4.
luteola maculata, 4.
mutabilis, 5.
Nelsonii, 4.
orchioides, 5.
pallida, 11.
pendula, 3.
pustulata, 8.
quadricolor, 4.
racemosa, 11.
reflexa, 1.
Regeliana, 1.
robusta, 10.
rubida, 2.
superba, 4.
tricolor, 4.
unifolia, 9.
violacea, 8.
virenti-flava, 5.

A. *Perianth ventricose, oblique at the base.*

1. **refléxa,** Thunb. (*Cœlánthus complicàtus*, Willd.). Bulb globose, ¾in. or less diam.: lvs. 2, thin, falcate, clasping the base of the st. for 1–2 in.: peduncle and infl. 2–6 in. long; spike usually few-fld., the rachis flexuose; fls. all erect or spreading, yellowish, about 1 in. long; inner segms. slightly longer than the outer and spreading at the very tip; stamens included, but style becoming exserted.—*L. Regeliana* is a hybrid of this and *L. tricolor* var. *aurea.*

AA. *Perianth oblong to cylindrical, not oblique or ventricose.*

B. *Fls.* (*at least the lower ones*) *drooping or pendulous.*

2. **rùbida,** Jacq. Bulb globose, about ½in. thick: peduncle and infl. 6–9 in. long: lvs. usually 2, much-narrowed to base, spotted: raceme 6–20-fld.; outer segms. bright red, tipped green; inner ones yellow below the tip, a little longer than the outer segms.

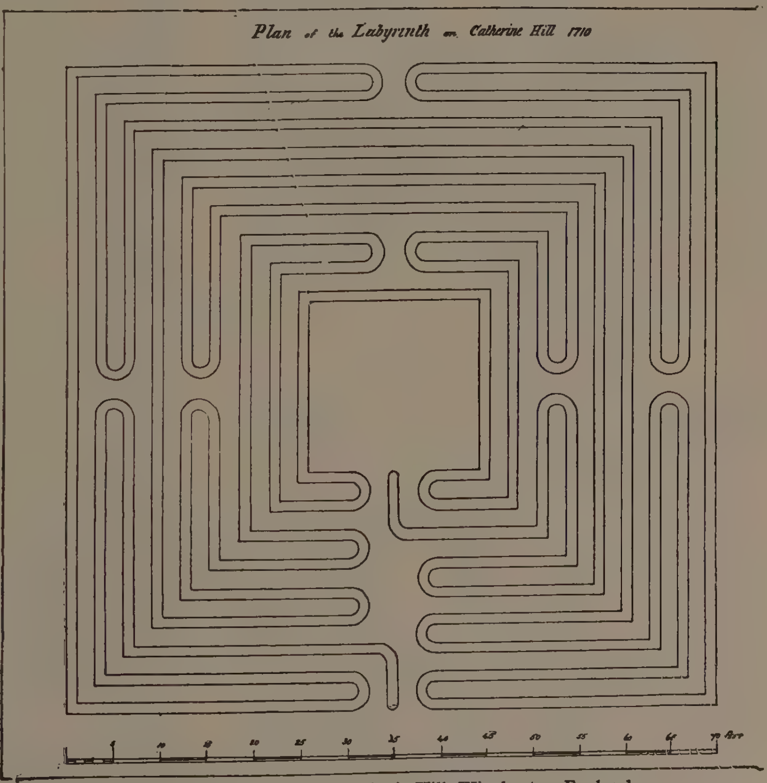
3. **péndula,** Ait. Bulb globose, about 1 in. thick: peduncle and infl. 6–12 in. long, more robust than in Nos. 2 and 4; raceme few- or many-fld., 2–6 in. long, all except the upper fls. more or less nodding; outer segms. linear-oblong, yellow, passing upward into red, not spotted; inner bright red-purple at the tip, little if at all exceeding the outer. B.M. 590. Gn. 18:60; 23, p. 142; 33, p. 249, and 45, p. 355. Gt. 61, p. 218. G.W. 10, p. 329. G. 5:551. F. 1871:265. V. 8:172. Var. **aureliàna,** Hort., has outer segms. red, barely tipped yellow; inner ones tipped green. R.H. 1890:396. G.C. III. 23:195.

4. **trícolor,** Thunb. Bulb globose, to 1 in. diam.: peduncle and infl. to 1 ft.: lvs. usually 2, 6–9 in. long, often spotted: raceme mostly 3–4-fld., sometimes many-fld.; lower fls. nodding; outer segms. yellow, tipped green; inner purplish red at the tip, much exceeding the outer. L.B.C. 8:767. B.M. 82. F. 1871:265. Gn. 18:60; 47, p. 163. G.W. 10:329. Var. **quadrícolor,** Baker (*L. quadrícolor*, Jacq.). Perianth with a red base and greenish yellow middle; outer segms. tipped green; inner ones tipped red-purple. L.B.C. 8:746. Var. **lutèola,** Baker (*L. lutèola*, Jacq.). Perianth lemon-yellow, tinged green toward the tip. B.M. 1020; 1704. L.B.C. 8:734. F.S. 18:1873. Var. **lutèola maculàta,** Hort. (*L. lutèola maculàta*, Hort.), differs from the preceding in having spotted foliage. Var. **Nélsonii,** Baker (*L. Nélsonii*, Hort.). Fig. 2055. Perianth bright yellow, both series of segms. faintly tinged green: probably the lachenalia most grown in this country, bearing freely for a long season long racemes of brilliant fls.: treated much as are hyacinths indoors, being kept cool. Gn. 49, p. 470; 75, p. 143. Gng. 5:262. J.H. III. 30:231; 62:291; 63:136. Gn.W. 16:25; 21:301. G.W. 43:591; 52:724. G.Z. 31:121. G. 19:174. **Var. aùrea,** Hook. (*L. aùrea*, Lindl.). Perianth bright orange-yellow. F. 1871:265. B.M. 5992.—Baker observes that "the varieties are connected by intermediate stages. Several hybrids between *L. pendula* and the varieties of *L. tricolor* are in cult., the finest of which is *L. Cammii*, Hort., which combines the bright yellow fls. of *L. aurea*, with the habit of *L. pendula*." Var. **supérba,** Hort., is described as a very large form with boldly colored fls. Var. **d'Ancônæ,** Hort., is a form with light yellow fls. tipped green and purple.

BB. *Fls. not drooping, all erect or at least spreading.*

5. **orchioìdes,** Ait. Bulb globose, to 1 in. diam.: lvs. usually 2, strap-shaped, often spotted, 1 in. wide, clasping the base of the st.: peduncle and infl. 6–12 in.; fls. white, yellow, red or blue, all ascending, the perianth only about ⅓in. long; stamens and style included; inner segms. somewhat longer than outer. B.M. 854; 1269. L.B.C. 11:1076 (as *L. mutabilis*). "The most striking color forms," says Baker, "are **atroviolàcea,** hyacinth-blue; **virénti-flàva,** greenish yellow, and **mutábilis,** inner segms. dull yellow, tipped red-brown."

6. **glaucìna,** Jacq. Bulb globose, 1 in. diam.: lvs. as in No. 5: fls. long, white, red, yellow or tinged blue, erect-spreading; perianth ½–¾ in. long; stamens and style reaching tips of inner segms. which are longer than outer. B.M. 3552. B.R. 1350; 1945 (both as *L. pallida*).



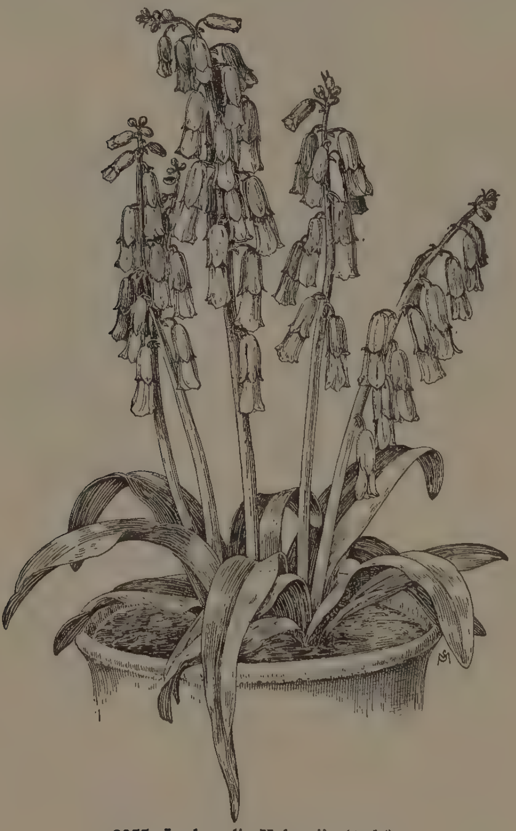
2054. The maze on St. Catherine's Hill, Winchester, England. From a plan made in 1710.

7. **liliflòra,** Jacq. Bulb globose: lvs. 2, lanceolate and falcate, about 1 in. broad, with pustules on the face: peduncle and infl. about 12 in., bearing 12–20 densely racemose fls. which are white; perianth ¾in. long, all the segms. spreading, the outer longer than the inner; stamens equaling inner segms. G.C. III. 38:259.

AAA. *Perianth campanulate or oblong-campanulate, not oblique or ventricose.*

B. *Infl. dense, spike-like.*

8. **pustulàta,** Jacq. Bulb ½in. diam.: lvs. 2, fleshy, pustulate or blistered on the face, lanceolate: peduncle 3–6 in.; fls. white or faintly tinged red, in a dense spike-like raceme 2–3 in. long; perianth ⅓in. long; outer segms. slightly longer than inner, and stamens somewhat exserted. B.M. 817. Perhaps synonymous with No. 11. Var. **violàcea,** Hort., is cult.



2055. Lachenalia Nelsonii. (×½)

BB. *Infl. looser, evidently racemose.*

9. **unifòlia,** Jacq. Bulb globose, small: lf. 1, linear-subulate and erect, brown-banded and clasping at the base: peduncle and infl. 6–12 in. long, carrying a lax 6–20-fld. raceme; fls. white, or more or less tinged with red or blue; perianth about ½in. long; inner segms. protruding, and the stamens of similar length. B.M. 766.

10. **convallarioìdes,** Baker. Bulb globose, ½in. or less long: lf. 1, linear and erect, channelled: peduncle 4–6 in. long, bearing fls. in a short lax raceme; perianth ⅛in. long, purplish becoming white; inner and outer segms. about same length; stamens included; fls. with heath-like odor. There is a var. **robústa,** Baker, more robust, with 20–30 fls., and lvs. rarely 2.

11. **pállida,** Ait. (*L. lùcida,* Ker. *L. racemòsa,* Ker). Bulb globose, ½in. diam.: lvs. 2, pustulate or blistered, strap-shaped: peduncle 6 in. long, bearing a moderately dense raceme 2–3 in. long; fls. white, the perianth ¼in. long; outer segms. tipped green, shorter than the inner segms.; stamens equaling inner segms. B.M. 1372; 1517.

L. víridis, Thunb.=Dipcadi filamentosum.—Various species have been more or less cult. under the name Scillopsis, but they belong in Lachenalia. The generic names Orchiops and Orchiastrum also belong here.

Wilhelm Miller.
L. H. B.†

LACTÙCA (from the old Latin name *lac;* referring to the milky juice). *Compósitæ.* Lettuce. A well-known group of hardy annual or perennial herbs, mostly native of the northern hemisphere.

Plants 2–4 or more feet high, with alternate, variously shaped lvs. and small-panicled heads of yellow, white or blue fls.: involucre cylindric, its bracts imbricated in several series; receptacle flat, naked; rays cut off even at apex, and 5-toothed.—More than 200 specific names have been given to the genus, probably half of which are synonyms with but only 8 or 9 known in cult., and these are doubtless forms of but 2 or 3 species. Aside from garden lettuce, only 1 species appears to be in the trade, though wild plants of other species are often gathered for medicinal purposes. All of the species possess narcotic and sedative properties, the sedative known as lactucarium, or lettuce-opium, being obtained principally from the European species, *L. virosa.* Lettuce has been known and used as a salad from a very remote period. It is said to have been served at the tables of Persian kings 400 B. C. See *Lettuce.*

A. *Fls. yellow.*

satìva, Linn. Lettuce. An annual plant, not known in the wild state but generally supposed to have originated from *L. Scariola,* Linn., in Asia. There are many garden forms assuming an endless variety of forms but which may be divided into 4 rather distinct types.

Var. **capitàta,** Hort. (*L. capitàta,* DC.). Common Cabbage Lettuce. Lvs. entire or sparingly dentate, broad, rounded, yellowish or brownish green, more or less wrinkled and in some garden varieties much curled, spreading, 6–14 in., usually quite compact.

Var. **intybàcea,** Hort. (*L. intybàcea,* Jacq. *L. quercìna,* Linn.). Cut-leaved Lettuce. Lvs. 6–10 in. long, deeply and irregularly cut on the edges, loosely spreading.

Var. **romàna,** Hort. Cos Lettuce. One to 2 ft. high: lvs. entire or sparingly dentate, much longer than broad, quite erect, forming a cylindrical or conical-shaped plant.

Var. **angustàna,** Hort. (*L. angustàna,* Hort.). Lvs. 1–2 in. wide, 6–12 in. long, entire, slightly spreading in habit.

AA. *Fls. blue or purple.*

Plumièri, Gren. & Godr. St. about 6 ft., stout: lvs. much cut, broadly oblong, bluish on the under side: fl.-heads terminal, corymbose, the rays purple. S. France. June–Aug.

L. Bourgæi (Boiss.), is a thick-stemmed bristly-lvd. perennial often 6 ft. tall: heads small, with pinkish bracts and lilac rays. Medit. region.—*L. canadénsis,* Linn. Biennial or annual 4–9 ft. high: lvs. entire or nearly so. Wild plants often gathered for salad.—*L. perénnis,* Linn. Root perennial, 2–3 ft. high: lvs. 8–10 in. long, deeply cut: fls. large, light blue. Native of Eu.—*L. Scarìola,* Linn. Prickly Lettuce. Annual or biennial, sometimes 6 ft. high, the st. stiff and often paniculately branched: lvs. 1–2 in. wide, 4–6 in. long: fls. yellow, inconspicuous. Intro. from Old World, and now a widely distributed weed.

H. C. Irish.
N. Taylor.†

LADY'S EARDROPS: Short-flowered fuchsias. **L. Garters:** *Phalaris arundinacea* var. *picta.* **L. Mantle:** *Alchemilla vulgaris.* **L. Slipper:** *Cypripedium.* **L. Smock** or **Meadow-Cress:** *Cardamine pratensis.* **L. Tresses:** *Spiranthes.*

LǼLIA (meaning uncertain). *Orchidàceæ.* A useful and attractive group of orchids, mostly with large, showy flowers borne singly or in two- to many-flowered racemes, which arise from the top of one- to two-leaved pseudobulbs. The plants greatly resemble cattleyas and differ only by the presence of eight perfect pollen masses instead of four.

Leaves oblong, coriaceous or fleshy, not plicate: pseudobulbs terminating the annual growth, ovate, clavate, fusiform or st.-like, long or short, consisting of 1 to several thickened internodes, or of slender and quill-like form with merely a small bulbous swelling at base, sheathed with scales and bearing 1 or 2 lvs. at the summit: sepals subequal, free, spreading; petals wider and sometimes longer, spreading; all usually plane; labellum free from the base of the column, more or less distinctly 3-lobed, the lateral lobes short, erect, folding over the column; middle lobe long, expanded, lanceolate-ovate, etc.; column concave in front, and thus narrowly 2-winged on the edges; pollinia 8, 4 in each locule; scape terminal, long or short, bracted.—About 30 species, dispersed in the maritime provinces of Mex. and Guatemala and in S. Brazil. No species is common to the two widely separated regions. A single species, *L. monophylla*, inhabits the mountains of Jamaica. In their native homes the plants are often found clinging to bare rocks and trees, where they are exposed to the full force of the tropical sun, and, in the wet season, to daily drenching rains. Some of the species grow at great altitudes. Thus, *L. autumnalis* var. *furfuracea*, is always found in alpine regions at elevations of 7,500–8,500 ft. For a list of cult. kinds, see R. A. Rolfe, G.C. III. 7:107, 256, 333, 355; 8:241, 652.

Lælia may be conveniently divided into groups, as follows:

Group I (species 1–10).—Pseudobulbs rounded, pyriform or ovate. The plants of this section are medium-sized, with the pseudobulbs terminating each year's growth, sessile at intervals on the rhizome, and sheathed at least at first with bract-lvs. The scape, except in *L. grandiflora*, is long and slender, erect, nodding or subhorizontal, and bears at its end 1 or 2 fls. (*L. anceps*), or a raceme of 2–7 fls. (*L. albida*). *L. grandiflora*, placed here on account of its thickened pseudobulbs, bears greater resemblance to the members of the next group.

Group II (species 11–13).—Pseudobulbs short-cylindrical, st.-like, or swollen-jointed, i. e., consisting of several internodes and sheathed with bracts. These plants are of dwarf habit, bearing 1–2 very large fls. on short scapes, so that the top of the fl. scarcely exceeds the lvs., which are oblong, about 6 in. long, and leathery.

Group III (species 14–23).—Pseudobulbs long-oblong, fusiform or clavate, tapering below to a sheathed and jointed stalk. This group contains the largest and most showy lælias. The pseudobulbous sts. are tall and tufted, a foot or more in length, forming robust, compact, almost bushy plants. The flowering sts. of *L. superbiens* are said to attain a height of 12 ft. The racemes bear 3–7 large, handsome fls.

Group IV (species 24–26).—Pseudobulbs slender, reed-like and tufted, clothed with scales and often somewhat swollen at base. This group includes a few species which are very distinct on account of their bright scarlet or orange-colored fls. and slender, reed-like pseudobulbs. *L. monophylla* is perhaps the smallest of all lælias, being scarcely over 6 in. high, with pseudobulbs about as thick as a crow-quill. One variety of *L. cinnabarina* has purple fls.

Cultivation of lælias. (E. O. Orpet.)

These orchids have ever held an important place in gardens, and were it not for the trifling generic distinction of having double the number of pollen-masses of the cattleya, they would have been known as a part of the last named, the ease with which both have been hybridized even from the beginning proving the close affinity; and one authority at least is willing to merge the two, were it not for the mixing up it would cause in garden nomenclature. The Brazilian species, *L. purpurata* and *L. crispa*, are strikingly beautiful, easy of culture, and are long-lived in gardens. These were the first to be used by the hybridist, and the multiple crosses made since, with the later addition of *L. tenebrosa*, show evidence of the gorgeous coloring of the labellum due to the lælia parentage.

It has always been the impression that the Brazilian lælias require very much warmth to enable them to grow well. This has been proved to be an error, as stronger growth is made in an intermediate temperature. The plants get an absolute rest in winter, flower better and grow stronger when kept at a temperature of about 50° in winter.

The Mexican kinds that mostly flower in midwinter, such as *L. anceps* and its white forms, will do equally well in a similar house, but are best grown outdoors in summer in the partial shade of overhanging trees, giving a spraying of water overhead at evening of each hot day. This has been found to be the only way to get the white forms to bloom freely, as they need special treatment and thorough ripening to secure good results. Removal indoors should take place before frost; cool nights seem to invigorate them, but while they experience slight frosts in Mexican uplands, it is harmful here. These lælias make an abundance of roots, and the plants should be kept off the ground to avoid the danger of slugs. If these gain access, soak the pots or baskets in water for an hour and the slugs will appear and can be caught.

The repotting of lælias must be done in early spring, or just before the appearance of the new bunches of roots at the base of the growths. Native-born species have a regular way of living, but the hybrids have a go-as-you-please habit, due perhaps to their mixed origin, that makes the repotting an operation that lasts throughout the year. Flowers are produced at all seasons, while, with introduced plants, their blooming is as fixed as the days of the year. This makes it hard to make a rule when to repot or separate plants; but, should the roots begin to get outside the receptacle, it is wise to give the plants more space. Good firm osmundine is the best material, as these are strictly epiphytal plants. Imported specimens are received with mats of dwarf polypodium attached, and these often grow with the plants in cultivation, giving a clue to the best way to treat them afterward. The other Mexican species, *L. Gouldiana*, *L. autumnalis* and *L. albida*, are not so durable in gardens as some others. They are most valuable midwinter-flowering orchids; they need similar culture as that given to *L. anceps*, but have to be replaced by new specimens after a few years, as they are not permanent.

There are many pretty dwarf-growing species, *L. præstans*, *L. Dayana*, *L. pumila*, *L. grandiflora*, *L. Jongheana* and others, that require extra care to keep them in health, and this care is largely in the matter of moisture. The plants are small, need shallow pans and to be suspended close to the roof glass where they dry out speedily, and unless moisture is given regularly, the health of the plants soon weakens. The drying out is desirable, for the plants experience this on rocks or trees in their native habitat, but there they have the benefit of the night dews that amount to a shower of moisture; this is easily imitated by spraying over the plants each dry evening. The roots will take this up during the night, and be fortified for the succeeding day. If one examines the aërial roots of *L. anceps*, they will be found to be in segments, some longer than others, the longer ones being those formed on a dull or wet day when evaporation was slower and the tender-growing tips could grow longer. This is suggestive in a cultural way.

INDEX.

acuminata, 10.
alba, 2, 4, 9, 12, 23.
albida, 3.
Amesiana, 9.
anceps, 9.
Arnoldiana, 5.
Ashworthiana, 9, 22.
atropurpurea, 22.
atrorubens, 4.
autumnalis, 4.
Barkeriana, 9.
bella, 3.
Boothiana, 20.
caulescens, 1.
Cauwelærtiæ, 21.
Chamberlainiana, 9.
cinnabarina, 26.
Crawshayana, 7.
crispa, 21.
crispilabia, 26.
Dawsonii, 9.
Dayana, 12.
delicata, 9.
Digbyana, 14.
Eyermanniana, 6.
flava, 1.
Förstermannii, 5.
Fournieri, 4.
furfuracea, 4.
glauca, 15.
Gouldiana, 8.
grandiflora, 2, 9.
grandis, 18.
harpophylla, 25.
Hilliana, 9.
holochila, 9.
Jongheana, 11.
Lageriana, 9.
Lawrenciana, 26.
Leeana, 9, 13.
lobata, 20.
majalis, 2.
majus, 2, 3.
Mandaiana, 22.
marginata, 12.
monophylla, 24.
morada, 9.
Nelisii, 22.
peduncularis, 10.
Percivaliana, 9.
Perrinii, 23.
Pinelli, 12.
præstans, 12.
prætexta, 22.
pumila, 12.
purpurata, 22.
rosea, 3, 9.
rubescens, 10.
Russelliana, 22.
Sanderiana, 9.
Schroederi, 22.
Schroederiana, 9.
Scottiana, 9.
Stella, 9.
sulphurea, 3.
superbiens, 19.
tenebrosa, 18.
Veitchiana, 9.
venusta, 4.
virens, 16.
waddoniensis, 9.
Williamsii, 9.
xanthina, 17.

The following names must be sought under Læliocattleya: *L. amanda, Brysiana, Dominiana, Dormaniana, elegans, exoniensis, Nyleptha, prasiata, Schilleriana, Turneri.*

GROUP I.

A. *Pseudobulbs not compressed or edged.*
  B. *Fls. bright yellow* .... 1. **flava**
  BB. *Fls. rose, purple or white.*
    C. *Scape scarcely equaling the lvs.: dwarf plants, with very large fls.* ... 2. **grandiflora**
    CC. *Scape slender, much exceeding the lvs.*
      D. *Fls. small, white or pale yellow* ... 3. **albida**
      DD. *Fls. large, rose-purple; rarely white.*
        E. *Lip 2-keeled* .... 4. **autumnalis**
        5. **Arnoldiana**
        EE. *Lip 3-keeled.*
          F. *Lvs. oblong* .... 6. **Eyermanniana**
          FF. *Lvs. lance-linear or oblong-linear* .... 7. **Crawshayana**
          8. **Gouldiana**
AA. *Pseudobulbs compressed and edged.*
  B. *Lip with a broad, elevated line down the center; ovary viscose* .... 9. **anceps**
  BB. *Lip with 3 keels; ovary not viscose*..... 10. **rubescens**

1. **flàva,** Lindl. (*L. cauléscens,* Lindl.). Lvs. 3–5 in. long, oblong-lanceolate, acute, very thick and stiff: scape 1 ft., erect, bearing 4–8 bright yellow fls. 2–2½ in. diam.; sepals and petals spreading, oblong-lanceolate, obtuse or subacute; labellum not longer than the petals; middle lobe recurved, crisped and undulate, having 4 elevated ridges running down the center; lateral lobes obtuse. Autumn. Brazil. B.R. 28:62.

2. **grandiflòra,** Lindl. (*L. majàlis,* Lindl.). Lvs. solitary, oblong, coriaceous, 6–7 in. long: fls. solitary, rarely 2, on a short peduncle, scarcely equaling the lvs., 5–8 in. across, showy, rose-lilac; sepals lanceolate, plane; petals oblong, acute, shorter and much broader than the sepals; middle lobe of the labellum large, expanded, emarginate, center white, shading to lilac at the margin, spotted with dark lilac; side lobes small, white inside, streaked with lilac. May, June. Mex. B.M. 5667. B.R. 30:30. P.M. 12:1. G.C. II. 19:628.—A magnificent orchid. Var. **âlba,** Reichb. f. White. A.G. 19:109; 20:371. G.C. III. 40:45. Var. **màjus** is advertised.

3. **álbida,** Batem. Lvs. lance-linear, acute: scape twice as long as the lvs.; fls. 2 in. across, pure transparent white except a yellow streak down the lip and a few crimson dots at its base, sweet-scented; sepals lanceolate, spreading; petals similar but broader, all very acute; labellum 3-lobed; side lobes small, erect; middle lobe large, round-ovate, reflexed. All autumn and winter. Oaxaca, Mex. B.M. 3957. B.R. 25:54. Gn. 35:314.—The first white-fld. species discovered. Var. **sulphùrea,** Reichb. f. Larger: fls. sulfur-yellow, with a rose-colored border on the middle lobe, and rose spots on the inner surface of the side lobes. Var. **bélla,** Hort., ex Williams, not Reichb. f. Fls. larger than the type; sepals and petals creamy white, faintly bordered with lilac; lip white, the middle lobe broadly bordered with deep rose and having 3 yellow ridges down the center. Var. **rôsea,** Hort. Fls. rose-colored. Var. **màjus** is advertised.

4. **autumnàlis,** Lindl. Lvs. oblong-linear, obtuse, coriaceous, 5 in. long: scape 1½–2 ft. long, 5–6-fld., with sheathing scales; fls. showy, fragrant; sepals lanceolate-acuminate; petals oblong-lanceolate, undulate; lateral lobes of the labellum large, erect, rotund-truncate, whitish; middle lobe obovate, obtuse, apiculate, recurved, deep purple; disk with 2 narrow yellow lamellæ. In color and general appearance much like *L. anceps,* but the segms. lack the green ribs. Autumn. Mex. B.M. 3817. B.R. 25:27. I.H. 1:17. P.M. 6:121. G.C. 1872:1009.—Grows on bare rocks and stunted trees in most exposed situations, often at great altitudes. Less valuable than *L. anceps.* Var. **furfuràcea,** Rolfe (*L. furfuràcea,* Lindl.). This seems to be a dwarf alpine form, with the ovary more scurfy and the petals unusually broad. It is always found at great elevations, occurring frequently at 7,500–8,500 ft. Intermediate forms exist. B.M. 3810. B.R. 25:26. Var. **atrórubens,** Backh. Pseudobulbs short: fls. large, deep rose or magenta, darker toward the ends of the segms. and the labellum; base of the labellum and lateral lobes white. Gn. 17:368. Var. **venùsta,** Hort. Goldring. In habit resembles var. *atrorubens:* stalk 2–3 ft.: fls. large, rosy mauve. Gn. 25:366. Var. **Fourniéri,** André. Fls. about 6–7 in. across; sepals revolute at the summit, purple-red; petals rhomboid, of the same color, all paler toward the base; labellum white, with the middle lobe colored like the segms. Larger than var. *atrorubens.* R.H. 1896:548. Var. **âlba,** Hort. Fls. pure white.

5. **Arnoldiàna,** Manda. Pseudobulbs 4–6 in. long, pyriform, deeply furcate, 2-lvd.: lvs. 5–7 in. long, leathery, lanceolate, thick and dark green: scape 1–4 ft. long, 3–11-fld.; sepals oblong-lanceolate, pointed; petals broader, ovate, all somewhat reflexed, rose-colored; middle lobe of the labellum reflexed, deep rose-purple, paler toward the center; throat with 2 yellow keels, spotted purple; lateral lobes straight, pale rose or white.—A species closely related to *L. autumnalis,* from which it differs in having bulbs growing erect and rigid lvs. and in the absence of the fetid odor of *L autumnalis.* (W. A. Manda.) Mex. A.F. 5:303. Var. **Fórstermannii,** Hort. Identical with the type, but has pure white fls., with a tinge of delicate pink on the ends of the segms. (W. A. Manda.)

6. **Eyermanniàna,** Reichb. f. (*L. autumnàlis* × *L. grandiflòra,* Reichb. *L. autumnàlis* × *L. albida,* Rolfe). Natural hybrid. Pseudobulbs like those of *L. grandiflora:* lvs. oblong, acute, very leathery, 6 in. long and 2 in. broad: racemes bearing 3–4 fls. up to 4 in. across (as large as those of *L. Gouldiana,* but smaller than *L. autumnalis*), rose-purple (white suffused with bright rosy crimson); sepals lance-oblong, acute; petals broadly oblong or almost rotund, obtuse; side lobes of the labellum oblong; middle lobe rounded, wavy, white bordered with rose and having 3 yellow keels on the disk fading to whitish on the blade. G.C. III. 4:109.

7. **Crawshayàna,** Reichb. f. Natural hybrid. Pseudobulbs and lvs. as in *L. albida:* scape few (2)-fld., long as in *L. anceps,* but thinner and with shorter, narrower sheaths; sepals and petals narrower than in *L. anceps,* of a fine amethyst-color; labellum open near the column; side lobes obtuse-angled, antrorse, rich purple at the tips; middle lobe cuneate, abruptly blunt, lower half rich purple; throat yellow, veined with purple, 3-keeled. According to Reichb., a hybrid between *L. anceps*(?) and *L. autumnalis*(?) or *L. albida* and *L. anceps.* J.H. III. 30:67; 54:27 (as *L. anceps* var. *Crawshayana*)

The plant there figured is probably the species in question, although, according to the figure and the accompanying description, the sepals and petals are wider than those of *L. anceps*.

8. **Gouldiàna,** Reichb. f. Pseudobulbs ovate, 2-lvd.: lvs. oblong-linear: scape slender, 1–2 ft. long, bearing as many as 6 deep rose-purple fls. resembling those of *L. anceps;* sepals lance-oblong, pointed; petals broader, ovate, acute; middle lobe of the labellum large, deeply colored, throat white and veined; side lobes white. Dec., Jan. Mex. G.C. III. 7:169.—A useful species, large plants often bearing 5–10 racemes. Perhaps only a variety of *L. autumnalis*.

9. **ánceps,** Lindl. Fig. 2056. Pseudobulbs scattered on the rhizome, ovate: lvs. 5–9 in. long, oblong-lanceolate: scape from the top of the pseudobulbs, 1½–2 ft. long, clothed with keeled scales and bearing 1–2 very showy, purplish rose-colored fls.; sepals lanceolate-acuminate; petals ovate-acuminate, all with a greenish line on the back; labellum inside of the lateral lobes yellow, with red marks; middle lobe oblong, acute, deep purple, white on the disk, with a thickened yellow keel terminating in 3 ridges. Mex. B.M. 3804. B.R. 1751. G.C. II. 24:405. P.M. 4:73. O.R. 15:145.—One of the most beautiful species of lælia, possessing many fine varieties. Var. **Barkeriàna,** Lindl. Sepals and petals subequal; middle lobe of the labellum rather narrow, acute. B.R. 1947. F.S. 11:1100. Gn. 25:534. Var. **Dáwsonii,** J. Anders. Scape 2–3 ft. long, 2–3-fld.; fls. white; interior of the labellum marked with radiating purple lines, with the usual yellow ridge. Juquila, Mex. Gn. 25:534. G.C. III. 1:424. S.H. 2, p. 175. F.M. 1871:530. Var. **álba,** Reichb. f. Sepals and petals as in var. *Dawsonii;* fls. pure white, with the disk of the lip pale yellow. Dec., Jan. G.C. III. 1:485; 15:172. J.H. III. 50:179. Var. **Hilliàna,** Reichb. f. Sepals and petals white; front lobe of the labellum bilobed emarginate. I.H. 33:584. Gn. 25:534. G.C. III. 1:425. Var. **Williamsii,** Hort. Pure white, narrower than in var. *Stella;* labellum white, large, with the disk and throat yellow, marked with crimson-purple. G.C. III. 1:349. Gn. 25:534. Var. **Lageriàna,** Hort. White, suffused with rose; lip dark lavender, mottled and streaked purple, the throat yellow, purple-veined. Var. **Leeàna,** Reichb. f. Fls. white, smaller than in *L. anceps;* petals very narrow and very acute; side lobes of the labellum blunt; middle lobe small, triangular, wavy, with a thick, well-developed keel; throat yellowish, veined with reddish purple. Var. **Schroederiàna,** Reichb. f. Fls. unusually large; sepals, petals and middle lobe of the labellum pure white; side lobes and throat streaked with broad lines of purplish crimson. Gn. 44:284. G.M. 33:813. G.C. III. 29:94. Var. **Sanderiàna,** Reichb. f. Fls. white; disk of lip crimson. G.C. III. 1:281; 25:136; 43:216. O.R. 9:9; 17:frontis. Gn. 44:284. G.M. 37:88. Var. **Veitchiàna,** Reichb. f. Sepals and petals white; disk of the labellum yellow, veined with brown; lateral lobes and anterior part of the middle lobe veined with purple. Gn. 25:534 (as *L. Veitchii*). Var. **Stélla,** Reichb. f. Fls. pure white; labellum with yellow throat, marked with light crimson lines. G.C. III. 1:280 and 8:500. Var. **Amesiàna,** O'Brien. Sepals and petals broad, feather-veined with mauve; labellum white; middle lobe crimson-purple. G.C. III. 23:59. Var. **Ashworthiàna,** O'Brien. Sepals pure white, lance-oblong; petals broadly ovate, also white; front lobe of the labellum broad, expanded, white, with a few blue dots and yellow keels on the throat; side lobes with lines of slaty blue. G.C. III. 15:103. J.H. III. 28:125. Var. **waddoniénsis,** Hort. Fls. pure white; side lobes of the lip marked with purple lines, disk yellowish. J.H. III. 56:349. G.C. III. 23:125. G.M. 41:115. Var. **Chamberlainiàna,** Hort. Sepals and petals soft rosy lilac; base and side lobes of lip purple-lined, the middle lobe a glaring crimson-purple, the callus orange. G.C. III. 31:71; 49:78. G.M. 45:101. Var. **Percivaliàna,** Reichb. f. Fls. small, but freely produced; sepals and petals white, tinged with bluish pink; lateral lobes of the labellum deep purple at the tips and spotted; throat yellow, with purplish crimson lines; middle lobe creamy yellow at the base; apex purplish. Gn. 25:534. Var. **delicàta,** Hort. ex Williams. Labellum white, suffused with mauve; throat orange-yellow; sepals and petals rose, mauve or lilac. Var. **ròsea,** Reichb. f. A variety having bright rose-colored fls., with the margins of the labellum darker rose. Gn. 25:534. Var. **grandiflòra,** Williams. A robust form resembling the type. G.C. III. 3:105. Var. **holochìla,** Rolfe. Sepals and petals nearly alike, pale lilac; lip petaloid, elliptical-lanceolate, light purple, yellow and white at the base. G.F. 4:173. Var. **Scottiàna,** Warner and Williams. Sepals and petals mauve; labellum deep purple, with a yellow throat. Var. **moràda.** This is a name under which importations of large, highly colored forms of *L. anceps* were sold by the Liverpool Hort. Co., England, as var. *grandiflora.*—Many other varieties appear under Latin names.

2056. Lælia anceps. (×⅓)

10. **rubéscens,** Lindl. (*L. acuminàta,* Lindl. *L. pedunculàris,* Lindl.). Pseudobulbs ovate to subrotund, clustered, sometimes rugose, 1-lvd.: lvs. oblong to lance-oblong, emarginate, 4–5 in. long: scape slender, jointed, sheathed with brown scales at the joints, 1 ft. long, with 2–8 graceful, fragrant fls.; sepals spreading, linear-oblong, acute; petals slightly longer and twice as wide, undulate; labellum as long as the petal; middle lobe of the same form but more undulate and with a stain of yellow on the disk, purplish red on the inner surface. B.M. 4905 and 4099. B.R. 26:41; 27:24; 31:69. F.S. 1:9; 7:742. P.M. 10:49. O.R. 14:41; 19:72.—A slender, graceful plant with small, whitish, lilac-tinted or rose-colored fls. much smaller than those of *L. anceps*.

GROUP II.

A. *Pseudobulbs ovate, evidently thickened.*
  B. *Lip with about 7 undulate keels* ...... 11. **Jongheana**
  BB. *Lip without or with plane keels* .... 2. **grandiflora**
AA. *Pseudobulbs oblong, more st.-like.*
  B. *Fls. greenish yellow* .... 15. **glauca**
  BB. *Fls. bright colored or white.*
    C. *Labellum firm, fleshy; lateral lobes convolute over the column* .... 12. **pumila**
    CC. *Lateral lobes of the lip resting on the middle lobe* .... 13. **Leeana**

11. **Jongheàna,** Reichb. f. Rhizome with remarkably thick root-fibers: pseudobulbs ovate-oblong, 1-lvd.: lvs. broadly oblong, 3–5 in. long, very thick and dark green: scape stout, shorter than the lf., 1–2-fld.; fls. 4 in. diam., bright amethyst-color; sepals linear-lanceolate, acute; petals broadly oblong-obtuse; labellum convolute; lateral lobes very shallow; middle lobe emarginate, white and crisp, with about 7 golden-yellow undulate ridges in the throat. Brazil. B.M. 6038. R.H. 1873:290. G.C. 1872:425. O.R. 12:273.—A dwarf species with remarkable leathery lvs. Said to equal *L. grandiflora* and *Cattleya Mossiæ.* Rare in cult. Many varieties are listed under Latin names.

12. **pùmila,** Reichb. f. (*Cáttleya pùmila,* Hook. *C. marginàta,* Paxt. *L. prǽstans,* Lindl. & Reichb. f. *L. Dayàna,* Reichb. f. *L. Pinélli,* Hort.). Pseudobulbs small, st.-like, with 1 oblong to linear-oblong lf. 5–6 in. long: peduncle shorter than the lvs., each bearing a single, large, drooping, rose-purple fl.; sepals oblong, acute; petals ovate-oblong, broader, undulate; labellum very involute; lateral lobes subquadrate, middle lobe short, emarginate, waved and crisped; throat yellow, apex rich purple. A pretty dwarf species from Brazil, very variable and useful. B.M. 3656, 5498. B.R. 30:5. F. 1850:89 (as *Cattleya spectabilis*). G.C. II. 23:597; III. 36:354.—Many variations of this plant have been described as distinct species, although botanically but one species. Some of them are well-marked horticultural varieties. Var. **prǽstans,** Veitch (*L. prǽstans,* Lindl. & Reichb. f.). A large-fld., highly-colored variety, with the sepals and petals much broader than in the type; labellum rich purple, very rigid and fleshy, lines almost obsolete. B.M. 5498. Gn. 53, p. 550. Var. **marginàta,** Hort. (*Cáttleya marginàta,* Paxt.). Fls. large; sepals and petals rose-crimson; labellum with a white border, crisp. Brazil. P.M. 10:265. I.H. 6:193 (as *Cattleya pumila* var. *major*). F.S. 18:1900. G.C. III. 22:262. A.G. 11:158. Var. **Dayàna,** Dean (*L. Dayàna,* Reichb. f.). Sepals and petals rose-purple; labellum with a deep purple margin. Earlier than the type. Brazil. R.H. 1890, p. 490. F.M. 1877:249. Var. **álba,** Hort. Fls. like var. *præstans,* but pure white with the base of the lip yellow. G.C. III. 21:11. J.H. III. 34:27; 43:349; 49:409, 475.

2057. Lælia purpurata. (×⅙). No. 22.

13. **Leeàna,** Reichb. f. Hybrid: pseudobulbs cylindrical, somewhat swollen, 1-lvd.: lvs. cuneate-oblong, very coriaceous: sepals and petals spreading, ligulate, acute, somewhat undulate, rose-color, lateral lobes of the labellum semi-ovate, acute, the tips resting on the middle lamella, white, tips purple; middle lobe broad, obcordate. Sept. "Natural hybrid of *L. marginata* and ———?" (Hansen).—As this plant has 4 pollinia, it is probably nearer Cattleya. It was imperfectly described by Reichb. as a doubtful hybrid.

GROUP III.

A. *Fls. greenish yellow.*
  B. *Labellum deeply fringed on the margin*..................14. **Digbyana**
  BB. *Labellum not fringed.*
    C. *Evidently 3-lobed*..............15. **glauca**
    CC. *Obsoletely 3-lobed*..............16. **virens**
AA. *Fls. all yellow*..................17. **xanthina**
AAA. *Fls. with only the sepals and petals tawny yellow; labellum some other color*..........................18. **grandis**
AAAA. *Fls. purple, rose or white.*
  B. *Labellum with several prominent toothed crests*..................19. **superbiens**
  BB. *Labellum destitute of crests.*
    C. *Petals and labellum waved and crisped.*
      D. *Fls. uniformly purple*.......20. **Boothiana**
      DD. *Fls. white and purple.*
        E. *Lip ovate-acuminate*.......21. **crispa**
        EE. *Lip rounded*.............22. **purpurata**
    CC. *Sepals and labellum plane, or nearly so*....................23. **Perrinii**

14. **Digbyàna,** Benth. (*Brassávola Digbyàna,* Lindl.). Pseudobulbs elongate, st.-like, 1-lvd.: lvs. elliptical, thick, fleshy, plane, slightly keeled: peduncle with a solitary, very large, fragrant fl. 3–5 in. across; sepals and petals similar, oblong, spreading, pale purplish green; petals slightly broader; labellum very large-cordate, entirely surrounding the column, white or cream-colored, with the margin cut into a broad laciniate fringe, which makes the fl. very striking. July, Aug. Honduras. B.M. 4474. B.R. 32:53. F.S. 3:237. G.C. III. 18:153. G.M. 46:307.—A slow-growing orchid.

15. **glaùca,** Benth. (*Brassávola glaùca,* Lindl.). St. short, creeping: pseudobulbs short, oblong, st.-like, compressed and sheathed with scales, bearing a single oblong, glaucous, very thick and leathery lf.: fls. usually single, on a stalk shorter than the lf., fragrant; sepals and petals spreading, oblong-lanceolate, obtuse, greenish yellow; labellum with a short claw surrounding the column, then expanding into a large 3-lobed limb, yellowish white, streaked with red in the throat. Mex. and Guatemala. B.M. 4033. B.R. 26:44. G.C. III. 7:357.

16. **vìrens,** Lindl. Plants about 6 in. high: fls. 1 in. across; sepals suberect, ovate; petals lanceolate, subequal; labellum obsoletely 3-lobed, cucullate; apex ovate, crisp, with obscure raised lines toward the base. Brazil.—The fls. are pale yellowish green, of no beauty.

17. **xanthìna,** Lindl. Lvs. oblong, longer than the fusiform pseudobulb: raceme 3–5-fld.; fls. 3 in. across, buff-yellow except the lip, which is white in front streaked with crimson-purple; sepals and petals subequal, oblong-obtuse, undulate, leathery and convex; labellum nearly quadrate when spread out, without raised veins. Brazil. B.M. 5144. F.S. 23:2418.—Intro. 1858. A second-rate species.

18. **grándis,** Lindl. & Paxt. Pseudobulbs st.-like, 1-lvd., 1 ft. high: lvs. rigid, oblong-lanceolate: scape erect, bearing 2–5 fls. 4 in. across; sepals and petals lanceolate, the latter a little broader, slightly curled or twisted; labellum white; front lobe large, bell-shaped, crenate-toothed, veined with purple. Spring. Brazil. B.M. 5553. F.S. 7, p. 238, and 23:2473.—A curious species with the sepals and petals colored tawny yellow, contrasting strongly with the whitish purple-veined lip. Var. **tenebròsa,** God. Lebeuf. Sepals and petals citron-yellow, less undulate; labellum trumpet-shaped, purple, with a broad border of white with many purple veins. G.C. III. 14:221. G.M. 36:531.

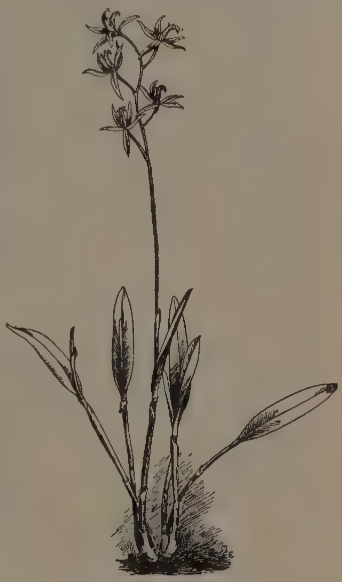
19. **supérbiens,** Lindl. Pseudobulbs 1 ft. or more in length, oblong, with 1 or 2 coriaceous oblong lvs. equaling the pseudobulbs in length: scape drooping, 5–6 ft. long, bearing a globose cluster of 10–20 fls. each about 6 in. diam.; sepals and petals nearly equal, spreading, oblong-lanceolate, obtuse, lilac-purple, paler below; labellum as long as the segms., middle lobe broad obcordate, waved and crisped; disk with several prominent toothed crests, yellow, deep crimson-purple on the margins; side lobes yellow with purple margins and stripes. Guatemala. B.M. 4090. F.S. 11:1178, 1179. P.M. 11:97. R.H. 1886:324.—A very large plant.

20. **Boothiàna,** Reichb. f. (*L. lobàta,* Veitch. *Cáttleya lobàta,* Lindl.). A strong-growing plant: pseudobulbs clavate, furrowed, 1-lvd.: lvs. lanceolate-oblong, about as long as the scape: scape 8–10 in. long, from the axil of the lf., 2–5-fld.; fls. about 5 in. across, uniformly violet-purple with rich crimson veins on the lip; sepals lanceolate, with reflexed margins; petals broad, oblong, undulate, crisp; labellum cucullate, the middle lobe reflexed, all beautifully waved and crisped. Much like *L. crispa* in habit. April, May. S. Brazil. R.H. 1874:331 (as *L. Rivieri*). G.C. 1848:403; III. 10:577. F.S. 20, p. 132. A.G. 13:608. O.R. 12:265.—This plant is not free-flowering, hence it is little cult., although a beautiful and distinct species.

21. **críspa,** Reichb. f. (*Cáttleya críspa,* Lindl.). Pseudobulbs clustered, elongate-clavate, 1-lvd.: lvs. large, 1 ft. long, oblong-lanceolate, emarginate: scape with 5–6 large, handsome, fragrant fls.; sepals linear-oblanceolate or spatulate, acute, margins revolute; petals much broader, with the margins beautifully waved and crisped; labellum standing forward, recurved at the apex; side lobes rounded, white, yellow at base, streaked with red; middle lobe long, ovate-acuminate, deep purple inside, veined, all remarkably waved and crisped. Summer. On lofty trees fully exposed. Brazil. B.M. 3910. B.R. 1172. Gn. 48, p. 504. J.H. III. 33:197. P.M. 5:5. O.R. 9:201; 17:305.—A fine white-fld. species resembling a cattleya in habit. Var. **Cauwelærtiæ,** L. Lind. Sepals and petals tinged with greenish yellow; base of labellum yellow. I.H. 38:121.

22. **purpuràta,** Lindl. & Paxt. (*Cáttleya Brysiàna,* Lem.). Fig. 2057. Pseudobulbs long-elliptical, 6–8 in. high: lvs. solitary, oblong, leathery, dark green, 1 ft. or more in length: scape erect, 3–7-fld.; fls. very large, 6–8 in. across; sepals linear-oblong, spreading, white, suffused with light rose; petals much broader, ovate, undulate, crisp, base attenuate, colored like the sepals; labellum very large, bell-shaped; middle lobe rounded, undulate, crisp, rich purple with darker veins, throat yellow. A robust plant, whose large fls., borne on strong erect stalks, make it one of the grandest lælias in cult. Spring. Brazil. I.H. 1, p. 54, and 3:83. F.S. 11:1138, 1139. Gn. 54, p. 17; 56, p. 46 (var. Mrs. Measures). G.C. II. 14:45; 20:533. A.F. 6:223. O.R. 15:156. G.M. 57:723 (var. *alba*). Var. **atropurpùrea,** Williams. Sepals and petals deep rose; labellum large, expanded, purple-magenta; throat yellow, veined with purple. Brazil. Var. **Ashworthiàna,** J. Anders. Petals wider than in the type, 2 in. wide, purplish rose, with darker stripes. A highly colored form. G.C. III. 20:39. Var. **Nélisii,** Hort., Versch. Sepals and petals subsessile, the former rose-colored outside; midlobe of the labellum ovate, acute. Much like the type in color. I.H. 15:569. Var. **Russelliàna,** Williams (*L. Russelliàna,* Hort.). Fls. large; sepals somewhat narrow, white, suffused with lilac; petals broader, deeper lilac; labellum large, rose-lilac; throat yellow, marked with rose. Autumn. Var. **Schrœderi,** Reichb. f. Sepals and petals white; labellum white, with a tinge of rose in the center; tube pale yellow, with fine, dark purple lines. I.H. 38:139. Var. **Mandaiàna,** Hort. Pseudobulbs thinner and narrower than in the type: fls. as large as those of the type, pure white, with a faint tinge of pink on the labellum. Var. **prætéxta,** Reichb. f. No description of this plant is available. Many other varieties appear under Latin names.

23. **Pérrinii,** Lindl. (*Cáttleya Pérrinii,* Lindl.). Pseudobulbs elongate: lvs. solitary, oblong, coriaceous, 8 in. long, equaling the st.: fls. showy, 2–3 on a short stalk; sepals oblong-linear, obtuse; petals a little broader, all rose-purple, darker at the tips; middle lobe of labellum cucullate, expanded, oblong, obtuse, undulate, with an inflated fistular cavity at the base, destitute of ridges, color deep crimson; lateral lobes erect, acute, pale. Oct.–Dec. Brazil. B.M. 3711 (as *L. intermedia* var. *angustifolia*). B.R. 24:2. P.M. 13:5. G.M. 37:717. A.F. 13:1196; 31:470.—Fls. rather pale. Var. **álba,** O'Brien. Fls. white, labellum tinged with yellow. There are several pale varieties of this plant.


2058. Lælia cinnabarina.

GROUP IV.

A. *Lvs. solitary.*
  B. *Scape 1-fld*........................24. **monophylla**
  BB. *Scape several-fld*..................25. **harpophylla**
AA. *Lvs. usually 2*......................26. **cinnabarina**

24. **monophýlla,** N. E. Br. Rhizome a matted mass sending up tufts of lf.- and fl.-sts.: flowering sts. 6–10 in. long, as thick as a crow-quill, rigid and erect, bearing a single linear-oblong, obtuse lf. 2–3 in. long, and several sheathing bracts; fls. 1–2 in. across, vivid orange-scarlet; sepals and petals similar, spreading, oblong, subacute; labellum very small, lateral lobes embracing the column, terminal minute papillose on the disk. Mountains of Jamaica, growing on trees at elevations of 3,000–5,000 ft. B.M. 6683.

25. **harpophýlla,** Reichb. f. Hybrid much like *L. cinnabarina.* Pseudobulbs slender, about 10 in. long, each bearing a single lance-linear lf.: raceme short, suberect, bearing 5–10 brilliant scarlet-orange fls.; sepals and petals oblong-lanceolate, acute; middle lobe linear, acuminate, crisp, with a whitish spot. A luxuriant free-flowering species. Feb., March. Brazil. Gn. 24:116. F.M. 1879:372. J.H. III. 43:283.—Probably a hybrid between *L. cinnabarina* and a Brassavola(?), Reichb. f.

26. **cinnabarìna,** Batem. Fig. 2058. Pseudobulbs elongate, cylindrical, but broadest at the base, sheathed with scales, bearing 1–2 linear-oblong, reflexed, acute, coriaceous lvs.: raceme terminal, erect, 15–20 in. long, with

4–5 medium-sized reddish orange fls.; sepals and petals linear-oblong, obtuse, spreading; labellum convolute, reflexed; lateral lobes acute, middle lobe large, oval, crisp. Brazil. B.M. 4302. P.M. 7:193. O.R. 20:361. —A summer-flowering species whose peculiar color and graceful habit render it very ornamental. Var. **crispilàbia**, Veitch (*L. crispilàbia*, A. Rich. *L. Lawrenciàna*, Hort.). Fls. amethyst-purple; labellum darker, finely crisp and undulate: raceme 12–14 in. long, bearing 3–5 fls. A pretty, free-flowering variety.

L. bélla=L. grandiflora × L. purpurata.—*L. Canàri*=L. Digbyana × L. xanthina.—*L. canariénsis*=L. harpophylla × L. anceps. —*L. Còwanii*, Rolfe. Habit of L. cinnabarina, but pseudobulbs taller: fls. yellow, in erect spikes. Brazil.—*L. chamonicénsis*=L. purpurata × L. Jongheana.—*L. Chatínii*=L. Jongheana × L. harpophylla.—*L. crispabròsa*=L. crispa × L. tenebrosa.—*L. Dánielsii*=L. Perrinii × Lc. Schilleriana.—*L. Degeestiàna*=L. Jongheana var. alba × L. flava. Sepals and petals white, the lip yellow. G.C. III. 48:274.—*L. Digbyàno-Móssiæ*=Brassocattleya Veitchii.—*L. édissa*=L. anceps × L. purpurata. G.M. 43:193.—*L. flavìna*=L. pumila × L. flava.—*L. gattonénsis*=L. anceps var. Dawsonii × L. cinnabrosa.—*L. Gílbertii*=L. tenebrosa × Lc. elegans.—*L. Górdonii*. Of doubtful origin. Pseudobulbs about 1 in. long, furrowed after first season.—*L. Gròganii*=L. flava × L. crispa.—*L. Gwéniæ*=L. Jongheana × L. Cowanii.—*L. Johniàna*, Schlecht. Pseudobulbs club-shaped: racemes few fld.; fls. greenish white. Probably Colombia. O. 1912:6.—*L. Latòna*, Hort. Veitch. Sepals and petals light orange-yellow; labellum whitish at base, the rest purple bordered with orange-yellow; middle lobe much undulated. A garden hybrid between L. cinnabarina and L. purpurata. Not advertised in Amer. A. Pericat, Philadelphia, writes as follows of this plant: "Lælia Latona, raised by Veitch, is a beautiful hybrid lælia of a distinct and unusual color, from L. purpurata × L. cinnabarina, the latter being the seed parent. The sepals and petals are of light orange-yellow; lip whitish at the base, the remainder red-purple bordered with orange-yellow, the margin of the apical spreading; lobe is much undulated."—*L. Lúndii*, Reichb. f. Plant small, about 6 in. high: fls. produced on young growth; sepals and petals narrow, white, suffused with lilac; lip 3-lobed. Brazil.—*L. lynwoodénsis*=L. Jongheana × L. harpophylla.—*L. Rógersii*=L. Dayana × L. Cowanii. —*L. Sidneyàna*=L. cinnabarina × L. Jongheana.—*L. Státheræ*=L. purpurata × L. flava.—*L. tenejàlis*=L. grandis var. tenebrosa × L. majalis.

HEINRICH HASSELBRING.

LÆLIOCATTLÈYA (compounded from *Lælia* and *Cattleya*). *Orchidàceæ.* A name proposed by R. A. Rolfe to designate the bigeneric hybrids of Lælia and of Cattleya, which readily hybridize. The species of the two genera have eight and four pollen masses respectively, while the hybrids are irregular in this respect. Many of the plants are natural hybrids, and many others have been produced by artificial crossing. For a list of læliocattleyas, see Rolfe in G.C. III. 6:78, 155. In the following account L.=Lælia; Lc.=Læliocattleya; C.=Cattleya.

The cultivation of læliocattleyas is the same as for lælia and cattleya. It is therefore important to know the parentage in each case, from which one may know whether warm or coolhouse treatment is needed. Many læliocattleyas are of such a vigorous constitution that they are nearly always in growth.

INDEX.

alba, 13.
amanda, 2.
Andreana, 7.
Arnoldiana, 5.
Brysiana, 1.
callistoglossa, 5.
corbeillensis. 3.
Dominiana, 6.
Dominyana, 6.
Dormaniana, 16.
Duvaliana, 10.
elegans, 1.
eximia inversa, 11.
exoniensis, 17.
intermedio-flava, 15.
Martinetii, 12.
Nyleptha, 1.
prasiata, 1.
radiata, 9.
Sallieri, 8.
Schilleriana, 13.
Stelzneriano-Hardyana, 4.
surperba, 1.
Turneri, 1.
velutino-elegans, 14.

KEY TO THE SPECIES.

A. *Fls. light or bright rose*............ 1. **elegans**
2. **amanda**
3. **corbeillensis**
4. **Stelzneriano-Hardyana**
5. **callistoglossa**
AA. *Fls. rose-purple, mauve, violet, etc.*. 6. **Dominiana**
7. **Andreana**
8. **Sallieri**
9. **radiata**
10. **Duvaliana**
11. **eximia inversa**
12. **Martinetii**
AAA. *Fls. white or whitish, or yellow*..... 13. **Schilleriana**
14. **velutino-elegans**
15. **intermedio-flava**
AAAA. *Fls. olive-brown*................. 16. **Dormaniana**
AAAAA. *Fls. tinted light blue*............. 17. **exoniensis**

1. **élegans**, Rolfe (*L. élegans*, Reichb. f. *C. élegans*, Morr.). Pseudobulbs terete, st.-like, 15–20 in. high: lvs. solitary, linear-oblong, coriaceous, 10–12 in. long: scape short, stout, 3–7-fld.; fls. 5 in. diam., light or bright rose, fragrant; sepals oblong, acute, often somewhat twisted or with revolute edges; petals much wider, lanceolate, margin somewhat undulate; labellum with the lateral lobes elongate-obtuse, whitish with purple apices, convolute over the column; middle lobe broadened in front, subreniform, margin undulate, crisp, entirely a very deep purple, without raised lines or callosities. May–Sept. Brazil. B.M. 4700. I.H. 4:134 (as *L. Brysiana*); 11:402. G.C. III. 42:248. G.M. 50:627. Gn. 60, p. 196. C.O. 7.—A showy, tall-growing species. Var. **Nyléptha**, O'Brien. Fls. large; sepals tinted with yellow and rose, lightly spotted with purple toward the tips; petals broader, more suffused with purple; lip bright purple in front, paler at the side lobes. G.C. III. 3:176. Var. **Túrneri**, Warner. Fls. large, richly colored; sepals and petals bright amethyst-purple, with deeper veins; lip with a large purple blotch on the middle lobe; side lobes white, tipped with rose. Gn. 47, p. 319; 49:384 and p. 385.—One of the finest of the genus. Var. **prasiàta**, Reichb. f. Sepals and petals rose, tinged with green; labellum white at the base and side lobes, middle lobe crimson-purple.—Var. *supérba* is advertised.

2. **amánda**, Rolfe (*L. amánda*, Reichb. f.). Natural hybrid between *C. intermedia* and perhaps *L. crispa*. Pseudobulbs thin, fusiform, 5–7 in. long, 1–2-lvd.: lvs. shorter than the pseudobulbs, cuneate-oblong, acute: fls. in pairs, from a small, narrow spathe; sepals oblong-ligulate, acute, light rose, with a grayish hue outside, wavy; petals similar but broader, with darker-tinted nerves on the inside; lateral lobes of the labellum enveloping the column, rich dark purple; middle lobe transversely oblong, short, emarginate, wavy, separated from the others by an exceedingly short isthmus, veined with rich purple. Brazil. I.H. 38:135.

3. **corbeillénsis**, Maron. Garden hybrid of *C. Loddigesii* and *L. pumila* var. *marginata*. Pseudobulbs 5–6 in. long, fusiform: lvs. about 6 in. long: fl.-stalk 2–3 in. long, bearing 1–2 showy fls. about 5 in. across; sepals and petals bright rose, the latter veined with deeper purple lines; throat of the labellum veined with yellow on a white ground; blade intense purple, bilobed and undulate. C.O. 5.

4. **Stelzneriàno-Hardyàna**, Maron. A garden hybrid of *Lc. elegans* var. *Stelzneriana* and *C. Hardyana*. Plants vigorous: pseudobulbs 7–8 in. long: lvs. 10 in. long by 2½ in. wide: sepals pale clear rose, deeper on the edges; petals undulate, rose on the margins, fading almost to white at the center; labellum purple-magenta, undulate lacerate on the margin, with a broad purple line in the center of the blade and 2 large white spots in the throat.

5. **callistoglóssa**, Rolfe (*L. callistoglóssa*, Reichb. f. *Lc. Arnoldiàna*, Hort.). Garden hybrid of *L. purpurata* and *C. labiata* var. *Warscewiczii*. Pseudobulbs as in *L. purpurata:* lvs. 12 in. long: petals broad, oblong, acute; sepals narrower, all pure rose; middle lobe of the labellum broad, retuse, dark purple, with yellow on the disk; side lobes small, obtuse-angled. C.O. 8. Gn.W. 10:501. G. 28:441.

6. **Dominiàna**, Rolfe (*L. Dominyàna*, Reichb. f.). Garden hybrid. Plants having the general habit of *C. Mossiæ:* pseudobulbs fusiform, rather short, 1-lvd.: lvs. linear-oblong: raceme bearing few large, hand-

some fls.; sepals narrowly oblong, acute, light purple, with dark reticulations; petals broadly cuneate-oblong, wavy, light purple; labellum cucullate, with the middle lobe large, spreading, all wavy and crisp, deep blackish purple. F.M. 1878:325.—Raised for Veitch by Mr. Dominy from a cross between *C. Dowiana* and some lælia,—according to Reichenbach, *L.* (*Lc.*) *elegans*. R. A. Rolfe suggests the more probable parentage of *C. Dowiana* and *L. lobata*. The first plant flowered in Aug., 1878.

7. **Andreàna,** Maron. A garden hybrid between *C. bicolor* and *Lc. elegans*. Pseudobulbs 8–12 in. long, st.-like: lvs. oblong, 6 in. long: fls. 6–7 in. across, rose-violet; sepals and petals spreading, narrowly oblong, with the margins recurved, those of the petals undulate; labellum contracted in the middle, with a subquadrate toothed and undulate middle lobe, violet-purple. R.H. 1896:328.

8. **Sallièri,** Maron. Garden hybrid between *L. purpurata* var. *Williamsii* and *C. Loddigesii*. Pseudobulbs 1–2-lvd., about 10 in. high: lvs. 8 in. long, 3 in. wide: fls. several on a stalk, which is shorter than the lvs., 5–6 in. across; sepals and petals mauve, with deeper lines; labellum tubular, colored like the segms., and expanding into a carmine blade, pale at the tip.

9. **radiàta,** Maron. Garden hybrid of *L. purpurata* and *C. nobilior*. Pseudobulbs almost round, bearing 1–2 coriaceous lvs. 7 in. long by 2½ in. wide: fl.-stalks about 7–8 in. long, bearing several large, showy, violet-red fls.; labellum deep red, with purple veins and a whitish throat.

10. **Duvaliàna,** Hort. Hybrid between *L. purpurata* and *C. Luddemaniana*. Sepals and petals half-spreading, light mauve; labellum broad, dark maroon-crimson on the lobes and in the throat, which is traversed by darker lines.—According to Arnold & Co., handsome fl. of striking appearance.

11. **exímia invérsa,** Hort. Hybrid between *L. purpurata* and *C. Warneri*, the inverse cross of *Lc. eximia*. Sepals and petals deep rose-purple; labellum bright magenta-crimson.—Said by Arnold & Co. to be one of the finest hybrids yet raised between these genera, resembling *C. Warneri*.

12. **Martinétii,** Maron. Garden hybrid between *C. Mossiæ* and *L. grandis* var. *tenebrosa*. Fls. resembling those of the *C. labiata* group; sepals and petals rose-violet; labellum red to mauve, pale at the margins, and netted with numerous deep red veins. G.M. 46:511.

13. **Schilleriàna,** Rolfe (*L. Schilleriàna*, Reichb. f.). Lvs. 8 in. long: fl.-sts. 20 in. long; sepals and petals white, elongate-lanceolate; labellum veined with purple on the throat; disk purplish yellow, middle lobe spotted crimson-purple. A natural hybrid between *C. intermedia* and *Lc. elegans*. Brazil. Var. **álba,** Hort. Petals and sepals pure white; middle lobe of the labellum rich carmine-magenta, presenting an agreeable contrast. June, July. I.H. 31:526. Gn. 17:132.

14. **velùtino-élegans,** O'Brien. Garden hybrid of *C. velutina* and *Lc. elegans*. Resembles in habit a stout form of *C. velutina:* fls. fragrant, 3–4 on an upright st.; sepals and petals creamy white, tinged with nankeen-yellow and veined with rose; labellum bluish white at base, side lobes folded over the column; middle lobe broad, toothed and crisp on the margin, rich crimson-purple, veined with white and having an orange blotch at the base.

15. **intermèdio-flàva,** Maron. Garden hybrid of *C. intermedia* and *L. flava*. Of medium habit: sepals and petals clear yellow; labellum with a bright rose-purple blotch in front.

16. **Dormaniàna,** Rolfe (*L. Dormaniàna*, Reichb. f.). Natural hybrid of *C. bicolor* and *L. pumila*. Pseudobulbs terete, thin, slender, about 1 ft. long, 1–2-lvd.; lvs. oblong-ligulate, acute: peduncle 2–5-fld.; petals and sepals narrow oblong-ligulate, olive-brown, marbled outside with wine-red spots; labellum light purplish white, with darker veins; middle lobe transversely obcordate, mauve-purple. Brazil.

17. **exoniénsis,** Rolfe (*C. exoniénsis*, Reichb. f.). Garden hybrid probably between *C. labiata* and *L. crispa*. Sepals ligulate-acuminate; petals oblong-cuneate, plicate, all tinted light blue; labellum undulate, crisp, deep orange at base with whitish side lobes; middle lobe rich purple, with darker veins.

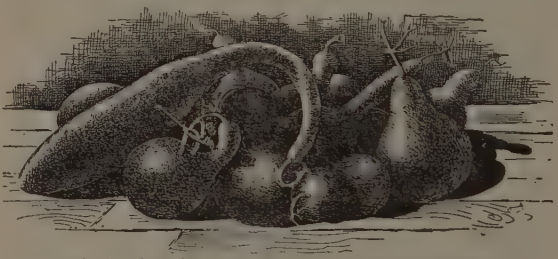
Lc. Aclándiæ=L. purpurata × C. Aclandiæ.—*Lc. Adólphus supérba*=L. cinnabarina × C. Aclandiæ. Fls. waxy; sepals and petals reddish Indian-yellow, ruby-spotted; front of lip and tips of lateral lobes purplish rose. G.C. III. 32:111. G.M. 45:666.—*Lc. Álbertii*=L. purpurata × C. velutina.—*Lc. Aleschiàna*=L. purpurata × C. Schilleriana.—*Lc. Alexándri*=Lc. elegans × C. granulosa var. Schofieldiana.—*Lc. amábilis*=Lc. Fascinator × C. Luddemanniana var. Stanleyi.—*Lc. amæna*=L. harpophylla × C. Eldorado var. alba.—*Lc. Andrómeda*=L. flava × C. aurea. Sepals and petals yellow; lip purple, marked, with yellow. Gn. 71:323.—*Lc. Árdenæ*=Lc. callistoglossa × L. Digbyana.—*Lc. Ármstrongæ*=Lc. Geo. Woodhanes × C. Dowiana var. rosita.—*Lc. aurénsis*=Lc. Behrensiana × C. aurea. — *Lc. Bállii* = L. cinnabarina × C. Schroederæ.—*Lc. Básketlæ* = Lc. eximia × C. Schroederæ. — *Lc. Behrensiàna*=Lc. elegans × C. Loddigesii.—*Lc. bélla*=L. purpurata × C. labiata. Sepals and petals light lilac; lip purple, marked with yellowish white.—*Lc. Beyrodtiàna*=Lc. elegans × C. Lawrenceana. —*Lc. Bievreàna*=L. crispa × C. Rex.—*Lc. Binòtii*=L. pumila × C. bicolor.—*Lc. blesénsis*=L. pumila × C. Loddigesii. Sepals and petals a bright rose, lined with deeper color; lip intense purple, marked with yellow. R.H. 1893:424.—*Lc. bletchleyénsis*=L. tenebrosa × C. Warscewiczii. Sepals reddish brown, tinged with greenish yellow; petals bright rose-purple, marked with deeper lines; lip bright rose-purple, lined with purple-crimson. A.G. 23:579. Gt. 55:1555. C.O. 27.—*Lc. broomfieldiénsis*=Lc. Clive.—*Lc. burbagénsis*=L. purpurata × C. granulosa.—*Lc. callístor*=Lc. callistoglossa × C. bicolor.—*Lc. Canhamiàna*=L. purpurata × C. Mossiæ. Sepals and petals light rose, the lip purple, the throat orange, brown-lined, the front lobe white-margined. G. 26:263. G.C. III. 51, suppl. May 25.—*Lc. Canhamiàna* var. *álba*. Sepals and petals nearly white. C.O. 19. J.H. III. 45:145; 55:76; 62:565. G.M. 52:867; 57:673.—*Lc. Cantiàna*=Lc. Geo. Woodhanes × C. Harrisoniana.—*Lc. Cassándra*=Lc. elegans × C. Loddigisii.—*Lc. Cátherinæ*=Lc. Schilleriana × L. longipes.—*Lc. Celéstinæ*=L. tenebrosa × Lc. elegans.—*Lc. Chárlesworthii*=L. cinnabarina × C. Dowiana. Fls. light yellow, the narrow lip wavy, purple-marked. G.M. 47:170.—*Lc. chardwarénsis*=L. cinnabarina × C. dolosa.—*Lc. chocophýlla*=L. harpophylla × C. Trianæ var. chocoensis.—*Lc. Choletiàna*=L. superbiens × C. Mossiæ. Sepals and petals light rosy lilac; lip dark rose, the disk yellow, the lateral lobes marked with dark lines. G.M. 45:215.—*Lc. Clárkii*=L. purpurata × C. picturàta.—*Lc. Clìve*=L. pumila × C. Dowiana. Sepals and petals rosy; lip deep, velvety purple, the throat orange-veined. J.H. III. 45:121.—*Lc. Còlmaniæ*=Lc. callistoglossa × C. Hardyana.—*Lc. Colmaniàna*=Lc. Arnoldiana × C. Dowiana var. aurea.—*Lc. Coòksonæ*=Lc. Clive × C. labiata. Se als and petals deep rosy lilac; lip velvety crimson, suffused with yellow in the center with rich purple lines. J.H. III. 45:375.—*Lc. cornùta*=L. autumnalis × C. labiata.—*Lc. Coùstonii*=L. tenebrosa × Lc. callistoglossa.—*Lc. Còwanii*=L. cinnabrosa × C. Mossiæ.—*Lc. Cránstounæ*=L. tenebrosa × C. Harrisoniana var. violacea.—*Lc. críspo-Hardyàna*=L. crispa × C. Hardyana.—*Lc. Cýbele*=Lc. elegans × C. Trianæ.—*Lc. Dàvidsoniæ*=Lc. bella × C. labiata.—*Lc. Dayàna*=L. crispa × C. velutina.—*Lc. Dénganii*=Lc. Cappei × C. Dowiana.—*Lc. Dénisii*=L. superbiens × C. Luddemanniana.—*Lc. Desgrangeàna*=L. lobata × C. labiata.—*Lc. Dietrichiàna*=Lc. M. Leimann × C. Vigeriana. Sepals and petals intense ruby-red; lip large, velvety, deeper than the sepals and petals, the throat streaked with yellow. R.B. 36:133.—*Lc. Digbyàno-Méndelii*=Brassocattleya Maronæ. —*Lc. Digbyàno-Schròederæ*=L. Digbyana × C. Schroederæ. G.C. III. 31:239.—*Lc. Donizéttii*=L. cinnabarina × C. Aclandiæ.—*Lc. Dormaneàno-aùrea*=Lc. Dormaniana × C. aurea.—*Lc. dourdanénsis*=L. purpurata × C. Schroederæ.—*Lc. Duchésnei*=L. purpurata × C. Schilleriana. Another hybrid of the same name is Lc. callistoglossa × C. speciosissima.—*Lc. Duquésnei*=Lc. warnhamensis × L. purpurata.—*Lc. Édwardii*=L. cinnabarina × C. Hardyana.—*Lc. Ehrenbergiàna*=L. Perrinii × C. Bowringiana.—*Lc. elegantíssima*=L. cinnabarina × C. intermedia.—*Lc. epicásta supérba*. A large-fld.-form.—*Lc. Érnestii pállida*. "A pretty form with cowslip-yellow sepals and petals."—*Lc. Éthelæ*=Lc. corbeillensis × C. bicolor.—*Lc. evershoténsis*=L. cinnabrosa × C. Forbesii.—*Lc. exoniénsis*=L. crispa × C. Mossiæ. Sepals and petals white, sometimes tinted rosy mauve; lip with the front lobe rich purple, crisped, the narrow margin white or pale mauve; disk yellow, purple-streaked. A.F. 20:527.—There are several different hybrids under this name.—*Lc. Fanyanàna*=L. tenebrosa × C. Trianæ.—*Lc. Farrántiæ*=L. purpurata × Lc. Pallas. — *Lc. Fascinàtor-Móssiæ*=Lc. Fascinator × C. Mossiæ. G.C. III. 49:422.—*Lc. faùsta*=Lc. exoniensis × C. Loddigesii.—*Lc. perrierénsis*=L. cinnabarina × C. Gaskelleana.—*Lc. Fírminii*=Lc. Ceres × C. Dowiana var. aurea. —*Lc. Flòryi*=Lc. "Violetta" × C. Trianæ.—*Lc. flavèola*=L. cinnabarina × C. Schroederæ.—*Lc. Fleùrenæ*=Lc. Agnes × C. Loddigesii.—*Lc. germània*=Lc. Cappei × C. Mendelii. Fls. chrome-yellow; lip with front lobe marked carmine-red. G.C. III. 49:325. G.M. 54:413.—*Lc. Godiniàna*=L. grandis var. tenebrosa × C. Gigas.—*Lc. Godmánii*=Lc. callistoglossa × C. Iris.—*Lc. Got-*

toiàna=L. tenebrosa×C. Warneri. Sepals and petals bright rose, the former shaded with yellowish brown, the petals pale on the margin; lip red-purple, narrowly white-margined. A.F. 23:1047. Gng. 13:150.—*Lc. Gottoiàna Hébertii* is listed.—*Lc. grácilis*=L. anceps×C. Bowringiana.—*Lc. Grogániæ*=L. Dayana×C. Harrisoniana.—*Lc. Hámiltonii*=L. Dayana×C. bicolor.—*Lc. Haroldiàna*=L. tenebrosa×C. Hardyana. Sepals pale yellow, slightly rose-marked; petals yellow, deeply suffused with rose; lip rose-purple, shading to crimson at base. G.M. 45:833 (as var. superba).—*Lc. Harriánceps*=L. anceps×C. Harrisoniana.—*Lc. Hárrisoniæ*=L. xanthina×C. Loddigesii.—*Lc. Hárrisoniæ-Schilleriàna*=Lc. Schilleriana×C. Harrisoniana.—*Lc. Hastediàna*=Lc. Greenwoodii×C. Dowiana var. aurea.—*Lc. heatonénsis*=L. Digbyana×C. Hardyana.—*Lc. Hémptinnei*=Lc. rouselensis×C. Dowiana var. aurea.—*Lc. Henriéttæ*=Lc. Greenwoodii×C. Luddemanniana.—*Lc. Herscéntiæ*=L. Boothiana×C. aurea.—*Lc. Hódgkinsonæ*=L. harpophylla×C. Mossiæ.—*Lc. Hópkinsii*=Lc. Pallas×L. tenebrosa.—*Lc. Húmbertii*=L. majalis or L. superbiens×C. Aclandiæ.—*Lc. Húrstii*=L. purpurata×C. Skinneri.—*Lc. Hyeàna*=L. purpurata×C. Lawrenceana. Sepals and petals rose-lilac, the sepals more deeply lined; lip entire, the limb nearly orbicular, crenulate-crispate, purple. C.O. 13.—*Lc. illústris*=L. Latona×C. Dowiana var. aurea.—*Lc. Imperàtrix-Regìna*=Lc. Martinettii×C. Mendelii.—*Lc. Íngramii*=L. Dayana×C. Dowiana. Sepals and petals light rose; lip dark crimson-purple, faintly marked with a lighter hue. J.H. III. 63:267 (as var. gigantea). O.R. 4:49.—*Lc. intermèdio-cinnabarìna*=L. cinnabarina×C. intermedia.—*Lc. invérsa*=L. purpurata×C. Warneri.—*Lc. Ísaacii*=L. Boothiana×C. Harrisoniana.—*Lc. Kerchòveæ*=L. anceps var. alba×C. Trianæ var. alba.—*Lc. labiàto-ánceps*=L. anceps×C. labiata.—*Lc. Lámbeauæ*=L. præstans×C. Hardyana.—*Lc. Lawrenceàno-callistoglóssa*=Lc. callistoglossa×C. Lawrenceana.—*Lc. leucásta*=L. harpophylla×C. bicolor. Sepals and petals clear yellow; lip with cream-white lateral lobes, the middle lobe narrow, elongated, purple. G.M. 44:775.—*Lc. lilácina*=L. Latona×C. Pitteæ.—*Lc. Líptonii*=L. anceps×C. labiata.—*Lc. Lucasiàna*=L. tenebrosa×C. labiata. Sepals and petals bright violet-purple; lip bright red-carmine, the limb strongly crisped, with brighter lines in the throat. C.O. 25.—*Lc. luminòsa*=Lc. Truffautiana.—*Lc. Lùna*=L. harpophylla×C. Harrisoniana.—*Lc. lùtea*=L. Latona×Lc. Ophir.—*Lc. Macbeaniàna*=L. anceps var. Schroederiana×C. Schroederæ. G.C. III. 51:237.—*Lc. Mardéllii*=Lc. devoniensis×C. Luddemanniana. Sepals and petals light lilac; lip with the front lobe magenta-purple, marked with deep yellow in the throat. F.M. 1881:437.—*Lc. Marìca*=L. cinnabarina×C. amethystoglossa.—*Lc. Marònæ*=L. Digbyana×C. Warcsewiczii var. imperialis. O.R. 1901:329.—*Lc. Massangeàna*=L. tenebrosa×C. Schilleriana.—*Lc. Maurícii*=L. purpurata×C. Trianæ.—*Lc. móllis*=L. Boothiana×C. Mossiæ.—*Lc. Moringstòniæ*=(?).—*Lc. Morningtòniæ*=Lc. Pallas×Lc. Fascinator. G.M. 54:411.—*Lc. Mossemiliàna*=Lc. bletchleyensis×C. labiata.—*Lc. Mòssiæ-grándis*=L. grandis×C. Mossiæ.—*Lc. Mùelleri*=L. purpurata×Lc. Canhamiana.—*Lc. Mỳra*=L. flava×C. Trianæ. G.M. 47:330. C.O. 10.—*Lc. Nephèlia*=Lc. Amesiana×C. Mossiæ.—*Lc. nivàlis*=L. glauca×C. intermedia.—*Lc. Nórba*=L. xanthina×C. Mossiæ. Sepals and petals white, tinged lightly with yellow; lip rose, with crimson venation. G.M. 46:725 (as var. superba).—*Lc. novíssima*=L. anceps×C. Gaskelliana.—*Lc. ochràcea*=L. harpophylla×C. Sallieri.—*Lc. odòra*=L. purpurata×C. Mendelii.—*Lc. Óliveri*=Lc. intermedio-flava×C. Percivaliana, although parentage doubtful.—*Lc. Paùlii*=L. purpurata×C. Schilleriana. Lind. 784.—*Lc. Peètersii*=L. glauca×C. Lawrenceana.—*Lc. perrilòsa*=L. Perrinii×C. granulosa.—*Lc. Perrìno-Móssiæ*=L. Perrinii×C. Mossiæ.—*Lc. Pisándra*=L. crispa×C. Eldorado.—*Lc. Pómmeryæ*=Lc. elegans var. Fournieri×C. Mossiæ var. imperialis.—*Lc. Pówellii*=Lc. Schilleriana var. Wolstenholmiæ×C. Mendelii.—*Lc. præstans-bícolor*=Lc. Binotii.—*Lc. Príngiersii*=L. purpurata×Lc. elegans. Lind. 750.—*Lc. Pàgetii*=L. superbiens×C. Trianæ.—*Lc. Réx*=Lc. Canhamiana.—*Lc. rígida*=L. superbiens×C. Laurenceana.—*Lc. Róbsoniæ*=Lc. Ingramii×C. Bowringiana.—*Lc. Roezliàna*=L. xanthina×Lc. elegans var. Schilleriana.—*Lc. ronselénsis*=L. cinnabarina×C. Forbesii.—*Lc. Rothschildiàna*=Lc. Martinetii×C. Mossiæ.—*Lc. rubiginòsa*=L. Boothiana×C. Schilleriana.—*Lc. salmònea*=Lc. G. S. Ball×L. Latona.—*Lc. Sandhursteàna*=Lc. Ophir×C. Hardyana.—*Lc. scampstonénsis*=Lc. La France×C. Dowiana var. aurea.—*Lc. Scherzeriàna*=Lc. elegans×C. gigas var. Sanderiana.—*Lc. Schiffmánnii*=(?).—*Lc. Schneìderi*=Lc. Amelia×C. Dowiana var. aurea.—*Lc. schoenbrunnénsis*=Lc. elegans var. Turneri×C. aurea.—*Lc. Schroederáscens*=Lc. highburyensis×C. Schroederæ.—*Lc. Schwarziàna*=Lc. bletchleyensis×C. aurea.—*Lc. Séguinii*=L. cinnabarina×C. Schroederæ.—*Lc. Sénartii*=Lc. elegans×C. callistoglossa.—*Lc. Shépherdii*=L. nigrescens×C. Dowiana. O.R. 1906:145.—*Lc. Skinnerobarìna*=L. cinnabarina×C. Skinneri.—*Lc. Solangeàna*=L. Perrinii×C. Eldorado.—*Lc. Statteriàna*=L. Perrinii×C. labiata. Sepals and petals much like those of C. labiata; lip with the base white, crimson-lined, the front lobe dark rich purple. J.H. III. 48:467.—*Lc. stellàta*=L. xanthina×C. intermedia var. alba.—*Lc. Stépmannii*=Lc. corbeillensis×C. Warscewiczii (latter described p. 690, vol. II.).—*Lc. Steppestediàna*=Lc. Andromeda×C. Luddemanniana.—*Lc. teignmouthiénsis*=Lc. amanda×C. labiata.—*Lc. ténegottoi*=L. tenebrosa×Lc. Gottoiana.—*Lc. Thièbauxiæ*=Lc. elegans var. Turneri×C. Mossiæ.—*Lc. Thurgoodiàna*=Lc. Martinettii×C. Hardyana.—*Lc. tigrìna*=Lc. elegans var. prasiata×Lc. Aclandiæ.—*Lc. Truffautiàna*=L. tenebrosa×C. Dowiana. Sepals and petals yellowish brown, darker lined; lip deep violet-purple, deeper lined, the front lobe narrowly white-margined. C.O. 23. O.R. 10:152.—*Lc. Vacùna*=L. cinnabarina×C. guttata.—*Lc. Válvassori*=L. purpurata×C. labiata var. Warneri.—*Lc. Veìsenpachii*=Lc. warnhamensis×C. Trianæ.—*Lc. Veitchiàna*=L. crispa×C. labiata. Fls. lilac; lip with the throat brown-striped, the disk amethyst.—*Lc. venústa*=Lc. Aphrodite×Lc. Schilleriana.—*Lc. Vinèsiæ*=L. tenebrosa×Lc. Phœbe.—*Lc. vívicans*=Lc. elegans×C. Eldorado.—*Lc. Watellieriàna*=L. crispa×C. guttata var. Leopoldii.—*Lc. Wavrénii*=L. Bootheana×C. Walkeriana. O.R. 1907:249.—*Lc. Wíllsiàna*=L. purpurata×C. Trianæ.—*Lc. Whitæ*=Lc. Vinesiæ×C. Mossiæ.—*Lc. Wigániæ*=Lc. Gottoiana×C. Mossiæ.—*Lc. Wílliamsonii*=L. purpurata×C. mariana.—*Lc. Wílsonæ*=L. Dayana×C. labiata.—*Lc. wintonénsis*=Lc. Mylamiana×C. Harrisoniana.—*Lc. Wòlteri*=L. pumila×C. Gaskelliana.—*Lc. Wòlteriæ*=L. anceps×C. Loddigesii. O.R. 1907:145.—*Lc. woodfordiénsis*=L. crispa×Lc. "C. G. Roebling."—*Lc. Wrígleyi*=L. anceps×C. Bowringiana. Sepals and petals rose-purple; lip purple, the throat lighter, purpel-lined, and with a touch of yellow. C.O. 33. G.M. 46:795.—*Lc. Wylamiàna*=L. crispa×C. granulosa.—*Lc. Zenòbia*=Lc. elegans×C. Loddigesii.—*Lc. zephỳra*=C. Mendelii×L. xanthina.

Heinrich Hasselbring.
George V. Nash.†

LAGENÀRIA (Latin, *lagena*, a bottle). *Cucurbitàceæ.* Gourd. Calabash Gourd (the true calabash is Crescentia). Probably one species, although several specific names have been given to the various forms: a tender tendril-vine, producing hard-shelled fruits in very many forms that are used for ornament and in the making of utensils; and the rampant vine makes a good temporary screen or cover.

Plant musk-scented, with a sticky feeling, monœcious or diœcious: fls. solitary, white, funnelform, very soft in texture, withering in the sun; staminate fls. on very long, slender stalks (usually exceeding the lf.); pistillate fls. mostly short-stalked, with three 2-lobed stigmas and hairy ovary: tendrils forked, long and slender: st. striate-grooved, soft-hairy: lvs. large, soft-pubescent, cordate-ovate or reniform-ovate, sometimes angled, the edges obscurely apiculate-sinuate, on prominent or long petioles. **L. leucántha,** Rusby (*Cucúrbita Lagenària,* Linn. *C. leucántha.* Duch. *L. vulgàris,* Ser.), is widely grown in tropical countries and is often spontaneous; probably native in Trop. Afr. and Asia. To this species belong the gourds known in this country as Hercules' club, sugar-trough, dipper, snake, calabash, bottle, miniature bottle, depressa, and others; see *Gourd*, Vol. III. In some countries, the young fr. is said to be eaten as we eat summer squash.



2059. Various forms of gourds, Lagenaria leucantha.

Lagenaria is a tender annual, which should receive the culture of squashes. The season in the northern states and Ont. is often too short for the full maturity of the frs., particularly if seeds have been brought from the S. Give a quick warm soil and sunny exposure. In the N., seeds may be started inside in pots, or on inverted sods, after the manner of cucumbers. The lagenarias are rampant growers, often running 30–40 ft., and covering the ground or a fence with a dense mass of large, roundish, soft lvs. It is exceedingly variable in its fr., and has received many species-names as *L. microcárpa*, R.H. 1855:61; *L. claváta; L. pyrothèca*, R.B. 23, p. 198; *L. virginàlis*, white-fruited, G.C. III. 11:85; var. *longíssima*, Gt. 48, p. 159; *L. verrucòsa*, Hort., with ball-shaped very warty fr., Gt. 39 (1890), p. 106. *L. verrucòsa* var. *Giordaniàna*, Hort., is a form with warty pear-shaped fr. The hard shells of the frs. are used for drinking-cups, water-jugs, and many domestic utensils. From the pear-shaped shell of a small-fruited form the Paraguayans drink their famous *maté*, or Ilex tea. Some of the commonest forms are shown in Fig. 2059. The long curved forms are often called snake gourds in this country (not to be confounded with snake cucumber, which is a Cucumis). These are sometimes several feet long. The form with a constricted middle is the bottle gourd. The grooved musical instrument in Spanish Amer. known as guira, guichara or caracho, is made from the gourds (marimbo) of this plant. The South African calabash pipes are derived from this plant and not from Crescentia.

L. H. B.

2060. Crape myrtle.—Lagerstrœmia indica. (×¼)

LAGENÓPHORA (*flask-bearing*, referring to the shape of the involucre). *Compósitæ*. Small perennial scapose herbs, resembling Bellis, allied to Brachycome, sometimes planted. Scapes sometimes bearing lvs., slender, unbranched; heads solitary and small, with a short involucre having bracts in about 2 rows; receptacle convex and naked; rays in 1–3 rows, usually white, female and fertile; disk-florets perfect: fr. compressed, more or less beaked, the pappus wanting.—Species about 16, mostly in Austral. and New Zeal., but some in E. Asia and in extra-tropical S. Amer. They are probably adapted to outdoor cult. in parts of the S. *L. Fórsteri*, DC., the "native daisy" of New Zeal., is described by Cheeseman as a small daisy-like herb, either tufted or with creeping and rooting stolons furnished with tufts of radical lvs. at the nodes: lvs. radical or cauline, the blade orbicular to obovate and 1 in. or less long, coarsely dentate or nearly lobed: scape 1–6 in. long, sometimes with 1–3 minute linear bracts; head ¼–½in. diam., the rays white and revolute, numerous. Variable. G.C. III. 49:69. *L. Billardièri*, Cass., of India and Austral., has lvs. radical or nearly so, oblong or obovate, sinuate-toothed: scape slender, 3–4 in., from a rootstock with thick fibers: head ⅙in. diam., with white short rays: variable in size of head.

L. H. B.

LAGERSTRŒ̀MIA (Magnus v. Lagerstrœm, 1696–1759, a Swede and friend of Linnæus). *Lythràceæ*. Showy-flowered shrubs and trees, one of which (the crape myrtle) is much planted in the southern states.

Leaves opposite or the uppermost alternate, mostly ovate, entire: fls. in axillary and terminal panicles, with bracted peduncles and pedicels, pink, purple or white; calyx with a funnel-shaped tube and 6–9 lobes; petals mostly 6, crinkled or fringed, with a long, slender claw (Fig. 2061); stamens many to very many, long, some of them upward-curved; ovary 3–6-celled, with a long bent style and capitate stigma: fr. a caps.; seeds winged at the top.—Species, according to Koehne (Engler's Pflanzenreich, hft. 17, 1903), 30 in S. and E. Asia, Austral., Philippines, New Guinea. The crape myrtle, *Lagerstrœmia indica*, is to the S. what the lilac and snowball are to the N.—an inhabitant of nearly every home yard. It is a strong-growing shrub, reaching a height of 10–35 ft., deciduous-lvd., producing an abundance of soft fringed and showy fls. in summer. The normal form has pink fls., but varieties with blush, white and purple fls. are not uncommon. It is hardy as far north as Baltimore, but north of that latitude it needs protection; even with protection it cannot be grown north of the Long Island region. *I. speciosa* is very little grown. Neither species seems to thrive in S. Calif. The many other promising species of Lagerstrœmia appear not to have been intro. commercially in this country.

índica, Linn. (*L. chinénsis*, Lam.). Crape Myrtle. Figs. 2060, 2061. Glabrous, smooth- and brown-barked shrub, with rather small (2 in. long) elliptic or oblong sessile mostly acute lvs.: panicle open, sometimes minutely pubescent; fls. usually bright pink, but there are blush, purplish and white forms; calyx not ribbed, glabrous or nearly so. Widely cult. in India, but probably native to China. B.M. 405. R.H. 1857, p. 627; 1874:130. Gt. 6:128; 54, p. 230. G.W. 6, p. 13; 10, p. 109; 13, p. 145. Gng. 1:151; 5:281. A.F. 9:85. F.E. 31:643.—Grown everywhere in the S. Atlantic and Gulf States for its profuse summer bloom, and sometimes it has escaped. The crape myrtle is of the easiest cult. The old bushes bloom profusely, but the plant will produce fls. the first year from seed. The seeds start readily in spring if sown in boxes in autumn and are not allowed to dry out. It is also prop. readily by cuttings of ripe wood. The bloom may be increased by cutting back so that fresh growth is secured. The plant may be grown in a tub or pot in a cool greenhouse, and will bloom 2 or 3 times a year if it is cut back. It has no special soil requirements. In the N. the root may survive if it is well protected, and strong shoots will arise that give bloom the same year. Sometimes the plants are lifted in autumn, carried over winter in a cellar and planted out in spring. As the crape myrtle blooms almost continuously for a period of 2 or 3 months (beginning in June far S.), it well repays what care may be given it under glass or in regions where it is not fully hardy.

speciòsa, Pers. (*Munchaùsia speciòsa*, Linn. *L. Flos-Regìnæ*, Retz. *L. Regìnæ*, Roxbg.). Tree, 50–60 ft., with elliptic or long-lanceolate obtuse lvs. 4–8 in. long: panicle large; fls. 2–3 in. across, varying from rose to purple from morning to evening, the calyx grooved, the petals erose-wavy: caps, 1 in. or more long. India. G.C. III. 15:77.—A noble plant in Trop. India; also intro. in S. Calif. In the Old World sometimes grown under glass and on walls out-of-doors.

L. H. B.

LAGÉTTA (native name in Jamaica). *Thymelæàceæ*. Lace-Bark. Three W. Indian trees, one of which, *L. linteària*, Lam., is familiar in Jamaica as yielding the beautiful and delicate lace-like material derived from many layers of the inner bark; this material has the look of a gauzy fabric, and it is used in the making of many articles of ornament and use. Sometimes the tree is grown under glass in collections of economic plants. It grows 20–30 ft. high:

2061. One flower of Lagerstrœmia indica. (Natural size) glabrous: lvs. alternate, broad-ovate, pointed, 3–5 in. long, evergreen: fls. small, white, in terminal racemes or open lax bractless spikes; calyx tubular-cylindrical, 4-toothed; corolla 0; stamens 8; ovary ovoid, with a single style and broad stigma: fr. small, globose, inclosed in the persistent base of the calyx-tube. B.M. 4502. J.F. 1:19. The lace-bark of New Zeal. is a very different plant, *Hoheria populnea* and also *Gaya Lyallii* (Malvaceæ). L. H. B.

LAGUNÀRIA (named for its resemblance to Lagunæa, which is now considered a section of Hibiscus and commemorates a Spanish botanist, Andrés de Laguna, 1494 or 1499–1560, physician to Pope Julius III). *Malvàceæ.* An Australian (or Norfolk Island) tree cult. outdoors in S. Calif. and indoors in Eu. It has large pale rose fls. like Hibiscus, 2½ in. across, with 5 spreading lobes, a column of stamens and a 5-lobed shield-shaped stigma. It differs from Hibiscus in having only 3, 4 or 5 deciduous bractlets, while Hibiscus usually has 5 or more. Lvs. entire: fls. axillary; calyx 5-toothed; ovary 5-celled.—Species probably only 1.

Pátersonii, Don. Scurfy-pubescent on young parts and infl.: lvs. oblong or broad-lanceolate or sometimes ovate-oblong, 3–4 in. long, white beneath when young: pedicels very short: bractlets at base of fl. 3–5, very obtuse and united; calyx about ⅓in. long; petals narrow, 1½ in. or more long, somewhat tomentose outside.—The Norfolk Isl. form (B.M. 769, as *Lagunæa Patersonia*) is more scaly-tomentose, lvs. broader, and bracts earlier deciduous. They may be different species or botanical varieties. The tree cult. in Calif. attains a height of 50 ft., making a regular pyramidal head and having a fine display of fls.; said to be well adapted to street planting. L. H. B.

LAGÙRUS (Greek, *lagos*, a hare; *oura*, a tail). *Gramineæ.* HARE'S-TAIL GRASS. A hardy annual: spikelets 1-fld., aggregated in a close panicle forming an ovoid head; scarious glumes persistent and clothed with fine woolly hairs: lemma with a dorsal awn.—Contains a single species, native of the Medit. region, cult. for ornament, the small white heads being used for dry bouquets. Seeds may be sown in fall and plants set out in spring.

ovàtus, Linn. Fig. 2062. Culms tufted, about 1 ft. high: lvs. and sheaths downy. R.H. 1890, p. 488. V. 3:217, 247. Dept. Agric., Div. Agrost. 20:86.—An attractive grass with soft white woolly heads 1–2 in. long. A. S. HITCHCOCK.

2062. Lagurus ovatus. (×¼)

LALLEMÁNTIA (J. L. E. Avé Lallemant, botanist of St. Petersburg). *Labiàtæ.* Annual or biennial herbs, of ornamental value for the flower-garden.

From Dracocephalum the genus differs in the character of the upper lip, in which the lateral lobes are on the face of the middle lobe: glabrous or canescent: lvs. opposite, dentate, the upper ones passing into narrow sessile floral bracts: fls. small, blue; calyx tubular, 15-nerved, straight, 5-toothed; corolla-tube slender, included in calyx or somewhat exserted, the throat widening; corolla-limb 2-lipped; stamens 4, didynamous; style 2-lobed: nutlets ovoid.—Species 4, Asia. **L. canéscens,** Fisch. & Mey. (*Dracocéphalum canéscens,* Linn.), is annual or biennial, 18 in.: lvs. narrow, long-petioled, the floral lvs. sessile: fls. blue, in whorls, with oblong ciliate bracts; corolla-tube exceeding calyx. Asia Minor, Persia. Variable; one form (var. *álbida,* Voss) being white. July, Aug. L. H. B.

LAMÁRCKIA (J. B. Lamarck, 1744–1829, distinguished French naturalist, author of the Lamarckian philosophy of organic evolution). *Gramineæ.* An ornamental annual grass, often cult. under the name of *Chrysurus cynosuroides* and *C. aureus.* Spikelets of two kinds, the fertile 1-fld., long-awned, surrounded by the long sterile spikelets of many obtuse glumes, arranged in a 1-sided crowded panicle.—Contains a single species, native from Medit. region to Afghanistan, intro. in Calif. Seeds may be sown in the spring, or better in the fall, and plants set out in the spring. **L. aùrea,** Moench. (*Achyròdes aùrea,* Kuntze). GOLDEN-TOP. Fig. 2063. Culms 6–12 in. high. R.H. 1890, p. 546. Dept. Agric., Div. Agrost. 20:147.—A handsome grass with oblong feathery golden yellow rather dense panicles 2–3 in. long. A. S. HITCHCOCK.

2063. Lamarckia aurea. (×¼)

LÀMIUM (Greek for *throat,* referring to the shape of the corolla). *Labiàtæ.* DEAD NETTLE. Annual and perennial herbs of the Old World, of which several run wild in this country as weeds and others are cultivated as hardy border plants.

Botanically, Lamium is distinguished by a 2-lipped corolla, of which the tube is somewhat longer than the calyx, the upper lip ascending and concave, and the lower one 3-lobed: stamens 4, in 2 pairs, ascending under the upper lip: fls. in axillary or terminal whorls, often rather showy: lvs. opposite, mostly crenate-dentate and petiolate: calyx awl-toothed.—Low herbs, of some 40 species in Eu., N. Afr. and Asia.

Lamiums are diffuse mostly pubescent or hairy herbs, commonly decumbent at the base and often almost trailing. They are of the easiest culture in any open soil. Useful for rockwork. The cultivated kinds are perennial, and are commonly propagated by division.

maculàtum, Linn. (*L. álbum* and *L. purpùreum,* Hort., not Linn. *L. variegàtum,* Hort.). Straggling or half-trailing perennial, the tips ascending, slightly hairy: lvs. long-petioled (except the uppermost), cordate-ovate, blunt, round-toothed: fls. 1 in. long, ascending in the clusters, the upper lip strongly arched or hooded, the tube 2–3 times longer than the calyx, hairy within. Eu. —Fls. usually purple-red, but sometimes varying to white (when it is known as *L. album,* but the *L. album* of botanists is a different plant, having pointed and sharp-toothed lvs.). The lvs. are usually whitish blotched along the midrib (var. *variegàtum*), and in this form it is common about old gardens, trailing in the waste places. The plant is also run wild. *L. purpureum* of the botanists is annual (see suppl. list below).

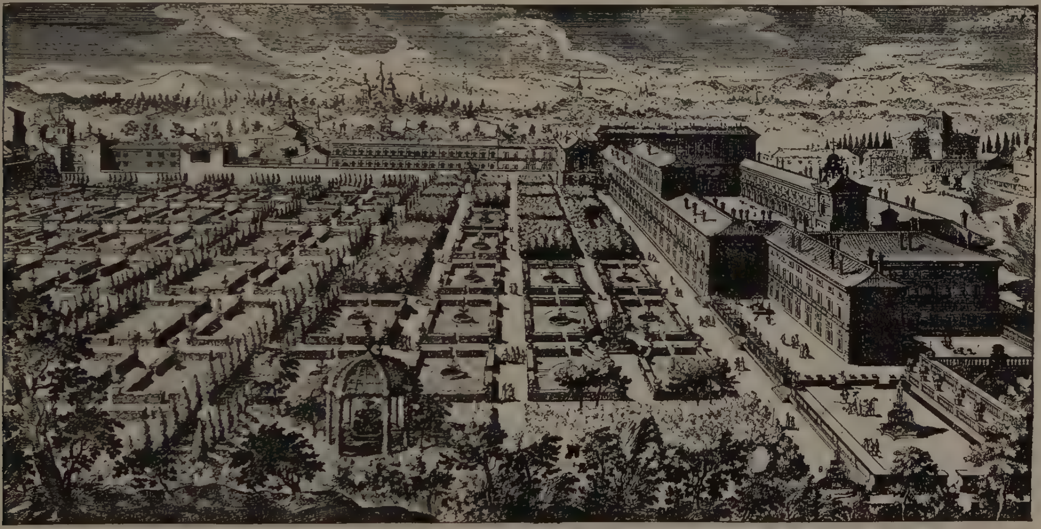
eriocéphalum, Benth. St. much branched, glabrous: lower lvs. long-stalked, puberulent, small, orbicular, somewhat incise-crenate; floral lvs. larger, deeply toothed, sessile or nearly so: calyx villous; corolla 3–4 times longer than the calyx, straight, purple. Taurus.—Said by some to be annual.

Galeóbdolon, Crantz (*Galeóbdolon lùteum*, Huds.). YELLOW ARCHANGEL. Perennial, to 1½ ft. high: lvs. ovate, petioled, toothed, only slightly or not at all cordate: fls. yellow, in dense axillary whorls; calyx-teeth short; corolla-tube scarcely exceeding calyx; upper lip long, arched. Woods and shady places, Eu. and W. Asia.—Little cult. in this country.

L. álbum, Linn., not Hort. Perennial with white fls. in close axillary whorls: lvs. petiolate, coarsely crenate, sometimes with a white spot in center. Eu., Asia.—*L. purálbum* is a garden hybrid between L. purpureum and L. album.—*L. purpùreum*, Linn. Annual with purplish red fls. in leafy whorls: lvs. small, orbicular, long-petioled, the upper ones short-petioled and ovate: there is a form (L. incisum, Willd.) with cut lvs. Eu., Asia. L. H. B.

LAMPROCÓCCUS: *Æchmea.*

LANDÓLPHIA (Landolphe, commander of a W. African expedition). *Apocynàceæ.* About 60 species of hairy or glabrous shrubs, mostly climbing by specialized tendrils, of Trop. and S. E. Afr. and adjacent islands, probably not regularly cult. Lvs. opposite, varying in size; stipules wanting: fls. mostly white or yellowish, small to medium-sized, rarely as much as 2 in. long in bud, in corymbs or panicles; sepals 5, free or connate at base; corolla salverform with a short more or less cylindrical tube, the lobes 5; stamens included; ovary entire, 1-celled; stigma conical, 2-lobed: fr. a globose or pyriform body, sometimes large. Some of the species are sometimes mentioned in horticultural literature but do not seem to be listed by dealers in ornamental plants. Most of them are presumably warmhouse subjects. Some of them are rubber plants. See Cyclo. Amer. Agric., Vol. II, p. 559. L. H. B.



2064. Gardens of the Pope, on the Quirinal, Rome. From Falda's "Li Giardini di Roma."

LANDSCAPE GARDENING is the application of garden forms, methods and materials to the improvement of the landscape; and the landscape, in this relationship, is any area, large or small, on which it is possible or desirable to develop a view or a design.

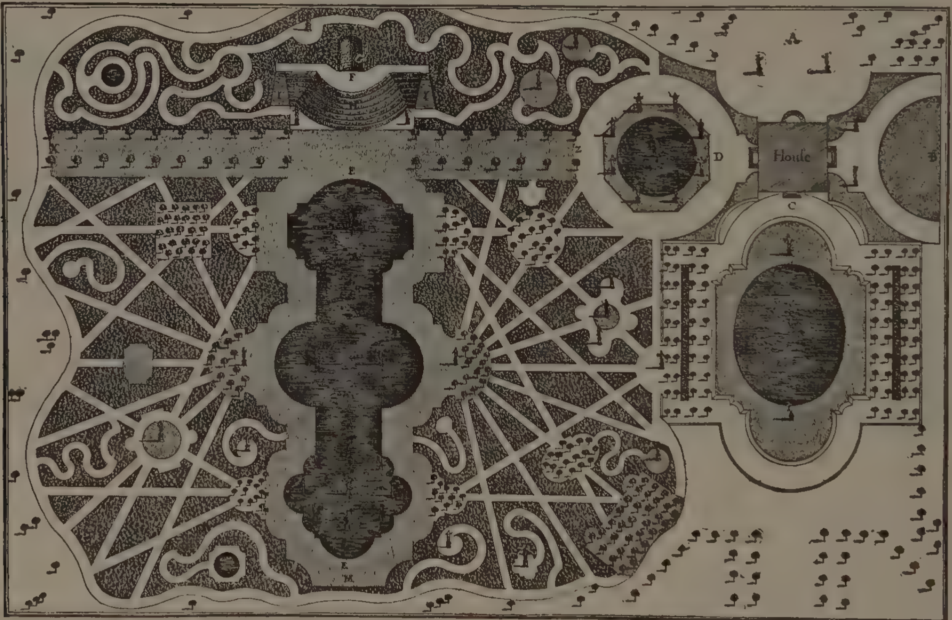
The art that designs and makes landscapes is known mostly by the name landscape architecture, although there is now a tendency to call it by other names. Landscape gardening is the older term; but this term is considered not to be broad enough or bold enough to suggest the large elements of design that form an underlying part of the art. The art of the constructing landscape artist is more than gardening. In this Cyclopedia, which deals with horticulture, there is naturally no attempt to cover the subject of landscape architecture; only the gardening or horticultural phases and their implications are considered, and this is why the term landscape gardening is used. This will also explain why many of the important landscape subjects are omitted from this discussion, as city planning, civic improvement, and the like (see *Garden Cities*, page 1313): for these phases are not particularly horticultural.

Here are brought together several discussions on the use of plant materials in the plan of the home ground and in the making of public landscapes. The articles are as follows:

The art of designing landscapes (Manning), page 1783.
The Japanese garden (Tanimura, Verbeck), page 1789.
Formal gardens (Vitale), page 1793.
The landscape treatment of small grounds (Cowell), page 1796.
The landscape treatment of parks (Olmsted), page 1801.
Landscape cemeteries (Simonds), page 1807.
Horticultural phases of civic art (Waugh), page 1811.
Landscape extension (Miller), page 1813.
Lawns and lawn-making in landscape planting (Parsons, Berckmans), page 1816.

"Gardening may be divided into three species—kitchen-gardening—parterre-gardening—and landskip, or picturesque-gardening: which latter is the subject intended in the following pages—It consists in pleasing the imagination by scenes of grandeur, beauty, or variety. Convenience merely has no share here; any farther than as it pleases the imagination." These are the opening lines of "Unconnected Thoughts on Gardening," by the poet William Shenstone, 1764. These sentences probably gave the world the term landscape gardening, to embody the growing desire to make grounds like nature. Milton, Addison, Pope, and the Dutch painters, expressed the awakening to the charms of the external world and hastened the day of freedom and naturalness. These and others had protested, directly or indirectly, against the artificialisms of living, as Bacon, also, in the following sentence, had protested: "As for the making of Knots or Figures, with divers Colored Earths, they be but toys, you may see as good sights many times in Tarts. . . I do not like Images cut out of Juniper, or other garden-stuff; they are for Children."

One does not know what Shenstone's protest meant until one knows the style of gardening that had been and still was in vogue. Gardens were fantastic constructions, elaborate with designs and formalities, cramped with geometrical details. A Roman garden (Fig. 2064) was good in its place, but there are other conditions and other ideals. Only infrequently can such gardens as these find the proper setting. If effective, they must be dominated or supported by architecture. In the freer atmosphere of the open country, they are evidently artificial: they are conceits. The reader will catch the feeling of the formal gardens of a later time by looking at Fig. 2065, which is a reduction from one of Batty Langley's designs in his "New Principles of Gardening," 1728. Langley seems to have been the extremest of geometricians. In fact, Part I of his book on gardening treats "Of Geometry." Yet his plates suited the taste of the time. The particular plan which is shown in Fig. 2065 he describes as follows: "The House opens to the North upon the Park A, to the East upon the Court B, to the South upon the Parterre of Grass and Water C; and Lastly to the West upon the circular Bason D, from which leads a pleasant Avenue ZX. The Mount F, is raised with the Earth that came out of the Canal EE, and its slope H, is planted with Hedges of different Ever-Greens, that rising behind one another of different Colours, have a very good Effect, being view'd from M, I, I, are contracted Walks leading up the Mount." The ideas of the time are further reflected in Fig. 2066, which is a reproduction, on a smaller scale, of one of Langley's pictures of artificial ruins. It is one of his "views of the Ruins of Buildings, after the old Roman manner, to terminate such Walks that end in disagreeable Objects; which Ruins may either be painted upon Canvas, or actually built in that manner with Brick, and cover'd with Plaistering in Imitation of Stone."



2065. One of Langley's "Designs for gardens that lye irregularly to the Grand House." 1728.

The awakening love of nature and of the spontaneous life, as expressed in writings and paintings, soon found expression also in gardens. In verse, Pope gave rules for the laying out of a spontaneous garden. The accompanying plan of Shenstone's garden, the Leasowes (Fig. 2067), and the picture of a glimpse therein (Fig. 2068), show how far his conceptions were removed from those of Langley, howsoever much they may fall short of the ideals of the present day. A full description has been left us of the Leasowes. Here is a glimpse: "Passing through a small gate at the bottom of the fine swelling lawn that surrounds the house, you enter upon a winding path, with a piece of water on your right. The path and water, over-shadowed with trees that grow upon the slopes of this narrow dingle, render the scene at once cool, gloomy, solemn, and sequestered; and forms so striking a contraste to the lively scene you have just left, that you seem all on a sudden landed in a subterraneous kind of region. Winding forward down the valley, you pass beside a small root-house, where on a tablet are these lines:

> 'Here in cool grot, and mossy cell,
> We rural fays and faeries dwell;
> Tho' rarely seen by mortal eye,
> When the pale moon, ascending high,
> Darts thro yon limes her quivering beams,
> We frisk it near these crystal streams.' "

The garden-art of the old time was largely a corollary of architecture. The garden-art of the present time, particularly amongst English-speaking peoples, exists for its own sake. Yet, one cannot say that the old-time garden-art is unlovely, or that it contradicts the canons of good taste. The two belong to different categories of esthetic feeling, and the mere fact that both of them use plant-subjects does not make them comparable. Garden-art, like painting or music or literature, develops along racial or national lines. The Latins and their descendants have liked the formal and conventional gardens; and since these gardens express the personal and national emotions, they need no apology, notwithstanding the fact they are condemned by some landscape gardeners.

A different type of endeavor is that which attempts to interpret nature in the making of landscapes. The ideal landscape garden, like the ideal landscape painting, expresses or emphasizes some single thought or feeling. Its expression may be gay, bold, retired, quiet, florid; but if it is natural, the expression will conform to the place and the purpose, and the expressions are not matters of rule. It should be a picture, not a collection of interesting objects. Mere planting and grading do not make a landscape garden: in fact, they often spoil it.

It is not enough to plant: the plants must be in the right place. A yard or a lawn with bushes or flower-beds scattered over it may be interesting as a mere garden, but it is not a landscape garden. A real landscape garden has open breadth, space, atmosphere. It usually has an open center with mass-planted sides, and vistas to the offscape. Incidentally, it may be ornamented; yet many persons even confound ornamental gardening with landscape gardening: it would be as proper to confound house-painting with architecture.

It will be gleaned from the above that the term landscape gardening precisely expresses the art of making a garden or tame area which shall be a landscape or picture. It is not every place that is adapted to the making of a landscape picture. Formal gardens are often more to be desired than natural gardens. They may conform to the principles of art, but it is the art of formal gardens, not of natural gardens. Too often have formal gardens been judged from the viewpoint of the natural or landscape garden, and hence confusion has arisen. There is now a slow but wholesome reaction against the too exclusive use of the true landscape or "natural" garden. In practice, however, one cannot separate the two, so that one practitioner is, or should be, competent to undertake either or both, although it naturally develops that a practitioner may have special aptitudes and qualifications in one or the other.

Landscape gardening has undergone many fluctuations of taste within a century. Such changes are to be expected as long as the human race makes progress. The constantly increasing wealth in plants modifies the spirit of the work. It is no longer worth while to follow any school or cult. Every style has its use and place. In small places, a formal or formalesque treatment of the ground plan may be desirable. In larger and freer places, the spirit of the fields may be given fuller expression. The fundamental consideration is that there must be a general theory or plan before any grading and planting takes place or structures erected, —these latter parts are only means to an end. Yet many persons who would be called landscape gardeners conceive that to plant a place is the whole of the problem. The working out of the details of the plan is to landscape gardening what building is to architecture, or what pen-work and grammar are to literature. It is the industrial or constructional part of the work. It is what has been called landscape horticulture (Bailey, "Garden and Forest," 1:58). It has to do with all the details of kinds of plants, the care of them, the making of lawns, and similar problems. The American writings on landscape gardening are mostly writings on landscape horticulture and kinds of plants.

A marked development of landscape art in recent time is the application of it to very small and plain home grounds and to secondary civic areas. Even the back yard of the tenement is within its range (Fig. 2075). This is an illustration of the extension of social democracy.

The practitioners.

The first American practicing landscape gardener of note was apparently André Parmentier, who came to this country from Belgium about 1824 and established a nursery on ground which is now in the heart of Brooklyn. He was a man of great taste and skill, and Andrew J. Downing considered his "labors and example, as having effected, directly, far more for landscape gardening in America than those of any other individual whatever." He laid out many places, even as far away as the southern states on the south and Montreal on the north. The first American book on landscape gardening was from the pen of A. J. Downing in 1841, without having undergone the tedious evolution of preliminary and imperfect editions which characterize so many horticultural and kindred writings. It was immediately popular, and exerted a great influence on American horticulture. Downing was also the second prominent practicing landscape gardener, although his untimely death left the country with no completed works of his genius. His best known public pieces are the grounds of the Smithsonian Institution and Lafayette Square, Washington, but it is doubtful whether the subsequent treatment carries out the spirit of the designer. A. J. Downing's pomological work was continued by his painstaking brother Charles; but the artistic work dropped at his death, and Henry Winthrop Sargent, who edited the sixth edition of the "Landscape Gardening," in 1859, declared that "there has been no one since Mr. Downing's death who has exactly filled the niche he occupied in the public estimation." Ignatz A. Pilat, an Austrian by birth, was early chief landscape gardener of Central Park, and a general practitioner of influence following Downing.

2066. An improvised ruin. 1728.

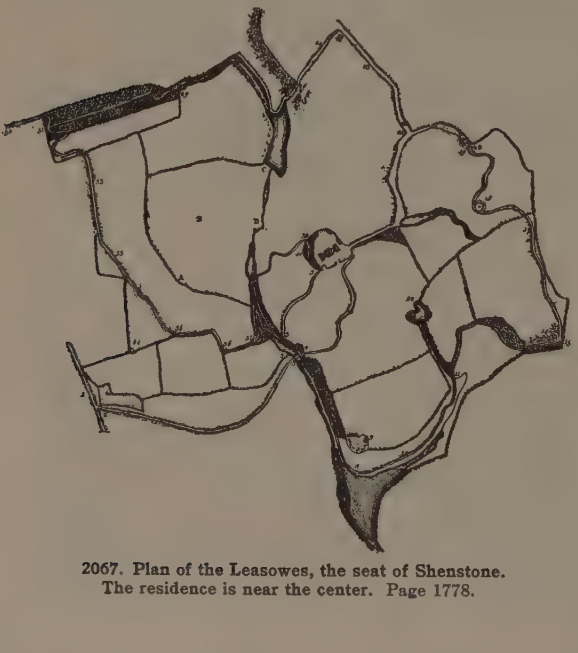
The subsequent genius of American landscape gardening, and the one who carried the art to its highest points of excellence, is Frederick Law Olmsted, who as a young man was inspired by Downing, and who became a landscape gardener when he was placed in charge of the improvements of Central Park, New York City, about 1856. For more than thirty years, Mr. Olmsted gave his talents wholly to this delightful art, and, more than any other American, moulded and crystallized public taste respecting the appreciation of landscape gardening. A leading spirit in the construction of this great park was Calvert Vaux, who, with Olmsted, was joint author of the original plan. Vaux was also associated with Downing. The initiation of Central Park as a pleasure-ground inaugurated the modern park systems of the country, and created what the Earl of Meath has designated the "veritable rage for park making" which has "seized the American public."

Within recent years, the number of practitioners of landscape gardening has greatly increased. The art is established in popular estimation. It has now fairly won its place, also, with the architects and artists. Tastes may change, but the changes will affect only the minor applications of the art. The desire for artistic treatment of grounds is ineradicable. Two national societies are conservators of the landscape gardening and rural art of the country: American Society of Landscape Architects, American Association of Park Superintendents. Other societies are also related to landscape art, as the American Civic Association, American Scenic and Historic Preservation Society, and the horticultural bodies. The subject is also taught in colleges in its amateur aspects and in a few places professionally. The discussion of city-planning has now taken hold of the public imagination, although little has yet been done to visualize the necessity of country-planning.

The kinds of landscape gardens.

The improved landscape, we have said, may be large or small. It may also represent any condition of residence or of public use. The illustrations herewith indicate, better than words, some of the merits and some of the possibilities in landscape. (Many of the illustrations have appeared in "Garden and Forest.") The improved or designed landscape area should appropriate the good views and scenes beyond itself or adjacent to it. The distant view in Fig. 2069 should not be missed from any landscape garden if one is so fortunate as to be in the region of such an offscape. Even familiar objects, as a spire, a distant residence, a well-proportioned bridge (Fig. 2070), a noble tree, may add much interest if brought into the home landscape by means of vistas. It would be a special good fortune if the landscape garden could lead into any kind of a wood or forest, particularly into anything so distinctive as the Jersey pines shown in Fig. 2071. In many places, the grounds may lead off naturally into an informal country road (Fig. 2072), which is always interesting with its irregular lines, variety of life, and stimulating suggestions. A stream is always an entertaining boundary, particularly when a walk may follow it, as in Fig. 2073.

America excels in landscape art applied to the rural and garden cemetery. The first distinct movement toward a rural cemetery was made in 1825 by Jacob Bigelow, of Boston, whose work was soon taken up by the Massachusetts Horticultural Society. As a result of the agitation by this admirable organization, Mt. Auburn Cemetery, at Cambridge, was established and incorporated in 1831. The consummation of this enterprise gave to the world a cemetery distinct from churchyards, removed from the city, and softened by the gracious touch of nature; and thereby, also, the young Massachusetts Horticultural Society set an example to all similar organizations and achieved for itself enduring fame. The work of Repton and Loudon had not then enlivened and broadened the conceptions of landscape gardening, and Mt. Auburn, whilst an excellent work of its kind, is not a landscape-garden cemetery. The modern art of garden-cemetery making—in which, as in the park, the continuous expanse of greensward is the fundamental conception of the fabric—originated with Adolph Strauch, who, in 1854, became superintendent of Spring Grove Cemetery, Cincinnati. Strauch's work at Spring Grove Cemetery has justly given him lasting fame, and his book describing the place must be consulted by anyone who traces the evolution of the garden-cemetery. The Board of Directors of the cemetery said, at the time of his death, that "he had filled the measure of his ambition by the consent of his profession, which ranked him as the equal of Repton and Pückler-Muskau as a master of art in landscape creation, which had been finally proved by him to be possible to be successfully applied in adorning and making attractive the last resting-places of humanity." At present, about one hundred or more burial-places in various parts of North America can be said to be landscape-garden cemeteries.



2067. Plan of the Leasowes, the seat of Shenstone. The residence is near the center. Page 1778.

2068. Glimpse in Shenstone's Leasowes. Page 1778.

The successful practice of landscape gardening depends, first, on an artistic temperament and an inherent love of nature; second, on an intimate knowledge of plants; and third, on familiarity with various arts and handicrafts, as the making of roads, grading, draining, enriching the land, and the like. Landscape gardening must be sharply distinguished from gardening: the former is the making of pictures with plants; the latter is the growing of plants without reference to the picture. In one, the interest centers in art: in the other it centers in plants. Since landscape gardening is primarily a matter of taste, it is impossible that it be dominated by arbitrary rules. However, a few general precepts and suggestions may be useful.

The motive of a true landscape garden, as already explained, is to make a picture. The picture should have a landscape or nature-like effect. The place should be one thing: it should emphasize some thought or feeling. It should have one central or emphatic object, and avoid scattered effects. In general, the advice is to bunch or mass the planting. One must distinguish sharply between the fundamentals and the incidentals,—those conceptions that are to give the character or tone to the place, and those that are embellishments or ornaments. In usual practice it is essential to keep one or more spaces open, and to plant the sides or boundaries with masses. The use of single or individual plants is only to emphasize or to heighten an effect, not to give it character: they are incidentals. Ornament should be an incident. Foliage and verdure is a fundamental requisite. In natural sod regions, greensward is the canvas on which the picture is spread. Plants are more

LXII. Example of the large rural park.—View in Prospect Park, Brooklyn.

useful for the positions they occupy than for their kinds. Walks and drives are no part of a landscape picture: they are a necessity, but they may be made to conform to the spirit of the picture, and also to add human interest to it. The place for walks and drives is where they are needed: otherwise they have no use or purpose. It is the part of a good landscape gardener to make his grounds conform to the buildings: it should equally be the part of an architect to make his buildings conform to the landscape. There should be views to desirable objects in the outlying landscape or the offscape. The undesirable parts or views should be covered. The designer should aim for a good prospect from every window in a residence, including the kitchen. The trees and bushes are sheared only when hedges, curiosities, and formal gardens are wanted: they assume their natural forms when a landscape garden is wanted (Fig. 2074). No tree or plant is placed until one is sure that it will mean something and add to the total good effect.

The open center is possible even in very small areas. Fig. 2075, for example, shows the principle applied to an ordinary city back yard. The planting is massed against the fences, and a free space is secured for other purposes. In a larger way, the open center is admirably illustrated in Fig. 2076. Again it is shown in a parking plan, Fig. 2077.

It is not to be assumed, however, that the principle of the open center is to apply invariably, or that it is always to face the direction of the public view. The planting may be disposed specially for the purpose of screening from the highway, and it may have artistic merit of its own. Fig. 2078 shows a good screen-planting, and it is well adapted to the character of the residence. Yet even in such cases as this, the open center may be an essential feature of the design, but it may face inward, and constitute an interior open space, rather than outward. Rather close and intimate planting may accentuate the character of a very personal or special residence, and a very open feature may detract from the interest. In such a case as that shown in Fig, 2079, for example, a rather heavy planting about most of the building would probably heighten the interest. This is a construction that suggests seclusion. Even with the open center, however, the bases and angles of buildings may be well tied to the lawn-surface by planting.

In city openings and certain other places, the open center may be no part of the plan. Here the only purpose may be to provide shade, shelter, and seating-space. In some cases, only a promenade is desired. The landscape, in the artistic sense, comprises these areas as well as those in which it is possible to secure a pictorial presentation with some completeness or wholeness of effect. Every open space, in city, village or open country, may find improvement under the hand of the landscape artist. Even the wharving or dock area of seaports, which are perhaps the least likely places for landscape work, may afford space and opportunity for artistic treatment; Fig. 2080, being a design by W. Hamilton Bell, is a suggestion of this kind.

Historic and important places.

Many estates and country-seats have contributed to the development and establishing of taste in landscapes in this country, particularly in the eastern states. It requires age to bring out the essential qualities of an estate. When a person builds a house of some pretension and plants the grounds on a design, he is anxious at once to photograph the effort; the result is that our periodicals are full of pictures of immature and undeveloped places.

There is need of a careful and sympathetic study of the historic estates in North America, as a contribution to the development of taste in both architecture and landscape treatment. The study should include the estates of the far Southwest and the Pacific coast, that represent the Spanish influence. At this place, only a few of the notable estates in the eastern part of the country may be mentioned. They naturally represent the English influence and the background of greensward.

In many respects, Mt. Vernon stands first. It remains a wonderful example of the satisfactory use of a landscape. Hyde Park, the Vanderbilt place on the Hudson, is one of the estates notable for its landscape features; also the Morton place at Rhinecliff, on the Hudson; Wodenethe, the H. W. Sargent place at Fishkill; Holm Lea, the estate of Charles S. Sargent at Brookline, Massachusetts; the Twombly place, in New Jersey; the Hunnewell estate at Wellesley, Massachusetts: Irving's country-seat, Sunnyside, on the Hudson; Jefferson's home, Monticello, Charlottesville, Virginia; the Drayton estate near Charleston, famous for its azaleas; the Middleton place on the Ashley, near Charleston, where early plantations of camellia were made; old estates on the James River, as Westover and Brandon; the great Vanderbilt place at Biltmore, North Carolina. There are many others. Mention might also be made of the Bartram estate in what is now Philadelphia, for while it was never a landscape garden, it has contributed much to the stimulation of interest in trees; and its historic value is great. See the biographical note on Bartram, Vol. III, p. 1564; also the references in Vol. I, p. 348.

2069. A worthy offscape.—Lake Yumoto, Japan. Page 1780

Some of the above places are prized chiefly for their horticultural features, in relation to landscape, rather than for the fundamental design. The Hunnewell estate is remarkable in this feature. The places laid out under the inspiration of A. J. Downing were notable for their planting, although there are few of these estates now remaining. It is probable that Downing's influence persists in some of the older places even if unrecognized by present owners and visitors. Downing admired the rural gothic in domestic architecture, and the change in taste in this direction has undoubtedly had something to do with the loss of interest in his landscape work. His untimely death prevented him from making a great impression in the way of actual examples. Downing had a real love of plants, and his knowledge of trees was remarkable and unusual among Americans of his time. His regard for trees was notable, and he knew their possibilities in the reconstructed or planted landscape. His ideas and his tastes were communicated to his friend and neighbor, Henry Winthrop Sargent, who transmitted them to another generation, and some of the most interesting and beautiful country places made in America in the last sixty years owe their existence to Downing's influence. It was this influence which has made the Arnold Arboretum what it is, a natural garden of great beauty and not a mere collection of trees and shrubs. It must be remembered, also, that when Downing died the only public grounds in the United States which could in any sense be called a park was Boston Common, and that it was through his knowledge and influence that Central Park in New York was established in 1852; and it was Central Park that led to the establishment of public parks and playgrounds in every American city.

2070. A commanding object in the offscape.

The artistic values in some of the old places, and the reasons for them, are discussed by Warren H. Manning, in the remainder of this introductory article.

"The principal lesson to be learned from a study of historic private estates in America is the fact that our system of land tenure does not lead, as does the English method of entailment, to the holding by a family of such estates for centuries. While there are many houses and some large property holdings in the older parts of this country that have remained in one family for many generations, even back to the period of the original grant or purchase, they are usually not notably fine estates. There are very few, if any, of such estates upon which the first acreage or the original design and intent of the founder have been continued in all essential details for three or four generations.

"Mount Vernon, under the ownership of an association, has been maintained much as it was designed by General Washington, although the original acreage of the property has been much curtailed since Washington's day, and the planting is now being restored. Such associations as the Virginia and Massachusetts societies for the preservation of antiquities, and the several colonial societies have rescued, restored and are maintaining many old homes with but a fragment of the original estate attached. Some cities are maintaining historic homesteads as public museums or in public parks, as New York holds the Van Cortlandt homestead in Van Cortlandt Park, which includes parts of the old estate diverted to other than its original uses.

"Family associations have been formed to hold the ancestral homes with a small part of the original farm holdings, such as the Fairbanks, Wyman, and Manning associations in Massachusetts. The United States Government holds Arlington, the home of Robert E. Lee, with most of the land diverted to other than the original use. The Pendleton house in Providence, Rhode Island, and the Swett house in Portland, Maine, are held as typical furnished homes of their day in association with art museums through the bequest of the last owners.

"This brief review indicates that it is the historical antecedence, not the beauty of landscape and gardens, that is responsible for the preservation of most of the ancient homes and estates, notwithstanding that the beauty of landscape determined the location and first design of many of the early homes and the grounds about them.

"There are two broad distinctions to be made between the notable properties of the North and of the South. In the South, the great estates included acres by the thousands with the extensive cultivation of great fields, while in the North the acres seldom ran into the hundreds, and the cultivation was usually more intensive. In the South, there was a comparatively small proportion of the property set aside about the mansion for lawns, gardens and other ornamental purposes, as compared with the homes of the North. In the South, the home buildings were usually broadly spread out, with symmetrical wings on each side of a main central structure. In this central structure, the use of the tall columns of the classic order, with either a projecting or a recessed portico or porch, was almost universal. However, there was a marked individuality in most of the buildings and a fairly well-marked distinction between two types of design that have been referred to as the Georgia-Colonial and the Virginia-Colonial, the distinction of the latter style being due chiefly to the work of Thomas Jefferson which was typified by his own home, Monticello, and by his University of Virginia.

"In the North, the mansions were usually carried a story or more higher than in the South. They were more compact and restrained, for pilasters were used very largely in the place of columns. Instead of the balance of wings on either side of the main structure, the wing was usually added at one side or at the rear, and extended to include the various outbuildings and shops with stables forming the terminus of the group, or being rather closely associated with the house in a group near at hand; whereas in the South the workers' houses, the plantation barn, and the shop for the wheelwright, blacksmith, the cotton press, and sheds for the drying of tobacco, were in separate groups at some distance from the mansion.

"Before the Revolutionary period, and for a quarter of a century afterward, the English influences in the design of estates, both North and South, were very marked. Within this period Thomas Jefferson's influence, not only in the design of buildings but also in the design of grounds, was powerful in the South, and especially in Virginia. At the end of this period André Parmentier exerted an important influence in the North, especially about New York.

2071. A good background for a landscape garden. Page 1780.

"In this colonial period and subsequent to it, there was an exchange of native and exotic plant material, through such men as John Bartram, Peter Collinson, Benjamin Franklin, Thomas Jefferson, and others, supplemented by such agencies as the Prince's Nurseries at Flushing, Long Island, and the Winship Nurseries at Boston. This interest was reflected in the writings of A. J. Downing, the first notable writer and practitioner in the designing of landscapes, whose successor, Frederick Law Olmsted, initiated systems of parks that preceded the city-plan movement of today. This period of testing exotic plants and fruit trees in private grounds and in a few public parks, that extended through the middle and latter part of the last century, established the fact that many of these varieties were too short-lived to be of permanent value. Others thus secured not only an established place in our gardens by reason of their adaptability to our conditions and their evidence of long life, but also a permanent place in our flora by becoming naturalized in fields and woods of both the North and South. This experience in exotics was followed by an interest in the natives of both the East and West of the United States, which has led to their use in nurseries and in gardens. In recent years, new groups of exotic plants and more of our native plants, are coming into general cultivation through the interest of Professor Sargent and the Arnold Arboretum, where a careful test is made before the plant is recommended for general use, and through the Department of Agriculture at Washington, and the Experimental Farms of Canada. Through these various agencies, an important part of whose support has always come from the owners of large private estates, a very large share of the earth's surface has been searched for new varieties.

"There are, therefore, represented in the great private estates one group in which special attention was given to the growing of collections and fine specimens, such as Wodenethe, the Sargent estate on the Hudson; Glen Cove, the estate of the late Charles A. Dana at Glen Cove, Long Island; the Payson estate in Belmont, Mass.; and the Hunnewell estate at Wellesley, Mass. In another group, the beauty of landscape was the dominant motive in design and maintenance, as represented by the Montgomery place south of Clermont on the Hudson, which was regarded by Downing as being second to none in America, and by Charles Eliot was placed among the first in his series of articles on "Some Old American Country-seats" in "Garden and Forest." In this same class would be the A. T. Lyman and Christopher Gore estates in Waltham, Mass. (Fig. 2076); Sunnyside, the Washington Irving place on the Hudson; Monticello, Jefferson's homestead at Charlottesville, Virginia; and the Arlington estate, the home of Lee near Washington.

"The work on the large private estates of the future should and probably will be on broader and more definitely directed lines than was represented by the great estates of the past. While there will always be individuals who prefer to make collections of interesting specimens, such owners will be able hereafter to avoid duplication of effort and work with clearly designated groups of plants, or secure more tangible return through plant-selection and plant-breeding by coöperating with such agencies as the Arnold Arboretum, the departments at Washington and Ottawa, and state institutions, instead of attempting to record and establish great general collections.

"There will be a group of individuals whose chief interest will center in the development of landscapes in a very much broader way than has been the general practice of the past, and which is indicated by the development of town park systems and town plans, and will be enlarged to include a national plan that will fit the lay of the land.

"The express train, automobile, and the aëroplane to follow, are training the eyes to see real landscapes more and the details of landscapes less. This breadth of view will lead men to become connoisseurs of the living landscapes instead of the painted landscapes alone. It will lead men to seek out the choicest landscape views and purchase them, and to acquire or control in these outlooks the essential features instead of attempting to acquire all the land for themselves."

Literature.

The best results in the planning of any place are to be expected when one employs a competent landscape gardener. Avoid the man who places great stress on flower-beds and unrelated designs. Yet one can do much by himself, and be the happier for the effort. Books will help. Some of the current American books on gardening as related to landscape are the following: Downing, "Landscape Gardening;" Kemp, "How to Lay Out a Garden;" Parsons, "Landscape Gardening," and "How to Plan the Home Grounds;" Long, "Ornamental Gardening for Americans;" Waugh, "Landscape Gardening" and "The Landscape Beautiful;" Maynard, "Landscape Gardening as Applied to Home Decoration;" Davis, "Ornamental Shrubs;" Van Rensselaer, "Art Out-of-Doors;" Bailey, "Manual of Gardening;" Underwood, "The Garden and Its Accessories." See *Borders, Banks, Garden, Herbs, Shrubs,* and other articles. The home vegetable-garden and flower-garden are discussed in Vol. III, p. 1738, p. 1747. L. H. B.

2072. An interesting marginal road. Page 1780.

The art of designing landscapes.

Landscape gardening is one of the terms used to designate the profession that conserves, develops and creates landscape, locates and arranges artificial structures, plantations, and passages therein for the convenience and pleasure of man. It is practised professionally as a fine art by men and women who have also adopted such titles as landscape architect and landscape designer; and by some architects. It is practised as a part of their duties by some superintendents of public and private grounds and made a part of their business by some dealers in plants.

This landscape art may include all objects within the scope of vision, from a narrow strip of sky and foliage between buildings, a lawn, a garden, a town, to a horizon-sweeping panorama.

In this, as in all professions, many are mere copyists who, in all their problems, duplicate or adapt with minor variations, styles, plans and patterns originated by others to meet the special requirements and conditions of each of their problems.

The artists of the profession as well as artists among painters of landscape are striving to give a quality of distinction to each of their productions. This distinction comes from a study of the distinctive beauty of the locality in which they work; a beauty that may be partly or wholly hidden by extraneous material. The designer of the living landscapes must also acquire a knowledge of the conditions and requirements of the use to which all or parts of their landscape is to be put by its occupants. The landscape painter is free to choose his subject while the landscape-maker often must create a new beauty in wholly artificial landscape compositions. Artistic distinction of design is gained through the omission by the painter or removal by the landscape-maker of extraneous material and incongruous incidents and by additions that will give greater harmony and unity.

The principles of design in this art of landscape-making are very similar to those of the landscape painters who can produce on canvas phases of natural beauty with such skill as to give great pleasure to the eye, and sometimes a stimulus to the imagination that is the gift of genius alone. Every student and lover of the living landscapes should study the pictures of the Barbizon School and of such artists as Hobbema, Claude Lorraine, Turner, Fragonard, Corot, Constable, Inness, Church, and Wyant. Church and other painters have chosen for their subjects passages in the wholly artificial landscapes of New York Central Park that was designed and constructed by the senior Frederick Law Olmsted, who was the great master of the artists who design living landscapes.

While there is as yet no accepted distinction between the landscape works of those who practise under the different titles referred to, the names suggest a distinction that may be helpful in outlining various phases of professional work.

Landscape architecture.

Landscape architecture, the French term for the profession, could be properly applied to the designs that formalize landscape in a large way, as did Le Notre's at Versailles, or to big formal gardens of today filled with architectural structures or architectural and sculptural bric-a-brac wherein foliage and flowers serve only to relieve the rigidity and severity of such immobile forms.

2073. A boundary stream and walk. Page 1780.

The term landscape architect was first applied by the New York City Central Park Commission on February 20, 1862, to their advisers, Frederick Law Olmsted and Calvert Vaux, and was retained by Mr. Olmsted in his later practice and adopted by a majority of his successors, notwithstanding the fact that the dominant spirit of American work is essentially informal. By informal in landscape gardening is meant naturalistic design in which irregular massing of the landscape elements predominates. By formal is meant design depending on a more exact symmetry.

There is a spectacular impressiveness in big formalized landscapes and gardens that is sure to elicit the brief admiration of the multitude. There may also be a beauty in proportion, a justness in scale, and a refinement of detail that will satisfy the discriminating critic, and give pleasure even to those whose greatest satisfaction comes from the greater variety and intricacy of informal and natural beauty. There are situations in which the formal treatment is undoubtedly best.

In formal design the land is forced to fit the plan; in informal design the plan is made to fit the land.

When there is abundant means properly to construct and maintain large formal layouts, they may with propriety be introduced in public parks and private show estates, especially in direct association with great buildings and their formal entrances and courts.

At the other extreme of formal design are the old-fashioned gardens with box-edged walks symmetrically arranged in a pattern that gives convenient access to beds.

Another distinctly informal garden type, the Japanese garden, is referred to here because it is so artificial in design and in construction. These gardens are conventionalized miniature landscapes. They may include miniature mountains with ancient, wind-swept, stunted trees, cliffs, ledges, turf, and water, or the imitation of water made in sand, edged or crossed by suitably placed stones. Very distinctly do these gardens appeal to the imagination. There is also a special sentimental significance given to the form and arrangement of such garden features as lanterns, seats, groups of stones and plants, similar to the significance of flower-stem and fruit arrangements in Japanese homes made to convey expressions of sentiment, courtesy and compliment to guests and friends. While we cannot reproduce a genuine Japanese garden with our materials, we may make our gardens appeal more to the imagination in expressing certain types of our own landscapes, and more to sentiment in establishing a recognized significance for the incidental structures therein.

A garden, formal or informal, in which especially favorable conditions are established for the growth of fine garden flowers, should have a place in grounds where the surpassing interest is not given by some natural feature. It is desirable that such gardens be entered so directly from a home as to become outdoor compartments of it.

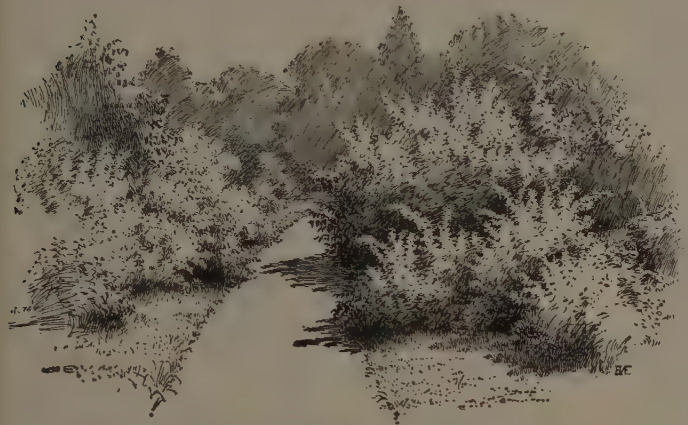
The design of small house grounds, small shut-in estates, and public grounds will fluctuate in style from period to period between the bondage of the rigidly formal to the freedom of informality. Nature's modeling of the surface in broad landscapes can never be greatly modified except by the introduction of artificial bodies of water, and by the arrangement of masses of foliage, of fields and of habitations as seen from selected viewpoints.

Landscape design.

Landscape design, a term as yet adopted by few practitioners, could properly be applied to the development of the broad landscapes and passages of natural beauty. Such beauty can be modified and enhanced but can rarely be reproduced by man or his money within a short time limit, as can be the lawn and the garden.

In the selection, development and refinement of broad landscape beauty, there would be little of the formality that has been mentioned as especially appropriate to the term landscape architecture, little of the new construction and exotic planting to be referred to later under landscape gardening.

Broad landscapes vary greatly in impressiveness and beauty from different viewpoints, even within a limited area, and the first problem of officials representing public ownership, or a private owner, before arranging with engineer or architect for detailed structural plans, is to choose with his landscape adviser the finest of the various available and accessible viewpoints. This would involve a study of the far distance, the middle distance, the foreground and the nearby foliage frame, of each of the sites that can be arranged conveniently to meet the needs of the public or the owner. In such study it may be often developed that the property purchases should include distant single trees, groups of trees, or forests and fields that may be quite separate from the main property and be held because they are essential elements in the beauty of the outlook.



2074. Good plant forms for the free style of design. Page 1781.

Another landscape of distinction would be a woodland glade walled in by splendid old trees, each one a patriarch with a ripened beauty and dignity that age only can give, the forest floor covered with an exquisite carpet of such evergreen trailing plants as linnea, wintergreen, bearberry, ferns and mosses, all having a refinement of detail that comes only with years of natural selection and adaptation to such special conditions.

In the development of such a forest retreat, foliage- and branch-framed pictures would be opened up into the woods or to fields or distant sky-lines beyond by carefully studied tree and branch removals. The beauty of adjacent woodland detail, such as a shrub or herb group in which one variety predominates, would be enhanced by the removal of other plants that interfere with a foliage and stem, floral or fruit composition already having or promising to have marked distinction. In other places the varieties elsewhere removed would predominate and be the ones retained and fostered.

Such notable broad landscapes or woodland passages will be seen by the owners and observers from the buildings or grounds of a resort or from a home about which would be the gardens and fields of utility and beauty that are needed to sustain and give pleasure to many persons.

The time will also come when persons of advanced taste will have their collection of living landscapes with simple retreats from which they and their friends can enjoy each scene. The automobile now makes it feasible to have such possessions in widely separated locations, and the cost of acquiring and maintaining such living pictures need be no greater than is often devoted to painted pictures.

Already nation and cities are beginning to preserve and acquire fine scenery in public reservations, and choice holdings of individuals will be devised to cities or to the nation as paintings and sculptures now are.

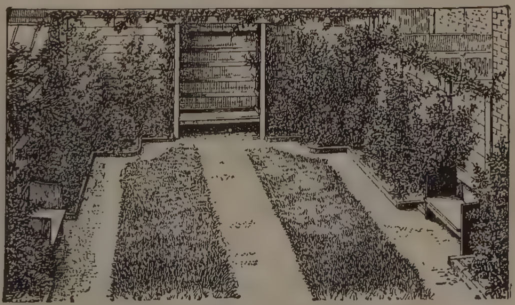
This work of the landscape designer wherein it is deemed more important to preserve and develop natural beauty than to destroy it and substitute artificial beauty, applies as well to the little home ground upon which natural beauty exists as to great estates or to great landscapes.

Landscape gardening.

Landscape gardening or gardening, the English term for the profession, now and in the period when such classics as Wheatley's "Observations on Modern Gardening," Price's "On the Picturesque" and the works of Repton and Gilpin were produced, is a term that may properly be applied to such distinctly horticultural phases of the profession as may be treated in detail in an horticultural cyclopedia. The term may well have special application to landscapes that must be largely or wholly artificial, in which the planting is chiefly the product of horticultural establishments. Such landscapes are represented by the average small park and the intimate home outlooks of lawns and gardens, rather than by the wild woods, the fields and the wide views.

If the landscape be only a single window outlook in a city block against bare walls with just one opening in which appears a graceful tree or vine branch, silhouetted against the sky, the artist will so arrange plants and vines about his window-frame as to shut out the bare walls and make the sky and the branch the central attraction of his picture. Here may be gained as much pleasure from hourly changes in the sky background, seasonal changes in the foliage, and from the occasional bird or butterfly visitor, as many a rich man gains from his galleries of paintings and acres of gardens. For suitable selection of vines in shade or in sun to execute the artist's ideals for the frame about a window-opening and for the flowering plants to be used in association with the vines, one would look to the local florists' establishments.

The main subdivisions of the average house-lot are usually lawns, garden, laundry and service-yard and house and service entrance walks, or if the lot is large enough, these walks may be roads. (Fig. 2081.) The lawn and the garden should by preference be on the sunny side and directly associated with and entered from the home living side of the house. The service or utility entrance passages and compartments are usually placed on the shady side. It was once regarded as essential that the living-room be on the street side of the lot and the service-rooms at the back of the lot, regardless of exposures or outlook. It is now regarded as the best practice to give the living-rooms the most attractive exposures and outlooks regardless of the street, and to place service-rooms and yards next to the street, or at the side of the lot when this arrange-



2075. The open center in a small rear lot. Pages 1779, 1781.

ment gives the advantage to either living-grounds or -rooms. Such service compartments may be screened from the public gaze by lattices covered with vines or shrub plantations. Examples of such exceptional but sensible layouts are shown in Fig. 2082.

From lots surrounded by houses and back yards are likely to be one or more outlooks that are similar to and can be treated like the narrow window outlook referred to above. When views are to be seen from several positions in house and grounds and at various heights, the arrangement of the boundary foliage-frame as well as the planting about the house, gardens and yards becomes more complicated. Such planting will include small trees, shrubs, vines and herbs chosen because the heights, breadths and outlines at maturity will occupy the designated position without unfairly encroaching upon lawns, gardens, passages or light openings of buildings. When one considers that such large trees as maples, elms, beech, and ash spread at maturity 40 to 80 feet, it is obvious that they should not be used freely on small lots or parks. Often a single tree shuts out all the view, and to secure outlooks without cutting it down, it becomes necessary to make framed-in openings at different heights by the careful removal of branches and twigs.

In parks or estates measured by acres instead of square feet, the control of outlook, the arrangement, for inter-communication, concourses, recreation, garden and landscape compartments, are made with similar purposes in view and with similar material as is the case in the design and construction of smaller private grounds.

In the large open areas, elevations and distances are usually on the scale that permits the use of large tree borders in place of shrubs and small tree borders, as well as the creation of larger landscape units by so disguising boundaries and buildings beyond as to give a visual ownership to a great landscape. This was done in a notable way by Olmsted from the Overlook and from Hagbourne Hill in Franklin Park, Boston.

The plant materials.

In choosing and arranging planting for all this work in landscape, the adaptability of plants to soil and climate, the hardiness, freedom from disease and insect pests, would be considered before the brilliancy or peculiarity of flowers, foliage or fruit. Horticultural varieties and forms would usually be added to enrich the detail, not to make the masses of landscape plantations. Plantations are more effective and usually less expensive if few varieties are used in large quantities, rather than many varieties in small quantities.

Persons of refined taste prefer a landscape made up of plants having the normal green foliage, with all the exquisite variations in tone, texture and shade throughout the summer season that follow the spring's outburst of delicate pinks, grays, reds and yellows in the budding leaves. Such persons enjoy the modelling, the coloring, the bark patterns on trunks, the varied ramifications of branches and twigs in winter. They are entertained by the brief but gorgeous riot of autumn color as by a yearly Mardi Gras. For those who like to live with the garish, the spectacular and the peculiar, there are enough odd horticultural forms to make a lawn landscape of curiously distorted branches and of yellow, purple and variously blotched, dissected and twisted foliage.

2077. The free center.—The Meadow, Central Park. Page 1781.

A very few of the finest of such forms, like the sturdy purple and the weeping beech, the vigorous Schwedler's maple, the lace-like Japanese maples, are worthy of a place in a lawn planted with the finer exotics and garden varieties, especially if the plants that carry their conspicuous colors through the summer are not allowed to compete with fine distant views or quiet lawn landscapes. Such forms may well be placed in special compartments, in which each color is massed as one masses roses in a special rose-garden. The most serviceable of these garden forms are such fastigiate types as the Lombardy poplar, to make foliage screens in narrow spaces or to give such points of emphasis in green landscape as does the church-spire in the village.

There is an important place in plantations on large areas for such very rank and rapid-growing, easily propagated and therefore cheap trees as the cottonwood, willow, Russian mulberry, soft maple, catalpa, black locust, and in the warmer regions, the eucalyptus and the camphor tree. Such trees will give high, dense masses of foliage in different soils quickly. It is usual, however, to plant slower-growing, more permanent, sturdy and interesting trees, such as hard maples, oaks, magnolias, with these rapid-growing nurse trees, the latter to be gradually removed as the more permanent trees develop. In coniferous plantations, the rapid-growing and short-lived Scotch and Austrian pine and fir balsam are not infrequently used as a filler for the more permanent and valuable pines.

In working up detailed planting plans, the knowledge that some 5,000 species and named varieties of woody plants can be purchased in American nurseries, should lead to great conservatism in planting to avoid the mussy mass of odds and ends that are scattered all over the open spaces of some small home and park grounds even now, in spite of the good advice that is being conveyed to

2076. The free and open front.—Gore Place, Waltham, Mass. Page 1781.

the public in lectures, books, government and state publications.

The thorns, flowering dogwood, red-bud, wild crabs, and in the warmer sections the red bay, crape-myrtle and camellia, with a spread of 15 to 20 feet, are most suitable to give shade and make screens and borders in small lots. Such large shrubs as the weeping golden-bell, mock orange, syringa or Persian lilac have an ultimate spread of 10 to 15 feet, so they should not find place in a narrow part of the border. For small areas, such narrow, tall shrubs as the white lilac and panicled dogwood will be suitable to give high and medium high foliage. For medium high borders, such shrubs as Lemoine's syringa, Missouri currant, weigela, Van Houtte's spirea, faced with such small kinds as the dwarf deutzia, Indian currant, snowberry, Scotch rose and the dwarfer forms of the Thunberg's barberry are the safest to use.

When there is not too much lime in the soil, a broad-leaved evergreen bed can be established on the shady side of the house in which such tall varieties of rhododendrons, as *album elegans* or *album grandiflorum*, would be next to the blank house walls faced down with the lower-growing and more spreading crimson- or purple-flowered varieties, or with mountain laurel, edged with the low andromedas or dwarf rhododendrons.

The narrow strip next to a neighbor's blank wall or back yard, or between the entrance passages and the laundry or other service-yards, may be planted with such narrow tall-growing shrubs as the panicled dogwood, or such easily procured pyramidal trees as the Lombardy or Bolleana poplars, or the less common pyramidal varieties of the birch and ginkgo. If the space be very narrow, one could have a trellis covered with flat-growing vines such as the Boston ivy and the Japanese honeysuckle, which is nearly evergreen, or the Virginia creeper, which will also grow in shade. If a full evergreen cover is desired, the creeping *Evonymus radicans* is the safest vine for the North and the English ivy, or creeping fig (*Ficus pumila*), for the South, all of which will grow in shade. If broad spreading vines are permissible, then use such as the American or Japanese bittersweet, wistaria, trumpet-vine, grape and deciduous roses in the North and in the warmer section the evergreen Cherokee rose, the Macartney, Banksian and other climbing roses, the bignonias, and passion flowers.

One should determine to give the lawn plantation individuality, and distinction, but not eccentricity.

If it is desired that the gray-greens predominate, then the royal willow, the Russian olive, the sea buckthorn, the sage willow, or *Lonicera Alberti*, represent typical plants to use, ranging from middle-sized trees to very low facing-down shrubs. The mullein pink, *Alyssum saxatile*, and *Cerastium tomentosum* are herbs having a similar foliage color.

For a dark green lawn border in the North, the laurel-leaf willow, white fringe, Russian rose, bayberry and pachysandra would give a similar range of heights. In the warmer sections, such dark green plants would include the figs, laurels, guavas, and pittosporums.

If a yellow floral display in shrubs to extend well through the season is desired in the North, one could use the Japanese varnish tree, Scotch laburnum, Cornelian cherry, golden-bell, globe-flower, witch-hazel, Japanese barberry, and a little farther south the winter jasmine.

If a red floral display is desired in the warmest sections, the bottle-brush tree, crape-myrtle, Japanese quince, russelia, hibiscus and poinsettias are available.

There are also several families of plants such as the heath and rose families, or the Coniferæ, that contain a sufficient variety in size, outline, foliage, flower and fruit completely to plant a place.

2078. Protection-planting.—The home of Florence Nightingale, Lea Hurst, England. Page 1781.

These planting suggestions relate chiefly to the older parts of the country with normal conditions of soil, cultivation and humidity. There are many sections and localities in which special soil, climatic and cultural conditions dictate the use of different types of plants and also determine the extent and character of plans for the development of places. On the southern California coast and in the arid Great Basin between the coast range and the Rocky Mountains, turf and the ordinary cultivated plants must be irrigated, and, as water is expensive and limited in quantity, only small areas can be maintained in turf and gardens at the normal cost of eastern places. To have a green landscape during the dry bare-ground season in these sections, advantage may be taken of evergreen orange, lemon and olive orchards cultivated for their fruit crop that come into the views. For other evergreen trees, Monterey cypress, Monterey pine, eucalyptus, pepper and camphor tree, are most easily procured. For the unirrigated land there are evergreen native shrubs like the rhus, the manzanita, the madrona, the bay and ceanothus, but as yet they are not offered by nurseries in quantities at reasonable cost. In the place of turf, inexpensive quick ground-cover plants like *Lippia repens*, various mesembryanthemums, agaves and cacti are used.

In the South, also, owing to the difficulty of establishing turf, the large lawn areas of the North are impracticable. Here about the only grass that can be relied upon for permanent sod is the Bermuda grass, which is brown in winter. Many evergreen plants can be grown here, however, under ordinary cultivation that cannot be grown out-of-doors in the northern states, such as the ivy, camellia, gardenia, Indian azaleas, Chinese privet, photinia, magnolia, hollies and aucubas.

In such northern states as Minnesota and the Dakotas, with a snowfall so light as to allow the ground to freeze deep, evergreens do not succeed and many of the deciduous plants of eastern nurseries are unreliable.

Where the ground is so deeply covered with snow through the winter as to prevent deep freezing, as about the Great Lakes, more coniferous trees and evergreen shrubs can be grown, even rhododendrons and azaleas in protected localities, unless the soil be limestone.

In poor gravel and sand some plants, such as the bearberry, crowberry and hudsonia, that will not do well in good soil, will make an attractive and permanent ground-cover, but they are not offered in quantities by nurseries. Soils that are wet much of the year support a few plants such as buttonball, red maple and willow, arbor-vitæ and tamarack in the North; in the South white cedar, cypress and palmetto. On seashores exposed to constant winds and the spray of high tides, bayberry, huckleberry, and wild roses predominate in the North, and in salt-marshes, baccharis and iva. In the South the mangrove grows at the edge of salt-water.

The wet-land limitations may make distinctive and attractive landscapes, even though they are not so accessible, that are quite as worthy of preservation and development as the upland woods, fields and lawns.

2079. A type of house that needs much intimate planting. Page 1781.

There are limitations in the supply of material in nurseries that must be considered in making landscape planting plans. The plants most desired to carry out the designer's ideal may be too expensive or offered in too small quantities by the dealers. Therefore, a working knowledge must be had of the available material as well as a knowledge of the habits and cultural requirements of plants.

The grading and mechanical work.

In the development of areas for habitation and for the recreation of many persons, there must be underground pipes and surface grading. Roads and walks must be provided as well as means for supplying light and water, disposing of sewage and other wastes in a sanitary and sightly way. Grading is required about buildings and in the construction of roads, game-courts and gardens, and is often resorted to in order to secure such special effects as are indicated below: shutting out of sight a road or walk that crosses the turf foreground of a distant view or across a lawn view; making a building which stands below a road-level to appear nearer this level by having the surface slope away from the building into a valley with its opposite side at the road made more abrupt, and covered with low shrubs; making buildings on formal terraces appear nearer the ground-level by substituting for the terraces a gradual ogee or reverse curve.

There are usually two classes of roads and walks, the long indirect pleasure ways for occasional use that are preferably turf- or leaf-covered and the direct thoroughfares from house to town and from building to building that are in constant use and must be well drained and thoroughly constructed on easy grades.

A 5 per cent grade is regarded as the desirable maximum for horse-drawn vehicles. Curves, even sharp curves, are made through irregular steep land to gain the necessary length to give easy grades. With automobiles steeper grades are permissible, while less abrupt curves without obstruction to the view of the road are much more desirable. The tendency is to accept steeper walks with fewer steps than formerly, not alone in the cities where ramps are being substituted for steps in the great railroad stations, but also in country parks and private grounds.

Automobiles are compelling new methods of road-construction that provide either a solid surface like brick, wood block or a concrete bed with tar and fine stone surfacing; macadam or gravel bound by asphalt, tar or glutrin; or gravel with surface application of oil or calcium chloride to lay dust. Water-bound macadam roads are out of date and a waste of money where there is much automobile traffic. When good gravel can be secured, it is likely to make the best and most economical country and private estate road if given the same attention in construction and care as was given the old macadam roads. In nearly every section of the country, good binding gravels are to be secured, such as the white cementing churt of central Georgia, the red Paducah gravel near the junction of the Ohio and Mississippi, the gray Peekskill gravel of the Hudson River, the reddish cementing gravels of eastern Wisconsin and the foothills at Santa Barbara, California, and the gravelly clays of the sandy foothill section of North Carolina of which so many hundred miles of excellent low-cost roads have been made about Pinehurst.

For little used drives and walks, well-drained turf or a covering of pine-needles or deciduous leaves are serviceable and attractive with a low maintenance-cost. Walks can be carried down steep places attractively with a minimum disturbance of the surface and vegetation at the lowest cost by the use of stick instead of stone steps. These are made of rounded or square pieces about 2 feet long used as risers for earth or sod treads and held in place by stubs driven down in the face at each end.

Sometimes a public water system is available, or a natural gravity supply either for direct service or to operate a hydraulic ram or a water-wheel pump to force water to a reservoir. At other times windmills, gasolene, hot-air, steam or electric pumps are installed to force water from dug or driven wells, ponds or streams, to an elevated reservoir that will give gravity supply, or to air-tight tanks at lower levels from which the water is forced through the supply-pipes by air-pressure.

It is very important that sewage be disposed of in such a manner as not to contaminate the water-supply. It is very likely to do so if it flows on the surface, through the ground from the ordinary leaching cesspool; or into sink-holes as it often does in the limestone regions of the South. The danger is multiplied under such circumstances if the supply is taken from a spring or stream or well below the house-level. Even if the owner's water-supply is taken from a higher level one should consider the neighbors below in the disposal of his sewage.

There are many sewage-disposal systems now devised that will, if properly constructed and maintained, so modify the liquids as to make the outflow pure and safe. They are based on the fact that bacterial and chemical action in so-called septic tanks combined with the action of the air on thin films of liquid filtering through sand and coarse gravel over which it is discharged intermittently from syphon chambers, will destroy all dangerous organisms.

City plats and squares.

A number of men who practise as landscape architects also call themselves city-planners. Such men and others in the profession are leaders in the city-planning movement that has, within a very few years, gained such marked headway that most cities and many small towns have plans prepared for their future extension, and some states have provided for planning-boards in cities.

Such plans include a provision for public parks and parkway systems, main thoroughfares, transportation lines and terminals, and for centers about which public buildings are grouped, for playgrounds at frequent intervals throughout the city, for public squares, and such other public open spaces as the special needs of each city indicated as desirable.

The tendency is to make such plans take advantage of the irregularities of the topography and fit them more closely than do many of the early plans that require a vast amount of cut and fill to make the surface fit their lines, to provide wider and more direct main traffic thoroughfares, to omit unnecessary curves in roads and paths, and to locate public buildings and monuments at points where they will form effective street terminals without interfering with direct passage.

The accompanying sketch (Fig. 2083) of a public square and its arrangement is an indication of this tendency, for the passages across it make direct routes from street to street. The proposed structures would represent a place for effective street terminals. Provision is made for the comfort of the public in the placing of drinking-fountains and seats set back from the sidewalk line. Enough trees are provided to give shade, and a place is indicated for flower-beds where they will not interfere with the openness and breadth of the center of the square. Such squares are coming to be islands of safety and places in which to rest in the center of great thoroughfares and towering buildings. The pretty flower-gardens, curving walks and playgrounds that might be appropriate in the less crowded residential section would be quite inappropriate in a city square.

Note that these public squares should be dominated by directness and simplicity. In these crowded meeting-places there is no warrant for the fancy curves and "features" that are often made so much a part of many landscape designs. Fig. 2084, for example, shows inadmissable plans for a busy city square, with no main passages and no opportunity for somewhat secluded or recessed seats. They partake more of the character of labyrinths, and would be more in keeping in grounds where a very few persons enjoy ample leisure, or in residential parts of cities.

The general results.

There is a growing spirit of coöperation and harmony among those who are developing landscapes and gardens. A distinctively American custom is that of throwing the front lawns together on each side of a residential street in order that all who pass may enjoy the greater breadth and beauty thus gained. A constantly increasing number of persons is considering the neighbors' interests as well as their own in the location of buildings, plantations, in the cutting of trees and in other features of the planning and making of a place. There is less of that kind of architectural and gardening originality that makes a place so out of harmony with all its neighbors as to make it an offensive vulgarity even though it may be fine in design.

For a history of landscape gardening see the introductory article. For a clear knowledge of the underlying principles that govern the profession, the reader is referred to "Charles Eliot, Landscape Architect," by his father Chas. W. Eliot; "Art Out-of-Doors," by Mrs. Schuyler Van Rensselaer; "Italian Gardens," by Chas. A. Platt.

There are many available books, American and English, in which the principles of design are referred to, but in which such practical considerations as the making and the laying out of plans, methods of construction, the description of plants and methods of cultivation are the most important parts.

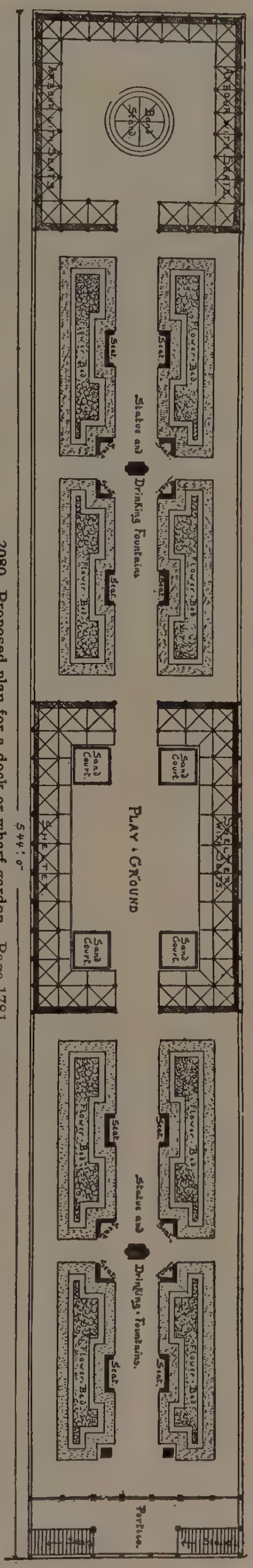
WARREN H. MANNING.

The Japanese garden.

Of a different and peculiar type, very intimate and personal, is the Japanese garden. It proceeds on different principles from the American and European garden. Examples are sometimes seen in this country, and it is well to understand the motive of them and to know what they hold in promise for us.

The garden in Japan.

It has been the theory in Japan that everyone should provide his home with all the joys and comforts associated with a garden, with the idea that it is not a general habit on the part of the housewife to secure her pleasures outside. Unlike others, the people of Japan are not contented merely with trees or flowers, but must add the rocks, streams, stone lanterns, outdoor wash-stands, wells, fences, with carp, frogs, crickets, and even bronze stalks. On the ground, one occasionally finds a private shrine, which is decorative rather than holy. A lake or pond wanders in all manner of angles, arched with projecting trees, and often dwarfed pines protect the

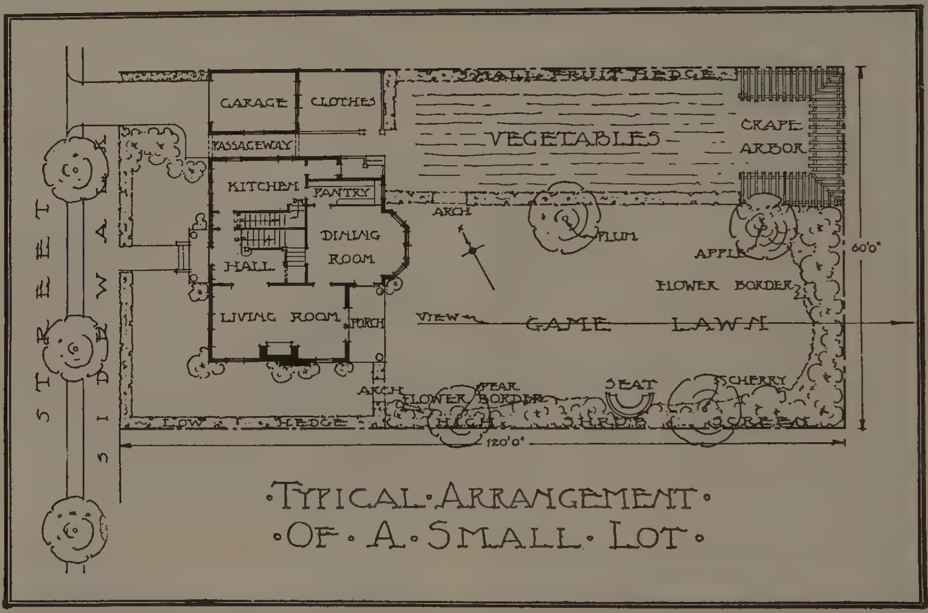


2080. Proposed plan for a dock or wharf garden. Page 1781.

goldfishes from their enemies. It floats a boat, surrounded with duckweeds or water-nuts. On its edges, there grow iris or reeds. (Fig. 2085.)

The laws of linear and of aërial perspective are carefully observed, no matter how large or small the garden may be. The relative stature of things, both near and distant, lightness and darkness, openness and density of foliage, the splendor or delicacy of their flowers, whether in size or in color, the season of blooming, the contour of the grounds,—all these points must be taken into account in determining where objects are to stand and how they shall be grouped. The character of the trees or shrubs controls the main part of the garden. Foreigners often feel the aspect to be rather gloomy, and to untaught eyes the best garden may be nothing but a patch of a grove.

In Japan, a greenhouse or nursery plot is never shown in the garden itself. The flowers have no recognized status or existence. They are usually hidden, and brought into sight only when in bloom. The roses, the lilies, the saffron, the balsams, the sunflowers, the chestnut trees, and many other things are not considered to be garden plants, whereas the bamboos, the oaks, the pines, the plums, the iris, the wistaria, the azalea, the lotus, the camellia, and others, are important. The maples are popular, but never the weeping willow. Some think it is an unlucky omen to the family that plants the crape-myrtle, grape, and other fruit trees. The different ways to place the trees or rocks indicate the degree of happiness of those who use the garden.

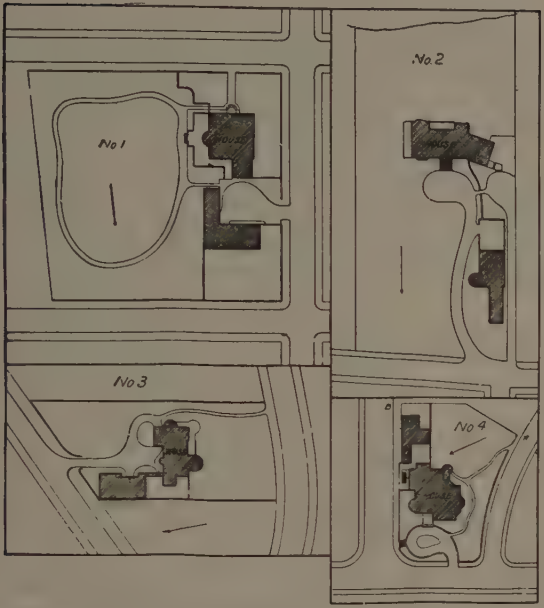


2081. Suggested arrangement of a small lot in which the desirable outdoor compartments of the grounds are properly associated with the indoor apartments of the house, and in which there is a minimum amount of road and walk surface to connect the different compartments. Each of the fruit-trees may be grafted or or budded to early, medium and late varieties. The small-fruit hedges may be made of such things as gooseberries, currants and juneberries, with the trimming to develop the fruit and to give also a uniform outline. The border planting is designed primarily to give seclusion and to screen objectionable views or to frame in attractive views; incidently, it may give an abundance of attractive flowers.

Yet the prime test is the proportion of the whole, and the arrangement of the walks in their prescribed order. The soil is bare or sometimes covered with mosses,—not lawns,—and it is cloven by a series of stepping-stones, leading to a little pavilion, sufficient to celebrate an old-school tea-party, or to a moon-viewing hillock, or to a place where one may secure a cool breeze on a summer evening or take a free sun-bath on a winter morning. It is a real revelation to have these privileges on one's territory, especially to those in the metropolis where the houses are thickly built. Some walks are so small that they are hopeless to set a foot in, although they may be a good imitation of some famous piece of scenery, with hills, valleys, cascades, streamlet, lakes, islets with trees; looking at the garden from the house, one may enjoy it as a sort of living picture. So, a little box of a foot square brings forth a landscape similar to a park of many acres.

There are so-called natural and formal gardens. The right choice between these two aspects of the art depends on the space, and on the features of its surroundings. While the spectator desires the innumerable delights of artistic work, he is loath to lose the hint of nature in a tiny dwarfed tree. The mountains farther back should be small and low, without trees, whereas those in the near distance must have much vegetation. The bed of the pond or river at a distance should be made high, and the nearer ones low. If one would show a pond larger, or cataract higher than in reality, one must exhibit only their parts, not an entire pond or river. The view should be appropriate throughout the year, and the sight acceptable on any occasion, either at the time of a little gathering or of a feast; it should be untiring to the eyes of daily admirers, and should discover something new to the frequent visitor.

One man sometimes devotes half his life to a single garden, as a garden could not have been completed with a single kind of stone unsuitable to the place. Each leaf and each twig has its direction as well as proportion, regulated by the most rigid and immemorial principles. The gardeners in Japan seem to have the knack of turning the plants into almost anything they like, thereby representing beasts, fishes, and even human figures. Even a supporting post for an old leaning tree, a straw-cover to protect the shrubs from frost, and a board or fence which is a reminder of shipwreck, enter into the place as part of its attraction. Of course, the hedges or fences are not the frame of the picture, but the important part of the garden. In one of the noted public gardens in the middle west of the main island of Japan, one would see a purple precipice of enormous



2082. Suggestions for subdivision of small grounds. Page 1786.

height yonder, with a forest of several ages, and down in its front lie the shrubs, rocks, and streams, the space between the two being made indistinguishable, as if both were in one stage.

No matter what nobility owns a garden, thousands of modest cottagers are now and then permitted to peep in, and to present their opinions, and such opportunity has gradually led them to provide lovely little gardens about their dwellings at virtually no cost or no burden. It is told that this gentle art is still largely kept a close secret of craftsmen, and has scarcely been put into books. Nevertheless, the soul of the household is conveyed into every garden, to open the flowers and to grow the trees, and not merely the skill of some hired gardener. Upon the principles laid some centuries ago, the sweet flowers enlighten the harmony of the family, the vigorous shrubs give a feeling that they have grown there in the course of the years, and so they all convey to the house a quiet air of being long married or a mother of growing children. This is the real sentiment of the Japanese, who can hardly live even a day without a garden. ISSA TANIMURA.

A classical Japanese garden (Verbeck). Fig. 2086.

The art of gardening was brought to Japan from China and Korea by the Buddhist missionaries in the sixth century. The first gardens were attached to Buddhist monasteries and generally were representations of celebrated scenes in China. Religious significance was given to their construction and the principal stones were named after Buddhist deities or their attributes.

From the Fujiwara to the Ashikaga era (seventh to thirteenth century), the evolution harmonized palace with garden, and bridges, small cottages, and conventional garden ornaments were introduced. During the thirteenth and fourteenth centuries, under the influence of the priests, Muso and Soami, of the Zen sect, the "Cha no yu" or "tea ceremony," made itself felt in the evolution of the garden which thenceforth was given a further religious character. Other great exponents of the religious "tea ceremony" were Enshiu and Sen-no-Rikiu; the latter designed the gardens at Fushimi for the great Hideyoshi in the sixteenth century. Both have left many monuments in the shape of beautiful gardens now existing. The laws of gardening established by these masters form the basis of all conventions of the art of landscape gardening in Japan today. Later artists elaborated landscape gardening until in the more recent Tokugawa era the art had reached its highest refinement.

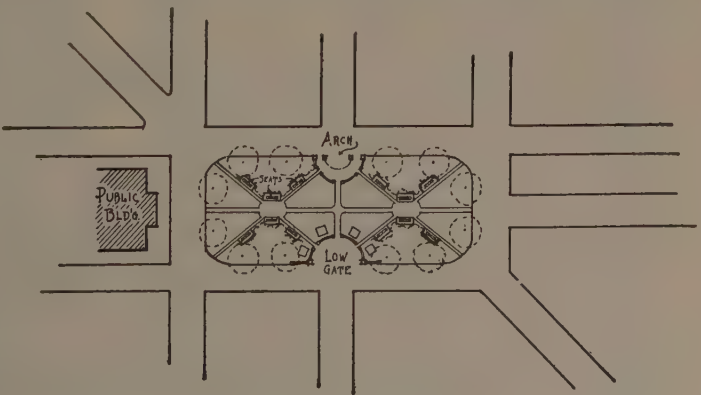
Many schools of gardening have been evolved from the classical models. There are the hill and the flat garden, those where the pond is the feature and others where the water is merely outlined and represented by dry water-courses of pebbles and sea-sand. There are the finished and highly ornate style; the intermediate or less elaborate style, following nature closely; and the free or rough style where bold and simple treatment predominates and but few of the conventional elements are introduced.

The Japanese garden is mostly green and is not of flowers. It is the scenery of a country in miniature, and gives the impression of a picture. The undulations of the hills, the outcropping of rocks and distribution of verdure closely follow nature. Hills, stones and trees have special names and have an order of rank according to shape, location, function and sacred character. Stones constitute the skeleton of the garden to which hills, vegetation and water-courses are subsidiary. Sex is attributed to stones, large, bold and rugged masses being regarded as masculine when placed in apposition to lower masses which are supposed to be feminine. Stones should be irregular and well-worn and placed as if arranged by natural forces.

In a Japanese garden there is a preponderance of evergreens for effect in winter. Of deciduous trees the plum and cherry are favored because of their breaking into leaf early in the year, and maples because of their autumnal coloring. Free use is made of azaleas, magnolias, camellias, rhododendrons, wistarias, tree peonies, daphnes, hydrangeas, and so on. Clipping and shearing of trees is much practised. Pines are bent into conventional shapes. Trees are stunted and dwarfed for use in the distance to heighten the effect of perspective. Flowering plants are placed in handsome pots adjacent to the dwelling. Iris is grouped near wells and watercourses.

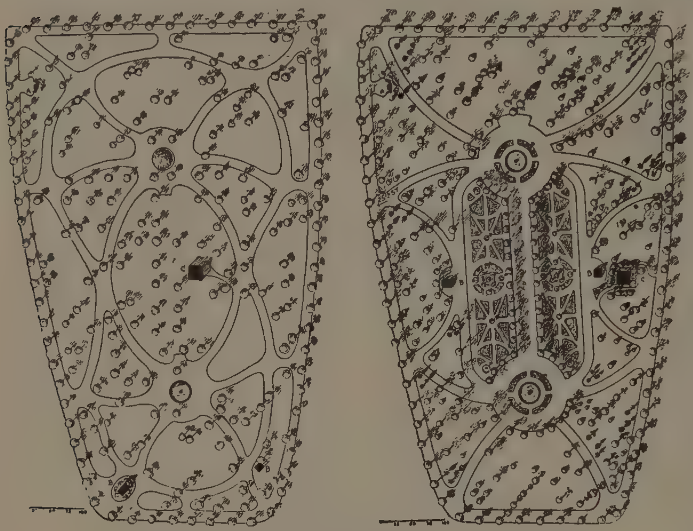
A typical garden following the classical ideals in intermediate style is here outlined.

The dwelling is so placed as to shield the garden from the malign influences of the north wind. The extreme vista must be to the south where rises hill 1, an imposing conical mound representing a distant mountain with sweeping sides. Beside it, to the left, should be its consort, hill 2, of lesser height and gentler slope. On the further slopes should appear a fringe of foliage to act at once as a frame to the picture and to harmonize it with scenery beyond the garden. Rising



2083. Plan for an open block or "square" in the busy part of a city. Page 1789.

from this group at the southern extreme should be a bold pine or oak, called Distance Tree. In the valley formed by hill 1 and 2, and shaded by a group of trees designed to produce the effect of profound solitude, flows a rivulet which terminates in a cascade. The first step of the falls which forms the cascade is high and narrow and is arrested by "Torrent Breaking Stone" which breaks it to form the second step of the cascade which is broader but of lesser height. The upper falls represents the male, and its consort, the lower cascade, the female element. Above the falls should be an image of Fudo, the presiding Buddhist deity of the waterfall, or a representation of the image by a stone in the semblance of a statue. To the left of the cascade should be the Guardian Stone, the most prominent feature in the garden. It should be a tall sentinel-shaped stone placed so as to seem to guard the garden, and represents the male element. Paired with it on the opposite side of the cascade should be the Cliff Stone, a lower stone overhanging the water, representing the female element.



2084. Inadmissible plans for a city square. Page 1789.

The Cascade Tree cunningly screens the waterfall to produce the effect of indefinite height. Minor trees and shrubs may be added to assist in this illusion or to conceal the water-supply. A short cataract then carries the waters to the lake which forms the central feature of the garden. Around this lake are winding walks and intersecting mounds and hillocks sloping to the water's edge, terminating in sandy beaches, and interrupted by great stone rocks or slabs and promontories, often ornamented with granite lanterns or pagodas. The contour of the lake is often an irregular triangle, the base of which is at the Principal View, adjacent to the dwelling. The other two sides taper toward the cascade which is at the apex of the triangle in the south, simulating the vanishing point in perspective. This effect of artificial distance thus created is further heightened by putting the largest trees and garden accessories in the immediate foreground and arranging others so as to decrease in size toward the distance.

The art of stunting trees grew primarily from the demand for dwarfed trees for use in producing artificial perspective and only secondarily from their use in the miniature garden. Trees of different species are grouped to contrast with each other, first, by form, and second, by color, and are placed in valleys or lower slopes of hills. The principal promontory should be bold and prominent and jut from one side of the lake so that a secondary view can be had of the garden only next in importance to the primary view at Perfect View Stone which is near the house. The distant peninsulas or promontories diminish in size. Portions of boundaries of the lake are so obliterated by shrubs and stones as to give the impression of indefinite extent, as if the visible waters were part of a large sea or chain of greater lakes. The base of the hills is covered with evergreen bushes clipped into spherical shapes interspersed with related rocks. The outlet of the lake should be in the west, to follow the law of the garden, that the water-course must follow the sun. Hill 3, which is a foothill of hill 1, is usually placed in the west. In the depression between the two should be a grove intended to suggest the location of a concealed hamlet. The principal feature in the west of the garden is Setting Sun Tree, generally a maple or other tree of red foliage, so placed as to cast the long shadows of the evening sun over the lake. Other trees are Perfection Tree, in the intermediate distance, of moderate height but classical contour; Tree of Solitude, to give secluded aspect to a portion of the garden; Outstretching Pine, overhanging lake, and so on. Hill 4 may be placed at the east to offset hill 3. Hill 5 is a slight elevation at the base of the garden to the north, on which Perfect View Stone is generally placed, and from which point the best view of the garden picture may be had. Near it may be placed Worshipping Stone, or it may be placed on an island. Moon Shadow Stone should be in the group of trees dedicated to solitude. Other stones are Snail Stone, the largest of the stepping stones, Idle Stone, Water Tray Stone, Stone of Two Deities, and the like.

Correctly speaking, two islands should decorate the

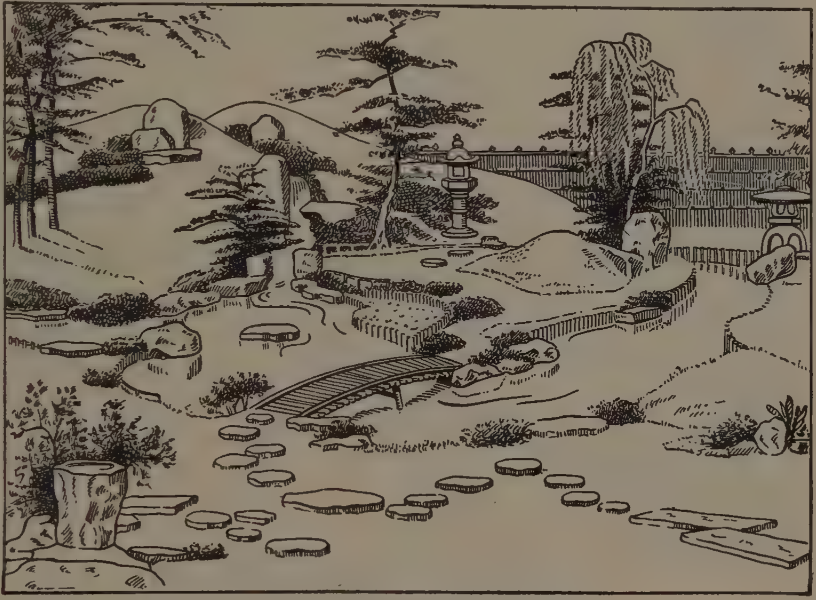
2085. Parts in Japanese garden design.

lake. The larger one is called Master Isle and is placed in the foreground. It should be easily accessible from the bank nearest the dwelling by stepping-stones, causeway or a narrow neck of land. A tea-house usually ornaments a promontory overlooking the lake. The names of stones on the island imply functions of ease and recreation, such as, Amusement Seat Stone, or Stone of Easy Rest. The second island should be smaller and is called Guest Isle, in honor of visitors. It is located in the background and the stones on it are named Guest Honoring Stone, Stone of Obeisance, Shoe Removing Stone, Water Fowl Stone, and so on.

Carefully studied effects from nature are introduced to blend the whole into a harmonious and well-proportioned picture. Variations and adaptions from such classical models are made according to taste of the artist, or to conform to the natural features and limitations of the location.

The author is indebted for assistance in preparing this article to the work "Landscape Gardening in Japan," by Josiah Conder, who is the recognized authority on the subject, from which two of the sketches in Fig. 2085, and also Fig. 2086, are adapted.

William Verbeck.


2086. Japanese garden, with stepping-stones in the foreground.

Formal gardens.

Historically considered, the formal garden is the gradual, natural evolution of the herb- and vegetable-garden which, since time immemorial, for household convenience was established near the country house. This garden assumed geometric form, because economical in space, easy of arrangement and distribution and obviously well adapted to the shape and proportions of the house. It was inclosed for safety; it had a central water-basin for watering convenience. Medicinal plants, small fruit trees, espalier fruit trees, and household vegetables were grown within the inclosure.

Very early, undoubtedly, in the artistic development of peoples, the beautiful aspects and possibilities of such gardens at different seasons of the year must have become apparent. Hence came a desire to improve the general effect by proper arrangement of the plants by well-balanced proportion, by ornamentation, and by cultivation and improvement of the original utilitarian plants, or by the introduction of new ones. Gradually, with a keener appreciation of beauty, persons began to separate the utilitarian part of the garden from the part devoted to pleasure and where only one inclosure catered to the physical and spiritual needs of the family, two separate units appeared: the pleasure- or flower-garden and the kitchen- and herb-garden. The geometrical form was naturally retained. The design remained symmetrical, well-balanced, harmonious. The inclosure, when of masonry, became an architectural feature adapted to the style of the house. If hedges were used, they were clipped and kept at uniform height. This cutting and trimming of the hedges invited attempts at producing, with the shears, green ornaments and fanciful shapes, and the topiary art was born. The central basin of water originally intended for purely utilitarian uses became the pool, the fountain. Trellises, small temples, statues, well-paved walks and ornaments of all kinds were gradually introduced and the formal garden slowly produced itself.

With the development of the fine arts and the accumulation of wealth, the art of gardening prospered, and the same principles of design which governed the arrangement of the pleasure-garden were applied to the more extensive layout of the entire country place.

Congruity, utility and convenience, simplicity, harmony and balance, the fundamental principles of all landscape design, found obvious expression in the formal conception. Thus the formal naturally became the first style of gardening.

This evolution is clearly apparent in all the great periods of history: in Asia Minor, in Greece, and in the Roman Empire. With the consolidation of the political, economic, and artistic conditions of those great civilizations, and coincident with their reaching the supreme stage of development, the art of gardening, exclusively formal, reaches its highest form of expression.

Political and military conditions in the Middle Ages shrink the villa-gardens to their original proportions of a kitchen-garden close to the walls of the castles, while the return to freedom, culture and wealth during the Renaissance restores the gardens to their former favor, nay, to a splendor never equalled before nor since. France and England imitate the Italian garden-art at first, then forge rapidly ahead to great achievements of their own.

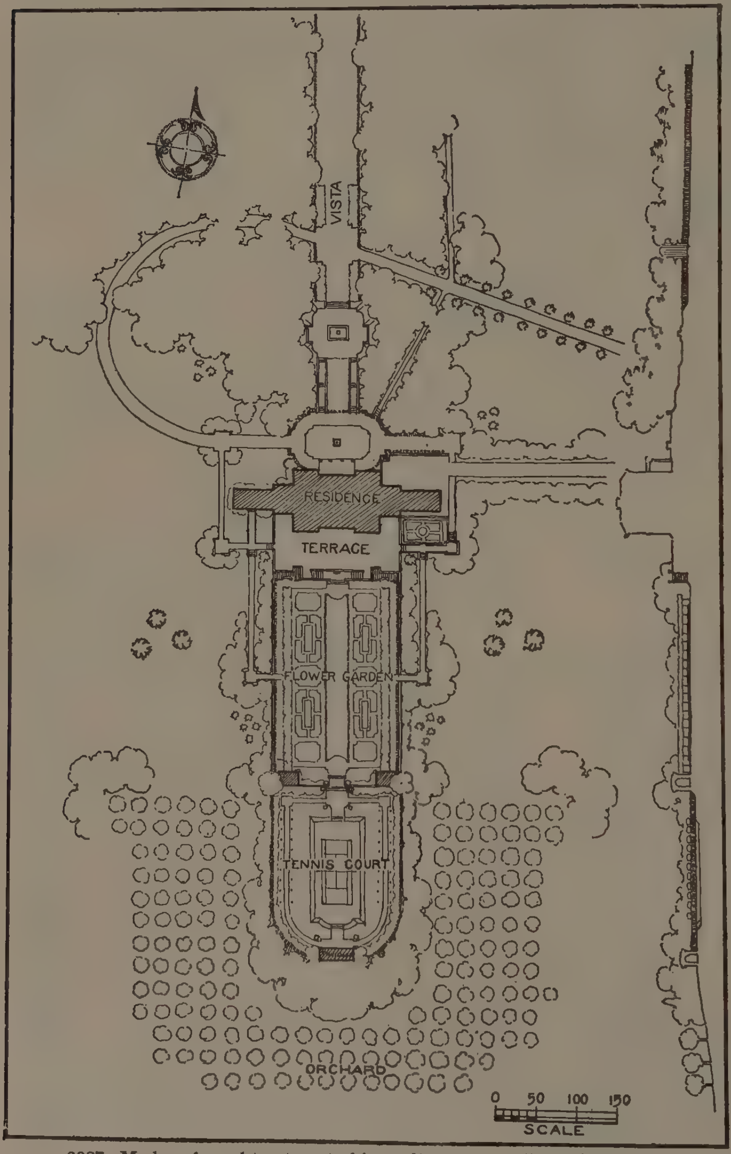
In America, one may follow the same cycle. From the herb- and vegetable-gardens answering the same purposes and disposed in the same way as those of antiquity, the art gradually develops and reproduces on a somewhat smaller scale, and in a more intimate and simple fashion, the formal gardens of the mother countries. The colonial gardens appear in New England and in the southern states, and gradually spread all over the settlements of the Atlantic coast. Historically, therefore, as well as technically, the colonial gardens belong in the general class of formal gardens.

Technically analyzed, formal gardening, in its best forms and examples, covers a limited area in the immediate surroundings of the country house and is intimately connected with it and its outbuildings. The principal axes of the house are prolonged and maintained as the principal axes of the gardens. Some of the adaptations are shown in Figs. 2087–2091.

In size and shape the gardens maintain a definite proportion and are well adapted to the size and shape of the buildings, even more than to the general conformation of the ground. The designer depends upon his ability to mould surfaces not to do violence to the general aspects of the country and carry out his work in harmony with the architectural structures. The extreme difficulty of doing this marks more than anything else the few really successful works of the kind. The disregard of such harmonious combination, and the consequent exaggeration of the artificiality of the composition is the surest sign of the decadence of the art.

The house is usually set on an eminence commanding a good view of the country as well as the gardens. Around the house, an esplanade, or first terrace, is, more or less laboriously, architecturally treated, and is connected by stairways with a lower terrace or parterre designed as a flower-garden. In this way, a connecting link between house and garden is secured, and the part of the grounds nearest the residence is arranged so that the eye can embrace at a glance the whole of the design and enjoy its beauty and the fascination of its color. Very often a third still lower terrace is less elaborately treated as if the intention of the designer were gradually to prepare the visitor for the end of the formal and the beginning of the picturesque surroundings of nature.

The ground plan being geometrical and symmetrical, the arrangement of vegetation is necessarily geometrical and symmetrical. Stately avenues constitute the approaches. The terraces are rectangular: special motives rectangular, circular, or elliptical. The flower-beds generally conform with the arrangement of the footpaths; often, as in the "parterres," they are designed in patterns of elaborate nature made with dwarf edging plants and filled with great varieties of flowering herbaceous plants. All vegetation is either of such nature that size and character remain uniform throughout the year, or it is made so by the use of the shears, or by periodical transplanting.



2087. Modern formal treatment of immediate surroundings of house on a large estate in America.

Water is usually made to play an important part in the composition. Pools, fountains, and cascades are ordinarily used as main features of design; often as secondary motives. Large surfaces of water add by their reflections to the charm of the general composition. Fountains and cascades contribute their lofty jets, and the pleasing sound of moving water to the animation of the garden.

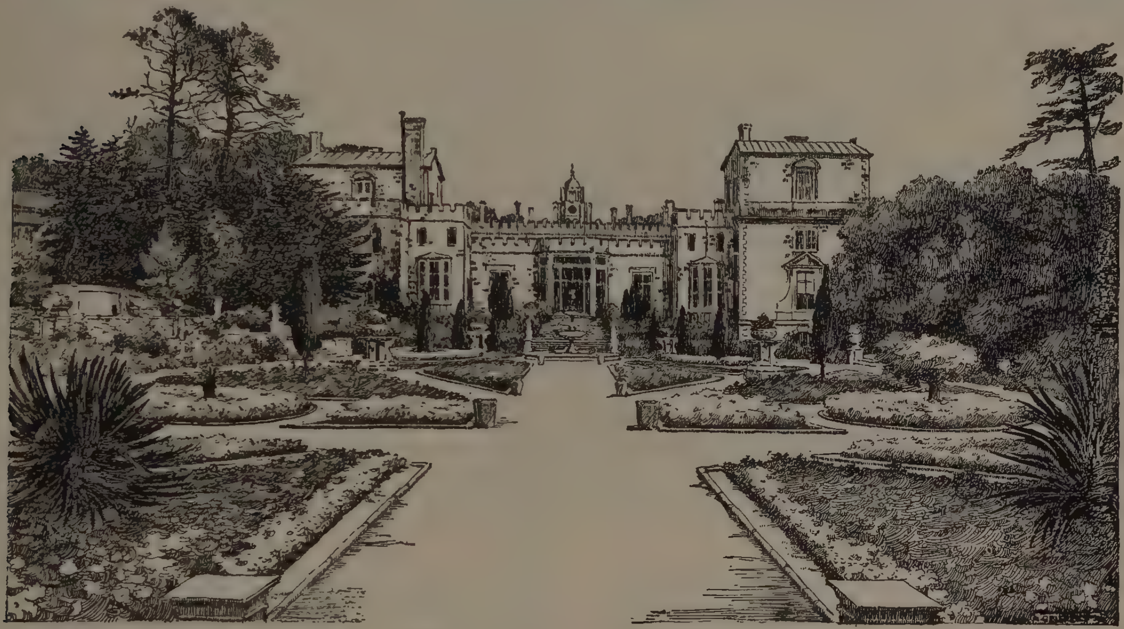
Seclusion is essential in all formal composition. By inclosing a garden within walls, hedges, or heavy planting, a frame or setting is created which gives relief to the design, clearly defines the area of the picture and compels the eye to abstract the inclosed part from the remainder of the environment. Finally seclusion gives privacy, making the formal garden what primarily and essentially it should be: a drawing-room in the open air.

If we now consider the art of formal gardening from the botanical point of view, we are compelled for the first time to make geographic and climatic distinctions.

Although the formal gardens of Italy, of France, of England, and of America are substantially the same so far as principles of design are concerned, they vary considerably in the nature of the plants used. Possibly, it is due to this fact that in the popular mind a technical distinction is made between Italian and French or English formal gardens, while in reality there is none. So one speaks of Italian or French, or English style of gardening, while the style is independent of the country where it is used. There are formal and informal gardens in all countries and these only should properly be called styles.

A botanical analysis of the formal gardens is here out of place. Moreover, it would require considerable time and space. We may, however, sketch summarily the character of the botanical materials used, keeping in mind that species and varieties necessarily vary according to locality and climate and are modified by soil conditions.

Avenues are usually made with deciduous trees of symmetrical and enduring form, such as oak, linden, locust, plane, and the like. Often evergreens are used: cypress, holm oak, pine, cedar. Hedges are usually evergreen and made of material that will easily stand the shears: box, arbor-vitæ, holm oak, hemlock, holly, yew and so on. The design of the parterres is outlined by means of dwarf box edging inclosing geometrical spaces filled with low-growing annuals or perennials. Roses are also very commonly used for this purpose.



2088. An open-center formal treatment.

Perennial and annual borders are planted against walls and hedges either in masses of single varieties or mixed in order to secure so far as possible a definite arrangement of height and color and to procure a succession of bloom.

Specimen evergreens of geometrical shape, such as conical, cylindrical, globular and spiral, are used to accentuate points of interest in the design or to establish the corners of beds in parterres, or the corners of hedges, or the axis, and so on. When the topiary art is given more freedom, the ornamental evergreens assume the shape of birds, ships, tables, and the like. Box, yew, and privet seem to be the most favorite materials for this work. Sometimes the same effects are obtained by growing ivy over a wire frame representing the object desired.

Plants in tubs or in ornamental vases, such as bay trees, lemon, or orange trees, box, century plants and oleanders, are intended, as a general rule, to supply ornamentation during the favorable season with plants which require the shelter of the greenhouse or the orangerie during the winter.

It has already been seen how in America the formal garden gradually developed by the same process that brought it into existence elsewhere. The colonial garden clearly reflected the social and economic conditions of the times in which it was produced. It was simple, well-proportioned and exceedingly well adapted to local conditions. It was small, secluded by a hedge or wall or fence covered with vines. The flower-beds were well defined by box edging; the paths were paved with brick. A good use of a few shrubs was made in these gardens, such as lilacs, mock orange, forsythia, calycanthus, and the like, to fill the corners, to soften the architectural lines of the house or the terrace, to give privacy to the entrance or to the porch. The lady of the house took charge of the garden and special care of the perennial and the annual beds. Most of the flowers acquired sweet, attractive names, reflecting an age of delightful sentiment and real love for the out-of-doors. To give only one example, the *Viola tricolor* or English pansy was known as ladies' delight, bird's-eye, garden-gate, none-so-pretty, Kitty-come, Kit-run-about, three-faces-under-a-hood, come-and-cuddle-me, pink-of-my-Joan, kiss-me, tickle-my-fancy, kiss-me-ere-I-rise, jump-up-and-kiss-me, and finally meet-her-in-the-entry-kiss-her-in-the-buttery, which is the longest plant name in the English language.

Since the colonial days, very much has been accomplished in the United States toward the development of the art of landscape design. The great variety of topographical conditions, of climate and soils, offered to the artist diversified problems and opportunities. The formal style has been used in moderation on the whole, and, if one disregards a few sad mistakes, with a great deal of common sense. The prevailing opinion is that its best adaptation is in the very small properties where it is evident that the house and the boundaries are too geometrical and close to allow aught else than a formal design. In the medium-sized country place when the topography is flat and several properties are close together, it is sometimes advisable, but, as a general rule, and certainly in the case of large estates, the formal style finds its best justification in the immediate surroundings of the buildings because their artificiality cannot be hidden or transformed. Here it usually answers all purposes of convenience and utility as well as it reveals harmony of composition. It is in fact the best means of gradual transition from the architectural to the rural and the picturesque.

Literature: Charles Latham, "The Gardens of Italy." Georges Biat, "L'Art des Jardins." Gressent, "Parcs et Jardins." Alice Morse Earle, "Old Time Gardens." Repton, "The Art of Landscape Gardening." Ellgood & Jekyl, "Some English Gardens." Mawson, "Art and Craft of Garden Making." Vacherot, "Parcs et Jardins." Platt, "Italian Gardens." Triggs, "Italian Gardens." Loudon, "The Villa Gardener." Ellgood, "Italian Gardens." Jane & Ross, "Florentine Villas." Hamlin and others, "European and Japanese Gardens." Kemp, "Landscape Gardening." Triggs, "Formal Gardens in England and Scotland." Edith Wharton, "Italian Villas and Their Gardens." Guy Lowell, "American Gardens." "Gardens Old and New" (Country Life Publishing Co.). Loudon, "Encyclopedia of Gardening." Fouquier, "De l'Art des Jardins." "The Century Book of Gardening" (Country Life Lib.). Andre, "I'Art des Jardins." Ferruccio Vitale.

The landscape treatment of small grounds.

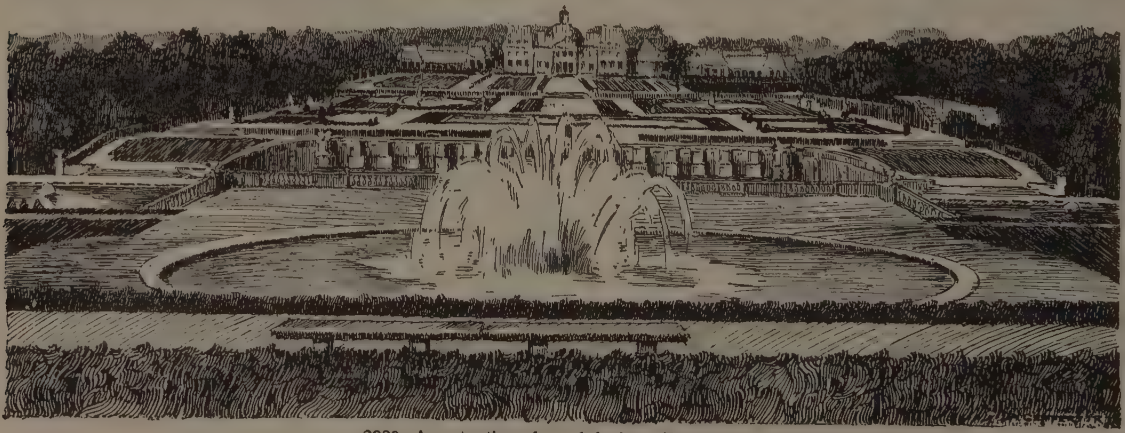
The art of landscape gardening is to many persons a subject that belongs only to landed estates or to great public parks. By them it is not expected to serve with its principles or its practice their modest suburban or city-lot-size home grounds, although in the same way, if upon a smaller scale, they seek tasteful, practical, interesting arrangement and embellishment. The home grounds is a problem not unworthy the finest art or the most expert landscape designer. Small places everywhere are becoming more and more charming as architects meet a growing demand for better houses, and their settings become more and more appropriate and pleasing, as owners, gardeners, and nurserymen apply the achievements of landscape gardening which they have observed. Many small places evince a beauty and effectiveness surpassed by larger ones only in extent; but for the most part they fall short of their possibilities and attain to a degree of artistic value limited to the mere beauty of the plants set out. That one place can surpass another of equal building-lot proportions and comparative amount of planting would lead to the conclusion that, for the designing of small grounds, there may be underlying principles practised in some cases, neglected in others. Achievements of good design are evident; methods, seldom.

Spaciousness does not make, but may enhance, beauty in grounds; but mere space suffices to lend independence, more or less seclusion and privacy, character and dignity. Hence the small place, more than the large one, must depend for its individual effectiveness and setting upon the general beauty of its neighborhood,—its environment; upon well-placed community plantings, and upon the skilful management of a principle of design called unity,—the tying together or harmonizing of all features of the scene in view at one time. Realizing this, it should ever be the paramount aim of a community or platters of real-estate subdivisions to retain all of the natural features and landscape character possible by preserving old trees, ledges, rivulets, good views and good building-sites unmolested, and also, so far as possible, to obliterate neighborhood eyesores. When land is laid out and houses constructed or at least restricted, by the same company, the greatest opportunity is afforded to realize the utmost of landscape and community attractiveness. To artistic grouping of buildings, to directing courses and appearance of streets, to preservation and adaptation of natural scenery for common enjoyment, should landscape gardening, as well as engineering and architecture, lend its best effort. Such development reflects directly upon very limited lot areas and affords a charm of environment impossible of attainment otherwise,—except by merest chance. Fortunate the dweller in the modern garden suburb!

Within the lot, in order to utilize to landscape advantage every inch of space, ground study should begin with house-planning and should be determined in much the same way. This saves later regret and expense and many times improves house designs as well as preserves beauty in setting. In large estates the landscape study usually precedes; in small lots, it is oftenest the last matter thought of and generally left largely to the local grader to work out. All of our houses, as a result, become ranged in line, drilled face to the front street, commonly designed, equally spaced, uniformly graded flat, totally ignoring the hints offered in native trees or uneven ground for individual character, or of homelike seclusion possible in the back yard.

In placing houses on uneven ground, great opportunity is presented to gain distinctive character and interest or even practical advantages not offered by the more popular level site. Close to the house differences in grades may properly be shown by terracing, but it is not well that in every instance the natural beauty of uneven site be sacrificed by cutting and filling in order to create plane surfaces. In the grounds apart from the house, especially, does uneven land prove a fertile source of suggestion for landscape treatment. A low spot may become readily enough a pool; banks, rock or alpine gardens; elevations, place for planting and seat; open hollows, flower- or vegetable-gardens. How such hints may be adapted and worked together into a harmonious and livable scheme, is a landscape-gardening plan. Plans made from these hints to fit the ground are not usually so attractive on paper as those made quite regardless of site suggestions. For pure individual charm in home grounds, one likes a natural site and orderly design combined. To accomplish this is a problem.

Solutions of such problems are illustrated by the home-grounds plans here presented. Standing trees, uneven land, a large house, a lot of 125 feet frontage were the conditions met in the design of Fig. 2092. In order to preserve a large oak to spread its high head above the house roof, a retaining wall was required to hold back the


2089. A pretentious formal design. Page 1793.

bank and roots and lawn. The house terrace and side porch nestles in beyond this, and the effect is of the terrace and porch being sunk into the ground behind the oak trunk. Add the treatment accorded the remainder of the lawn, and it becomes a very charming spot. The place is attractive because all the trees were retained at sacrifice of level lawns, planting chosen which associated itself with tree trunks and shade, and the walks are curving and inconspicuous. One of them passes behind a group of shrubs to the half-hidden garage, while a branch finds a seat built into the bank like a retaining wall under rhododendrons, and looks out upon a bit of open circular grass-plot in the sun, bordered with perennials backed by a hedge. The sun-dial rests atop a huge native boulder. Simplicity is the keynote of the plan; rhododendron and naturalized bulbs, that of the embellishment.

In Fig. 2093, all open lot, a formal garden in close relation to the house is adapted to a low portion of the lot instead of filling it up expensively. The garden is one for flowers, not architecture, and the children's play-yard under the trees is a pleasant association, in keeping.

Both of these plans, and Fig. 2094 as well, illustrate a point to be observed in planning small grounds, that house-orientation may be determined as much by the factors of site as by the usual one merely of sun. If attractive views are to be had toward the rear of the lot, advantage if possible should be taken of the fact. Such pleasant possibilities for porches and windows should not be given over undisputed to kitchen service while the family seeks the little comfort possible on the "front porch." If objectionable objects are presented to the view, they should by all means be screened off. This is accomplished usually by a thick planting of ornamental trees, shrubs and evergreens. This itself may prove so attractive as again to command a consideration of the back lot, for such screens have been known to develop into beautiful backgrounds for flower-gardening, always on view from the best windows or porch and enjoyed in perfect seclusion and privacy. A logical extension of the screen-plantings is the arranging of small trees and shrubs along the entire lot boundaries for the purpose of affording seclusion from all abutting properties, or even from the street-front. This need not be regarded as a "spite-fence" or any manner of unneighborly act; for with charming material in flower and fruit, in a beautiful form, it also lends privacy to the neighbor from his side of the foliage. Landscape gardeners would say in truth that the attainment of seclusion in home grounds is an important principle of the design. Planting is a better way than fencing.

In addition to seclusion, the second most important principle of design is served by this same screen and border shrubbery—that of adding to the space an apparent extent. The eye measures straight lines subconsciously. Seclusion alone may be attained by tall sheared hedges, rows of trees, masonry walls or vine-clad fences, but, however well executed, the effect is disappointing. A feeling of amplitude, of interest, satisfying beauty, is to be attained only through indefiniteness of boundary lines and concealment of corners; by irregularly shaped open lawn; by softness and blending of color in the foliage mass that frames it. Subtle variations in grades of the lawn uniting with studied outlines of the bounding shrubbery so that one augments the other, afford pleasing variety and entrancing shadows; bits of lawn half concealed in the border by jutting foliage, paths or stepping-stones leading behind and through the border itself to find a hidden seat, a bit of a garden or unusual plants and naturalized flowers,—all of these devices tend to create an impression of spaciousness and to afford pleasant curiosity and constant interest. Such effects can be secured in areas 100 feet square. Green in foliage, especially grayish green, lends distance; yellow and strong colors shorten it. Lawns interspersed with many individual specimens, plants and flower-beds however fine, are reduced in appearance of size. A few stragglers in group arrangement standing in the lawn near the shrubbery or in studied relations to views or little vistas are allowable. (Fig. 2093.) Planting or bedding in straight rows, whether of trees, shrubs or flowers, is likely to reduce the apparent extent. But there is reason to like straight walks when they go directly to an interesting point and do not mar the beauty of a lawn-picture which they take their traveler to examine. (Fig. 2095.)

2090. The rear or personal garden in the formal treatment. Page 1793.

Secluded spaciousness in small grounds should be sought, for obvious reasons. The irregular open space bounded by soft indefinite foliage massed in a curving outline of bed seems the successful means of attaining it. The materials of which this massed border is composed is a subject determined by its relation to the general plan. As the growth should be highest and thickest where views must be intercepted and lower and thinner where they may be desired, hints are afforded as to placing jutting points and receding bays in its outline. In a general way, such borders should not comprise a catalogue of nursery stock. Choose material first which by ultimate height of growth and foliage habit serves the purpose, and secondly associate with it other material valuable for bloom, fruit or foliage. Mass these in little groups or plantations of three to ten or more, the groups uniting and running together to form a happy mixture of foliage. (Fig. 2095.) In the mixtures, however, strive to find a keynote to maintain through the whole composition. This is struck by the site, the house, the personality of the owner. It may be a wooded place and woodsy plants like cercis, cornus. single viburnum, amelanchier, or hemlock and white pine and arbor-vitæ, rhododendron and kalmia, ferns and little naturalized shade-loving plants, would be appropriate. (Fig. 2092.) Or it may be an open sunny place and the feeling of the fence-line or roadside wildness desired; then choose rhus, wild roses, sambucus, crategus; or birch, wild cherry, sassafras, nut trees; red cedar, Scotch pine; wild asters, sunny asclepias and coreopsis. (Fig. 2094.) If more refined garden feeling is desired, then lilacs, syringa, weigelas and deutzias, spireas, snowballs, may be used with ginkgo, magnolia, Lombardy poplars, oaks and maples; hollyhocks, larkspurs, iris and peonies. (Fig. 2093.) With rustic rockwork and stony ground one should associate plant forms of the same prostrate type,—charming low matted junipers and yew; trailing wichuraiana roses and shrubby celastrus; erect cedars, cembra and mughus pines; larch, red birch, ash and hickory; and a whole list of low alpine herbaceous flowers.

2091. The formal flower-garden or herb-garden of colonial days. Page 1793.

Uneven sites seem to demand the cultured wildness of rhododendron foliage and flowering dogwood, an absence of close-cropped effect and a prevailing freedom and informality. This may be conditioned, however, upon the demands of the building, for there are cases in which uneven ground may be better altered; that is, when the desire is to derive the gardening lines from the building lines. Uneven ground should then become terraced and embellished with plants that are more stiff and conventional in type, more man-made to harmonize with the building. Privet and boxwood hedges, and strong colors of foliage and flowers, Irish juniper, globe-shaped arbor-vitæ, *Catalpa Bungei*, sciadopitys, and other plants of strong character would be appropriate.

Besides site and association, much depends upon the personality of the designer and preferences of the owner as to choice of plants. To the methodical mind, the leaning is to rare species, individual plants, botanical sequence in arrangement; to the flower enthusiast, all niceties of color harmonies and combinations in mass; to the tree-lover, generally too little room for his hobby. To the iris, rose, peony, phlox and fern enthusiasts, room and good position is given by the front edges of the shrubbery border or at sides of paths in vegetable-garden to further his ambition; and to the bird-lover, chance for pleasure in providing shrubs which bear berries for winter attraction and comfort to his friends. But whatever is planted should be chosen with the thought of having it both happily placed in the general scheme of embellishment and thrifty in growth. Position of plantations first, choice of material second, preparation of ground and care always,—this is a home-grounds program.

Gardening and architecture necessarily meet upon very close terms in suburban-lot areas. Domestic architecture needs the softening influence of foliage, the heightening effect of trees and backgrounds, land grading of an interesting and artistic as well as simply practical kind. Hints at house design should be drawn even from the natural environment and exigencies of site. Gardening requires, in small areas especially, close sympathy with the architectural style and a subservience in its design to the practical requirements of the house and owner. Its materials, structural or planting, should be appropriate to the character of the house and to the effects that logically accompany its design. Both architecture and landscape gardening in small lots should be simple and upon a scale determined by the area at disposal, not so far as design is concerned, but dependent upon the pocketbook of the owner. Richness of material is the only proper way of extravagance, not by quantity or by mere showiness. As to planting, it is to be observed that very few places are over-planted when shrubbery is the material. Trees and evergreens more often defeat their purpose by being planted too closely.

Simplicity, then, is the third and always constant principle underlying landscape gardening in small grounds. By it is meant not elimination of interesting subjects in grades, constructions or plants, or even garden accessories, such as pools, arbors, and treillage, but fitting and unobtrusive use of them. The flowing outlines of wild copse, of modulated contour in meadow land, of unmolested trees, are simplicity ideals. In domestic gardening, such ideals should almost without exception prevail. Even if drawn down to straightened lines of formal treatment, necessary sometimes when the type of building demands architecturally treated foliage nearby, the ideal of simplicity in both design and plant material should govern the designer. Formal garden designs are oftentimes very satisfying when properly used in small areas farther from the house, reached and pivoted upon an extended house line, as straight walks from the house or terrace. (Fig. 2093.) Full of interest as regards design, beauty in detail of material, construction and accessories, and with a certain charm in its very primness set amidst ample soft flowing lines of shrubbery and trees, the small formal back yard adds a logical and an interesting feature. Sparsity of planting—not the ideal of foliage and growing things in a garden,—too much furniture, paths too wide and numerous, a lack of simplicity of both architectural and plant-forms, are reasons why formal grounds are not generally more pleasing. They are not produced successfully by mere drawing of lines, with T-square and triangle, and the amateur is safer in informal gardening. However, formality exists in each place here illustrated by house terrace and prim planting or softened wall treatments, walks, steps and walls, and even in the little geometrically arranged gardens, but dependent almost altogether upon hardy plant growth and simplicity of plan for their charm.

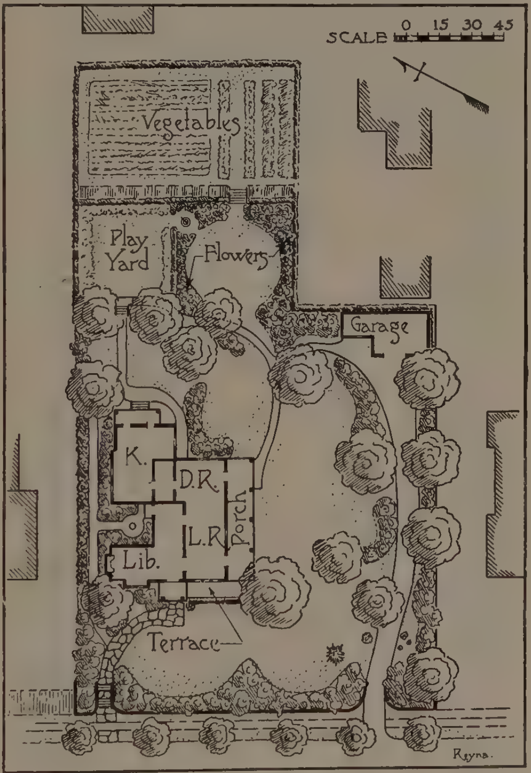
These gardens (Figs. 2092–2095) may be considered as informal formal gardens. The true formal architectural garden would embrace much embellishment of clipped trees, color balances and complicated design with much less emphasis upon foliage and floral effect. This in small-scale yards is generally bad practice, resulting in many failures, because it fails to lend the charm so urgently demanded in almost all problems. In the plans here shown, there is formal treatment so far as balance and instrumental lines are concerned, but the warming influence of natural growth saves the garden and makes it useful.

Too little thought is given by house-planners to adequate planting at base of buildings, the vital spot oftentimes of uniting house and site. The want of relief afforded by grouping of shrubbery and dwarf evergreens at this ground-line is responsible largely for that gaunt, cold, inhospitable expression many houses present. Boundaries should be planted; so also should an area immediately about the house wall. Walks and driveways should be kept at least 6 feet from the building; terraces should be arranged with planting space against the wall or outside against the terrace. The corners of buildings need especially to be supported and softened. Plants of rich and striking character are appropriate close to the house, even to sheared and tubbed plants, used to support or embellish architectural features, and close-cropped hedges of the nature of boxwood used like softened building-lines. Annual plants bedded out, or herbaceous perennials, serve the purpose in summer, but fail from their transient character. Dwarf evergreens seem felicitous by being conspicuously present in the barren season. Vines upon the wall or trellis, of course, are invaluable to relieve the blankness and do so in the least of soil-space. The softest possible wall treatment is a combination of evergreen and deciduous plants with an allowable interspersment in summer of flowering material set in front of climbing vines.

Concerning the details of developing a plan upon these premises, different designers will vary in practice. For the amateur for whom this is written, it is safe to advise at first a survey—or chain measurement of the ground locating accurately each tree, rock or native element that may stand, as well as buildings, in or adjoining the property, and views which for any reason may seem undesirable or in any way less desirable than others. These will be starting-points for a boundary planting, for the location of a garage oftentimes or even a garden to contribute to the effective screening of the view. Draw accurately on a scale of say ⅛ inch to the foot a plan locating these existing conditions and with the house plan reduced to the same scale proceed to study locations for it with consideration of all that has been said above, and with "sketchy" plans similar to those shown here search for schemes that will accomplish the needs of the place and bring out its beauty. Drawing out in this way different schemes that may be possible, coupled with observation in parks and private estates, will help most in the outlining of tasteful borders and practical unobtrusive walks and driveways. These with the lawn are fundamental in home pictures; gardens, pools, arbors, rockeries, are valuable in affording greater interest and additional service of the ground.

Much of the design depends upon the way the land may be graded and, unfortunately, there are few rules to lay down. It is quite simple to level and terrace ground to a conventional formality; to grade natural-shaped slopes is far more difficult to plan and to specify on paper and depends largely upon the ability and artistic sense of the foreman and overseer of the actual earth-moving. A visualization of the regraded surface is sometimes possible by stringing white cord from point to point adjusted by taughtness or sag to fit the desired levels. Drive grade-stakes into the ground to correspond to the cord and adjust the work accordingly. The sagging cord will give the natural undercurving line so essential to simple scenery. In either formal or informal setting, the grade across the front of a building should be quite level unless it be possible to overcome the unevenness by planting heavily the lower end. It is not necessary that the front and rear corners upon the same end be graded level, but even here the appearance of unevenness is relieved by foundation planting. Steep banks should be rounded over at top and at bottom unless amounting to a frank formal terrace, in which case the top should be a sharp horizontal line. It is obvious that in any grading, the owner of a small area should save his top soil to put back on top. Grade with the subsoil to within 6 inches at the least of the desired finished surface and use only good soil in this upper layer, being careful in the operation to get no stone nearer than a foot of the surface. A caution may be sounded also with respect to grading close to standing trees, for it is important generally that roots be not injured by cutting or exposure nor trees smothered by filling against the trunks. Standing trees restrict lowering of grades but filling can be safely accomplished by "welling in" the trunks by a dry stone wall the depth of the fill.

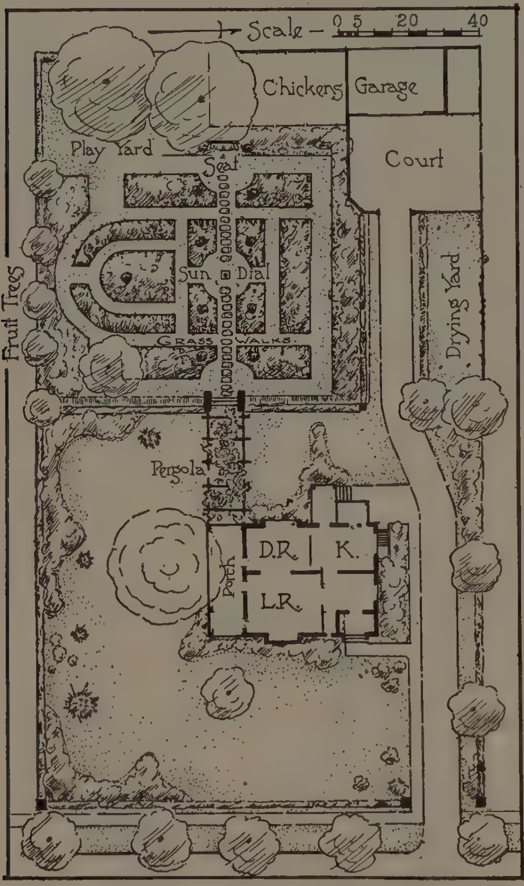
Grade and general plan being decided upon, details of planting and constructions logically follow. When the details precede, as often is the case with amateurs, unity in the place is usually lacking as a result. Fig. 2095 shows a plan developed from a sketch as suggested above, ready for the workman to carry out, for the nurseryman to supply the plants. Note the house while presenting a welcoming front door to the street, is arranged with porch and house-terrace at the rear where possibilities existed. The lawn is arranged to



2092. Uneven ground with old trees demands informal treatment.

become a clear bit of greensward inclosed by marginal shrubbery. In Fig. 2094, an open front lawn and secluded rear landscape garden determined the plantings. Boundaries are forgotten by the studied outlines of this shrub plantation, which, it should be noted, are in long simple sweeps, rather than little wiggly kinks so often seen. Projecting points and receding bays in this shrub mass afford interest to the lawn vistas, as well as seclusion to the back yard and pleasant course for the walks to the sun-dial, pool, and rustic arbor at entrance to the vegetable-garden at the extreme rear of the lot.

In Figs. 2092 and 2093, use is made of the side lawns for the family enjoyment. The boundary plantation is evident and in one case has been extended to a complete border across the street front. This was made possible by the elevation of the lawn above the sidewalk and the use of a stone retaining wall which the planting relieves gracefully. This street front might have been treated more cheaply and very well by a planted bank which also affords a pleasing street appearance and a perfectly secluded lawn.



2093. Formal garden pivoted on an extended house line.

The make-up of these plantations is of simple material chosen for good foliage, hardiness, and seasonal attractiveness of flower, habit, and winter fruit or bright bark. The plants are mainly those which mix well, without clashing of bright foliage colors or incongruous forms. The consideration of size to which the plants will attain is very important and much material valuable in the large park must be eliminated from the lists for small places. Those plants which grow slowly and are in the nature of dwarf species are appropriate and particularly useful for the permanent plantings. Quick- and rank-growing plants may be used for screens, but provision should be made here also for permanent but slower plants to come on and replace the others. Planting quick-growing material or close planting for immediate effect is a dangerous practice, for the proper thinning is usually not accomplished and the entire planting will be robbed of beauty. It is better to space plants at reasonable distances, and use less, but of large nursery sizes.

It may be valuable to note, as to choice of plants for small areas, those which were common to the planting plans of the three places here illustrated. The list does not contain all the plants possible to use in like circumstances in the northeastern states, but will afford at least an indication of choice depending upon the restrictions of space, amateurish care, results not too far remote.

PLANTS SUITABLE FOR SMALL GROUNDS.

Those marked with an asterisk (*) are common to the three places here illustrated.

Deciduous trees.

*Maples—Acer campestre, A. saccharinum and var. Wieri, A. tataricum, A. ginnala, A. rubrum, A. palmatum, in variety.
*Shad-bush—Amelanchier canadensis and others.
*Ohio buckeye—Æsculus (Pavia) glabra.
*Birch—Betula alba and B. laciniata of trade lists, B. lenta.
Catalpa—Catalpa bignonioides.
Hackberry—Celtis.
*Flowering dogwood—Cornus florida, and var. rubra. Also shrub species.
Double-flowered cherry—Prunus avium fl.-pl.
*Red-bud—Cercis canadensis.
Cercidiphyllum japonicum.
Yellow-wood—Cladrastis tinctoria.
*Beech—Fagus sylvatica, and varieties, all of which require much space for growth finally.
*Maidenhair tree—Ginkgo biloba.
Varnish tree—Kœlreuteria.
*Larch—Larix leptolepis.
Liquidambar.
*Magnolias—the Chinese species in variety. M. stellata is very low.
*Crab-apples—Pyrus floribunda, Eva Rathke, Kaido, etc.
*Ironwood—Ostrya virginica, slow and good.
*Sorrel tree—Oxydendron arboreum.
*Poplars—Populus nigra var. fastigiata, P. alba var. Bolleana.
*Oaks—Quercus palustris, Q. coccinea, Q. pedunculata var. fastigiata.
Pagoda tree—Sophora japonica.
*Mountain-ash—Sorbus americana, S. Aucuparia.
*Deciduous cypress—Taxodium distichum, very useful.

Evergreen trees.

*Fir—Abies concolor.
*Spruce—*Picea Engelmannii, P. excelsa (for screen only), *P. orientalis, *P. pungens, and P. pungens var. glauca.
*Pines—Pinus Strobus, P. Laricio var. austriaca, *P. Cembra and *P. Mughus, which are indispensable.
*Douglas spruce—Pseudotsuga Douglasii, a fine screen or specimen.
*Umbrella pine—Sciadopitys verticillata, dwarf and interesting.
Hemlock—Tsuga canadensis, nothing better under shade.

The following are really mostly trees, but used as dwarfs either for massing or standing alone. They are material which is valuable:

*Japanese cypress—Chamæcyparis, in variety.
*Arbor-vitæ—Thuya, in variety, according to form desired.
*Cedar—Juniperus, tall and dwarf or prostrate forms.
*Yews—Taxus cuspidata, T. canadensis.

Evergreen shrubs.

Andromeda floribunda.
*Azalea (Rhododendron) amœna.
Cotoneaster.
*Ilex crenata.
Kalmia latifolia.
Leucothoë.
*Mahonia Aquifolium.
Rhododendron maximum, *R. catawbiense, hybrids.
*Yucca.

Hedges, evergreen.

*Buxus sempervirens.
Thuja occidentalis, T. orientalis var. pyramidalis.
Tsuga.

Hedges, deciduous.

*Berberis Thunbergii.
*Ligustrum ovalifolium, L. Regelianum.
Rosa rugosa.
Spiræa Thunbergii and S. Van Houttei.
Rhamnus cathartica.
Acanthopanax (Aralia) pentaphyllus.
Hibiscus (Althæa) syriacus.

Shrubbery borders.

*Abelia chinensis.
Acanthopanax (Aralia) pentaphyllus.
*Æsculus parviflora, excellent in shade.
*Althæa (Hibiscus syriacus).
*Amygdalus (Prunus).
*Azaleas.
*Berberis Thunbergii, *B. vulgaris.
*Callicarpa purpurea.
Calycanthus floridus.
Ceanothus americana.
*Cephalanthus occidentalis.
*Cercis japonica.
Chænomeles japonica.
*Clethra alnifolia.
*Cornus alternifolia, *C. alba, C. mas.
*Deutzia scabra var. crenata. *D. gracilis, *D. Lemoinei.
*Diervilla (Weigelas).
*Elæagnus multiflora.
Evonymus alata, *E. atropurpurea.
Exochorda.
*Forsythia Fortunei, F. viridissima.
Grasses like *Festuca glauca, *Miscanthus.
*Hydrangea arborescens var. sterilis, H. paniculata var. grandiflora, H. quercifolia.
*Hypericum aureum, *H. Moserianum, H. calycinum.
Kerria japonica fl.-pl.
*Lespedeza Sieboldii.
Ligustrum Ibota, and var. *Regelianum.
*Lonicera bella.
*Lycium chinense.
*Myrica cerifera.
*Philadelphus, in variety.
*Rhodotypos kerrioides.
*Rhus canadensis.
Robinia hispida.
Rubus odoratus.
*Sambucus racemosa.
Sorbus (or Aronia) arbutifolia.
*Spiræa, in variety.
*Stephanandra flexuosa.
*Symphoricarpos racemosus, S. vulgaris.
*Syringa—the lilacs in species as specimens, and in hybrids.
Viburnum Opulus, V. Lentago, *V. tomentosum, and var. plicatum.
Xanthorrhiza apiifolia.

Vines, self-clinging.

*Evonymus radicans var. vegeta.
Hedera Helix.
Parthenocissus quinquefolia,*P. tricuspidata.

Vines, upon supports.

*Akebia quinata.
Campsis chinensis.
*Celastrus.
*Clematis in variety.
*Lonicera Halliana.
*Roses.
Wistaria.

Arthur W. Cowell.

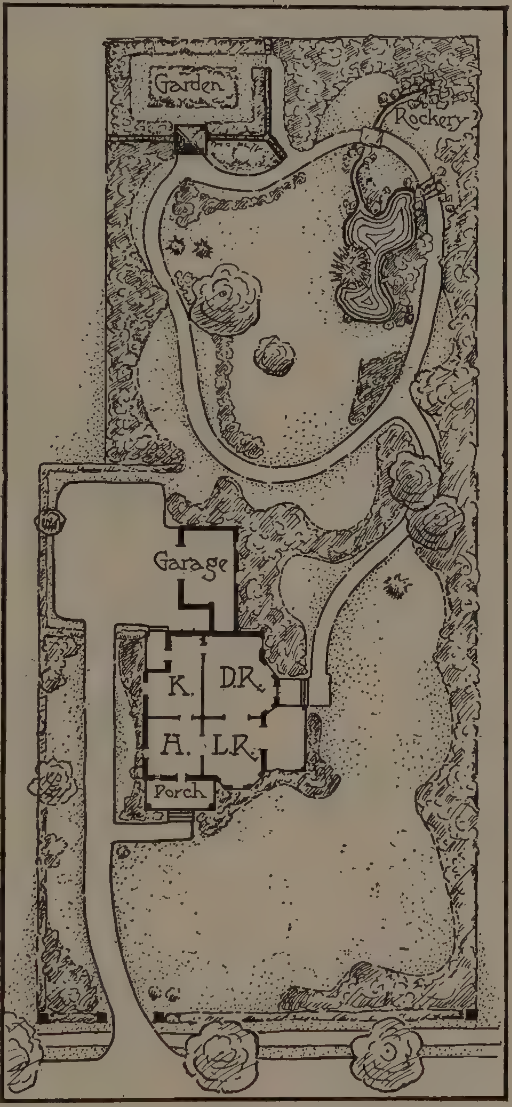
The landscape treatment of parks.

Parks are tracts of considerable size set apart primarily for enjoyment. Originally, in England, a park was a place for the preservation of deer for the chase, hence the word is often used to denote the landscape character commonly associated with such deer parks, which during the eighteenth century came to be managed much more for the sake of their landscape beauty than for deer-hunting. As a type of landscape, the deer park is characterized by comparatively broad stretches of pasture lying between irregularly and rather widely spaced masses of tree foliage. It is extremely simple and quiet in character, and while it often contains many other elements, such as ponds or running water, thickets of bushes under the trees or occasionally outstanding, or artificial structures such as drives, bridges or appropriate buildings, these features are all subordinate if the scene can be called typically park-like.

Private parks attached to country houses, in America, are usually so called because they have, or are intended to have, something of this park-like type of scenery (Figs. 2098–2102). A place departing very widely from this type is called, according to its character, a wood or grove, a garden, a farm, or more vaguely by the general term of country-place.

Public parks.

Public parks (Figs. 2097–2102) are so called, not because their scenery is necessarily of the type properly associated with the word "park," but because the Royal Parks were open to the people of English cities at the time when they began to feel the need of making municipal provision for the outdoor recreation of their growing populations. The earliest important pleasure-grounds created by cities having been modeled after these Royal Parks were themselves called parks, and the term was gradually extended to apply to almost any tract of land set apart for public enjoyment, regardless of the kind of enjoyment or the character of its scenery. But the best usage appears to confine the meaning of public park to a tract of considerable

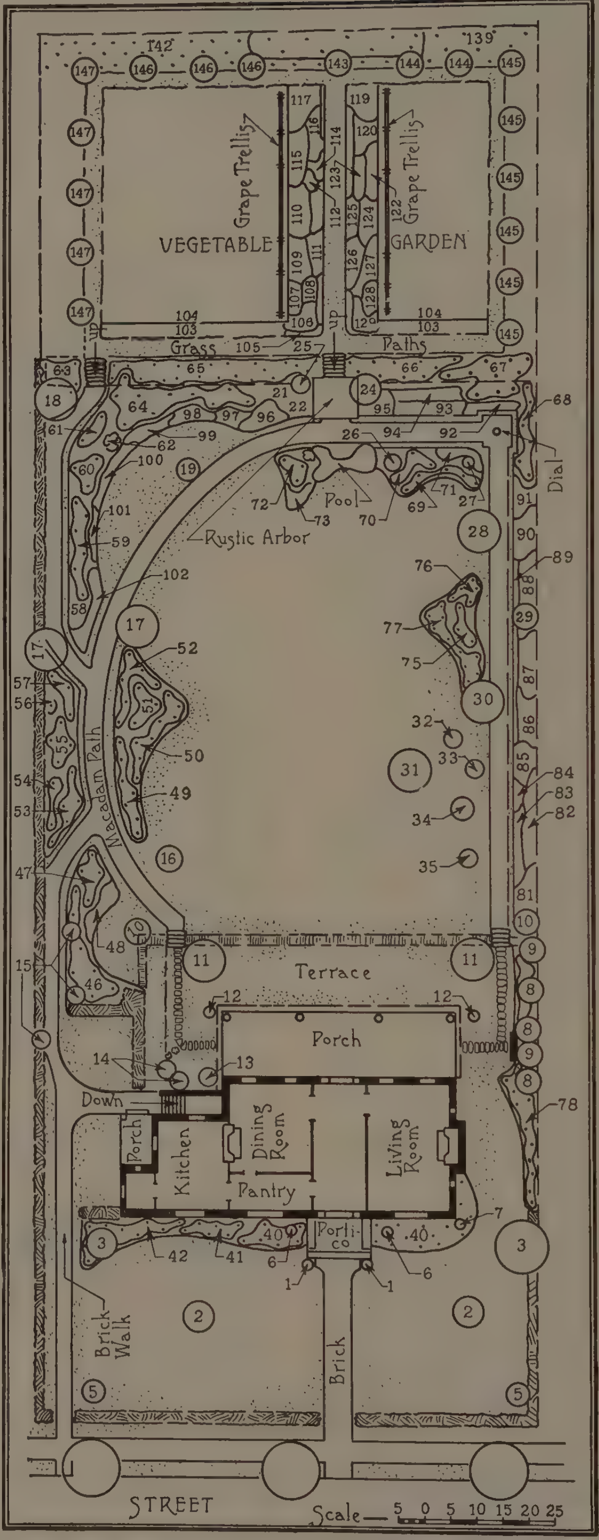


2094. Outline subdivision of a residence site. Pages 1797–1800.

size, leaving the lesser spaces to be called squares, gardens, playgrounds, places, and so on. Another special use of the word in America is its application to tracts of land in the West, many square miles in extent, either set apart by the government, as Yellowstone Park, or naturally distinguished by the presence of comparatively gentle grazing-land in the midst of rougher country. "Park" is also used in a more general way to indicate the general purpose of any open land devoted to public recreation, or of the organization controlling it, as "park system," "park department," and the like.

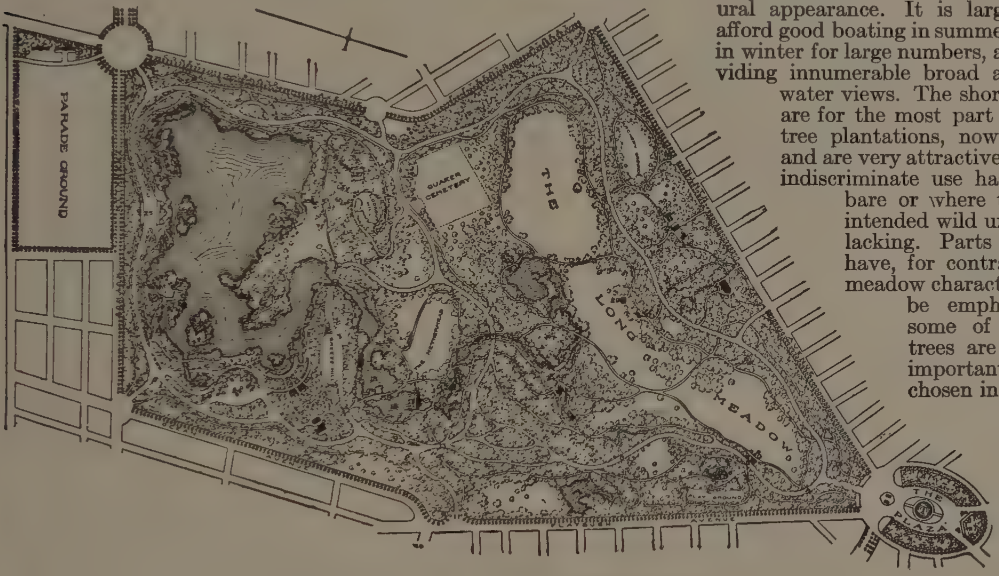
A large city park system usually contains parks of varying size and character and many smaller pleasure-grounds. No rigid classification can be made, but the following may be regarded as reasonably distinct types, each having its own field of usefulness, its own merits, and its own limitations. In practice, the lines between these types cannot be distinctly drawn, but poor results are often due to losing sight of the distinct and often conflicting motives which have given rise to these types.

1. *The large rural park* (Figs. 2096, 2099, 2100), generally from 200 to 1,000 acres, is in most cases the chief feature of a city park system. It is seldom undertaken except by large cities or cities so rapidly growing that the need of such provision can be clearly foreseen. Its main object is to provide conveniently in some degree for the inhabitants of large cities that sort of recreation which is to be obtained by strolling or driving in a pleasant country district. There is no doubt that the enjoyment of beautiful natural scenery is to most city dwellers one of the most refreshing antidotes for the wearing influences of crowded city life. When cities are of moderate size and are surrounded by a beautiful country district, this enjoyment is readily accessible to the mass of the population and it has fortunately become more so in proportion to the size of the cities within the generation embracing the transition from the nineteenth to the twentieth century, through the development of trolley car lines and the use of the bicycle and the automobile; but this increased accessibility of the country has been in part offset by the growth of the cities during the same period, and by the serious impairment of the rural quiet of the suburban regions through the same cause—improved cheap transportation. It is therefore necessary, if the people of large cities are to have easy access to refreshing rural scenery, that the municipality should withdraw from its taxable area a tract sufficiently large to provide such scenery within its own limits. The cost, both directly in money and indirectly through interference with the street system and with the normal commercial development of the land, is necessarily very great, and only the purpose of providing beautiful scenery, thoroughly contrasting with the city life and measurably sequestered from all its sights and sounds, can justify this cost, because almost all the other purposes served in public recreation grounds can be met more economically and far more conveniently in smaller areas distributed at frequent intervals throughout the city. The essential characteristics of a well-designed and well-managed park of this class are, therefore, that all of the numerous other objects which it may serve are subordinated to the provision of beautiful scenery and to rendering this scenery accessible and enjoyable by large numbers of persons, and that the



2095. Completed plan ready for execution, developed from a sketch plan. The numbers refer to a planting-list which should accompany the plan. Pages 1797–1800.

subordinate objects are met only in such ways and to such a degree as will not interfere with the simplicity and the rural and natural quality of the scenery.



2096. Plan of Prospect Park, Brooklyn, to illustrate the large rural park.

Prospect Park, in Brooklyn, begun in 1866, is here described in some detail for the purpose of affording a concrete example of the principles that the writer wishes to illustrate respecting rural parks. (Fig. 2096.) It has an area of 526⅙ acres. Its main entrance is about 3½ miles from New York City Hall, or 1¾ miles from Brooklyn City Hall. It is approached from the city by four lines of trolley cars, but is at the city end of the Parkway System, so that it must be reached through ordinary streets. The chief features of its design are: (1) the open, park-like landscape of the Long Meadow; (2) the woodland section, hilly and rising to an elevated outlook; (3) the lake and its surroundings; (4) a series of minor passages of scenery and elements of interest fitted in at points not appropriated for the main effects. The most characteristic and most valuable part of the park is the Long Meadow with its surrounding masses of wood, from the shade of which the outlook ranges over one of the most beautiful and simple park landscapes in the country. But one is not brought directly to the Meadow from the outside streets. One goes at first through a formal plaza, then through a retired shady ante-chamber, just long enough to give a sense of retirement from the city, then, if on foot, through an archway under the drive that does away with the nervousness of crossing a throng of vehicles, and then one comes out suddenly upon the joyous, sunny greensward. Its extent—over 50 acres—is enough to secure an effect of breadth and enlarged freedom without bringing its whole expanse into a single view. One can see that it reaches beyond the projecting groves and scattered trees that form the background of the main composition, and he is tempted to stroll on and open up the prospects thus suggested. The surrounding groves are freely used for picnic parties, and although much of the ground is trampled bare beneath the trees, but little serious harm is done. A carrousel or merry-go-round with its loud, mechanical organ, the only discordant feature of the place, was removed to this point a few years ago. This piece of apparatus was originally located in a retired section devoted to children's games, where all sorts of amusement apparatus might be placed without intruding on the park at large. The children's playground, not being shady or attractive for its purpose, has now been transformed into a rose-garden. On the lower edge of the Long Meadow are the pools which are at the source of the park ornamental water system. They illustrate both the value of water in a park landscape and the practical difficulty of securing and maintaining agreeable natural shores within the confines of a large city. Where the banks are clothed with shrubs the effect is admirable, but wherever the grass-land comes to the water's edge and in many places where shrubs once grew, the ground has become foot-worn to utter bareness. Adequate policing and prompt repair of points that cannot withstand too free use should never be lacking in all city parks. Leaving the Meadow, the water flows down through a ravine in the woodland portion of the park wholly overshadowed by trees with a varied undergrowth. Through this woodland section the paths and drives are comparatively narrow, numerous and intricate, as befits the intricacy and detail of sylvan scenery, and points of special interest are marked by simple rustic seats, shelters, outlooks, and the like. In the southern part of the park is a lake 62 acres in extent, of artificial formation, but of natural appearance. It is large enough to afford good boating in summer and skating in winter for large numbers, as well as providing innumerable broad and beautiful water views. The shores of the lake are for the most part wooded with tree plantations, now well grown, and are very attractive except where indiscriminate use has worn them bare or where the originally intended wild undergrowth is lacking. Parts of the shore have, for contrast, the open meadow character, which will be emphasized when some of the planted trees are cut. Several important points were chosen in the design of the park as places for the gathering of large and dense crowds, and were planned with that end in view. The first of these was the concert grove near the east end of the lake. The great breadth of bare ground or pavement unavoidable wherever large crowds gather frequently, makes absurd any attempt to simulate natural scenery in such a place, and in the design of the concert place a grove of formally planted trees with architectural accessories was made upon gently rising ground, arranged radially at one side of a little bay in the lake, upon an island in which the bandstand was to be placed. Upon another side of the bay a large concourse for carriages was also provided, and in connection with the formal treatment of the concert-grove was built a shelter, a restaurant and a terrace overlooking the main drive. While the grove was still so young as to be unattractive, a bandstand was erected in a natural grove near the Nethermead, a place in which the intricate woodland scenery with its brook and pools and shrubbery, and the correspondingly intricate arrangements of narrow paths and bridges, bridle-path and drive, were unfitted for accommodating a large crowd. Here the people are now drawn in thousands, on foot, on bicycles, in automobiles, and on horseback, all tramping about together, making bare earth where the grass and bushes once grew, and blocking the narrow bridges. The unused concert place now has a display of bedding plants. The second gathering-place was at the top of Lookout Hill, which rises 100 feet above the surrounding country and commands a noble view extending out to sea. Here is a large carriage concourse, although a shelter and other provisions designed for those on foot were never built. The plantations upon the flanks of the hill have become so high and so continuous that the views are nearly closed. A third point, the Breeze Hill Concourse, which originally enjoyed a good view of the lake as well as a good breeze, is no longer attractive as a viewpoint because of the growth of surrounding trees, and has been planted with perennials, as a Colonial Garden. Of the other subordinated features of interest may be mentioned the Deer Paddock, the Wild Fowl Pond, the Vale of Cashmere, the Archery Grounds and the Greenhouses. The space set apart on the plan for a Deer Paddock is a detached open area of suitable park-like kind; this land is now used as a tree and shrub nursery, and the deer have been transferred to unsuitably steep and broken ground in the midst of the woodland section. The Wild Fowl Pond is in such a situation that there is little temptation to go down and injure its steep banks by walking along them, and the effects of the views from path, road and shelter across its surface to the picturesque foliage of its opposite margin are admirable, especially when it is enlivened by moving birds. The Vale of Cashmere is a narrow valley containing a little winding pool and filled with a rich and varied massing of rhododendrons and other flowering shrubs and evergreens, growing in an irregular and picturesque manner. However a visitor may be impressed by any of these special features, he need see none of them that he does not particularly care for, as they are all self-contained and do not obtrude themselves upon the dominant park landscape, for the sole object of securing which the limits of the park were extended to their present size.

2. *The small city park* (Fig. 2097), from 10 to 200 acres or thereabouts, is usually an effort in the same general direction as the large rural park, with a limitation fixed by the difficulty of setting apart a large body of land in one piece at a point of access to a large population. It is almost impossible to attain within so small a space the degree of seclusion from the city and the sense of breadth, simplicity and freedom that are the essential features of the landscape of a rural park; yet small passages of interesting and agreeable scenery are often attainable, and the obviously artificial objects which may intrude upon them can often be so treated as to produce a harmonious effect. The scenery can seldom be quite natural in appearance, but it can often be very beautiful, a certain elaboration, elegance and even magnificance taking the place of the more quiet and restful simplicity of a large park, in a way that appeals so obviously to many persons that there is more or less tendency to develop large parks in the same direction. It is unfortunate that it should be so, for, as these ends can be attained almost as well upon small parks as upon large, it is clearly a mistake to treat one large park in this style instead of several of smaller size so distributed as to serve conveniently a larger population. It is because more cities have small parks of this elaborate treatment than have large and simple rural parks that so many persons have a perverted conception of what constitutes a park.

Morningside Park, New York, is an example of a small city park upon an extremely rugged and picturesque site, planned, in order to enhance this quality, with an avoidance of decorative elaboration. It occupies a craggy hillside strip from 250 to 500 feet wide and ⅔ mile long, with a difference of elevation from 50 to 100 feet between one side and the other, rendering the land unfit for streets or buildings. From its situation, as well as its narrow shape, it is essentially unsecluded; indeed one of its most notable features is the impressive and utterly unrural view which it offers over the busy streets and houses that stretch away from its base. This view and the boldness of the crags is emphasized by a stone terrace along the upper edge, supporting a promenade and a tree-lined boundary street. Convenience of passage is met by numerous broad paths, with masonry steps fitted to the irregularities of the ledges. The planting among the ledges was designed to be of the wild sort such as often clothes broken ledges naturally, while the more level land at the base of the crags is treated by contrast as a smooth lawn, with scattered trees. The natural boldness of the crags is partly lost by an effort to extend turf over every possible area, and the shrub planting is possibly rather too garden-like in style to be in entire accord with the situation, but in general the park is treated in a manner approaching that of the large parks, although without any attempt at complete rural seclusion. It contains a little over 30 acres, exclusive of the boundary streets and promenades.

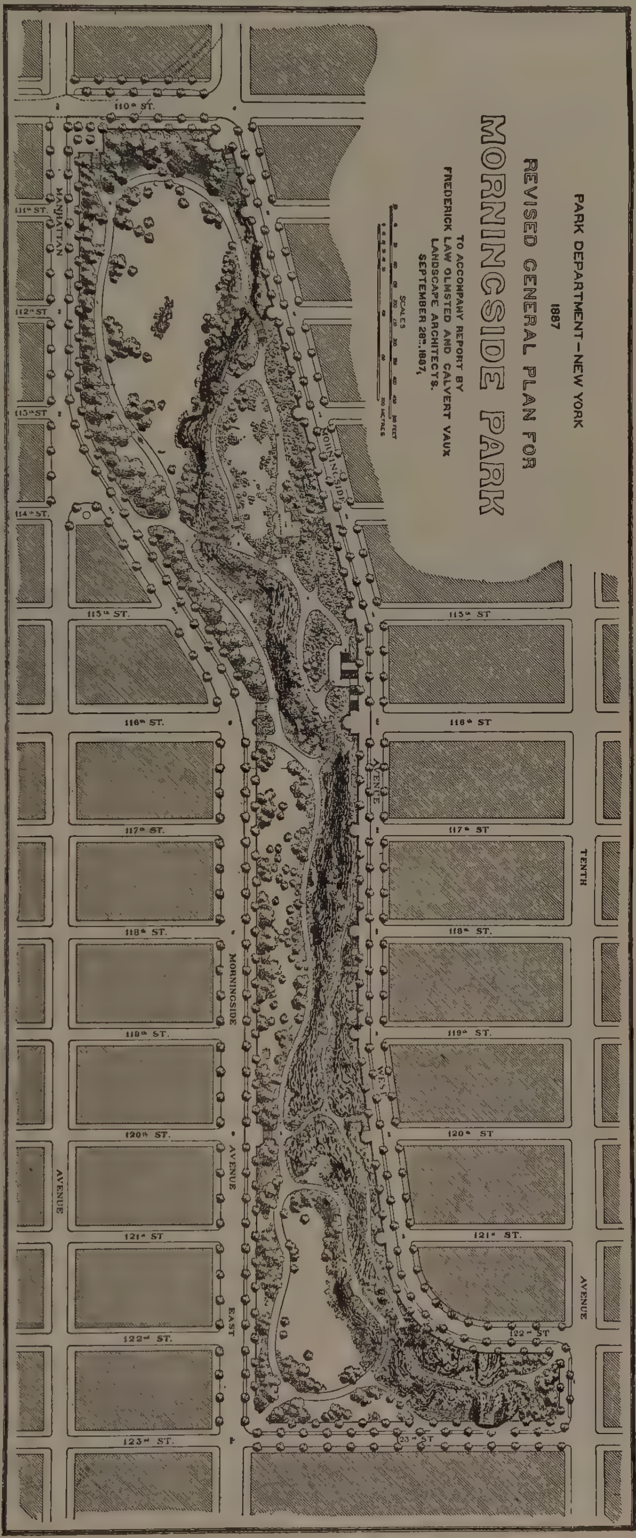
More commonly, small parks are used for the display of interesting and showy flowering shrubs and trees, and make a feature of fountains, statues and other sculpture more or less good. In moderation and skilfully used, such objects, are entirely appropriate and desirable in parks of this class, and add much to the effect of elegance and richness. The enjoyment is more closely related to that offered by architecture and decorative design and other pleasures forming a part of the daily city life.

3. *Neighborhood pleasure-grounds* are spaces of varying size coming within the scope of the park system, and including numerous aims other than the enjoyment of scenery. Sometimes the leading feature is a playground for athletic sports, sometimes a sort of outdoor kindergarten for little children, sometimes a concert grove and promenade, sometimes a menagerie, sometimes a public bathing-place or bowling-place. The area is usually restricted, and, as the name indicates, the object is to offer the maximum of outdoor recreation for the people of a single neighborhood, when they have not the time to go far afield. As children out of school hours are most in need of such provision, playgrounds form an important feature in many grounds of this class; but in all the best examples the means of meeting the various practical requirements, whether athletics, band-concerts or what not, are so arranged as to produce a pleasing effect on the eye as well. This is the more difficult from the fact that these grounds get very hard usage, and it is practically impossible to maintain a respectable turf on the area devoted to a playground, which is sometimes left in loam with grass worn bare in streaks and patches by the playing, but it is better surfaced with well-compacted gravel. So far as any single example can represent this class, which must vary in every element with local conditions, "Charlesbank," in Boston, opened in 1883, may be taken as an illustration. This playground occupies a tract of about 10 acres upon the borders of the Charles River at a point near a district of considerable congestion, and occupied by a population of a poor class. A promenade was established on the edge of the sea wall about 2,000 feet in length, and between it and the street a playground was laid out, having an average width of about 250 feet. Within this long, narrow belt of public ground were established two outdoor gymnasia, each with a running-track and a building for dressing and bathing. One of these outdoor gymnasia was designed for women and children and the other for men and boys, and they are at the opposite extremities of the playground. The tract between them was laid out with walks, trees, shrubs and turf, and was intended primarily to appeal to the esthetic senses. The "Charlesbank" has well proved the practicability of maintaining, within the very heart of the city, a tract of ground occupied by greensward and trees, despite the fact that it is frequented by

thousands of men, women and children. The city of Boston provides free instruction in gymnastics upon the playground, and yearly over 70,000 women and girls, and 200,000 men and boys have made use of the facilities offered. The total cost of this playground for land and improvements was $382,000, and the yearly cost of maintenance is $10,000.

4. *Squares, places, gardens,* and the like, usually of small area, are scattered about a city, often at street intersections. Their principal functions are to furnish agreeable sights for those passing by them or through them in the course of their daily business, and to provide a pleasant resting-place or promenade for the much smaller number who take the time to use them so. Because of the almost constant passing through such squares, the best arrangements all provide for reasonably direct and convenient paths along the lines most used (see Fig. 2083). Otherwise, manyof those who use the square are likely to be so irritated by the indirectness as to miss much of the pleasure they might otherwise receive. A formal plan of walks, either on straight lines or curved, is generally adopted for such squares, and is well suited to the conditions and to the decorative treatment of the area, providing much more effectively than an irregular plan for the statues, fountains, and gay flower-beds which have their most appropriate location in such a place. Shade trees, either as a complete grove, or in rows along the paths, or grouped in some more complex plan, are almost essential features of such squares, but where displays of flowers are to be made, open spaces must be left for sunlight. A modification of this type of square is sometimes met with where the space, instead of being used as a short-cut and for enjoyment from within, is designed primarily to present an agreeable picture to those passing it upon the adjacent streets. When the area is very small and the passing is almost wholly along one side, and in other special cases, this treatment is most effective, because, where the only aim is a beautiful pictorial effect from a limited point of view, better results can be obtained than when appearances must be reconciled with other uses of the land. Nevertheless there are few cases in which a small square will not have a greater recreative value to the public if its pictorial aspect is somewhat sacrificed to such uses as resting and promenading.

5. *Parkways and boulevards,* as parts of a park system, serve usually as pleasant means of access to parks from other parts of the city, or from one park to another, and also as agreeable promenades in themselves. Commercial traffic is usually excluded from them. Boulevards are arranged formally, usually upon straight lines, with rows of shade trees and parallel ways for those on foot and on wheels. The simplest type has a broad drive in the center with a walk on either side separated from the drive by a belt of turf and it is always shaded by trees. Frequently, two driveways are provided with a broad space between containing trees and turf, and sometimes foot-paths, bicycle-paths, bridle-paths or other conveniences, and often shrubs, flowers, statues and other decorations. A further development is arranged like the first form, with the addition of narrow streets for house frontage on each side, sometimes with a widening and elaboration of the planting-spaces between the middle drive and the side roads. Of recent years some boulevards have been made to provide for electric-car



2097. Plan of Morningside Park, in the upper part of New York City, to illustrate the small city park.

tracks upon a special turfed reservation with rows of trees, thus enabling the cars to be run at high speed with little danger of collision with other vehicles. Such reservations are generally between two roadways, but in some suburban districts, notably in the city of Rochester, a single track reservation is placed on either side of a single roadway, between the curb and the sidewalk. A parkway, so far as it can be discriminated from a boulevard, includes more breadth of turf or planted ground and includes, usually, narrow passages of natural scenery of varying width, giving it a somewhat park-like character and inducing a less formal treatment of the roads, paths, and accessory features. Parkways are frequently laid out along streams so as to include the natural beauties of brook or river scenery and to preserve the main surface-water channels in public control, thus providing for the adequate, economical and agreeable regulation of storm-drainage and floods.

6. *Outlying reservations* of almost undeveloped country scenery, usually from 500 to 5,000 acres in extent, are wisely included in the park systems of some of the larger cities on account of the increasing difficulty of reaching the unspoiled scenery of the open country, and because, otherwise, the increasing numbers of persons seeking such scenery upon the outskirts of the suburbs secure their pleasure at a constantly increasing discomfort to themselves and to the private landowners upon whose property they are forced to trespass. The most notable of such reservations in America are those of the Boston Metropolitan District, comprising four forest reservations with a total area of over 10,000 acres, with 33 miles of connecting parkways. The most notable of such reservations in Europe are those of London, especially Epping Forest (5,346 acres) and Richmond Park (2,358 acres); and those of Paris, amounting to about 20,000 acres, chiefly maintained, not by the city, but by the national government.

Management.—The usual and best method of managing city parks is by an unpaid commission of three or five members appointed for terms of three or five years and retiring successively, with a view to continuity of policy and independence of local politics. Of late, a strong movement for municipal efficiency has led to placing the park department of some cities in charge of a single commissioner who is chosen for his business ability rather than for his cultivated taste. This is a great mistake. Business efficiency in park management is important but should be secondary to the main purpose of attaining and preserving landscape beauty in the large parks and the avoidance of freakishness in all the parks. The single park commissioner is dangerous because he has the power and the instinct to order the immediate execution of any personal notion or whim, whereas a board instinctively desires to discuss new projects and has to be persuaded of their merit and wisdom before it will vote for them. In creative art the best designing is personal, but in maintaining works of art a consensus of opinion is much safer. The commission appoints as executive officers a secretary and a superintendent, the latter having some technical skill, and each devoting his whole time to the work and receiving a salary. Under the orders of the superintendent, who receives his instructions direct from the board, are employed an engineer, local superintendents, gardeners, foremen, and so on. The engineer is generally an assistant of the city engineer, assigned temporarily to park work. When new parks are to be acquired or plans are to be made for their development, a professional landscape architect is employed to advise the board and to make plans, and is usually retained at least in a consulting capacity during the period of construction. Some large cities retain a consulting landscape architect permanently to advise them with regard to questions of improvement and maintenance affecting the design of the parks.

Statistics.—Reliable statistics of parks are almost unattainable. The accompanying incomplete compilation has been corrected to 1914, except a few items which are starred.

Name of city	Large parks and parkways	Acreage	Other spaces	Acreage	Total acreage	Total appropriation and cost	Population, 1910	Cost per capita	No. inhabitants per acre
Albany, N. Y.	5	283.	12	23.6	306.6	*$2,135,700.00	102,344	$20.86	333
Baltimore, Md.	10	2,170.56	40	130.08	2,300.64	*10,000,000.00	574,575	17.40	249
Boston, Mass., City	15	2,134.8	39	415.88	2,550.68	19,310,056.34	722,465	28.80	263
Boston, Metropolitan	14	9,427.88	14	819.92	10,247.80	19,134,462.34	1,520,470	12.58	148
Buffalo, N. Y.	7	861.76	49	367.34	1,229.10	5,000,000.00	446,889	11.19	364
Chicago, Ill	24	3,712.76	163	1,037.86	4,750.62	*29,561,660.00	2,185,283	13.50	459
Cincinnati, O.	11	2,081.23	62	319.62	2,400.85	3,390,189.76	398,452	8.50	166
Cleveland, O.	15	1,804.907	35	120.96	1,925.86	2,276,159.58	560,663	4.05	299
Des Moines, Iowa	5	662.	16	55.26	717.26	1.163,500.00	94,238	12.35	130
Denver, Colo.	7	1,933.42	43	575.08	2,508.50	5,598,000.00	237,885	23.50	123
Duluth, Minn.	6	259.	42	117.9	376.9	*550,000.00	86,749	6.30	230
Essex County, N. J.	10	3,199.99	3	33.29	3,233.28	5,893,483.44	512,886	11.50	158
Hartford, Conn.	7	644.32	11	7.97	652.29	2,010,117.11	105,107	19.12	139
Indianapolis, Ind.	10	1,582.34	14	79.88	1,662.22	3,478,323.31	253,668	13.71	152
Kansas City, Mo.	7	1,902.06	14	93.54	1,995.60	5,853,890.93	273,943	21.37	137
Louisville, Ky.	5	1,364.9	10	114.7	1,479.6	*1,003,520.00	233,216	4.30	158
Milwaukee, Wis.	10	775.858	30	175.886	951.744	5,893,882.01	408,683	14.42	429
Minneapolis, Minn.	22	3,536.56	69	246.69	3,783.25	7,144,725.78	333,472	21.42	88
New York City	23	8,445.	129	595.	9,040.	*50,000,000.00	3,667,216	13.90	405
Borough of Brooklyn	17	1,481.85	15	91.91	1,573.76	*20,000,000.00	1,916,655	10.45	1,218
Omaha, Neb.	6	866.43	7	51.44	918.	2,066,405.54	131,093	15.80	142
Peoria, Ill.	4	395.	4	36.	431.	1,881,984.02	69,280	27.16	160
Pittsburgh, Pa.	5	1,191.	11	121.38	1,312.38	16,355,447.00	557,773	29.30	425
Philadelphia, Pa.	16	6,437.1	93	366.01	6,803.11	*6,250,000.00	1,549,008	4.	228
Richmond, Va.	*4	*354.	*9	*31.	*385.	*132,000.00	127,628	1.03	
St. Louis, Mo.	11	2,620.30	40	144.27	2,764.57	3,079,302.06	723,347	4.25	260
St. Paul, Minn.	8	996.28	50	127.21	1,123.49	2,701,580.24	231,533	11.66	206
San Francisco, Cal.	3	1,226.	30	624.	1,850	3,744,605.00	416,912	8.98	225
Springfield, Mass.	2	546.88	46	48.35	595.23	*169,000.00	88,926	1.90	149
Toledo, Ohio	7	869.	27	337.65	1,206.65	597,614.85	180,412	3.30	534
Washington, D. C.	5	2,686.91	400	1,180.36	3,867.27	*4,495,237.00	348,077	12.	93
Wilmington, Del.	5	405.62	26	66.55	472.17	*422,351.46	90,953	4.60	214

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F. L. Olmsted.

Landscape cemeteries (Fig. 2103).

The cemeteries of the present day have come into existence from a desire to have burials made at a distance from centers of population, and among beautiful surroundings. They are often called "rural cemeteries." The first one in the United States to merit this name was Mt. Auburn, near Boston, Massachusetts, founded in 1831. Since then the idea of having burial-places park-like in their character has been spreading until they contain today some of the most beautiful landscapes developed by the hand of man. The wish to have in the cemetery the beauty of trees, shrubs, lawns and flowers has gradually led to the abolition of fences, coping and other lot enclosures, and a reduction in the number of monuments and the size of headstones. There are many who now believe that the last resting-place should be surrounded by the quietness and beauty of these features of nature's handiwork without distracting stonework or artificial objects. There are others who say that "the cemetery should be a cemetery," meaning by this expression that it should resemble somewhat closely the old conventional churchyard or graveyard, with its multitude of crowded tomb-stones inscribed with the names and good qualities of those buried within its walls.

All agree that the cemetery should be so situated and maintained as to menace in no way the healthfulness of surrounding neighborhoods. The ideal location is one where the ground is somewhat undulating and thoroughly drained by having a porous subsoil, while the surface soil is sufficiently rich and deep to support a good growth of vegetation. In some instances, as at Forest Hills, Boston, and at Woodlawn, New York, it has been necessary to blast and remove rock and then fill in the space with earth. In other cases, the natural soil has been so poor that it has been necessary to cover it with rich earth hauled from a long distance. In still other cases, it has been necessary to select a clay soil because there was no other, or to make ground by excavating lakes, using the material excavated to raise the surrounding land, or to inter above ground in structures erected for the purpose, as at New Orleans.

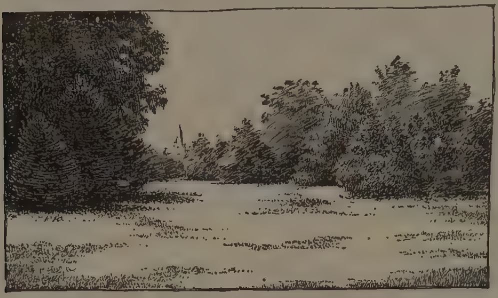
When a site is chosen, it is usually subdivided into sections and lots, which must be made accessible by the construction of drives and walks. A drive should pass within about 150 feet of every place available for burial. The width of the roadways should vary according to the size of the cemetery and the probable amount of driving. If the area is very small, not over 4 or 5 acres, it may be unnecessary to have any road or drive. In a little larger area, a grass drive 8 feet wide might suffice; in one still larger, a driveway 16 feet; and, finally, a cemetery designed to accommodate large populations should have good roadways 24 to 32 feet in width. Formerly these roadways would have been made of ordinary macadam or gravel, but with the increased use of automobiles, the material used for roadways should be bitulithic concrete, bitulithic macadam, cement concrete, or brick, preference being given to the first.

Walks should generally be left in grass and form part of a continuous lawn, such walks being better in appearance and more easily maintained than those made of gravel. The location of the drives will determine the shapes and sizes of the sections. The plans should be made after a careful study of the ground in question, the drives being placed so that they will have easy grades, command good views, and be as few as possible while being approximately 300 feet apart. When the ground is irregular in shape, or has steep slopes, or contains streams or lakes or valuable trees, these features may make it necessary to construct more drives than would otherwise be needed. They can generally be staked out on the ground by eye with a better effect than if drawn first in an office by the use of some geometrical curve. They should nearly always be curved to produce the most pleasing result, a curved driveway being advisable because: (1) when the margins are properly planted certain portions of the ground are always hidden; thus becoming more interesting; (2) they insure varied effects of light and shade; (3) they make the average distance from the cemetery entrance to the lots shorter than if one follows straight lines and turns right angles.

2098. Entrance to an American residence park. Page 1801.

An open tract, to begin with, is in many ways preferable to one that is thickly wooded, but groups of trees or single specimens that have broadened out in a natural way would be very valuable, since they would help to take away the naked, forbidding appearance of land newly planted with young trees. On a vacant area, it is usually advisable to plant some large trees for the sake of immediate effect. These can be grouped about the entrance, a fork in the drives, the top of a hill, the margin of a lake, or other distinguishing position. The objection to a piece of land covered with thick woods is that the necessary thinning to get sufficient open space will leave tall, spindling trees, unused to exposure. These are not very attractive in themselves, are very likely to die and are liable to be blown down. If there are thick woods in the land chosen, the trees chosen to remain should be those that are healthiest and have the lowest branches. Some of the trees removed might be cut off at the ground, when the sprouts springing from the stump will form beautiful bush-like specimens.

The necessary buildings will vary with the size of the cemetery, but they should always be modest in appearance and suitably embellished with shrubbery and vines. The office would naturally be placed near the entrance to avoid unnecessary walking, but it should not be built immediately on the highway or public street. The large arch frequently built over the gateway is usually too pretentious in appearance and not in keeping with the character of the grounds. A natural archway of living trees would be better. The chapel, if any, should be placed some distance within the grounds to give it greater seclusion and quietness.



2099. Vista in a large rural park. Page 1801.

Whether there should be greenhouses or not cannot be discussed here on account of the limits of this article. It may simply be said that with the great variety of flowering trees and shrubs which we have to choose from, as well as the thousands of hardy flowering herbaceous plants, most beautiful effects can be produced without the expense, the continual labor and the bare beds more than half the year, which would follow the construction of greenhouses and the use of bedding plants. Usually the selection for planting of material found growing in the adjacent country will help produce satisfactory results with little expenditure of money and time. To prevent intrusion, a fence along the boundary of the cemetery is necessary, but this can be a simple inexpensive wire fence, serving in places as a support for vines, and in places being hidden by a belt of trees and shrubbery. No one would now make the cemetery dreary by confining the planting to spruces and weeping willows. On the contrary, every effort is made to secure bright cheerful effects by the selection of all kinds of flowering happy-looking plants. The modern cemetery becomes, in fact, a sort of arboretum. It includes some evergreens which are most suitably grouped along the boundary belt, and which should contain all kinds of hardy pines, as well as some of the more stiff and formal spruces. The planting of Norway spruces has in many places been overdone. The development of attractive landscapes in cemeteries is of so much importance that Mr. Strauch, the greatest cemetery designer that we have had, used to call the present method "the landscape lawn plan."

2100. Water scene in a large rural park. Page 1801.

A good landscape in the cemetery is usually the result of years of growth. It must first be intelligently designed, and then receive care and attention from someone familiar and in sympathy with the scheme adopted. To insure such attention, and to protect the interest of all lot-owners, as well as to maintain the dignity and character of a city of the dead, rules have been adopted by all leading cemeteries. These rules are the result of study and experience on the part of many men. At a meeting of the Association of American Cemetery Superintendents, held at Boston, in 1890, the following rules were recommended by a unanimous vote of those in attendance:

Rule 1. (This should be a general rule, stating the authority and conditions on which lots are sold and the restrictions on transfers. The rule, of course, would have to be varied according to conditions existing in each cemetery.)

Rule 2. The trustees desire to leave the improvement of lots, as far as possible, to the taste of the owners; but, in justice to all, they reserve the right, given them by law, to exclude or remove from any lot any headstone, monument or other structure, tree, plant, or other object whatever which may conflict with the regulations, or which they shall consider injurious to the general appearance of the grounds; but no trees growing within any lot shall be removed or trimmed without the consent of the trustees.

Rule 3. Lot-owners may have planting or other work done on their lots at their expense, upon application to the superintendent. No workmen other than employees of the cemetery will be admitted to the cemetery except for the purpose of setting stonework.

Rule 4. No iron- or wirework and no seats or vases will be allowed on lots, excepting by permission of the trustees, and when any article made of iron begins to rust the same shall be removed from the cemetery.

Rule 5. The trustees desire to encourage the planting of trees and shrubbery, but, in order to protect the rights of all and to secure the best general results, they require that such planting shall be done only in accordance with the directions of the superintendent of the cemetery.

Rule 6. No coping nor any kind of inclosure will be permitted. The boundaries of lots will be marked by corner-stones, which will be set by the cemetery, at the expense of the lot-owner, with the centers upon the lines bounding the lot. Corner-stones must not project above the ground and must not be altered nor removed.

Rule 7. No lots shall be filled above the established grade.

Rule 8. All interments in lots shall be restricted to the members of the family or relations of the lot-owner.

Rule 9. No disinterment will be allowed without the permission of the trustees, of the lot-owner, and of the next of kin of the deceased.

Rule 10. Mounds over graves should be kept low, not exceeding four inches in height; and stone or other enclosures around graves will not be allowed.

Rule 11. Foundations for all monuments, headstones, and the like, shall be built by the cemetery at the expense of the lot-owner and fifteen days' notice must be given for the building of foundations. The cost of the same must be paid in advance.

Rule 12. Every foundation must be at least as wide and as long as the base stone resting upon it, and must not project above the surface of the ground. All foundations must extend as low as the bottom of the grave.

Rule 13. Only one monument will be permitted on a family burial-lot.

Rule 14. (This should be a rule limiting the height of the headstones, and the lower this limit is made the better. Even with the lawn is considered best.)

Rule 15. All stone and marble works, monuments and headstones, must be accepted by the superintendent as being in conformity with the foregoing rules before being taken into the cemetery.

Rule 16. No monument, headstone or coping, and no portion of any vault above ground shall be constructed of other material than cut stone or real bronze. No artificial material will be permitted.

2101. Edge of the concert grove in Prospect Park.

Rule 17. The trustees wish, as far as possible, to discourage the building of vaults, believing, with the best landscape gardeners of the day, that they are generally injurious to the appearance of the grounds, and, unless constructed with great care, are apt to leak and are liable to rapid decay, and in course of time to become unsightly ruins. Therefore no vaults will be permitted to be built unless the designs for the same are exceptionally good, and the construction is solid and thorough. The designs must be submitted to the trustees, and will not be approved unless the structure would, in their judgment, be an architectural ornament to the cemetery.

Rule 18. Material for stone or marble work will not be allowed to remain in the cemetery longer than shall be strictly necessary, and refuse or unused material must be removed as soon as the work is completed. In case of neglect, such removal will be made by the cemetery at the expense of the lot-owner and contractor, who shall be severally responsible. No material of any kind will be received at the cemetery after 12 o'clock M. on Saturdays.

Rule 19. The trustees shall have the right to make exceptions from the foregoing rules in favor of designs which they consider exceptionally artistic and ornamental, and such exceptions shall not be construed as a rescission of any rule.

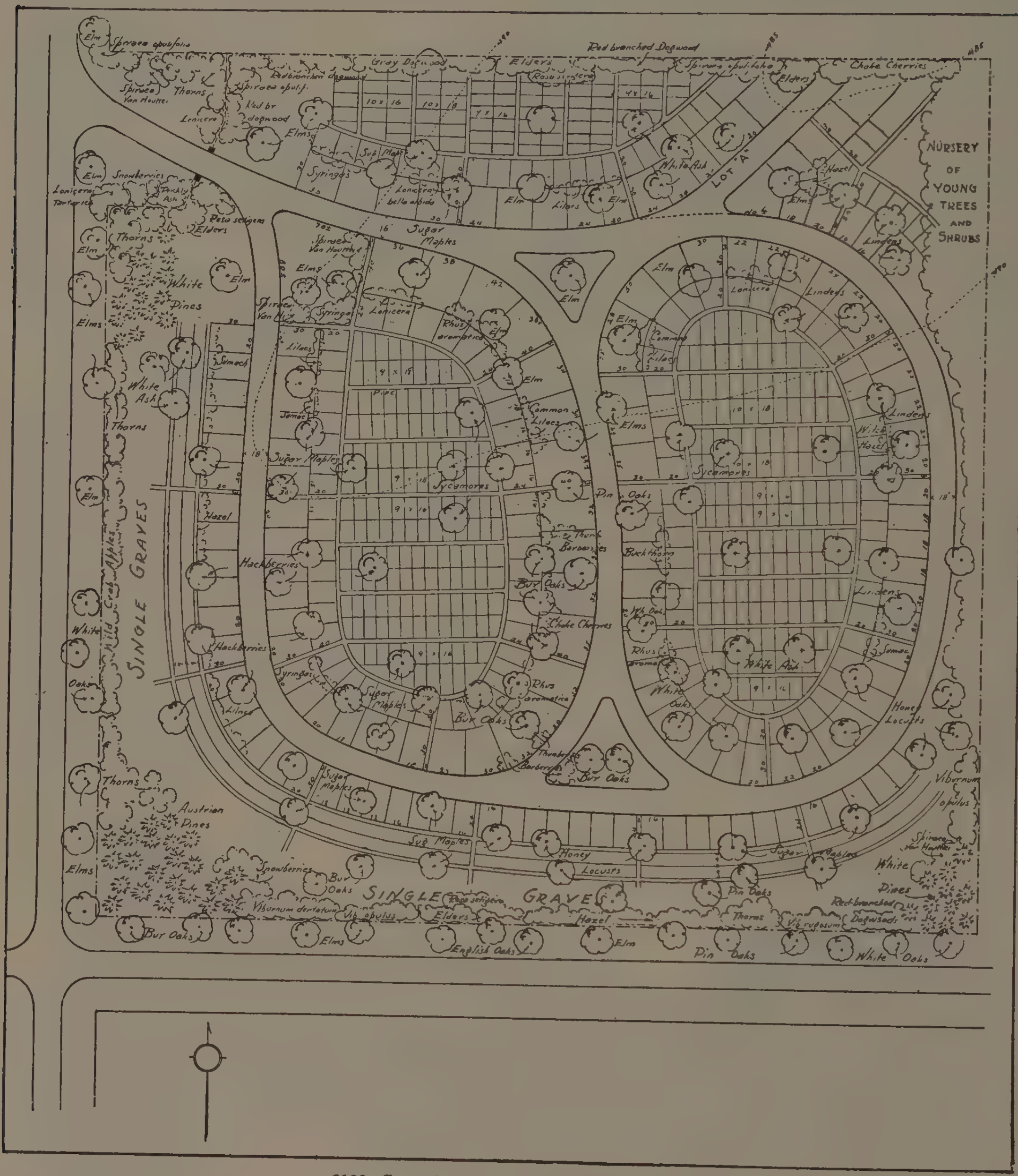
Rule 20. It shall be the duty and right of the trustees from time to time to lay out and alter such avenues and walks, and to make such rules and regulations for the government of the grounds as they may deem requisite and proper and calculated to secure and promote the general object of the cemetery.

Rule 21. The superintendent is directed to enforce the above regulations and to exclude from the cemetery any person willfully violating the same.

Cemeteries should be established upon a basis to enable those in authority to take uniform care of the grounds for all time. The prices charged for lots should be high enough to enable a fund to be set aside that will yield an annual income sufficient to pay all necessary general expenses. In laying out a new cemetery, those in charge should seek the best advice available. Such advice should be based on a thorough knowledge of landscape gardening and the special needs of burial-grounds. Much information can be obtained by visiting Spring Grove, at Cincinnati, Ohio, generally recognized as the pioneer of park-like cemeteries, and perhaps the

2102. A park-like effect in a private place.

best example in the world. Oakwoods Cemetery, at Troy, N. Y., Swan Point Cemetery, at Providence, R. I., and Forest Hills Cemetery, at Boston, are some of the prominent examples of the system now in vogue. Graceland Cemetery, at Chicago, although much smaller in area than those already mentioned, contains some good landscape effects. There are many other cemeteries in the vicinity of the large cities of the United States which can be commended on account of the good taste displayed in them. There are others which, while containing many beautiful trees and expensive monuments, include also many fences, railings, copings and hedges that serve as examples of what to avoid rather than to imitate.



2103. Ground plan of a landscape cemetery.

Our leading cemeteries should keep pace with the best thought of the times, with the best theories of religion, science and economics. They should be, as the name implies, sleeping-places—places of rest and freedom from intrusion. It seems natural that people should seek for such a place the very best production of landscape-art, a place where spreading lawns give a cheerful warmth and sunlight; where pleasing vistas show distant clouds or the setting sun; where branching trees give grateful shade, furnish pleasing objects to look at, and places for birds to come each year and sing again their welcome songs; where blossoming shrubs delight the eye, perfume the air, and make attractive nesting-places. Such places may seem to exist more for the living than for the dead, but the living are the ones that need them. If it seems natural to choose a most beautiful park, a real picture, we might call it, for a sleeping-place, it seems strange to put into this picture obelisk after obelisk, stone posts and slabs of all shapes and sizes, and stone tombs within whose walls their owners hope to have their dead bodies preserved forever. The history of sepulture shows the futility of trying to preserve one's body or one's name with the help of stone. A man can hand his name down to posterity only by his own work, and even if his body should be preserved as long as were those of the ancient Egyptians, it might finally be used only for fuel. These facts should be recognized in the modern cemetery. The ground should assist in changing the body back into inorganic forms or to receive the ashes, if the quicker process of cremation is adopted. The scenery should solace those that are bereft.

It is repugnant to our best feelings to use the same land over and over again, as is done in many cities in Europe and, to some extent, in the United States. A cemetery is frequently spoken of as the last resting-place, and it serves mankind best when it is so in fact, since in that case, after it has served its purpose of purification, it becomes a park, a breathing-place for the people of the city, whose growth is likely to crowd the vicinity with houses. The memory of past generations will certainly be sweeter if it is associated with trees than if it is connected with tombs, catacombs and pyramids. The problem presented to cemetery associations is, therefore, how to secure the most pleasing combinations of growing plants, including trees, shrubs, flowers and grass; the most satisfactory views; the most harmonious and restful park, for the cemetery is really a memorial park.

Those seeking information on this subject will find it in the reports and histories of the various cemeteries and in encyclopedias. The development of the landscape idea in connection with cemeteries is given in some of the reports of those institutions, that of Spring Grove, for the year 1869 being especially valuable. The reports of the Association of American Superintendents contain many papers of interest. The volumes of the "Modern Cemetery," afterward the "Park and Cemetery," the leading periodical devoted to the interests of burial-places, contain articles relating to all phases of the subject. All books relating in any way to landscape gardening are of value in cemetery work, since they treat of all its natural features. O. C. SIMONDS.

Horticultural phases of civic art.

It is the plan of this work to discuss horticultural phases of landscape gardening without entering upon questions of design. It must be said, however, that problems of structural design and orderly arrangement are much more fundamental and important to all phases of civic art than the mere ornamental horticultural treatment. This statement having been distinctly understood, we may proceed to discuss the horticultural phases of this subject which are indeed extensive and important.

Civic art may be somewhat accurately defined as the conservation, improvement, and utilization of public property. With negligible exceptions, civic improvement deals exclusively with public property or with property owned by quasi-public corporations; or, at farthest, with private property administered in the public interest.

The forms of public property in most common use are roads, town commons, parks, "squares," playgrounds, school grounds, church grounds, cemeteries, railroad station grounds, historic and scenic reservations, and forest reservations. Some horticultural treatment is requisite for the development of practically every one of these several types of public property. This means chiefly the use of trees, shrubs and grass.

Streets.

In all except the crowded business streets in mercantile and manufacturing sections of cities, street trees are considered desirable. Indeed some of the finest and most important business streets in the world are beautifully parked with trees and shrubbery; e. g., Unter den Linden, Berlin; and the Ringstrasse, Vienna.

The usual method of treatment is to plant a double row of trees, one on either side of the street, carefully alined with the street and regularly spaced. These trees in any certain section should be all of one species and of one age. As a rule these trees will be placed between the curbing and the sidewalk, though other arrangements are made in special cases. Wide boulevards and pretentious residence streets are sometimes planted with four rows of trees. In this case it is generally desirable for all of the trees to be of the same kind and age, though good effects are occasionally produced by having the two intermediate rows of an entirely different and contrasting species. Occasionally a narrow parking in the middle of a wide street may be planted with a single row of contrasting ornamental trees such as palms, magnolias, hawthorns or apples.

In many narrow streets it is desirable to plant a single row of trees which would usually be of some small-growing and very hardy species such as horse-chestnut or ailanthus. This single row should be placed just inside the gutter line on the north side of streets running east and west and on the east side of streets running north and south. (For species of trees suited to different sections, see Waugh's "Rural Improvement.")

In addition to trees, most streets need a strip of grass. Indeed the trees will not thrive unless there is some open planting strip where the soil is exposed, and this planting strip should practically always be kept in grass. These grass spaces should be of regular patterns—that is, they should not be cut to pieces by intersecting paths and roads—they should be evenly graded and should be kept well cut and trimmed.

In streets or boulevards where elaborate parkings are maintained, the horticultural embellishments may reach to almost any extent. A common treatment in continental Europe, but one hardly known in America, is the use of festoons of ampelopsis or clematis. In America, street parkings are commonly made up of shrubbery masses, sometimes interspersed with groups of hardy herbaceous material or even with cannas and other hothouse plants. The present custom is to arrange these parkings with marked informality. It may fairly be suggested that the character of street development would make a more formal treatment more effective.

Such shrubbery parkings should be confined to the most hardy and resistant species, such as spireas, barberries, the best viburnums, privets, and the like.

It hardly needs to be remarked that such parkings are expensive. They should not be undertaken except in circumstances where liberal treatment can be given. The initial cost of development, for parking alone, should run from $5,000 to $10,000 a mile; and the average annual up-keep from $2,000 to $3,000 a mile.

Country roads.

Tree-plantings along country roads are quite as desirable as along city streets, although the problem here is decidedly different. Some species of trees, particularly large-growing conifers, can be used on country roads which are not available for city planting. Some objection has been made at times to tree-planting for country roads on the ground that it prevents the road-bed from drying out, especially in springtime. This objection is somewhat captious and is not generally accepted. While it would seem undesirable to have all country roads everywhere planted with trees, it may safely be said that permanent plantings should be much more extensive than they now are.

In this connection it seems proper to notice a scheme which is frequently urged in this country, viz., the planting of country roads with fruit trees. One prime argument always advanced by the advocates of this plan is its successful use in Europe. Extended observation in all the countries of continental Europe convinces the writer that fruit trees along country roads are rather rare. Especially uncommon are examples of extensive municipal planting and maintenance of such fruit trees. At the same time Europe has certain definite advantages over America in enterprises of this kind. On the whole the plan seems generally impracticable in America. The exceptions to be noted are rows of apple trees rather frequently seen alongside of farm fields in New York state and New England. These are indeed very beautiful and a great addition to the public pleasure in the use of the roads. They are always held as private property.

Scenic roads.

Besides the planting of simple rows of trees along country roads, much more extended developments will be highly justified in many cases. First of all, the shrubbery borders along the roadside may be conserved and improved. Where such natural shrubbery borders do not exist, they may be planted and such plantings should be designed and carried out by expert landscape gardeners, seeing the work is of such general value. Numerous promising experiments have been made in the last few years in this direction of developing attractive roadside plantings.

Such public roadside plantings may properly become the conservation grounds of native species. It is a signal and unfortunate fact that in many parts of the country, especially where agriculture is particularly effective, many of the finest native species are rapidly disappearing. This applies to trees, shrubs and native herbaceous flowering plants. Many of these native plants are not noxious weeds in the ordinary sense. The weeds in fact are able to take care of themselves and do maintain their kind against the assaults of organized agriculture. Many shy and delicate species, however, of the utmost interest and beauty, give way quickly before the plow. These are the species which should be carefully protected by gardeners everywhere and which might with special propriety be encouraged along country roadsides.

Another similar service of the roadside plantings may be rendered in the conservation of native birds. These also, and especially the rarer and more interesting species, are disappearing before the encroachments of civilization. Some attention paid to the encouragement of birds in these roadside plantings would be highly justified on grounds of public policy.

There should be considered further the fact that the country roads everywhere constitute the most popular public parks in existence. The automobiles always take to the country roads, rather than to the city parks, from an absolute and almost universal preference. They find these roads more enjoyable than any other scenes. This suggests that the roads should have along many miles of their extent the same careful scenic treatment which is given to the scenery and plantings along park roads. This means not only skilful ornamental planting, but occasional cutting out of trees for opening up views, the removal of unsightly objects, the abolition of the roadside dump, and the subjugation of the billboard.

It may fairly be suggested further that in many parts of the country special scenic roads should be opened up, the main object of which is to develop stretches of fine scenery. These should in fact be laid on such indirect and circuitous lines as to prevent their use by business traffic. They would follow winding streams or the shores of lakes, or would climb over ridges of hills where the views were extensive. This is a type of landscape gardening not generally undertaken anywhere in the world, but one which seems especially suitable to the genius of America.

Care and protection of trees.

While it is always desirable to have more extended plantings of trees both in city streets and along country roads, the preservation of existing trees presents nearly everywhere a more immediate and serious problem. Street trees are subject to many kinds of damage. Aside from the usual insect and fungous enemies, they have to contend against bad soil conditions, against the inroads of telephone linemen, trolley companies, gas mains, electric light wires, and all similar public utilities which have learned to use the road for their private profit, and largely to disregard the public rights in tree property. The regulation of gas mains and electric wires is perhaps the most difficult, as it is the most common, problem of all. In general, every effort should be made to remove wires from streets, and where this cannot be done, to see that they are kept out of the tree tops and everywhere properly insulated and stayed.

In certain parts of the country, public trees are considered of such great value that their care has been turned over to a special officer, the tree-warden. Such officers should have definite and fairly extended powers. Their business is to enforce the legal rights of the public in the trees, and to protect them from the attacks of private interests as well as from the attacks of insects and fungi. The tree-warden may easily be one of the most useful public officers in a municipality.

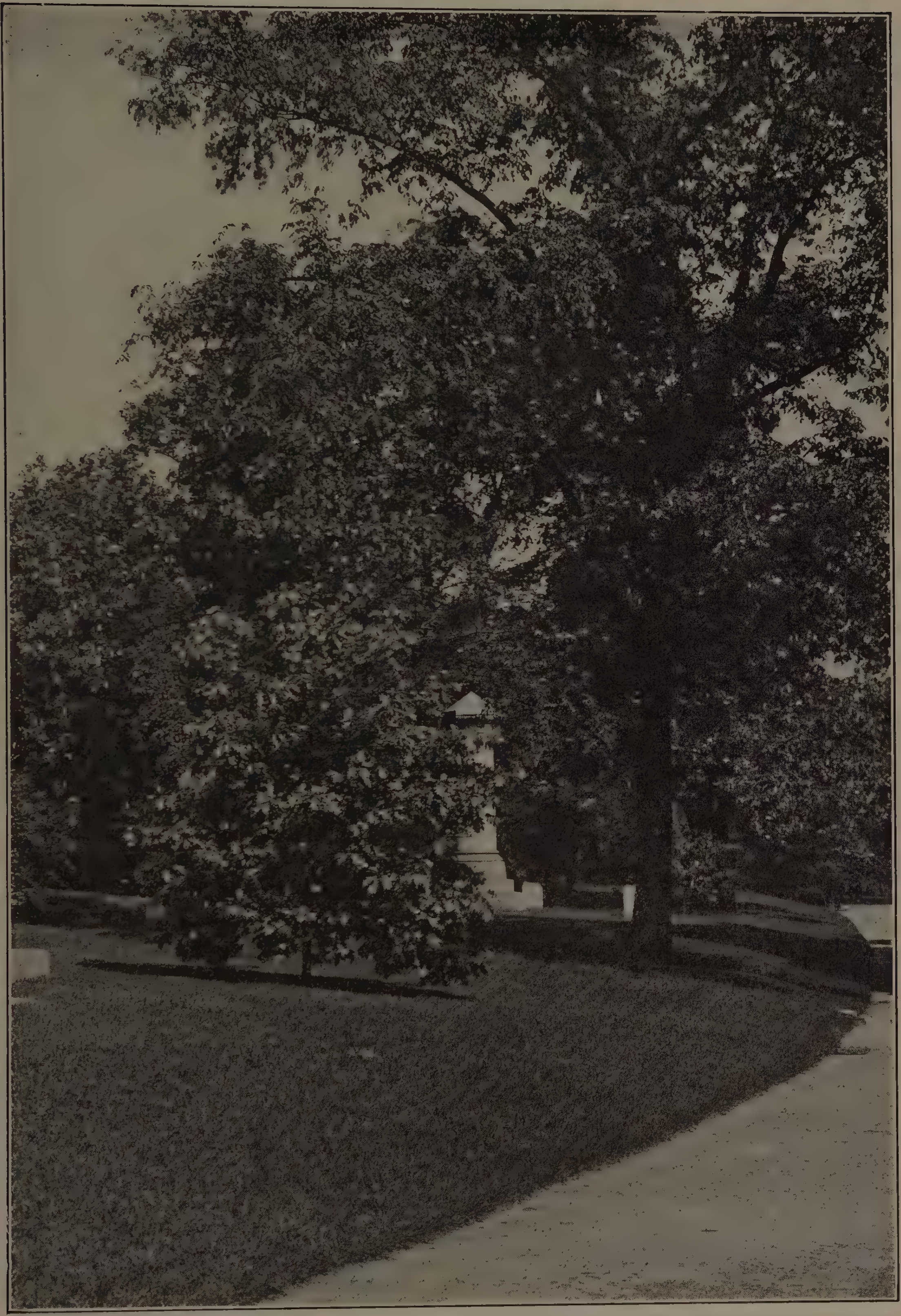
Along with an aroused public interest in trees, has arisen an army of "tree doctors," a considerable number of whom are low-grade quacks. Expert service in the repair and preservation of trees is everywhere to be encouraged, but very cautious discrimination must be exercised. It will not do to assume that the company getting out the biggest advertisements really knows the most about trees.

Town commons.

In the northeastern states nearly every village has its town common, a small central open space usually very attractive. It gives indeed a special character to each town which possesses something of this sort. In mid-western states there are somewhat similar "parks," usually open spaces of one or two square blocks in extent. In the southern and southwestern town there is often a courthouse square having somewhat the same character except that, unfortunately, the main public building is usually placed in its center. All such commons, parks, or squares, however, require pretty much the same horticultural improvement. In general the embellishment most desirable is to be found in fine well-grown trees. These should nearly always be of the same species and of the largest, most vigorous native kinds, rather than of any fussy "ornamental" species. Most public squares or commons are at their best when the horticultural treatment is confined to such large trees and smooth strips of lawn. The use of flower-beds on such grounds is to be generally reprobated. While their exclusion is not an absolute rule, the exceptions are very rare.

Shrubbery borders are sometimes used on these town commons or parks. In special cases they may be justified, but the presumption is against them.

When public buildings are placed on such squares (they should always be placed outside the squares, facing upon them), it is frequently desirable to soften their outlines by foundation plantings. These should be of hardy shrubbery, usually such as has fine texture. Species of weedy growth (such as hazel and *Rosa carolina*) should be avoided. Species of coarse texture may be used with large coarse architecture, especially with heavy rusticated brick or stonework,



LXIII. View in a landscape cemetery.

and in positions where they will always be seen from a considerable distance. Attention should be given to placing on the north side of buildings those species which will thrive in shade, such as barberry, privet, rhododendron. On the south side should be placed plants which will withstand the sun; and perhaps some drought, for example, spireas, coral berry, ceanothus.

The treatment of parks is more fully discussed elsewhere (see *Parks*, page 1801).

School grounds.

School grounds throughout the country are generally neglected. They present a bare, unattractive appearance wholly inappropriate to their use. This condition is widely recognized and nearly every community is anxious to correct it. The problem, however, is difficult.

Generally speaking, large trees are the most useful amelioration for school grounds. These should be placed especially on the south and southwest sides of the school-house in order that the shadows may fall upon the building during school hours. Large-growing native species are particularly desirable, although throughout the northern states the common domestic apple tree seems entirely appropriate, especially for the rearward parts of school lots.

Good lawns are very desirable on school grounds wherever they can be maintained. They are, however, admittedly impossible in many cases.

Border plantings of shrubbery may be attractive, especially at the backs of school grounds, and more especially upon large grounds. Foundation plantings about the building are nearly always desirable when they can be maintained. Other horticultural embellishments such as flower-beds, are to be looked upon with disfavor.

On large school grounds such as every country district ought to have, there should be maintained school-gardens. In addition to the regular school-gardening work, good country schools should undertake to maintain small arboreta of native species. These may also be developed in the form of bird-gardens, adding interest to the gounds and supplying material for constant study.

Grounds designed for play must usually be bare. In some cases turf can be maintained, and is of course, desirable wherever it is possible to have it. Shade trees should be supplied wherever there is room, especially about the margins.

Church grounds.

The church grounds present no such difficulties as are found on the school grounds. They are rarely overrun by crowding multitudes. There is ample opportunity for every sort of horticultural improvement. It is surprising that this opportunity is not more widely acknowledged. The small country church is especially in need of good tree-plantings, but even in villages of considerable size the church grounds are large enough to use a number of large trees. Foundation plantings of shrubbery are effective with a great many church buildings, especially stone buildings of Gothic type with buttresses. The plain wooden churches of the Middle West also need foundation plantings wherever they can be supplied.

It would seem best in connection with many church grounds to develop pleasant outdoor playgrounds, social grounds, or even such places as would be particularly adapted to outdoor meetings. In many parts of the South and West, outdoor evening church services are decidedly popular during the long summer months. But definite and proper provision for them is rarely made.

Cemeteries.

The park cemetery is a distinctly American idea and is of such importance that it is more fully treated in a separate article (see *Cemeteries*, page 1807). At this point we may merely call attention to the squalid unkept rural and village cemeteries, where very simple improvements would be highly valuable. These would consist chiefly of plantings of good trees and shrubs with such turf lawns as could be kept up.

State, county, and national parks.

Another form of the public improvement which is destined to play a conspicuous part in American life in years to come is the larger public park maintained by county, state, or by the nation. These all of course require extensive horticultural development, chiefly in the planting of trees and the maintenance of native shrubs and herbaceous species. The national forests really belong in this class. In them the conservation and exploitation of the tree flora has both an economic and a social value. This general matter, however, is discussed under Parks.

Home grounds.

Most village improvement undertakings make a strong point of the improvement of home grounds. This, however, is based entirely on the public interest, the public in fact, having a very great concern in the attractive appearance and sanitary condition of all home grounds. The horticultural treatment of the home grounds is a subject which has received very general attention in America. The selection of trees, shrubs, and other ornamental materials is naturally controlled chiefly by personal taste of private owners, and it seems impossible here, without going too far afield, to give specific directions on this sort of work. As the problem is approached from the village improvement standpoint, results are frequently aimed at through some form of emulation. Various kinds of public contests are established with prizes for the best-kept front yard, the best-developed back yard, for the best flower-garden, and so on. Where such contests have been wisely planned and tactfully directed, the results have been good. FRANK A. WAUGH.

Landscape extension.

The field of university extension work in landscape gardening, or "landscape extension," is the education of the people of a state from the apathy that tolerates bare home grounds, badly planned cities, and wholesale destruction of native scenery and vegetation. Much work in this direction has been done, and always will be, by private landscape architects, by nurserymen, and by magazines and newspapers, but the best opportunity for educational work of a fundamental nature lies with the state universities and agricultural colleges.

Popular demand for landscape extension.

The most obvious demand for landscape extension is the endless succession of letters asking for help in designing and planting home grounds that are too small to justify employing a private landscape gardener. This need is met, to some extent, by commercial agencies that give "free plans" in order to get profits from the sale of planting materials. Some of the work done in this way is of good grade, but much of it is of a gaudiness and artificiality that represents a natural swing of the pendulum from apathy. The money and time wasted on the gardenesque style of planting has been saved to many individuals by showing them how nations and individuals pass through showy and artificial stages before arriving at the naturalistic. Letters from the people clearly indicate that they wish the guidance of public taste in landscape gardening entrusted to educational rather than commercial agencies.

A second popular demand for landscape extension comes from organizations that ask for help in making comprehensive designs for communities. Such work is even more vital than designing home grounds, because it does not merely consider beauty, but goes deeply into the housing problem and all other factors involving the health and prosperity of every inhabitant. Ordinarily such designs must be made by city planners, but landscape-extension workers can render the state a worthy and invaluable service by helping to educate each community to the city plan as an ideal toward which local forces should work steadily, year after year.

A third popular demand for landscape extension is for technical advice on all public problems involving beauty. Road, bridge, drainage, and other projects often threaten the needless destruction of beauty which it would cost much money and many years to repair. Local protests are entitled to a fair hearing and organizations sometimes ask that expert valuation of the natural beauty involved be presented before courts, and legislative bodies. Organizations interested in conservation are continuously asking for advice on aims and methods, as well as popular lectures. The state legislature is besieged by various bodies with competing propositions for additions to the state park system. A logical outcome of all such unrelated efforts is a survey of each state's resources in natural beauty, showing low-cost lands unsuitable for agriculture, their location, size, character, ownership, salable value, relative importance to the people, dangers threatening valuable scenery and how these dangers can be avoided. Such a survey naturally leads to a comprehensive policy for state-owned reservations, and for some control of the great scenic features of state-wide interest, which, in states having no mountains, hills, or seashore, generally comprise water-courses of all kinds, including drainage-ditches, railroad and traction rights-of-way, and the roads. Some of these problems will be undertaken by private landscape architects through commissions, and some by state landscape architects, permanently employed, like state engineers and architects of state highways, waterways, health, sewers, buildings, and lands. Obviously, such work is related to landscape extension, and such commissions or officers may be located at the university for the same reason that a state often locates there such departments as the natural history, geological, and water surveys, and the like.

The aim of landscape extension is to teach the people the best ways of designing and planting public and private grounds for utility, health and beauty. Landscape extension is the democratic side of an art that has been too aristocratic. It is part of a national desire to popularize all the fine arts, as music and the drama have been brought into the daily life of the masses by means of mechanisms and moving pictures. Such aims can never be realized wholly by professional and commercial agencies since economic necessity often forces them to subordinate public needs to private gain. The people should have a set of representatives who decide every question relating to outdoor efficiency and beauty from the standpoint of the people. In this article all questions are so considered.

The lines of work are too varied to be treated here in detail. Some of the most obvious and popular ones may be named and illustrated in a constructive way under the five headings of individual, rural, town, corporation, and state opportunities.

Individual opportunities.

Designing farms and farmsteads.—Some work has been undertaken in several states in planning whole farms for efficiency, and men are now being trained for this work. Many farmstead plans have been made by students in agricultural colleges, under the direction of an instructor. Mail-order plans are not made by private landscape architects, and farmers, as a rule, will not pay for a visit. The great opportunity of landscape extension is to show the farmers how to make surveys and furnish enough information to enable an expert to design the farm layout with the cost of a visit.

Home grounds in cities.—Technically the design of a small city lot is much the same as that of the farmstead, but with less chance for enframing views, more need of screening unsightly objects, and often a narrower range of materials, owing to smoke, gas, shade, and the like. City people are more eager to spend money on home grounds than country people. After a twenty-minute talk at Peoria, Illinois, 750 out of 2,600 persons signed pledges to do some permanent ornamental planting within a year. Later these persons were asked how they kept their promises. Those who replied had spent about $8,000 in the two years, ending November 25, 1914.

Rural community opportunities.

Community plans.—Small communities can often direct their growth without expensive changes. Good work has been done in Massachusetts in designing rural centers. Facilities for such work will probably be furnished in several states under the Smith-Lever law. The census classifies as "rural" communities having 2,500 inhabitants or less. Some of these communities can afford to employ private city planners. Others may have to be designed by state aid, such as landscape extension can provide. Illinois has a community advisor and a director of community clubs who help local organizations federate toward the permanent improvement of rural communities.

County court-house grounds.—The planting of $10 worth of vines on the walls of a court-house may be the first step toward a county plan, such as that made for Moore County, North Carolina. The farm advisor movement is beginning to bridge the gap between town and country. Trenton County, Missouri, is one of the first to unite all business men (including practically all of the farmers) in a single county improvement organization.

Township parks.—It is now recognized that country people need parks and playgrounds quite as much as city people, and that they are entitled to have something of a higher grade than amusement parks run by commercial interests. Leaverton Park, near Palestine, Illinois, is a high-class farmers' park organized under a little-known law permitting several townships to unite in levying adequate taxes for making and maintaining rural parks.

Town opportunities.

Town planning and planting for efficiency and beauty.—Massachusetts has a law requiring every city of 10,000 inhabitants or more to have a city plan. Such plans should be made by private landscape architects. The function of landscape extension is to promote the ideal of a city plan and to furnish, on request, the names of two or more competent city planners.

School grounds.—It often happens that money can be raised for planting, but not for plans. In such cases landscape extension may furnish designs. Such work is educational to children and townspeople, and the results, though quickly attained, are permanent.

Street trees.—The needless butchery done by wire-using corporations leads to frequent requests for lectures on street trees. Such efforts commonly result in the establishment of a shade-tree commission or city forester, controlling the corporations in harmony with laws like those of New Jersey, Ohio, and Massachusetts, as presented in Solotaroff's "Shade Trees."

Neighborhood planting.—Frequently the greatest improvement that can be made in the shortest time and at the least expense is to plant the front yards of a single street for three to five blocks. Shrubbery for foundations and for connecting the whole street into a park can often be planted at a cost of $15 to $25 for a family. This work is expensive to a state, owing to the large number of persons whose taste must be educated to conform to a plan that will set a higher standard for the community. However, such effort greatly stimulates the planting of home grounds in all parts of a town. There is serious danger of debasing public taste by leaving neighborhood planting to commercial agencies that make no plans and merely plant "best sellers," especially curiosities and other gardenesque materials. Careful plans should be made by state aid in the many cases in which the cost of experts cannot be afforded.

Corporation opportunities.

Railroads.—The first duty of railroads toward public beauty is commonly thought to be the building of good stations and planting of station grounds. The Boston and Albany and the Pennsylvania have already begun to beautify their rights-of-way in a permanent and naturalistic manner. Theoretically, the principles of wild gardening can be applied to rights-of-way so as to save the wild flowers and shrubbery, with little more expense than the cost of mowing everything. It is probable that railroads running through monotonous, level countries, can restore or create a characteristic type of scenery at reasonable expense. Some even think that this can be done in such a way as to increase passenger traffic. The laws which, the railroads assert, compel them to cut down all brush and weeds, have been interpreted by lawyers to refer only to noxious vegetation.

Traction lines.—Interurban lines sometimes ask for advice on the merits of plans submitted for trolley parks. These are generally in the gardenesque style, where naturalistic treatment would be better for the people. At least one line has shown a disposition to get better plans and consider a comprehensive policy for all its parks and station grounds.

State opportunities.

State parks.—Every state needs large reservations of cheap land where the toiling millions may restore the energies necessary to do the world's work. Wisconsin and other states have reservations where laboring people who have only two weeks' vacation may camp amid wild surroundings. Every type of natural scenery should be represented, for scientific and educational purposes.

Waterways and drainage.—Great public improvements, like flood prevention and reclamation projects, are commonly conducted without regard to the rights of beauty. Competent landscape architects should be employed in all large engineering works affecting the face of nature. Water-courses are commonly treated as sewers and otherwise defaced. Landscape extension can arouse each local community to do its share toward restoring beauty to the watercourses.

Roadside planting.—Every state and county can have a great rural park system without the cost of buying land, by saving or restoring to the roadside the native trees, shrubs and flowers. The famous drives connecting Madison, Wisconsin, with the surrounding lakes, afford a good example. The comprehensive plan now being made for the Lincoln Highway, contemplates a consistent scheme of roadside planting from the Atlantic to the Pacific. Several miles of planting have lately been done near Monticello, Sidell, and Barrington, Illinois. The cost of restoration varies from $500 to $1,500 a mile, or about 10 per cent of the cost of constructing concrete roads.

State character.—One of the greatest opportunities of landscape extension is to show how every home and town may connect with a large scheme to give the whole state a characteristic beauty. The Middle West had developed a prairie style of landscape gardening based upon conservation and restoration of native beauty and repetition of the horizontal line of prairie land or sky, by means of trees and shrubs with horizontal branches or flower clusters. One designer has submitted an itemized list of $6,000,000 worth of work accomplished from his plans in the prairie style since 1901. Each state may have something like the "Illinois way of planting," which is the use of a high percentage of permanent materials native to the state.

Methods of landscape extension.

All activities of landscape extension except administrative, can be summarized under the heads of lectures, publications, and design.

Lectures.—These are necessarily illustrated, and high-grade colored lantern-slides are much more effective than plain ones. Before-and-after pictures showing money spent in the state on permanent native planting are more convincing than random, theoretical, temporary, or foreign subjects. Apathy may be indicated by those who stay away, but those who attend the lectures are generally enthusiastic to the point of making pledges, and of asking for more state aid in design than it is proper to grant. Mere enthusiasm for wholesale public planting often leads to poor arrangement, unfit material, and neglect of cultivation. Carefully organized campaigns give better results than individual lectures. Traveling expenses are paid by local communities.

Publications.—The traditional type is the practical circular, which is essential, but presupposes general interest in planting. The inspirational type is exemplified in a type or form of publication that contains many illustrations, for the reason that landscape gardening must be taught chiefly by means of pictures. Since truth in landscape gardening is not exact but comparative, the pictures may well be arranged in contrasting pairs.

Design.—In rich, old communities the people are not apathetic, but willing to improve if someone will show them what to do. Therefore, after every lecture, each community is likely to ask for a well-designed demonstration. In the West, many communities have no example at all of landscape gardening, or a poor and antiquated one. They will wait indefinitely unless the state supplies a standard. Such designs have been supplied on conditions about as follows:

1. The project must be educational. Therefore, it should not compete with landscape gardeners, and it should be the smallest unit that will stimulate a large amount of designing and planting.
2. It should be for public, not private, benefit. Therefore, front yards may be designed in street plans, but not back yards, except for corner and vacant lots where screening of unsightly objects may be necessary.
3. A reasonable guarantee must be furnished before the plan is made, that a definite sum of money will be spent, if the plans are acceptable, and adequate provision must be made for maintenance.

Some results of landscape extension.

At the end of its second year, the Division of Landscape Extension at the University of Illinois had 5,200 pledges "to do some permanent ornamental planting within a year." The signers were then asked to tell how they had kept their promises. The number who replied were 991, or 19 per cent of the signers. Of these, 206 spent nothing, while 785 spent a total of $75,117 (not including labor), the average being nearly $76. The mean expenditure of those who spent over $100, was $392. This class is composed of persons who can afford the services of a landscape gardener. The mean expenditure of those who spent less than $100 was $22. This represents the general public which commonly thinks that it cannot afford the services of a landscape gardener. The average expenditure ($22) is about five times as high as expected. Not all of this planting was due to the influence of landscape extension, for many persons had determined to plant something before they heard a lecture or read a circular. In such cases, the extension service often influenced the people to choose more appropriate plants and arrange them in better ways than they could have done without state aid or with commercial aid.

Relation to private landscape gardeners.

Obviously, landscape extension should develop in harmony with the principles laid down by the American Society of Landscape Architects for the elevation of the profession. It is a general policy for universities to show no favoritism and therefore always to suggest two or more men competent to do any particular piece of work.

Relation to nurserymen.

Landscape extension should be in sympathy with the ideals of the American Nurserymen's Association, so far as they agree with educational and professional standards. Incidentally, the propaganda creates much business for nurserymen, but its prime purpose is education. Therefore, when persons submit plans in the gardenesque style made by nurserymen, and ask for criticism, landscape extension workers should inform both parties simultaneously that the naturalistic style is considered superior to the gardenesque by the profession, and should furnish, on request, a list of landscape gardeners practising in the state. When prices are habitually excessive, the nurserymen, at least, should be informed. A university cannot recklessly promote mere quantity in planting; it must stand for quality and fair play. Landscape extension generally deals only with permanent materials, leaving to other agencies the promotion of temporary plantings, as well as fruits and vegetable-gardens.

Historical note.

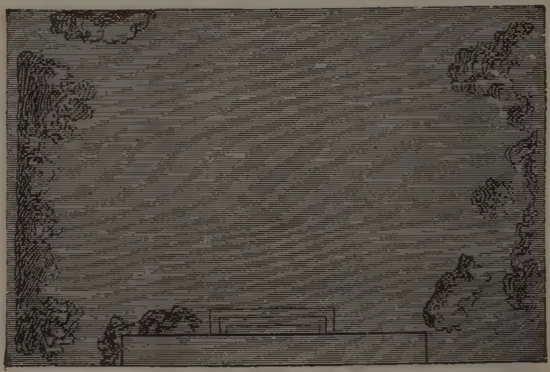
The phrase "landscape extension" was used officially in February, 1914, at the University of Illinois. Prior to that, university extension work in landscape gardening had been undertaken in several states, notably in Massachusetts, but incidentally to regular teaching. The first state to employ a man to give his entire time to landscape extension was Illinois, where the work was begun in October, 1913. It is organized under the Department of Horticulture. Since then full-time workers have been engaged in Massachusetts, Iowa, New York and elsewhere.

WILHELM MILLER.

Lawns and lawn-making in landscape planting.

For most persons the word lawn bears a vague meaning, compounded of their recollection of grass-covered spaces dotted over with trees and shrubs, and of broad areas covered simply with closely mown turf. Both are correct impressions: but the more important feature is that a lawn shall be an open area of grass space (Figs. 2104, 2105). Many exceptions or additions to this definition may, however, be admitted. A great white oak, for example, rugged and picturesque against the evening sky, needs only to be seen to furnish an ample excuse for its retention on any lawn. But this would be a happy chance, not affecting the principles which should govern the construction of a lawn on an open area.

It may readily appear that the lawn will, as originally designed, prove too sunny or too strongly wind-swept over its extended expanse; but the remedy for this will be found to lie not so much in planting single trees or detached groups of trees over the uncovered area, as in extending limbs, points, promontories and peninsulas of trees or trees and shrubs directly out from the main body of bordering plantations which will usually frame the lawn and the different pictures that will appear in any properly unified scheme of landscape gardening. The art of the designer will display itself in determining the relative sizes of the lawns and these inclosing or framing plantations. A careful eye must, of course, be given to the individuality of the lawn itself, which should never be allowed to run over into the neighboring plantations. A like principle applies to all kinds of art—it is fundamental and vital in its character. The reader may fancy that its application would tend to limit the beauty of landscape gardening by eliminating certain features of natural beauty, such as trees, shrubs, and beds of flowers, but if he will look at an open lawn with discerning and sympathetic eyes, he will find that the "moving cloud-shadows, waving grass, rich patches of dark and light green, studded with the starry radiance of the humble flora of the grass, and the hundred incidents of blazing or subdued color and form that appear on the surface of an open meadow," need no added beauty of tree or shrub to perfect their nearly unapproachable loveliness. So important does the writer consider the essential and peculiar beauty of the lawn as distinguished from that of any other part of the home domain, that he always feels inclined to term it the true focus of the picture, the central point of interest in any landscape gardening design.



2104. Ground-plan of a nature-looking grass space, showing relative importance of lawn and planting

This being the case, it behooves us always literally to leave no stone unturned or clod of earth untilled and unfertilized in order to secure a satisfactory open lawn. Did the reader ever see such an one? Let him answer frankly to himself whether he has or has not seen a lawn which showed no traces of quick-grass and other early weeds in July, nor any summer grass and later weeds in August and September,—above all, a lawn which would stand a protracted drought without artificial watering. Very likely he will think it is impossible to make such a lawn under the conditions of soil and climate which each and all of us are apt to believe specially characteristic of the spot of ground on which we live. Perhaps, on the other hand, he will declare that he has seen such a lawn in some remote place, but if we question him, ten chances to one we shall find that his observation of this exceptional lawn is limited—that he has not wintered and summered near it, or seen it during its periods of "storm and stress." The writer knows one place where such a lawn can be seen, and he refers to it, not because it is properly a lawn, for it lacks the requisite framing plantations; but it is perfect in the first essential of a good lawn—it is a piece of perfect lawn grass. A brief description will show how this standard of excellence was reached. The lawn consists of small patches of grass turf on a private farm in Manchester, Connecticut. Each patch was worked and turned over with various ingeniously contrived hoes, forks and rakes until the last lurking weed was removed that could be found by dint of skill and untiring patience. The soil was that of an old garden, and naturally good. It was tilled in the most thorough manner and not fertilized at all, for fear new weeds be introduced. Then, in this mellow and receptive medium, were set cuttings or joints of the hardiest and most luxuriant varieties of grasses which had been discovered by months and even years of keen and intelligent search in the old meadows of both the Old and the New World from Austria to Australia. The result is an elastic firmness, an endurance, depth and richness of the turf which suggests to the tread the deep pile of some Eastern carpet woven in a hand-loom.

But all can not attain this standard on their lawns. For those who do not look higher than the ordinary standard—and even this is none too often desired, or even understood, by the general public—the following directions for lawn-making may be given:

1. The lawn should be carefully graded, either convex, level or concave, in such comparatively long, suave and graceful lines as will accord with the peculiar conformation of the ground (Fig. 2106).

2. Plow, harrow or spade, and fork the soil of the lawn to a depth of 2 feet, if possible, and keep removing the stones and burning the gathered rubbish for several weeks, or as long as you can persuade yourself to do it, or pay anyone else to do it; with the full assurance that no matter how much you do, you will not be likely to destroy all the weeds and win the very best possible results.

3. Enrich the soil by a covering of still richer mold. Next to this in efficiency are bone-dust, lime, superphosphate, nitrate of soda, and nitrogenous manures like ground flesh and bone mixed in proportions suited to the special soil, which may vary materially in a distance of a few hundred yards. The usual proportions are one ton to the acre of ordinary artificial fertilizers, such as superphosphate of lime and bone-dust, or fifteen to twenty-five of well-rotted stable-manure. If artificial fertilizers are not available, then take cow-manure, sheep-manure, or last of all, because it is the most productive of weeds, ordinary stable-manure. These natural manures are, after all, the best, save for their weed-bearing qualities. They will need composting with several times their bulk of good soil and even spreading and harrowing or raking in throughout the surface of the lawn.

4. For turfing, the cleanest grass seed that can be obtained at any price will be found the best in the end. The bulk of this seed should be Kentucky blue-grass or June-grass (*Poa pratensis*) mixed with red-top or herd's-grass (*Agrostis alba* var. *vulgaris*), or *Agrostis canina*, the Rhode Island bent-grass. The advantage of using several kinds of grass is that the first-comers hold possession of the ground against incursions of weeds until the stronger but slower-growing Kentucky blue-grass gets complete roothold, when, in the struggle for life, the earlier growths of grass, being weaker, go to the wall and are crowded out of existence. How fine this blue-grass may become under favorable conditions it will be needless to point out to those who have seen the grass meadows of Kentucky.

2105. An open area of grass space.

5. On a calm day the seed should be sown evenly over the lawn surface—a task which can be well done only by much skill and experience. The ground will then need careful raking with a fine-toothed iron rake, and rolling with an iron roller, the heavier the better. In very dry weather or very windy weather it is hardly worth while to sow grass seed.

6. As soon as the grass has grown 3 or 4 inches, cut it first with a scythe and afterward with the lawn-mower, in order to secure a good thick-set turf. Every spring, and oftener if wet weather prevails, a compacting with the iron roller will serve a good purpose. Fertilizing on the top of the lawn in the winter is always in order, provided the remainders of rubbish from the stable-manure that may be used be removed early in spring before the grass starts.

7. The last and perhaps the most important care to be given the lawn in the process of its establishment is the weeding of the first summer. The next is the weeding of the second summer—and the third is the weeding at any time it may need it, no matter how many years may have elapsed since its construction. The onion-patch and the flower-garden need no more weeding than the lawn, if for no other reason than because the use and beauty of either onion-patch or flower-garden can never, combined, equal those of the home lawn. In it, skill and patience and the love of beauty find abundant reward.

Samuel Parsons.

Lawns for the South.

For many years handsome lawns in the South were a rarity, and it was the impression, generally, that good lawns were not possible in that region. Unfortunately, many kinds of grasses not suited to certain sections of the South were sown. Being unadapted to the soil and climate, consequently failure followed.

By careful and judicious selection of the hardier varieties of grasses, and a proper and careful blending of them, beautiful lawns are now possible in almost every part of the South, but, to be successful, the soil must be properly prepared and fertilized. Most of the southern soils contain an excess of acidity, and, therefore, this must be corrected by an application of lime. This should be used at the rate of 1,000 to 3,000 pounds to the acre, and should be evenly distributed over the area to be treated. Soils lacking in humus should have this deficiency supplied by the following treatment: Cowpeas, soy-beans and velvet beans should be sown in the spring, and crimson clover in the fall, and when matured, cut and allowed to lie upon the ground for a few days, then chopped up fine with a cutaway harrow, and properly turned under, so that none of the stems and roots remains on the surface. Apply a good high-grade fertilizer, bone-meal, sterilized sheep-manure, or a material containing a high percentage of phosphoric acid, nitrogen and potash. Apply at the rate of 500 to 800 pounds to the acre. This should be thoroughly incorporated with the soil. In the spring, previous to preparing a lawn for fall seeding, thoroughly rotted barnyard manure can be used. The only objection to barnyard manure is the risk of bringing foreign weeds and grass seeds into the lawn. Before putting in the seed, the ground must be very carefully graded and raked smooth. Seeding should be done at the rate of fifty to one hundred pounds to the acre, according to the varieties used. Rake in the seed lightly and then roll. Never attempt to sow grass seed on a windy day. In the spring a top-dressing of bone-meal should be applied.

Mow the lawn regularly. Water when needed, but apply so it will fall lightly on the ground. Many lawns are ruined by applying the water with too great force.

2106. An easy grade for a lawn.

For the extreme South, Bermuda-grass (*Cynodon Dactylon*), St. Augustine-, Charleston-, or goose-grass (*Stenotaphrum secundatum*) are the best. About Miami, Fla., a fine-leaved form of Korean lawn grass, *Osterdamia matrella* (*Zoysia tenuifolia*) is very successful, withstanding drought well. The Bermuda is a plant of trailing and stoloniferous habit. It is a native of India. It is widely disseminated throughout the South and is a most valuable and reliable grass for pasture. Unfortunately, with the first approach of frost it turns brown and does not present an attractive appearance during winter.

When it is not desired to tear up a Bermuda lawn, it can be given a bright and cheerful aspect during winter by first cutting the Bermuda-grass very close, then scarifying same with a rake or small cutaway harrow, the blades set straight so as not to turn up the lawn, applying a liberal amount of bone-meal and sowing a good lawn grass adapted to the locality. Rake this in and roll.

A Bermuda-grass lawn can be made by cutting the roots in short lengths, chopping with a hatchet, or passing roots through a feed-cutter, and sowing the roots broadcast, and plowing in lightly; or the uncut roots may be planted in furrows, same covered to a depth of 4 inches, the ground then leveled and rolled. The roots may be planted in autumn, or from February until May, but, when they are planted late, care must be taken that the roots are not exposed to the sun so as to dry out. The Bermuda-grass will give excellent results if kept well enriched and frequently mowed. It adapts itself to almost any soil, except that which is extremely wet.

The St. Augustine-grass is an early-growing perennial plant, with flat or channelled leaves. It is found naturally in the pine-barren swamps and ponds from Florida to North Carolina, and it is well adapted to the sandy soil of the coast, even those which are commonly termed "salt-water lands." It is, therefore, of unquestionable value for such localities. This grass is grown from rootlets, planted in rows a few inches apart, but, to get the best results, the soil must be well prepared and fertilized. It requires frequent applications of the lawn-mower. It is a coarse grass, but has a good color and adapts itself to soils where few other grasses are possible.

Joint-grass (*Paspalum distichum*) is a native of the South and is usually found in moist or low grounds. It can be utilized in soils that are too wet to suit Bermuda, but, at best, makes an indifferent lawn, as it is of low creeping and not sufficiently dense habit.

For the middle sections of the South, some good mixtures of the different hardier grasses, thoroughly tested, have been made, and when the ground has received the proper preparation, satisfactory results have been attained.

For the upper or mountainous sections of the South, blue-grass and many of the mixtures of the hardier grasses are very successful. L. A. Berckmans.

LÁNSIUM (from the Malayan name *lansa* or *lanseh*). *Meliàceæ.* A small group of oriental trees, of which one species is cultivated for its edible fruits.

The genus is allied to the umbrella tree (Melia) grown in the S. U. S., and the tropical mahogany (Swietenia). Lvs. imparipinnate: fls. produced in axillary panicles; sepals 5, petals 5, the 10 stamens formed into a tube: fr. a berry, 5-celled, each cell containing 1 or 2 seeds.—Species about 4, in India and Malaya.

doméstieum, Jack. Langsat. Lansa. Lanseh. Lanzon. Ayer Ayer. A medium-sized, rather slender tree, native of the Malayan Archipelago: lvs. with 3 or more pairs of elliptical to obovate, alternate, shortly petiolulate lfts., about 4–6 in. long and 2–3 in. broad: fr. globose or ovate, 1–1½ in. long, calyx persistent, the sepals small, dry, brownish; seeds 1 or 2 developed, remainder usually aborted, of variable size, oval; testa membranous.—The langsat is frequently seen in the markets of Manila, Canton, Singapore, Penang, and other cities in that part of the world. The round to oval frs. are borne in clusters, and are not unlike loquats in general appearance, except that the color is a dull straw or brownish yellow, and the thick leathery skin, which does not adhere to the flesh, is pubescent on the surface. The flesh separates into 5 or less distinct segms. like those of an orange, and is white, translucent, very juicy, and of a subacid pungent flavor, sometimes tasting slightly of turpentine, especially if the thin membrane which surrounds the segms. gets into the mouth. It is eaten fresh or prepared in various ways. Ward wrote that the langsat "is by many reckoned the finest fruit in the peninsula. The month of July is the season at Malacca when it is had in the greatest perfection." Its season extends to Sept. A variety known as "duku" or "doekoe" is larger than the type, and considered much the better of the two. Both the duku and the langsat are commonly planted in gardens, and spring up along the roadsides. They have recently been planted in S. Fla. and the W. Indies. The duku is produced in smaller clusters than the langsat, and is spherical in form, varying from 1–2 in. diam. The skin is about ⅛in. thick, leathery, dull brownish yellow in color, covered with a thick grayish pubescence. The flavor is very pleasant and refreshing, scarcely comparable to that of any temperate fr. The seeds retain their vitality for some time, if not allowed to become too dry, and germinate readily when planted in light, loamy soil. Seed prop. is the only method known to be employed in Malaya. F. W. Popenoe.

LANTÀNA (old name, once applied to a viburnum). *Verbenàceæ.* Mostly shrubs or undershrubs, sometimes half-climbing, with opposite or verticillate rough dentate leaves, and spikes or cymes of small verbena-like flowers; one species or group much grown by florists, and a few others sometimes planted.

Plant scabrous, hirsute or pubescent: fls. small, red, orange, white or otherwise, in dense spikes or heads, gamopetalous, the calyx very small, the corolla somewhat irregularly 4–5-parted but not bilabiate, the corolla-tube slender; stamens 4, didynamous, attached midway in the tube, included; ovary 2-loculed, becoming a fleshy or dryish drupe with 2 nutlets: bracts subtending the head often imitate an involucre. Verbena differs in having achene-like nutlets and long-tubular 5-

toothed calyx.—Species probably 50, mostly in Trop. and Subtrop. Amer., but also in the Old World. Lantanas have been long in cult., and it is difficult to refer the garden forms to botanical species. The species themselves are confusing. Most of the garden kinds are of the *L. Camara* type. There are several camara-like species which probably have hybridized to produce these forms; but Voss regards these species as only forms of *L. Camara* (preferring, however, to use the name *L. aculeata*). Accepting *L. Camara* in Voss's sense, the garden lantanas may be said to be derived from that species; and this view is adopted below. In recent years, a strain of very dwarf varieties has become popular as border plants. The lantanas are free-flowering in winter and summer, but an odor of foliage and flowers that is disagreeable to many persons prevents them from popular use as cut-flowers. They are very useful in window-gardens and the dwarf kinds make good subjects for hanging-baskets. From the window they may be transferred to the open in summer, where they bloom profusely.

The culture of the florists' lantana is relatively simple. It is grown under glass for bloom in cold weather and also in the open in summer. It has been improved in its usefulness as a bedding-plant of late years, largely through the efforts of French hybridists. The older varieties were mostly rather tall and lanky, later in coming into bloom, and dropped their flowers badly after rain-storms, but were showy in warm and dry weather. The new varieties are dwarf, spreading and bushy in habit, early and free-flowering, and the heads or umbels of bloom average much larger, with florets in proportion; nor do they drop from the plants as did the old varieties in bad weather. These newer kinds are not so well known as they should be. They are very desirable for any situation where sun-loving bedding plants are used, in groups or borders, window-boxes, baskets and vases.—The lantana is not particular as to soil, provided the exposure is sunny, and also that the soil is well supplied with moisture at least until a fair growth has been made. When well established the plants do not seem to mind drought, and continue bright and attractive in the hottest weather. They should not be transplanted out in the open before danger of frost is over. If the old plants are wanted for propagation, cut them back and transfer to pots early in September, and when they start into new growth the soft wood will furnish cuttings that root easily. Keep young stock in a warm position through the winter months, and repot in April.—Save the old plants, after frost has nipped their freshness late in autumn, prune severely back, remove them indoors, giving them a temperature anywhere above 40°, and with a little attention and fresh soil, every plant will be a perfect specimen, covered with blooms in May. Gardeners train them into fine standards, as prim and shapely as need be. Among the French varieties are very dwarf spreading growers, about 8 inches high. (Grove P. Rawson.)

A. *Plant mostly spiny (at least when wild): fr. juicy.*

Càmara, Linn. (*L. aculeàta,* Linn.). Fig. 2107. Small shrub, 1–4 ft. high, hairy, sometimes with short hooked prickles: lvs. rather thick, rugose, scabrous above but pubescent beneath, ovate or cordate-ovate, mostly short-acuminate, crenate-dentate, the petioles short: clusters of fls. on strong axillary peduncles which may or may not exceed the lvs.; fls. in a dense, nearly flat-topped head, usually opening yellow or pink but changing to orange or scarlet, the bracts narrow and not conspicuous. Trop. Amer., extending north to Texas and S. Ga. B.M. 96. L.B.C. 12:1171 (as *L. scabrida,* Ait.).—In the wild, the plant may grow 10 ft. high, and it is usually prickly (hence the name *L. aculeata* of Linnæus). The cult. plant is less prickly or even unarmed. Color of fls. varies on different plants, and there are many named forms. This group is now a prominent plant in many tropics. It is possible that more than one species is involved in the following forms. *L. hýbrida* is a name for the dwarf garden forms. *L. Píctavi* is a hybrid between *L. Sellowiana* and a garden form.

Var. **nívea,** Bailey (*L. nívea,* Vent.). Fls. white, the outer ones becoming bluish; heads rounder. B.M. 1946.

Var. **mutábilis,** Bailey (*L. nívea* var. *mutábilis,* Hook.). Remarkable for the change of color in the nearly globular heads: in little more than a day, the fls. may change from white through yellowish, lilac, rose and blue. The outer fls. open white and run through yellowish, rose and lilac; the inner ones open yellowish. B.M. 3110. R.H. 1852:461.

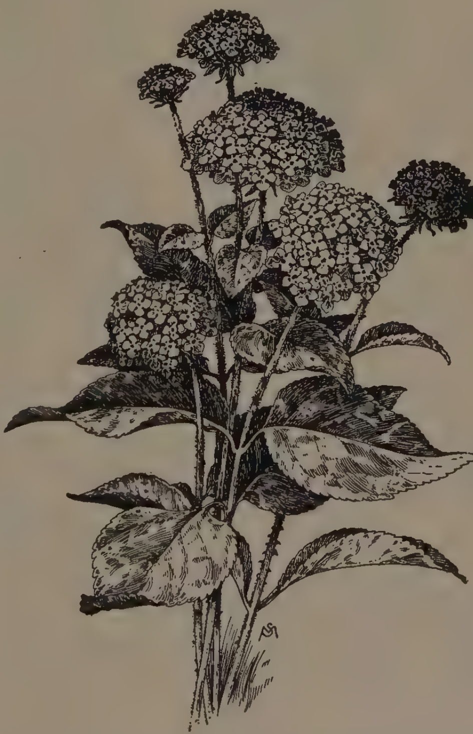
Var. **místa,** Bailey (*L. místa,* Linn. Not spelled *mixta* by Linnæus, although it is so spelled by later authors). Outer fls. opening yellowish and becoming saffron and brick-red; inner fls. yellow, changing to orange. Said to be distinguished by numerous recurved prickles on the branches.

Var. **cròcea,** Bailey (*L. cròcea,* Jacq.). Fls. opening sulfur-yellow and changing to saffron. R.H. 1852:461.

Var. **sanguínea,** Bailey (*L. sanguínea,* Medikus). Fls. opening saffron-yellow, changing to bright red.

AA. *Plant not spiny: fr. either juicy or thin-fleshed.*

lilácina, Desf. Particularly recommendable in S. Calif. for its upright panicles of rosy lilac shining berries, which persist through the winter: erect, with spreading 4-angled hirsute branches: lvs. opposite, ovate to oblong or lanceolate-triangular-acute, the base rounded or slightly cordate, crenate, hairy-scabrous above and velutinous beneath: fls. rose-lilac with yellow throat: berry succulent. Brazil.—The *L. purpurea* of Cyclo. Amer. Hort., 1900.

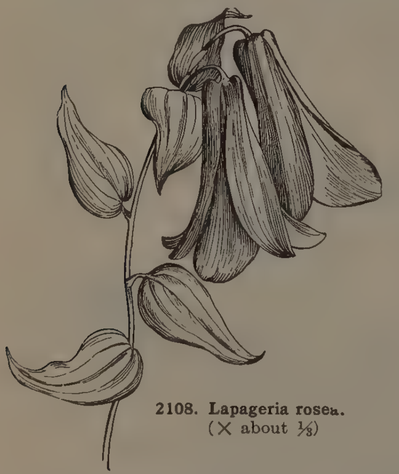


2107. Lantana Camara. (×½)

salvifòlia, Jacq. (*L. salviæfòlia,* Mey.). Erect, much branched, aromatic, unarmed, 3–6 ft., pubescent on young parts: lvs. opposite or in 3's or 4's, short-petiolate, oblong-ovate, rounded or subcordate at base, obtuse or somewhat acute, crenate-serrate, pubescent, punctate-glandular: fls. lilac or pink in a subglobose or cylindric peduncled axillary spike; calyx tubular, not ribbed, but more or less distinctly 4-nerved, obscurely 2-lobed or 4-toothed; corolla-tube straight, slightly dilated about the middle, pubescent above on outside but glabrous within, ¼–½ in. long: fr. a purple subglobose drupe with sweet edible pulp, used for food in Zululand in times of scarcity. Trop. and S. Afr. *L. salviæfolia*, Hort.(?).

trifòlia, Linn. (*L. ánnua,* Linn.). Half-shrubby, hairy: lvs. ovate-lanceolate or elliptic-oblong, pointed, crenate-dentate, in 3's or 4's: heads becoming ovoid or oblong, the involucre not conspicuous; fls. rose-lilac varying to white, with yellow throat: fr. rather pulpy, showing well amongst the bracts. Trop. Amer. B.M. 1449.—The name *L. annua* seems to have been applied to young plants, on the impression that they were annuals. The picture of *L. annua* in B.M. 1022 is quite as likely to be a form of *L. Camara.* Little known in cult.

Sellowiàna, Link and Otto (*L. delicatíssima,* Hort.?). WEEPING OR TRAILING LANTANA. Twiggy, slender plant with lopping or trailing pubescent branches: lvs. small, ovate, tapering below, close-toothed: fls. small, in long-stalked small heads, rosy lilac, the outer bracts or scales of the involucre broad-ovate and hairy and half or less as long as the slender pubescent corolla-tube. S. Amer. B.M. 2981. B. 3: 115. R.H. 1852: 461 (?).—A very profuse bloomer in both winter and summer, and most desirable for pot or basket cult. Should be better known. Verbena-like. The plant seems to be an escape in Fla.



2108. Lapageria rosea. (× about ⅛)

involucràta, Linn. Low, much-branched bush, with obscurely 4-angled gray branches, and blunt, ovate, small, crenate-dentate lvs.: fls. small, nearly or quite equaled by the ovate involucre-bracts. Trop. Amer., reaching north to S. Fla. and S. Texas.—Said to be occasionally cult. indoors for the light lilac or white fls.

L. H. B.

LAPAGÈRIA (from a personal name, probably for the Empress Josephine, *née* Tascher de La Pagerie). *Liliàceæ.* CHILEAN BELLFLOWER. A single species, a noble, half-hardy evergreen twiner, allied to the smilaxes, considered to be one of the choicest subjects to grow under glass.

Leaves alternate, lance-ovate or cordate-lanceolate, 3–5-nerved, acuminate: fls. large and showy, bell-shaped, hanging singly from the upper axils or somewhat racemose at the end of the vine, about 3 in. long; stamens 6, borne on the torus or slightly attached to the base of the inner segms., shorter than the perianth; ovary sessile and 1-loculed, with 3 parietal placentæ, ripening into a 3-angled, oblong, fleshy, indehiscent, berry-like beaked fr. and bearing nearly globular seeds imbedded in the pulp. **L. ròsea,** Ruiz & Pav., is the only species. Fig. 2108. It has rose-colored or rose-crimson fls., with lighter spots. Chile. B.M. 4447. F.S. 5:491; 20:2059–2060. R.H. 1850:101. Gt. 47, p. 101. G.C. III. 20:657 (frs.); 25:45. Gn. 34, p. 321; 48, p. 475; 49:174; 55, p. 57. G. 1:557; 18:626; 34:753. G.W. 14, p. 328. H.F. II. 6:40. Gng. 5:356. Mn. 7:191.—The species is variable in vigor, floriferousness, size, color and substance of bloom, and there are a number of named horticultural subvarieties. Var. **albiflòra,** Hook. (var. *álba,* Hort.), has white or whitish fls. B.M. 4892. R.H. 1852:441. F.S. 20:2059–2060. Gn. 41, p. 53; 49:174 and p. 175; 54, p. 277. J.H. III. 61:349. G.W. 10, p. 8. G. 2:387; 5:409; 17:271; 32:335. F.S.R. 2, p. 221. A.G. 13:745. Gng. 2:187; 5:356. Var. **supérba,** Hort. Fls. large, brilliant rich crimson. Var. **Ílsemannii,** Hort. Fls. larger and more brightly colored than those of the type itself: vigorous and free-flowering. Gt. 46:1445. Var. **Bénsonii,** Hort. Fls. of lighter tint than those of type, especially in interior of the perianth. Var. **gattoniénsis,** Hort. Much like the type. A double-fld. form of the white variety is shown in G. C. II. 17:777.

Lapagerias are tall-twining plants, suitable for rafters or walls in coolhouses, or for culture in the open in the milder parts of the country. They are commonly propagated by cuttings and layers, but strong plants may be secured from seeds, although varieties may not come true. The first live plants were introduced into England in 1847. Lapagerias should be seen more frequently in America. They are considered to be not easy to grow, and a good display is usually regarded as an evidence of skill. Franceschi says that in California the plant prefers shady places "where the atmosphere will never become too dry."

Lapageria rosea and *Philesia buxifolia* have been hybridized by Veitch, producing a plant known as *Philageria Veitchii,* Mast. (G.C. 1872:358). Philesia afforded the pollen. It is not in the American trade, but is a most interesting hybrid. For an anatomical study of it, bearing on problems of hybridity, see J. M. Macfarlane, Trans. Roy. Soc. Edinburgh, 37, pt. 1, p. 207 (1892).

L. H. B.

Lapageria rosea and var. *albiflora* should occupy a position in all cool greenhouse collections. We have no cool greenhouse twining plants that can be compared with them. They can be grown in large pots, trained on a trellis as specimen plants, or if for cut-flowers, they may be planted out on a bench or in a border. Strict attention must be paid to drainage, and the soil must not get into a "sour" condition.—Layering is the best way to propagate lapagerias. When a shoot gets somewhat bare of foliage, it may be twisted backward and forward in a box near where the plant is growing. The box should be filled first, with sand and fine peat, in equal proportion, to the depth of about 3 inches. Peg the shoot to keep it in position and cover with some of the compost. If there are leaves on the shoot, cover them only about one-third. Keep the soil moderately moist; and in time growths will start from the joints, which after a while will throw out roots, and when a sufficient number are formed to support the plants, separate them from the stem and place them in pots large enough to receive the roots without breaking them. The potting material should be one part fiber of loam, out of which all the fine loam has been shaken, one part osmunda fern root (osmundine), one part charcoal, and one part sharp sand. Water carefully until they get a good hold on the compost, after which they may be kept moderately moist.—Lapagerias require to be at all times shaded from the sun, and kept in as cool a temperature as possible. A north house, from which the frost is kept, is an ideal position. If the plants are to be grown in pots, they must be shifted into larger pots before they get too well rooted. This will encourage strong breaks to start from the bottom. These shoots, as soon as they emerge from the soil, should have a piece of cotton-wool twisted around them, for if there are any snails nearby, they will be sure to eat the tender tops, which will ruin the plants. A few stakes should be placed around the pot, to which to tie the shoots, until such time as the plants are big enough to train on the permanent trellis. Be sure to tie them in a regular way, as they will be easier untwisted when the time arrives for their removal.—If lapagerias are intended to be planted on a bench or in a border, they should be well established in pots first. Do not fill all the bench or border at once; it is better to supply only enough material to last for one season, adding a little each year as they require it. The compost should be same as advised for potting, and it should be in rather a lumpy state, as lapagerias do not thrive in any soil of an adhesive nature. The bench or border should be well drained, so that the water may pass through freely, copious supplies being necessary when they are in active growth. After they are well established, treat with manure-water as advised for ixoras. Insect pests may be destroyed by fumigating with hydrocyanic gas in cool weather, and a free use of the syringe at all times. (George F. Stewart.)

LAPEYROÙSIA (Jean François Galoup de Lapeyrouse, distinguished French naval officer, born 1741). *Iridàceæ.* African bulbs, something like freesias, but with mostly blue or red flowers, produced in summer instead of spring.

Corm with matted tunics or coverings, flattened at the base: lvs. usually only 1 or 2 to each st. (sometimes several), very narrow, in some cases nearly terete, distichous: peduncle mostly branched; fls. small, red to white and yellow; perianth-tube subcylindrical, long or short, somewhat dilated upward; segms. nearly equal, spreading, oblong-lanceolate; stamens inserted in the throat; ovary 3-celled: fr. a small caps., oblong or globose, loculicidal.—Species about 50 in Trop. and S. Afr. By dealers they may be listed under the name of Anomatheca, which Baker has reduced to one of the 3 subgenera of Lapeyrousia, characterized by having several lvs. forming a 2-ranked basal rosette, accompanied by a long, branched st. Lapeyrousia is further distinguished from Freesia by having a more slender perianth-tube, with the stamens inserted at the throat instead of below; also by the ovules being more regularly superposed instead of crowded together. The species of Lapeyrousia have an egg-shaped or globose corm about ½in. thick, and matted with tunics: lvs. linear or sword-shaped: infl. various, often a loose, 1-sided, more or less zigzag spike, as in Freesia; fls. variously colored, 1–2 in. across; perianth-tube long or short; segms. spreading, 3 larger than the other 3.

Some of the lapeyrousias can be grown outdoors in the North with some winter covering, and are said to be quite hardy south of Washington, D. C., if planted deep. These plants will probably never have anything like the degree of popularity enjoyed by freesias, because of their later season of bloom and lack of fragrance. Probably the most popular kind is *L. cruenta,* which grows 6 to 10 inches high, blooming in summer and fall. In a sheltered place and in light, porous soil it generally succeeds in the North without any protection, but the bulbs are safer in very severe winters under a covering of litter or straw. The bulbs increase rapidly, and should be divided every few years before they become too crowded.

A. *Color of fls. chiefly blue or violet.*

corymbòsa, Ker. (*Ixia corymbòsa,* Linn. *Anomathèca corymbòsa,* Hort.). This belongs to the subgenus Ovieda, having usually 1–2 basal lvs., while the next 3 species belong to the subgenus Anomatheca, having more numerous lvs. *L. corymbosa* has 1 basal lf. which is spreading, sword-shaped, 4–6 in. long: infl. a dense flat-topped cluster of as many as 15 fls., each about 1 in. across, with practically regular segms., blue, with a star-shaped white figure near the throat, outlined in black after the fashion of Quedlinburg phlox. S. Afr. B.M. 595. J.H. III. 32:379.

AA. *Color of fls. red, with 3 darker spots at the base of the 3 smaller segms.*

B. *Size of fls. 2 in. across.*

grandiflòra, Baker (*Anomathèca grandiflòra,* Baker). Lvs. 1 ft. or more long: fls. bright red; stamens as long as the segms.; the 3 style-branches each 2-cut. Zambesi S. B.M. 6924.—A newer species than *L. cruenta,* and perhaps destined to greater favor. Corm globose (ovoid in the others here described).

BB. *Size of fls. 1 in. across.*

cruénta, Benth. (*Anomathèca cruénta,* Lindl.). Lvs. ½–1 ft. long: segms. bright carmine; stamens less than half as long as the segms.; the 3 style-branches uncut. Transvaal, south. B.R. 1369. L.B.C. 19:1857. P.M. 1:103. J.H. III. 31:397.

júncea, Pourr. (*Anomathèca júncea,* Ker.). Lvs. strap-shaped (linear in the 2 preceding species), 6–8 in. long: segms. pale red or rosy; stamens half as long as the segms. Coast region, S. Afr.—Less known in cult. than the others.

WILHELM MILLER.

LAPÓRTEA (François L. de Laporte, entomologist of the nineteenth century). *Urticàceæ.* Perennial herbs, shrubs, or trees, a few species of which are sometimes grown in glasshouses for the showy foliage or fruits.

Leaves alternate, often large and variously colored, mostly dentate: fls. monœcious or diœcious, clustered in loose cymes, small and inconspicuous; sterile fls. with a 4–5-parted perianth (or separate sepals), 4 or 5 stamens, and rudiment of an ovary; fertile fls. with 4 sepals or 4-lobed perianth, the 2 outer usually much smaller: fr. an ovate or oblique compressed achene.—Species 40–50, widely scattered, mostly of tropical countries; one *L. canadense,* reaches to Canada. They are provided with stinging hairs, and must be handled with caution. The horticultural species are prop. by seeds, and also by cuttings started in heat. The generic name Laportea is retained in the "nomina conservanda" of the International Code as against Urticastrum.

Three species-forms appear to be best known in cult., as follows: **L. Schómburgkii,** Bull. Ornamental-lvd. plant (usually known as var. *versicolor*) from Polynesia: lvs. large, with fleshy petioles and deciduous herbaceous stipules; blade deep green, with purplish rib and veins, mottled with gray-green and cream-white, sometimes one-half being creamy white. G.Z. 20, p. 145. **L. gìgas,** Wedd. Tree, to 80 ft., India to Austral.: lvs. broadly cordate-ovate, obtuse or short-acuminate, more or less sinuate-toothed, 10–12 in. or more long. **L. moroìdes,** Wedd. Shrub or small tree of Queensland: lvs. broadly ovate, 6–8 in. long and nearly as broad, peltate at base, short-acuminate, prominently toothed: fr. mulberry-like, purple, borne beneath the crown of lvs. and remaining for nearly a year. B.M. 7057. Gn. 61, p. 71. Gt. 54, p. 289 (also 49, p. 68 as *L. gigas*). A showy greenhouse plant, worthy of attention except for the virulently stinging hairs.

L. H. B.

LÁPPA: *Arctium.*

LÁPPULA (diminutive of *lappa,* a bur). *Boraginàceæ.* Annual, biennial or perennial herbs, of probably forty species, some of them native in North America. They are related to Myosotis, but lack sufficient horticultural character to bring them into the trade-lists. In the older manuals they are known under the name Echinospermum. The four little nutlets are burs and adhere to clothing, and the plants are mostly weedy in appearance. The flowers are blue or whitish, small, in spikes or racemes.

LARCH: *Larix.*

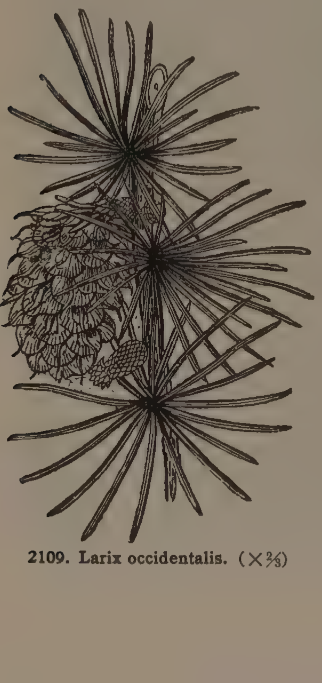
LARDIZABÀLA (after the Spanish naturalist Lardizabal y Uribe). *Lardizabalàceæ.* Two shrubby evergreen climbers in Chile with once- to thrice-ternate lvs.: fls. diœcious, purple-brown; sepals 6, and 6 petaloid nectaries, sometimes called petals; the staminate fls. in pendulous racemes, with 6 connate stamens; the pistillate ones solitary, with 6 distinct sterile stamens and 3 cylindric ovaries, developing into oblong, many-seeded berries. The pulpy edible fr. is sold in the Chilean markets and cordage is made of the fibrous sts. Only the following species, which is similar to the well-known *Akebia quinata* but has short-stalked pointed lfts. in 3's, is cult. in S. Calif. for its handsome foliage and the odd-looking dark-colored fls.; it is readily prop. by cuttings of half-ripened wood under glass. **L. biternàta,** Ruiz & Pav. Lvs. twice ternate or on the flowering branchlets usually simply ternate; lfts. leathery, ovate, acute or mucronate, entire or with 1 or 2 almost spiny teeth, dark green and glossy above, paler and reticulate beneath, 2–4 in. long: staminate fls. about 1 in. across, purple-brown, in a dense, about 15-fld. drooping raceme; the petaloid nectaries lanceolate, white, the pistillate fls. slightly larger, solitary, slender-stalked: fr. oblong, 2–3 in. long. Winter or spring. B.M. 4501. G.C. III. 52:467. Gn. 28, p. 489. J.F. 1:5. B.H. 3:339. P.M. 1, p. 28.

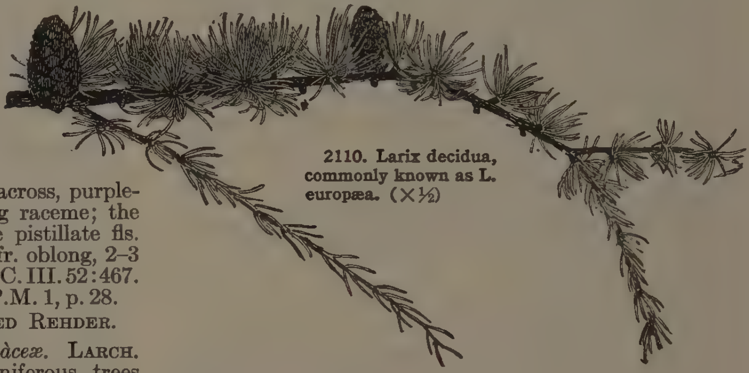
Alfred Rehder.

LÀRIX (ancient Latin name). *Pinàceæ.* Larch. Tamarack. Ornamental deciduous coniferous trees chiefly grown for their bright or light green foliage and regular habit.

Branches whorled, at least while young: lvs. linear, in crowded clusters on short spurs except on the leading shoots where they are spirally arranged: fls. monœcious; staminate fls. small, globose to oblong, solitary, consisting of numerous short-stalked, spirally arranged anthers; pistillate fls. larger, consisting of several or numerous scales, with 2 naked ovules at the base, each scale borne in the axil of a much longer bract: cone with woody, 2-seeded scales, persistent on the axis; seeds with large, thin wings, ripening the first year.—About 10 or 12 species in the colder regions and the high mountains of the northern hemisphere.

The larches are handsome trees of regular pyramidal habit, but in old age becoming sometimes irregular; they are particularly handsome in spring with their light green tender foliage and studded with their usually bright purple pistillate flowers. They are all hardy North except the Himalayan *L. Griffithii*, and are often planted as park trees, chiefly for the light green foliage and the regular conical, or in some varieties pendulous, habit. The most beautiful is probably *L. leptolepis*, with the foliage turning bright yellow in fall, while the others assume only a pale yellow color. They are also very valuable forest trees, especially for the northern and mountainous regions; no forest tree goes farther north than the larch, reaching in North America 67° and in Siberia 72° of latitude. The wood is hard, heavy and very durable, and much used for construction, that of *L. occidentalis* being considered the best of all American conifers. From the European larch turpentine is obtained. The bark contains tannin, and an extract is used for tanning leather. The larch grows in almost any kind of soil, including clay and limestone, and prefers a somewhat moist, but well-drained soil and an open situation; the American larch grows well even in swamps. Unfortunately several insects and fungi prey on the larch, and sometimes do considerable damage, especially the leaf-eating larvæ of some moths. Propagation is usually by seeds sown in spring, and the young seedlings shaded; varieties are grafted on seedlings, mostly on those of *L. decidua* (*L. europæa*), either outdoors by whip- or cleft-grafting or in the greenhouse by veneer-grafting; they may also be increased by cuttings of nearly ripened wood under glass or by layers, but this method is rarely practised.


2109. Larix occidentalis. (×⅔)


2110. Larix decidua, commonly known as L. europæa. (×½)

A. *Bracts longer than the scales: scales numerous, stiff, spreading or recurved after maturity.*

occidentàlis, Nutt. Fig. 2109 (adapted from Pacific R. R. Report). Tall tree, to 150 ft., with dark-colored bark, becoming bright cinnamon-red on older trunks, and with short, horizontal branches, forming a narrow pyramidal head: branchlets pubescent when young: lvs. rigid, sharply pointed, triangular, keeled beneath, 1–1¾ in. long, pale green: cone oblong, 1–1½ in. long; scales orbicular, almost entire, tomentose beneath. Brit. Col. to Mont. and Ore. S.S. 12:594. G.F. 9:497. Gt. 20:685, figs. 8–10. G.C. II. 25:652. B.H. 22:8, figs. 3–5. B.M. 8253. R.H. 1909, pp. 252, 253.

AA. *Bracts much shorter than scales.*

B. *Lvs. with 2 white lines beneath: scales numerous, reflexed at the apex.*

leptólepis, Murr. (*L. Kaémpferi*, Sarg., not Carr. *L. japónica*, Carr.). Tree, to 80 ft., with horizontal branches, forming a pyramidal head: branchlets yellowish or reddish brown, glabrous and glossy; spurs short and globular: lvs. rather broad, obtuse, soft, ½–1½ in., light or bluish green: cones ovate-oblong, ½–1½ in. long, with emarginate, roundish ovate scales. Japan. S. I. F. 1:2. G.C. II. 19:88; III. 40:290. G.W. 8, p. 496. Gt. 20:685, fig. 5. B.H. 22:8, fig. 2.—The handsomest of the larches as a lawn tree. Var. **mìnor,** Murr. (var. *Murrayàna*, Maxim. *L. japónica*, Murr., not Carr.). Dwarfer form with smaller cones. Gt. 20:685, fig. 2. B.H. 22:9, fig. 4. Var. **prostràta,** Beissn., a prostrate form.

BB. *Lvs. without white lines, very narrow: scales erect-spreading, straight or slightly incurved at the apex.*

C. *Scales usually puberulous or finely tomentose, slightly incurved at the apex, numerous.*

decídua, Mill. (*L. europæa*, DC. *L. Làrix*, Karsten). European Larch. Fig. 2110. Tree, to 100 ft., with pyramidal, later often irregular, head: bark dark grayish brown: branchlets slender, glabrous, yellowish: lvs. compressed, triangular, soft and obtuse, bright green, ¾–1¼ in. long: pistillate fls. purplish: cones ¾–1½ in. long, with many almost orbicular scales, usually puberulous, or glabrous on the back, loosely appressed at maturity. N. and Cent. Eu. F.E. 29:117. H.W. 1:3, pp. 108–112. M.D.G. 1908:316, 317. G.W. 9, p. 512. Gt. 20:684, fig. 3. B.H. 22:7, fig. 1. Var. **péndula,** Koch (*L. europæa* var. *péndula,* Lawson. *L. americàna* var. *péndula,* Loud.). With pendulous branches; sometimes confounded with the American larch. Gt. 20:684, fig. 11. B.H. 22:8, fig. 1. Gn. 35, p. 245; 39, p. 84. Var. **fastigiàta,** Koch (*L. europæa* var. *fastigiàta,* Beissn.). Of columnar habit. Var. **virgàta,** Hayek (*L. europæa* var. *virgàta* Hempel & Wilhelm). Branches long and tortuous, very sparingly branched. M.D. 1905:10. H.W. 1, p. 113.—A hybrid of this and the preceding species has been received from Dunkeld, Scotland, and is now growing at the Arnold Arboretum. It is of vigorous growth, but has not yet produced cones.

sibírica, Ledeb. (*L. europæa* var. *sibírica,* Regel, and var. *róssica,* Regel). Tree, to 120 ft., with straight slender st. and rather short ascending branches: branchlets yellow: buds grayish brown and dark brown or nearly black at the base: lvs. linear, 1–1½ in. long: pistillate fls. usually green, sometimes whitish or brownish: cones ovate-oblong, usually 1½ in. long; scales fewer and larger than in the preceding species, finely tomentose on the back, half-spreading at maturity. N. E. Russia to Siberia. Gt. 20:684, figs. 1, 2. B.H. 22:7, figs. 2, 3.

cc. *Scales glabrous, striate, straight at the apex, half-spreading at maturity, usually rather few.*

larícina, Koch (*L. americàna,* Michx. *L. microcárpa,* Desf. *L. péndula,* Salisb.). Tamarack. Hackmatack. Tree, to 60 ft., with horizontal branches, forming a narrow pyramidal head, sometimes broad and open on older trees; bark reddish brown: branchlets slender, glabrous, reddish yellow, often bloomy: buds reddish brown: lvs. like those of the former, but of light bluish green color: cones small, oval or almost globular, ½–¾in. long; scales few to 20, almost orbicular and entire, glabrous. Canada, south to Pa., west to Ill. and Manitoba. S.S. 12:593. Em. 106. Gt. 20:684, fig. 7, 8. B.H. 22:10, figs. 2, 3.

dahùrica, Turcz. (*L. Cajánderi,* Mayr). Tree, to 70 ft., of fairly regular habit while young, old trees usually irregular with wide-spreading branches: branchlets bloomy: buds yellowish brown, darker or nearly black at the base: lvs. linear, about 1½ in. long: cones small, ¾–1 in. long; scales orbicular or ovate, rounded or emarginate at the apex, lustrous, about 20 or more. E. Siberia. Gt. 20:684, figs. 9, 10. B.H. 22:9, figs. 5, 6. Var. **Príncipis Ruppréchtii,** Rehd. & Wilson (*L. Príncipis Ruppréchtii,* Mayr). Cones larger, to 1½ in. long; scales more numerous, truncate at the apex; bracts at least on the lower part of the cone more than half as long as the scales. N. China. G.W. 10, p. 566.

L. chinénsis, Beissn.=L. Potaninii.—*L. Gríffithii,* Hook. f. & Thoms. Pyramidal tree, to 60 ft., with spreading and pendulous branches: lvs. soft, obtuse: cones 2–3 in. long, oblong, with exserted and reflexed bracts. Himalayas. F.S. 12:1267–68. R.H. 1868, p. 371. Gt. 20:685, figs. 1–4. B.H. 22:10, figs. 4–7. G.C. II. 25:719; 26:465; III. 41:130, 131. B.M. 8181.—*L. Kaémpferi* Carr.=Pseudolarix Kaempferi.—*L. Kaémpferi,* Sarg.=L. leptolepis.—*L. kurilénsis,* Mayr (L. dahurica japonica, Regel). Allied to L. leptolepis, to 70 ft.: branches wide spreading; young branchlets deep bluish red, puberulous: lvs. rigid: bracts as long or somewhat shorter than scales. N. Japan. S.I. F. 2:1. G.W. 6, p. 499 (habit).—*L. Lỳalli,* Parl. Allied to L. occidentalis, but lower: young branchlets tomentose: lvs. quandrangular: young cones deep purple, the scales with fringed margin. Brit. Col. to Wash. S.S. 12:595. G.C. II. 25:653; III. 23:357. Gt. 20:685, figs. 11–13. B.H. 22:9, figs. 1–3. M.D.G. 1905:129 (habit).—*L. Mastersiàna,* Rehd. & Wilson. Allied to L. Griffithii. Tree, to 60 ft.: lvs. bright green, ¾–1⅓in. long: cones about 1½ in. long: bracts long exserted and reflexed, gradually narrowed into a mucro. W. China.—*L. olgénsis,* Henry. Allied to L. kurilensis, but scales pubescent. Amurland.—*L. Potanínii,* Batal. (L. chinensis, Beissn. L. thibetica, Franch.). Allied to L. occidentalis. Tree, to 80 ft.: branchlets glabrous: lvs. acute or obtusish, about 1 in. long: cones oblong-ovate, 1–2 in. long: bracts lanceolate, exceeding the nearly orbicular scales; scales spreading at maturity. W. China. G.C. III. 39:178.—*L. thibética,* Franch.= L. Potaninii.

Alfred Rehder.

LARKSPUR: *Delphinium.*

LÀSIA (Greek, *rough* or *prickly,* referring to the aculeate caudex, scape and foliage). *Aràceæ.* Two perennial herbs, woody at the base, allied to Dracontium and Cyrtosperma, not tuberous, with a more or less decumbent caudex, native in E. India, Ceylon, Java, Cochin-China. **L. spinòsa,** Thwaites (*Dracóntium spinòsum,* Linn. *Pòthos spinòsus,* Ham. *Làsia heterophýlla, L. Zóllingerii, L. Jénkinsii, L. Hérmannii* and *L. desciscens,* Schott), is offered abroad. It is a glasshouse subject: caudex about 1¼ in. thick, prickly: petioles 9–18 in. or more long, prickly; blade variable in shape, hastate or entire, or deeply pedately pinnatipartite: spathe 6–10 in. long, the upper part rolled into a tail-like extension, the open or spadix-bearing part short. E. India.

L. H. B.

LASIAGRÓSTIS: *Stipa.*

LASIÁNDRA: *Tibouchina.*

LASTHÈNIA (name of a woman who was a pupil of Plato). *Compósitæ.* Low, slightly succulent annuals, glabrous or only puberulent, with opposite lvs. and numerous inch-wide heads of yellow fls. in early summer: rays 5–15; receptacle conical or even subulate, with projecting points bearing the narrow flattened achenes; pappus none, or of 5–10 scales: involucral bracts making a bell-shaped or hemispherical cup.—Species about 6. Ore. and Calif., and Chile.

glabràta, Lindl. (*L. califórnica,* Lindl. *Hologýmne glabràta,* Bartl.). Height about 1 ft.: lvs. linear or lanceolate, usually 1–4 in. long, some sheathing at base: peduncles long, somewhat enlarged below the erect head; pappus none. Calif. B.M. 3730. B.R. 1780, 1823.—The plant cult. under this name is likely to be *Baeria gracilis,* which see. In Lasthenia the bracts of the involucre are united to form a green cup with toothed border, while in Baeria the bracts are not united.

Harvey Monroe Hall.

LASTRÈA (C. J. L. Delastre, Austrian botanist). *Polypodiàceæ.* A name commonly used in the trade, especially in England, for species of Dryopteris. Also spelled *Lastræa.* On the basis of priority it has no claim to recognition, as it was established by Bory in 1824, while we have Nephrodium, 1803; Aspidium, 1801; Tectaria, 1800; Polystichum, 1799, and Dryopteris, 1763.

The following additional species properly classified under Dryopteris (Vol. II, p. 1078) are in the American trade under the name Lastrea (the combinations are for Dryopteris, not Lastrea):

A. *Lowest pinnæ reduced to auricles: texture thin.*

sáncta, Kuntze. Lvs. 6–9 in. long, 1–2 in. wide on short slender stalks; lower pinnæ very much reduced; under surface glandular. W. Indies.

palústris, Kuntze. Lvs. 2–3 ft. long, 8–12 in. wide, on long straw-colored stalks; lower pinnæ reduced, the upper ¾in. wide, cut down to the rachis into linear-oblong lobes. Brazil.

montàna, Kuntze. Lvs. 1½–2 ft. long, 6–8 in. wide; lower pinnæ greatly reduced to mere auricles; upper pinnæ 1 in. wide, cut into close blunt lobes. Eu., W. N. Amer. A var. **cristàto-grácile** is also cult.

AA. *Lower pinnæ scarcely reduced: texture firm.*

rígida, Kuntze. Stalks stout, densely scaly: lf.-blades 1–1½ ft. long, 4–6 in. wide, oblong-lanceolate, the lower pinnæ not reduced; segms. with mucronate teeth. Eu. Var. **argùta** is native and wild in Calif., and is often considered a distinct species.

lépida, Moore. Lf.-blades 1½ ft. long, 6–7 in. wide, ovate, bipinnatifid or bipinnate, the lower 4 or 5 pairs slightly smaller: indusia hairy. Of greenhouse origin.

Other species cult. under the name Lastrea, as *L. aristàta* and *L. Richardsii*, belong to the genus Polystichum, which see.

L. M. UNDERWOOD.
R. C. BENEDICT.†

LATÀNIA (East Indian name). *Palmàceæ.* Tall, spineless palms, with solitary robust annular trunks.

Leaves ample, terminal, long-petioled, suborbicular, palmately flabelliform, plicately multifid; segms. smooth or spiny on the margins; rachis short; petiole 3-sided, concave above; ligule shell-shaped; sheath short: spadices many feet long, compressed at the base and branches, sheathed with incomplete sheaths; staminate-fld. branches cylindrical, digitately arranged at the ends of the branches, very densely clothed with imbricated bracts; pistillate portion somewhat twisted, few-fld., sheathed with very broad dentate bracts; staminate fls. in tiny pits and half-exserted beyond the bracts, the perianth smooth and shining; pistillate fls. larger: drupe globose, obovoid or pear-shaped, yellow.—Three species of fan palms from the Mascarene Isls. *L. borbonica* is one of the dozen commonest trade names among palms, but the seeds offered under this name are said to be almost invariably those of *Livistona chinensis*. *Latania borbonica* of the botanists is properly *Latania Commersonii*, which has 3-seeded frs., while those of *Livistona chinensis* are 1-seeded. Allied genera are discriminated under *Hyphæne*. G.C. II. 25:75.

Latanias are essentially warmhouse palms and require moderate shading through the greater part of the year, and also an abundance of water. A well-drained and rather light compost is most suitable for them, and if the soil at the time of repotting is of the same temperature as the house in which the plants are grown, there will be less risk of a check to the delicate rootlets. They should have a night temperature of not less than 60° to 65°. As they grow very freely, it is advantageous to plant out if possible. Propagate by imported seeds sown over strong bottom heat. Bone-meal is a good fertilizer for these palms. *L. Commersonii* is a particularly striking palm, the leaf-stems being quite long, smooth, and colored bright crimson, as are also the ribs of its fan-like leaves, this coloring being especially bright on the young foliage. *L. Loddigesii* is the strongest grower of the genus, the leafstalks reaching a length of about 8 feet, usually chocolate-colored and quite glaucous, the leaves thick and leathery and their ribs reddish while young, though never developing such bright tints as those of the preceding species. *L. Verschaffeltii* is also very attractive, though possibly a little more delicate than the other two, its leafstalks being long and rather slender, and orange-yellow in color, the ribs of the leaflets also yellow and the leaves themselves of a light shade of green. (W. H. Taplin.)

A. *Lvs. glaucous.*

Lóddigesii, Mart. (*L. glaucophýlla*, Hort.). About 50 ft. in nature, cult. specimens 10–20 ft.: lvs. 3–5 ft. long, very glaucous, primary veins slightly tomentose beneath, tinged with red, especially in young plants; segms. 2 ft. long, less than 3 in. wide, unequally acuminate, the edges spiny in young plants; petioles 3–4½ ft. (or more) long, tomentose, entire in the mature, spiny in the young plant: spadix 3½–4 ft. long: drupe pear-shaped, 3-angled, 2½ in. long, 1¾ in. thick. Mauritius.

AA. *Lvs. not glaucous.*

B. *Petiole densely tomentose, with an orange margin.*

Verschafféltii, Lem. (*L. aùrea*, Duncan). Wild specimens 40 ft.; about half this in cult.: lvs. pale green, 4½–5 ft. long, the segms. 2½ ft. long, above 2 in. wide, acuminate, the entire margins and veins slightly tomentose beneath; petioles 5–8 ft., densely tomentose, with entire, orange margins, spiny in young plants: spadix 4–8 ft. long: drupe slightly 3-angled, 2 in. long, 1½ in. wide. Isl. Rodriguez. I.H. 6:229. G.C. III. 31:152.

BB. *Petiole red, slightly tomentose.*

Cómmersonii, Gmel. (*L. rùbra*, Jacq. *L. borbónica*, Lam., not Hort.). Lvs. 5–5½ ft. long, dark green above, paler beneath; segms. lanceolate, acuminate, 2 ft. long, 3¼–3½ in. wide, their margins entire, spiny in young plants, veins and margins tinged with red; petiole 4–6 ft., slightly tomentose, the margins smooth, spiny in young plants: spadix 3–6 ft. long: drupe globose, 1½–1¾ in. diam. Mauritius. Not A.F. 4:567 and 7:127, A.G. 13:141; 15:389 and 19:557, V. 9:199, G. 2:459, all of which are *Livistona chinensis.*

L. erécta and *L. variegàta* are trade names. Any specimens in cult. will probably be found to be varieties of some of the above.

N. TAYLOR.†

LATHRÆA (*hidden*, Greek, alluding to habitat). *Orobanchàceæ.* TOOTHWORT. Root-parasities without green herbage, sometimes sown or encouraged in shrubberies where their host-plants grow.

Allied to Orobanche, but the calyx with 4 broad short teeth or lobes rather than with 2 or 4 pointed sepals, and the fls. not regular: low herbs, brownish, flesh-colored or bluish, bearing many small fls. in scaly racemes or spikes, the sts. usually simple and erect; stamens 4, in 2 pairs, with 2-celled anthers: caps. 1-celled, opening by 2 valves.—Species 5. Eu., Asia, Japan. In N. Amer., the family is represented by Orobanche (the broom-rape), Conopholis (squaw-root or cancer-root), Epifagus or Leptamnium (beech-drop), Aphyllon or Thalesia, Fig. 231, Vol. 1, by some united with Orobanche, and Boschniakia of the far Northwest. They are scarcely horticultural subjects, although some of the species seem to establish themselves readily when planted where there are proper hosts.

Two species are more or less recorded in horticultural literature. *L. Clandestìna*, Linn. (*Clandestìna rectiflòra*, Lam.), Eu., has very many densely crowded sts. 4–6 in. high, from densely interlaced rhizomes: fls. pale gray-purple or violet, darker purple on the lower lip, 2 in. long and erect in racemes 3–5 in. high. Grows on willow and poplar, and other hosts. G.C. III. 35:292, 293, showing a group established on roots of beech and willow. G. 36:242. A showy species. *L. Squamària*, Linn. (*Squamària Orobánche*, Scop.), Great Britain to Russian Asia: pale rose-color, with flesh-colored or faintly bluish fls. which are streaked with purple or dark red: rootstock scaly, fleshy, creeping: fls. many, nodding, short-stalked or in a dense spike. On roots of hazel.

L. H. B.

LÁTHYRUS (name used by Theophrastus for some leguminous plant). *Leguminòsæ.* Annual and perennial, climbing and upright herbs and shrubby plants with pinnate leaves, half-sagittate stipules and showy papilionaceous flowers.

Stems flat or winged, in some species: lvs. equally pinnate, ending in a tendril or in a point; lfts. 2 or several; stipules leafy, large and prominent, half-sagittate: fls. solitary or racemose, on long axillary peduncles; calyx oblique-campanulate, 5-parted, the upper teeth often shorter; corolla dark blue, violet, rose, white or yellow, or a union of these, the standard large, broadly obovate or roundish, notched, with a short claw, the wings falcate-obovate or oblong, the keel shorter than the wings, incurved, obtuse; stamens diadelphous (9 and 1) or monadelphous below; ovary 1-celled, the pod several-seeded; style curved, usually twisted, flattened, hairy along the inner side: pod flat or terete, 2-valved, dehiscent.—A genus according to the Index Kewensis, of more than 200 species, occurring in the northern hemisphere, Amer., Eu., Asia, and in Afr. and

S. Amer. *Orobus niger* and *O. vernus* are common garden names, but Bentham & Hooker, also Engler & Prantl, make Orobus a subgenus of Lathyrus, characterized in part by the lack of tendrils. See *Orobus.*

The genus is best known by the sweet pea. Most other forms are perennial, although some of these are cultivated as annuals. All are free-growing plants, so independent in their ways that they require a place to grow by themselves, apart from other plants of like habit or size. Hence they are to be grown alone, on trellises or against walls, in rock-gardens, or allowed to form a wild tangle among strong shrubs. The chief value of the annuals is for cut-flowers, although their part in the garden is not to be ignored. As a temporary screen in summer for shutting out unsightly objects, they are valuable, or for quickly covering trellises or rough places otherwise unsightly.

2111. Lathyrus tingitanus. Sometimes sold as a form of sweet pea. (×⅓)

The perennials are of comparatively easy cultivation, succeeding in any garden soil. The annuals are more exacting in their requirements, demanding a moderately rich garden soil, abundant moisture, coolness and depth for their roots, and open sunlight. All are grown from seed, sown very early in the open to secure the required coolness for the roots. The perennials are propagated, in addition, by division, special varieties being increased by cuttings in the fall, after the flowering season, or in spring from old plants stored in the greenhouse. The roots of perennials are long and fleshy, and, when once established, usually continue for years without attention.

INDEX.

albiflorus, 7.
albus, 7, 8, 19; suppl.
flaccidus, 19.
grandiflorus, 3, 7.
lætiflorus, 15.
latifolius, 7.
luteus, 16.
magellanicus, 8.
magnificus, 7.
maritimus, 11.
montanus, 16.
myrtifolius, 10.
niger, 18.
odoratus, 1.
ornatus, 20.
palustris, 10.
polymorphus, 17.
pubescens, 9.
rotundifolius. 5.
Sibthorpii, 6.
splendens, 7, 13.
sylvestris, 4.
tingitanus, 2.
undulatus, 6.
venosus, 12.
vernus, 19.
violaceus, 14.
Wagneri, 4.

A. *Habit climbing: lvs. tendril-bearing.* (*Lathyrus.*)

B. *Plants annual: lfts. 1 pair.*

1. **odoràtus,** Linn. Sweet Pea. St. rough-hairy, winged: lfts., oval or oblong, mucronulate; stipules lanceolate: peduncle 2–4-fld., much longer than the lvs.; fls. in shades of blue, red, yellow and white, fragrant, the shield large and showy, expanded, sometimes "hooded:" pod 1–2 in. Summer. Italy. B.M. 60.—For cult. and varieties, see *Sweet Pea.*

2. **tingitànus,** Linn. Tangier Scarlet Pea. Fig. 2111. Sts. spreading, winged, glabrous, 3 ft. long: lfts. linear-lanceolate, obtuse, mucronulate; stipules lanceolate: peduncle 2-fld., longer than the lvs.; fls. 1 in. long, dark red-purple; shield large, purple, wings and keel bright red: pod 4–5 in. long. June, July. W. Mediterranean region. B.M. 100.—An earlier annual than the sweet pea, and because of its vigor will run it out. It has been grown for forage.

BB. *Plants perennial.*

C. *Lvs. with 1 pair of lfts.*

D. *Stipules narrow.*

3. **grandiflòrus,** Sibth. and Smith. Everlasting Pea. Two-flowered Pea. Fig. 2112. St. winged, 4–6 ft. long: lfts. large, ovate, obtuse, mucronulate, undulate; tendrils branched, short; stipules small: peduncles, 2–3-fld., longer than the lvs.; shield large, obcordate, notched, broad, rose-purple, wings dark purple: pod linear, 3 in. June, July. S. Eu. B.M. 1938.—Larger vine than *L. latifolius*, but weaker and less rampant. Fls. as large as those of the sweet pea. Free-flowering, succeeding in any soil, not requiring much light. Adapted to banks, along path-margins in woods, among strong shrubs, and as a covering for rocks.

4. **sylvéstris,** Linn. Flat Pea. St. straggling or climbing, 3–5 ft. long, stout, winged, glabrous, with creeping rootstock: lfts. linear-lanceolate, thick, with winged lf.-stalk: peduncle 3–6-fld., equaling the lvs.; fls. ½in. long; standard rose, with green spot on its back; wings purple at summit; keel greenish: pod lanceolate, 2–3 in. long. All summer. Eu.—Inferior ornamentally to other perennials; sometimes mentioned (in the domestic var. *Wagneri*) as a forage plant and for plowing under in a green state as a fertilizer. Grows well on poor, unimproved sandy soil, and is unaffected by frosts and droughts. For garden cult., it may be sown in a seed-bed and transplanted when of suitable size. Its seeds in the wild state are said to be to some degree unhealthful, but in the cult. form this quality has been bred out.

5. **rotundifòlius,** Willd. Persian Everlasting Pea. Low-growing, winged species: lfts. ovate; stipules toothed: peduncles many-fld., longer than the lvs.; fls. large, rose-pink. June. Russia and the East. B.M. 6522.—A species of easy cult. requiring a cool, shady and sheltered position. Adapted to stony banks.

6. **undulàtus,** Boiss. (*L. Sibthorpii*, Baker). Sts. twining, broadly winged: lfts. oblong: peduncle 5–6-fld.; fls. a mauve-red.—A form intermediate between *L. latifolius* and *L. rotundifolius*. A somewhat tender species, said to be 6 weeks earlier than any other.

DD. *Stipules broad.*

7. **latifòlius,** Linn. Everlasting Pea. Perennial Pea. Fig. 2113. St. winged, 4–8 ft.: lfts. ovate-elliptic or ovate-lanceolate, somewhat glaucous, mucronate, 2–3 in. long; tendril branching: peduncle many-fld., longer than the lvs.; fls. rose, large: pod flat, 4–5 in. long. Aug. Woods of Eu.—This is the common perennial pea, and one of the hardiest and most easily cult.

species, thriving almost anywhere, even among flags and boulders. A rampant grower, it is a good trellis plant, and is adapted as a cover to wild, rough places, as a rock-garden, where it scrambles over bushes and stones. It succeeds in shade and grows rapidly, but, like all species of Lathyrus, it is impatient of removal, owing to the size and length of its roots. It is not fragrant. Its varieties are not clearly defined. Var. **álbus,** Hort., the white form, is adapted to the same uses as the type, and is, besides, valuable to florists who want white fls. in midsummer. Var. **spléndens,** Hort., dark purple and red, is said to be the best form of the type, but does not come true from seed. There is a striped form, also. Other trade names are vars. **albiflòrus, grandiflòrus, grandiflòrus álbus** and **magníficus** with large richly colored fls.

2112. Lathyrus grandiflorus. (×⅙)

8. **magellánicus,** Lam. Lord Anson's Blue. St. 3–5 ft. long, smooth, angled, somewhat branched: lfts. ovate or oblong-linear; tendrils branched; stipules cordate-sagittate, broad: peduncles long, 3–4-fld.; fls. dark purple-blue. June, July. Straits of Magellan. —A strong-growing, woody, almost evergreen species covered with a bluish bloom. Since it is a maritime plant, salt is said to assist its growth. It is sometimes regarded as an annual. Var. **álbus,** Hort., "Lord Anson's White," is the white form.

9. **pubéscens,** Hook. & Arn. A soft-hairy, diffusely-branching shrub: st. 4-angled: lvs. with rarely 2 pairs of lfts., ending in a stout trifid tendril. Extra Trop. S. Amer. from Valparaiso to Chiloe in Chile. G. 32:499.

cc. *Lvs. with more than 1 pair of lfts.*

10. **palústris,** Linn. Marsh Pea. Wing-stemmed Wild Pea. St. slender, 1–3 ft. long, glabrous or somewhat pubescent, often winged, rather erect: lfts. 2–4 pairs, oblong-lanceolate, acute, 1–2 in. long; tendrils branched; stipules small, lanceolate: peduncles 2–8-fld., scarcely longer than the lvs.; fls. purplish, ½in. long: pod 2 in. long. Summer. N. N. Amer. and N. Eu., in moist places.—A good bog-plant. Var. **myrtifòlius,** Gray (*L. myrtifòlius,* Muhl.). Myrtle-leaved Marsh-Pea. Has smaller, obtuse lvs., broader and larger stipules, the fls. pale purple. July, Aug. Banks of rivers, N. N. Amer. to N. C.

11. **marítimus,** Bigel. Sea or Seaside Pea. Beach Pea. St. stout, 1–2 ft. long, angled, decumbent: lfts. 3–6 pairs, ovate-oblong, thick, glaucous, nearly blue, 1–2 in. long; stipules lf.-like, broadly ovate and cordate-hastate: peduncles 6–10-fld., a little shorter than the lvs.; fls. purple; wings and keel paler, ¾in. long: pod 1½ in. long, hairy. May–Aug. Gravelly and sandy seacoasts throughout northern hemisphere.—A spreading plant with creeping rootstock and of rapid growth, very tenacious of life. A good plant in rock-gardens and in gravelly soil.

12. **venòsus,** Muhl. Showy Wild Pea. St. stout, 2–3 ft. long, finely pubescent, strongly 4-angled: lfts. 4–6 pairs, oblong-ovate, obtuse, often pubescent below, 2 in. long; stipules narrow, short: peduncle crowded, 8–16-fld., rather shorter than the lvs.; fls. purple, 6–8 lines long: pod smooth. June, July. Shady places and along streams, Canada to Ga.

13. **spléndens,** Kellogg. Pride of California. St. subshrubby, slender, more or less soft-pubescent: lfts. 4–6, ovate-oblong to linear, ½–1 in. long, acute; stipules narrow: peduncle 6–12-fld.; fls. pale rose or violet, large. Dry hills of coast ranges, S. Calif. Gn. 52:162.—A greenhouse plant 1 ft. long or more, becoming 8–10 ft. at home, where it dies down during the summer. Elsewhere it adapts itself to climate but is not hardy in N. U. S. Sometimes confused with a variety of *L. latifolius.*

14. **violàceus,** Greene. Sts. slender, shrubby below, 4–8 ft. high, acutely angled: lfts. about 12, elliptic, obtuse with reflexed tips: fls. in racemes, 10–14 in each, ¾in. long; violet-blue, banner veined with darker veins.—One of the most beautiful of the California species, native of Los Angeles County.

15. **lætiflòrus,** Greene. Wild Pea. Shrubby, 4–8 ft. tall: lfts. of firm texture, elliptic-lanceolate: fls. 1 in. long, fragrant, white faintly flesh-colored, the banner obcordate, veined with red. S. Calif.—Plant under bushes or on banks.

aa. *Habit not climbing: lvs. not tendril-bearing.* (*Orobus.*)

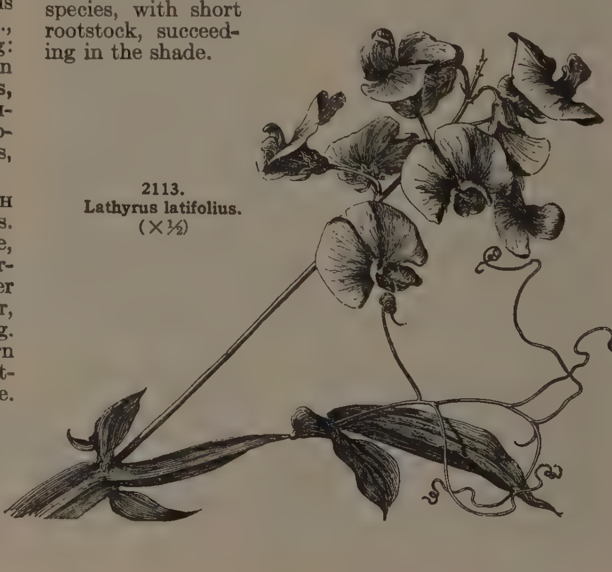
b. *Fls. yellow.*

16. **montànus,** Bernh. (*Órobus lùteus,* Linn. *L. lùteus,* Baker). St. simple, angled, smooth: lfts. 5–8 pairs, large, elliptic-lanceolate, pointed, glaucous below: peduncles many-fld., a little shorter than the lvs.; fls. large, orange-yellow. June, July. Forests of the Alps.—A shade-enduring species with fls. in erect, spike-like clusters and adapted to borders and rockeries.

bb. *Fls. not yellow.*

17. **polymórphus,** Nutt. Prairie Vetchling. St. rather stout, usually low, glabrous or finely pubescent, erect, a little woody at the base: lfts. 3–6 pairs, scattered, narrowly oblong, acute, thick, 1–2 in. long; stipules narrowly acuminate: peduncle 2–6-fld., a little longer than the lvs.; fls. purple, large. March–July. Grassy, alluvial plains, Colo. to New Mex. and Ariz.

18. **nìger,** Bernh. (*Órobus nìger,* Linn.). Black Pea. Black Bitter Vetch. St. erect or ascending, branched, angled, 1–2 ft. long: lfts. 6–8 pairs, elliptical or ovate, ½–1 in. long, light green, turning black when drying; stipules narrow, small: peduncles 6–8-fld., longer than the lvs.; fls. purple, small. June, July. Mountainous and rocky districts, Cent. Eu. B.M. 2261.—Slender species, with short rootstock, succeeding in the shade.



2113. Lathyrus latifolius. (×½)

19. **vérnus,** Bernh. (*Órobus vérnus,* Linn.). Spring Bitter Vetch. St. simple, somewhat pubescent, 1–2 ft. long: lfts. 2–3 pairs, ovate-acuminate, light green; stipules entire: peduncles 5–7-fld., shorter than the lvs.; fls. blue-violet; keel shaded with green, nodding. May, June. Hills and woods, S. and Cent. Eu. B.M. 521.—A compact, tufted plant, growing quickly in sun or a little shade; best in deep, sandy loam, in a sheltered position; hardy. Var. **álbus,** a white form, is rare. Var. **fláccidus,** Ser. (*Orobus fláccidus,* Rad.) has very narrow flaccid lvs.

20. **ornàtus,** Nutt. Fig. 2114. St. sometimes branched, glabrous, often glaucous: lfts. few pairs, lanceolate-linear, rigid and strongly veined; stipules entire: peduncles about 4-fld., longer than lvs.; fls. large, purple, very showy. Plains eastern base of Rocky Mts.

L. álbus, Linn. f. Root of clustered club-shaped fibers: lfts. 2–3 pairs, linear to lanceolate: fls. white or yellowish, standard sometimes purple, or rose on back. Eu.—*L. Cicera,* Linn., and *L. Ochrus,* DC., are annual forage plants.—*L. tuberòsus,* Linn., has been imported. It differs from all described above by having tubers. It is a native of the northern parts of the Old World, and bears red fls. which are generally fewer and smaller than those of L. sylvestris.

A. Phelps Wyman.
John W. Harshberger.†

LAUREL. Properly *Laurus nobilis,* but other broad-leaved evergreens have taken the name. The kalmias are known as laurels. The cherry laurel is *Prunus Laurocerasus,* and in America *P. caroliniana.* Portugal laurel is *P. lusitanica.* Ground laurel is Epigæa.

LAURÈLIA (from Laurus, because of resemblance in leaves). *Monimiàceæ.* Aromatic forest trees, 2 in Chile and 1 in New Zeal.: lvs. coriaceous, opposite, mostly serrate: fls. in axillary cymes or racemes, diœcious or polygamous, apetalous; perianth or calyx of male fls. with a short tube and 5–12 lobes in 2 or 3 series, and 4–12 stamens; perianth of other fls. narrower-tubed and elongating after fertilization, 3–5-cleft, the stamens reduced to scales or the outer ones perfect; carpels numerous, with solitary erect ovules: achenes small, included in the perianth.

serràta, Bert. Huanhuan Tree. Timber tree in southern parts of Chile, and hardy in parts of S. Ireland, to 70 ft., with fetid wood: lvs. broadly oblong-lanceolate or lanceolate, nearly or quite obtuse, glandular-serrate with open spreading teeth, bearing pellucid glands, aromatic: infl. axillary, cymose, simple or paniculate, the 8-parted perianth greenish yellow, the segms. equal; pedicels very short. B.M. 8279. G.C. III. 36:401 (as *L. aromatica*).

L. nòvæ-zealándiæ, A. Cunn. Tree, to 80 or 120 ft. high, and trunk 4–6 ft. diam., with radiating buttresses: lvs. to 3 in. long, oblong to obovate, coarsely and bluntly serrate: fls. in axillary racemes ½–1 in. long on silky pedicels: lvs. and young branches aromatic when bruised.—*L. sempérvirens,* Tul. (L. aromatica, Poir.). Chilean Laurel. Lvs. undulate-serrate with appressed teeth: infl. longer than in L. serrata and lax, perianth-segms. differing or subequal, fertile stamens usually exceeding 4; pedicels exceeding the fls.

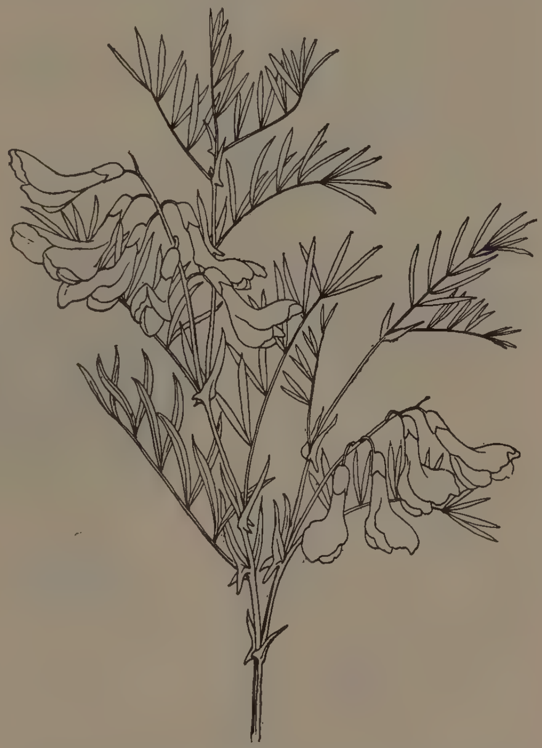
L. H. B.

LAURESTINUS: Popular name of *Viburnum Tinus.*

LAUROCÉRASUS: *Prunus.*

LAÙRUS (the ancient name). *Lauràceæ.* Laurel. Sweet Bay. The laurel or sweet bay tree of the florists is the most universal of evergreen tub-plants.

Laurus gives name to the family *Lauraceæ,* which includes Cinnamomum, Camphora, Persea, Sassafras, Lindera, Benzoin, and other genera. Many species have been referred to Laurus, but with the exception of two, these species are now placed in other genera. These two are *L. nobilis,* Linn. (the subject of this sketch), and *L. canariensis,* Webb & Berth., of the Canary Isls. They are small trees, with stiff alternate simple lvs.: fls. diœcious or perfect, small and inconspicuous, in small axillary umbels which in bud are inclosed in a globose involucre; perianth with a short tube and a 4-parted limb; stamens 8–12 or more, and staminodia often present (staminodia usually 4 in fertile fl.); ovary scarcely sunk in the receptacle, the style short: fr. a small berry.—**L. nóbilis,** Linn., the sweet bay, has stiff, dull green, entire, alternate lvs. lanceolate or lance-oblong in shape: yellowish fls. in early spring: succulent, purple, cherry-like frs. It is native to the Medit. region, sometimes attaining a height of 40–60 ft., but rarely assuming a true tree-like form. As a cult. subject, it is grown as a small standard tree, with a close-sheared top. The lvs. are sometimes used in cookery and the making of confections, because of their pleasant aromatic flavor. The wreaths with which the heroes of antiquity were crowned were made of laurel lvs. It is the laurel of history and poetry. Many other trees are known as laurel because of the similarity of their lvs. The cherry laurel is *Prunus Laurocerasus;* the Portugal laurel, *Prunus lusitanica;* laurel of the southern states, *Prunus caroliniana;* the laurel, or mountain laurel of Calif. is *Umbellularia californica.* The *Laurus Benzoin* of trade catalogues is *Benzoin æstivale; L. Sassafras* is the sassafras tree; *L. Camphora* is the camphor tree (see *Cinnamomum*). It should be said that the bay rum of commerce is not made from the sweet bay, as some persons suppose, but from a pimenta.



2114. Lathyrus ornatus. (×1)

The laurel endures abuse and neglect, the head can be trimmed to almost any shape, and the growth may be kept within small limits year after year. F.R. 1:669. (Fig. 2115.) It is, therefore, the most popular of plants for decoration of open-air or exposed restaurants, esplanades, architectural appurtenances, and the like. Although much used in America, it is still more popular in Europe. Of the European dealers one may order plants with heads trained to pyramids, cones, globes, and the like, and with bodies long or short. The plant will endure considerable frost. It is grown in the open in England: "The sweet bay bush in the farmer's or cottage garden comes with its story from the streams of Greece, where it seeks moisture in a thirsty land along with the wild olive and the arbutus. And this sweet bay is the laurel of the poets, of the first and greatest of all poet and artist nations of the earth—the laurel sacred to Apollo, and used in many ways in his worship, as we may see on coins, and in many other things that remain to us of the great peoples of the past" (Gn. 47, pp. 301, 307). Although so universally used, there are few important horticultural varieties,—the variegated-leaved and crisped-leaved (the crimped-leaved being sometimes known as *L. regalis*) forms being the best known. There is also a willow-leaved form (known as *L. salicifolia*). Propagated by cuttings, and sometimes by seeds. L. H. B.

Cultivation of bay trees. (H. A. Siebrecht.)

The sweet bay trees in their various trained forms of standard, globular, oval, conical and pyramidal shape, are almost indispensable in connection with the now prevailing architecture of our modern palaces of the Renaissance, Venetian, as well as Colonial and old English forms. Most of the leading architects require these formal and highly ornamental trees for the proper setting of their building designs.

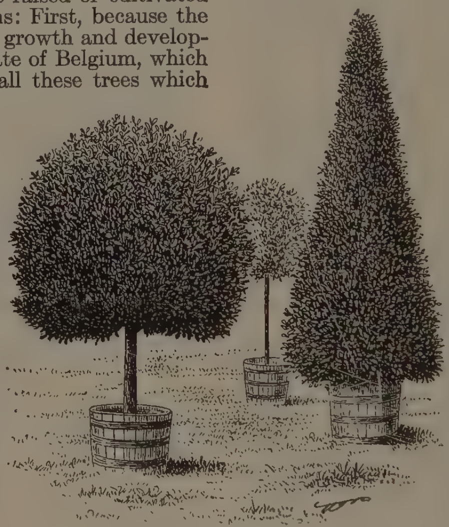
Very few such trees, if any, are raised or cultivated in this country, for several reasons: First, because the climatic conditions for their rapid growth and development are far inferior to the climate of Belgium, which country produces nine-tenths of all these trees which are used in all shapes and forms; second, the higher labor cost and expenses to produce them in this country prohibit the cultivation and constant training.

It is estimated that several hundred thousand bay trees are sold every year in Europe and America. They are mostly imported from Belgium and Holland, where they are cultivated as follows: Cuttings 3 to 4 inches long from well-ripened wood are put in sharp sand, either under bell-glasses or in glass cases. Bottom heat is not essential. After the cuttings have rooted, they are placed in small pots, in fairly rich sandy loam, with good drainage, and can then be put in a hotbed, with gentle bottom heat, where they will at once make a good strong growth. After this they are planted, as a rule, in nursery rows, in rich sandy soil, with perfect drainage. They will make a strong shoot 3 to 5 feet in length in one season. These shoots are tied up to stakes. At the end of the growing season and long before the cold weather sets in, these young plants, together with their stakes, are taken up and put into their winter quarters, which usually is a well-lighted and ventilated shed—an ordinary barn-like shed, sometimes built several feet into the ground and provided with skylights and ventilators. These plants are set in close rows and watered once or twice a week, according to the weather. Little or no fire heat is used in these sheds unless the weather gets extremely cold. The temperature is kept just above freezing. In the spring they are taken out and either potted and plunged in nursery rows, or planted out, as before. Plenty of water, rich peaty soil and the congenial moist atmosphere near the seacoast induces them to make a fast and luxuriant growth. Thus they are cultivated continually until the plants have been trained into the desired form, and as soon as they have attained enough of this form to show their character, which usually is from five to six years after propagation, they are planted in properly proportioned hardwood tubs and are then ready for the market, or to be further cultivated, perhaps for a good many years, until they grow into large specimens. The trees are cut back and trimmed into shape once a year, after the new growth is well matured.

The peaty muck soil in which they are grown abroad is very deceptive to Americans, and many fine trees have been ruined by not understanding its nature. Its dark color always makes it look moist. Sometimes when the soil looks moist enough the trees are really dying from drought.

In retubbing trees, there is danger of using for filling material a soil that is too heavy. The water then runs into the new soil, leaving the old soil dry. If the trouble is not detected soon the trees may be spoiled. The only thing to do in such cases is to comb out the old ball and cut back to live roots. The tree can then be planted in the open to gain a new set of roots, after which the top can be cut back to live wood. The tree may thus be eventually brought into a good shape again.

As a rule, bay trees are not good house plants. They do not like the dry heat of a dwelling. They can, however, stand considerable heat if they have plenty of fresh air and plenty of water. In spring and early summer, when they are making and finishing their growth, they can stand any quantity of liquid manure or of strong manure mulching, for they are great feeders. The cured leaves of the sweet bay are used in putting up packages of rice, and impart a rich and agreeable aroma.



2115. Laurus nobilis in tubs.

LAVÂNDULA (Latin, *lavo*, to wash; referring to the use of lavender in the bath). *Labiàtæ.* This group includes the lavender (*L. vera*), an ancient garden favorite because of its pleasant odor.

Perennial herbs, subshrubs or shrubs: lvs. commonly crowded at the base, pinnatifid or dissected: whorls 2–10-fld., crowded into long-peduncled cylindrical spikes, which are unbranched or branched from the base; fls. blue, violet or lilac; calyx tubular, 13–15-striated, 5-toothed; corolla-lobes nearly equal, or the posterior lip 2-cut, the anterior 3-cut; stamens 4, didynamous, declined, included in the tube; style shortly 2-cut at the apex.—Species upward of 20, Canary Isls. to India. In the N., winter protection should be provided for lavender. The plants of this genus grow naturally in dry and hilly wastes, except *L. multifida* which is found growing in peat.

A. *Spike loose: upper floral lvs. fertile, shorter than the calyx.*

B. *Lvs. not densely woolly.*

vèra, DC. (*L. angustifòlia*, Moench). LAVENDER. Subshrub, 1–3 ft. high: lvs. oblong-linear or lanceolate, entire; younger ones often clustered in the axils, white-tomentose, revolute at the margins; older ones greener, 1–1½ in. long: spikes interrupted; whorls 6–10-fld. Summer. Perhaps a form of *L. Spica*. Var. **compácta,** Hort. (var. *compácta nàna*, Hort.). Compact form: larger, deeper-colored fls., blooming 3 weeks earlier than type: 9 in. Rock-garden or border.

Spìca, Cav. Dwarfer than the true lavender, whiter, the lvs. more crowded at the base of the branches, spike denser and shorter. The floral lvs. are lanceolate or linear (rhomboid-ovate acuminate in *L. vera*), and the bracts are linear-awl-shaped, shorter than the calyx, while in *L. vera* the bracts are almost absent. Medit. region.

BB. *Lvs. densely woolly.*

lanàta, Boiss. Differs also from the preceding in having much longer and less crowded spikes. Spain. It grows 1–2 ft. high and needs winter protectioin in N. J.

AA. *Spike dense: upper floral lvs. sterile, comose.*

B. *Lvs. entire.*

Stœchas, Linn. Shrub, 2–3 ft. high: lvs. tomentose, about ½in. long: spikes short-peduncled, densely comose; fls. dark purple. Medit. region. Cult. in S. Calif.

BB. *Lvs. pinnate-dentate.*

dentàta, Linn. Lvs. pubescent: spikes long-peduncled; fls. deep purple. Medit. region. B.M. 400.—Intro. 1900 by Franceschi.

multífida, Linn. Cut-leaved Lavender. Herbaceous biennial, evergreen, 1–2 ft. high: lower lvs. petioled, upper sessile; lfts. decussately pinnatifid, hoary: spike simple, square, spiral: fl.-lvs. ovate, nerved, villous: fls. lilac. Calabria and Canary Isls.—Prop. by seed. Summer to fall. Not widely cult. Offered in S. Calif.

Wilhelm Miller.
A. C. Hottes.†

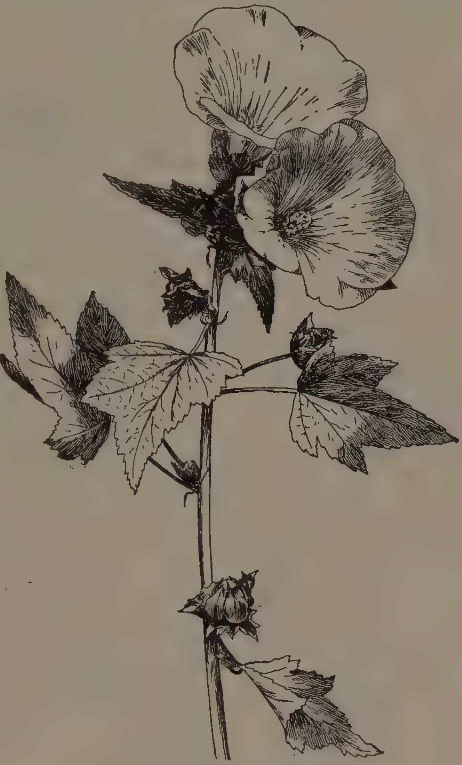
Cultivation of lavender. (M. G. Kains.)

In the eastern United States, lavender is grown in but few gardens, but in California, where climatic and soil conditions seem favorable, it is more commonly planted, although not on a commercial scale. The dry soil of that state and the light limestone soil of the Black Belt of Alabama and adjacent states seem to be most inviting to this industry.

The generic name is derived from the ancient use of its flowers and leaves in bath perfumery. The flowers long retain their strong fragrant odor after drying, and upon distillation yield a lemon-yellow very fluid oil of aromatic, bitterish, burning taste. Though this is officinally credited with stimulant and tonic properties, it is seldom administered in the pure state. Its chief uses are in the manufacture of perfumery, aromatic vinegar and lavender water, an alcoholic solution of the oil and other odorous substances. For these purposes, English oil has long commanded the highest price, but recently the French product has been claimed superior. Though all parts of the plant are aromatic, and both leaves and flower-stems are used in oil manufacture, oil obtained in the first half hour of distillation from flowers alone is much superior to the later distillate and also to the oil obtained from a mixture of flowers and stems. These grades, and also the highly valued product of very dry seasons, are always sold separately.

Lavender is best propagated by cuttings of one season's growth taken with a heel of older wood, in late autumn or early spring. When set 3 to 4 inches asunder in rather moist soil and shaded, they strike more readily and produce more symmetrical plants than older wood. Seed does not propagate desired varieties, and division is not advised, since plants so obtained are more susceptible to disease than those made from young-wood cuttings. After danger of frost, the one-year-old plants are set 4 feet asunder in rows 6 feet apart, running north and south. Closer planting and the hedge-method yield a smaller quantity of bloom. Dry, light, calcareous, even stony soils upon sites where sun and air are unimpeded by trees, favor this plant. Upon such fewer are injured by frost, and the oil is of superior quality. In moist soil so much water enters the plant as to enfeeble it, and upon rich lands yield and quality both suffer. Light fertilizing with stable-manure or ashes turned under in autumn, and spring harrowing, are advised. During the first year in the field the plants should be clipped to prevent flowering and to encourage stockiness. Vigorous plants so treated may grow to a height and a diameter of 5 feet, and when two to four years old produce secondary bloom-spikes after the general harvest, which usually occurs in early August. Plantations should be destroyed when four to six years old and the land rested with other crops before setting to lavender again. Cutting in clear weather, in early blossom, before the dew is off and at once distilling give best results; but no delay should occur. Cutting in wet weather, in the heat of the day, holding blossoms long before distilling and exposing them to the sun after cutting result in serious losses. One pound of flowers yields from one-half to one drachm of oil, and an acre from two to twenty-five pounds. The annual output of the stills of Grasse, France, is from 80,000 to 100,000 kilogrammes.

"Oil of spike," obtained from a broad-leaved, much whiter and smaller species (*L. Spica*), is less fragrant than true lavender oil, being analogous to oil of turpentine, with which it is often adulterated. It suggests the odor of rancid coconut oil. Officinally, it is credited with carminative and stimulant properties, and has been found useful in nervous languor and headache. It is used by artists in the manufacture of varnishes, by porcelain painters, and to a small extent in perfumery, mainly as an adulterant. From 20,000 to 25,000 kilogrammes are annually produced at Grasse. See also "Culinary Herbs" by M. G. Kains, 1912.



2116. Lavatera trimestris. (×½)

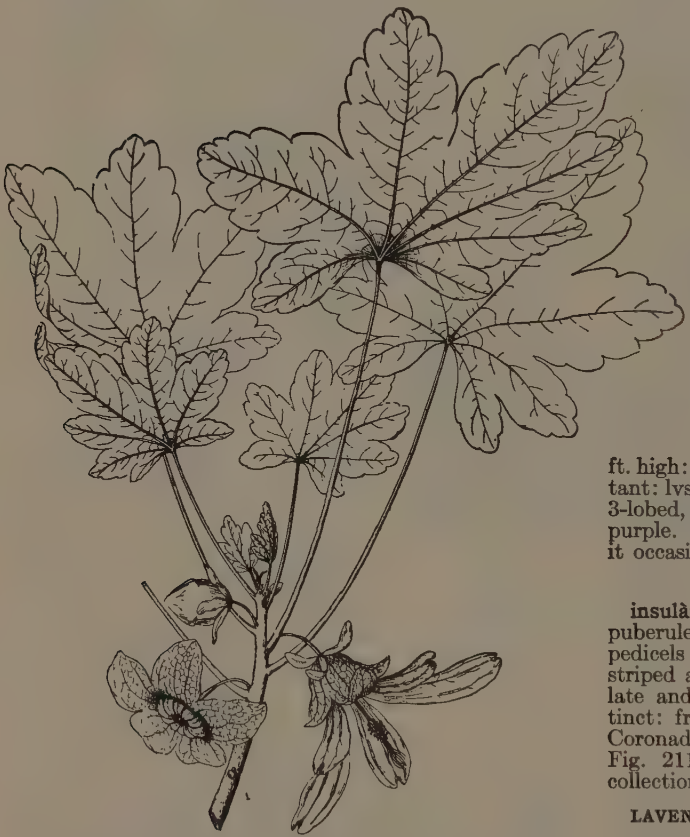
LAVÁNGA (from the Bengal name). Sometimes written *Luvunga. Rutàceæ,* tribe *Cítreæ.* Lavangalata. Climbing shrubs, distantly related to the orange.

Leaves alternate, trifolioliate, with long wingless petioles; lfts. with motile petiolules; spines axillary, strong, recurved: fls. in axillary clusters, 4–5-merous; stamens twice as many as the petals; anthers linear; ovary 3-, 4- or 5-celled with 2 superposed ovules in each cell: fr. oval or oblong, resinous within (without pulp vesicles) and having a thick oily lemon-like peel. —Several species are known, occurring in India, the Malayan Archipelago and Cochin-China. These plants should be intro. into the U. S. for trial as stocks for citrous frs., and for use in breeding experiments. The name is commonly spelled Luvunga, but appears as Lavanga in the original publication.

scándens, Buch.-Ham. (*Limònia scándens,* Roxbg.). Climbing shrubs with fragrant white fls. and yellowish resinous frs. the size of a pigeon's egg. This strong-growing scandent shrub occurs in India and the Malayan peninsula. WALTER T. SWINGLE.

LAVÀTERA (one of the Lavater family of Zurich, at the time of Tournefort). *Malvàceæ.* Flower-garden annuals and biennials, and some ornamental shrubs, the taller known as tree mallows.

Herbs, shrubs and trees, tomentose or hairy: lvs. angled or lobed, sometimes maple-like: fls. sometimes 2–4 in. across, variously colored, rarely yellow, solitary in the axils or borne in terminal racemes; column of stamens divided at the summit into an indefinite number of filaments; petals 5; ovaries few to many, united about an axis which is conical or umbrella-shaped at top; fl.-bractlets 3–6 or 9, joined into an involucre.—Species about 25, mostly in the Medit. region, but extending to the Canaries, Asia, Austral., and the islands off S. and Lower Calif.



2117. Lavatera insularis. (×½)

These plants are of the easiest culture, the first species being the commonest, and all propagated by seeds. There seem to be no double forms.

A. *Plant annual, herbaceous.*

triméstris, Linn. (*L. ròsea,* Medikus). Fig. 2116. Height 3–6 ft.: lvs. nearly glabrous, upper ones angled: fls. rosy, 4 in. across: receptacle or axis of the fr. expanded at the apex into a disk, inclosing the ovary. Medit. region. B.M. 109. Gn. 24, p. 89; 51, p. 212; 53:62; 61, p. 180; 65, p. 354. Gn. W. 23:363. Var. **álba,** Hort., has white fls. Var. **spléndens,** Hort., is an improved garden strain. Gn. 73, p. 314. G. 33:141.—This species is an excellent flower-garden subject, of the easiest cult., usually growing 2–3 ft. in height and blooming summer and autumn, with attractive rose-pink or red fls.

AA. *Plant biennial, woody at the base.*

arbòrea, Linn. With annual flowering branches, forming a shrub 3–10 ft. high or less: lvs. 5–9-lobed, softly downy on both sides, rarely nearly glabrous: fls. pale purple-red, about 2 in. across: receptacle small, marked with little pits, not exserted. Eu. Cult. in the form of var. **variegàta,** which has mottled lvs. Gn. 23, p. 114. G.Z. 28, p. 49. V. 8:99.

AAA. *Plant perennial, shrubby or even tree-like.*

B. *Fls. 1–4 in the axils, pedicelled.*

assurgentiflòra, Kellogg. Shrubby, 6–15 ft. high: lvs. glabrous or sparingly stellate-pubescent, 5–7-lobed, 3–6 in. wide: fls. purple; petals 1–1½ in. long, with long, narrow, glabrous claws, and a pair of dense, hairy tufts at the base: axis of the fr. low-conical, about as long as the carpels. S. Calif. Isls.—It makes a strong, round-headed shrub, with large red fls., and is one of the best plants to stand saline winds. Used extensively as a windbreak for vegetable-gardens about San Francisco, and is common in old yards throughout Calif., and has been suggested for forage; very resistant to drought. From seed it will reach 6 ft. or more and will bloom within a year.

BB. *Fls. solitary, sessile.*

Ólbia, Linn. Perennial, shrubby, about 6 ft. high: hairs of the st. pilose, somewhat clustered, distant: lvs. softly tomentose, lower ones 5-lobed, upper 3-lobed, highest oblong, scarcely divided: fls. reddish purple. S. Eu. G. 36:733.—Cult. in England, where it occasionally sows itself.

BBB. *Fls. solitary, stalked.*

insulàris, Wats. Fig. 2117. Low bush, cinerous-puberulent, with 7-lobed obtusely dentate lvs.: fls. on pedicels shorter than themselves, yellowish white striped and tipped with purple, the petals long-spatulate and emarginate; bractlets spatulate, almost distinct: fr. of about 10 carpels, in an enlarged calyx. Coronados Isls., near S. Calif. G.F. 9:165 (reduced in Fig. 2117).—Probably not cult. outside amateurs' collections in S. Calif.

WILHELM MILLER.
L. H. B.†

LAVENDER: *Lavandula.*

LAVENDER COTTON: *Santolina Chamæcyparissus.*

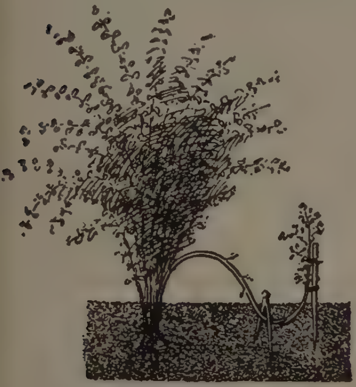
LAWN: *Landscape Gardening,* pp. 1816–1818.

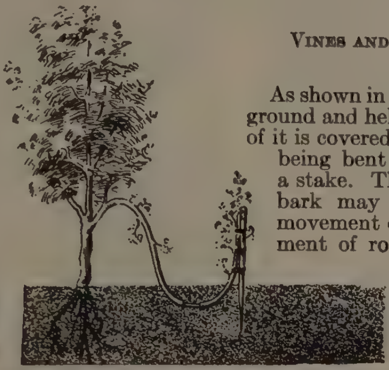
LAWSÒNIA (John Lawson, who published, in 1709, an account of his travels in North Carolina; see page 1505). *Lythràceæ.* HENNA. Shrubs, grown in Florida and southern California for ornament.

Sometimes becoming arborescent, 6–25 ft., glabrous, the branches more or less spinescent: lvs. opposite, lanceolate, attenuate into a petiole or a narrow base, entire, acute: fls. 4-merous, rather small, in terminal panicled cymes; calyx-tube very short or none, the lobes 4; petals 4, ovate, wrinkled, on the top of the calyx-tube; stamens usually 8, exserted, sometimes only 4 and sometimes 12; ovary 4-celled, with a long style and a capitate stigma: caps. globose, exserted beyond calyx.—One variable species as defined by Koehne (Engler's Pflanzenreich, hft. 17, 1903).

inérmis, Linn. A handsome shrub with many very fragrant fls. Var. *álba,* Hassk. (*L. álba,* Lam.) has white fls.; otherwise they are rose, an *L. rùbra* is listed, and var. *miniàta*, Hassk., is cinnabar-red. Widely cult. in tropical countries, but probably native in N. Afr., to W. and S. Asia; naturalized in W. Indies, where it is known as "mignonette." Its lvs. produce the henna or alhenna of the Arabs (cyprus of the ancients), a yellow dye which is used in Egypt and elsewhere by women to color their nails, and by men to dye their beards, and for other similar uses. It is also known in W. Indies as "Egyptian privet," and sometimes as "reseda." It is the camphire of the authorized version of the Bible.

L. H. B.

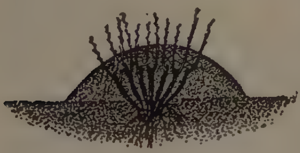

2118. A layer notched at the bottom.


2119. A layer ringed or girdled at the bottom.

LAYERS, Propagation by. A layer is a stem that is made to take root while still attached to the parent plant. The whole subject of propagating plants by means of layers is known as *layerage;* the actual operation or practice is *layering.*

The tendency, under favorable conditions, to produce roots from the cambium zone of some part of the stem is manifested by many plants, especially in the tropics. It may be noticed in the species of ficus cultivated in the greenhouse, in epigæa and *Rhus Toxicodendron* in the woods, in tomato vines in the garden, in grape-canes lying on the ground, and frequently in young apple trees when the trunk becomes covered with earth to an unusual depth. With most such plants, rooting by detached parts is easily accomplished, and this being more convenient, layering is usually practised only with those plants that do not root readily from cuttings.

The mode of root-production is essentially the same whether the part is a layer or a cutting. The proper conditions as to moisture, temperature, food-supply, seem to stimulate the formation of one or more growing points in the cambium zone. The multiplying cells force their way through the bark, and if favorable soil contact is secured, supporting roots are soon developed. It is when the food supply is deficient or the cell action is so slow that the detached part will perish before supporting roots can be established, that rooting while the parts are still attached to the parent plant and nourished by it need be employed.


2120. Mound- or stool-layering.

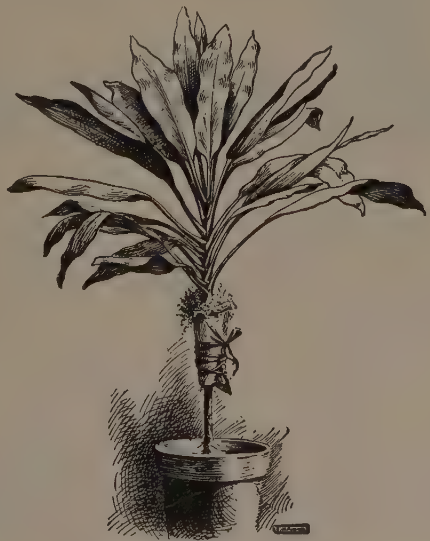
The different methods of layering are matters of detail adapted to the varying plants to be dealt with. Usually branches are chosen of rather young wood, which can easily be brought under the soil and which, when rooted, can be removed without damage to the old plant. The most favorable season is usually the spring or time of most rapid cell-growth. The methods of layering may be represented in the following diagram:

- TREES AND SHRUBS . .
  - *Bowed branch—*
    - Bark ruptured.
    - Bark ringed.
    - Tongue cut.
    - Tip layered.
  - *Mound- or stool-layer.*
  - *Potted or aërial layer.*
- VINES AND CANES . . .
  - *Simple layer.*
  - *Trench layer.*
  - *Serpentine layer.*

As shown in Fig. 2118, a suitable branch is bent to the ground and held in place by a forked pin, so that a part of it is covered with 2 or 3 inches of rich earth, the end being bent to an upright position and fastened to a stake. The bend and consequent rupture of the bark may be all that is needed to obstruct the movement of food-material and cause the development of roots at this point. If not, a tongue may be cut not deeper than one-third the thickness of the branch from below upwards and near a bud or node. In Fig. 2119 a layered branch is shown with a ring of bark removed, a good practice with thick hard-barked species.

For many low-branched shrubs, mound- or stool-layers are prepared (Fig. 2120), as follows: In the spring, head the bush back to a series of stubs, which will produce a large number of vigorous young shoots. By midsummer, in some cases, or the following spring, a mound of earth is thrown around the old stool and the base of the new shoots, and from these latter abundant rooting is secured, so that by the following autumn or spring they may be separated and set in nursery rows. Dwarf apple stocks, and English gooseberries, are propagated extensively by means of mound-layers.

When a branch cannot be brought to the ground, sometimes the earth is brought to the branch by clasping the halves of a broken or specially made pot around a tongued or girdled branch. The receptacle is filled with earth and sphagnum moss to retain the moisture; or the moss may be held in place by a cone of strong paper (Fig. 2121). It may be necessary to support the pot with a light stand of stakes. Where a moist atmosphere is retained, as in a conservatory, merely a ball of sphagnum bound around the branch with twine will serve an equally good purpose with less trouble. This kind of propagation is known as air-layering, Chinese layering or circumposition.


2121. Air-layering.

In the case of vines, a cane may be laid horizontally in a shallow trench, covering a few inches to induce rooting, and leaving a node or two exposed for growth, and so on to the end, as shown by Fig. 2122. After young shoots are well started from the uncovered buds, the earth may be filled in to the level of the ground line.

In Fig. 2123 is shown what is often called the serpentine layer, in which the cane is bent, parts being covered and the intervals left above the ground. It is held that by this means the tendency of the sap to flow to the extremity and there make the strongest growth, is overcome, and even rooting secured the whole length of the cane. This method is often used with quick-growing vines like clematis and wistaria, from which it is possible to secure a succession of layers from the annual growth in spring and early summer.

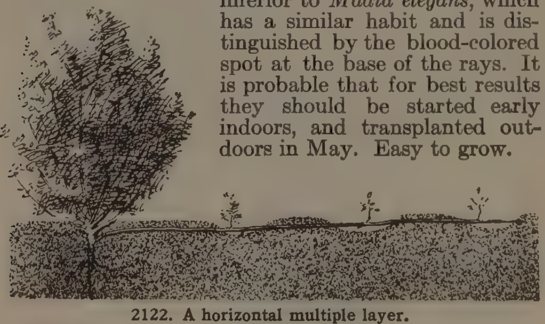
The "tips" of black raspberries are layers of a special kind. In this case, the cane bends over and takes root at its end, thereby providing a natural means of propagation. Many plants produce stolons, or shoots springing from the crown and having a strong tendency to take root at joints or tip; this attribute is sometimes indicated in the name of the plant, as *Cornus stolonifera*.

All of the foregoing operations are more readily successful in the more moist situations; more successful in the nearly saturated atmosphere of the southern states, for instance, than in the comparatively dry conditions of the prairie states.

S. C. Mason.

LÀYIA (Thomas Lay, naturalist in the Beechey voyage). *Compósitæ.* Annual herbs with yellow or white flowers in spring or early summer.

Leaves chiefly alternate, all entire or some, particularly the lower, pinnately toothed or lobed: fls. about 1–1½ in. across, and the rays distinctly 3-toothed; ray-fls. 8–20; disk-fls. fertile, their tubular corollas 5-toothed.—About 13 W. American species. The species described below are diffuse, much-branched and about a foot high. For general cult. they are probably inferior to *Madia elegans*, which has a similar habit and is distinguished by the blood-colored spot at the base of the rays. It is probable that for best results they should be started early indoors, and transplanted outdoors in May. Easy to grow.



2122. A horizontal multiple layer.

A. *Rays entirely white.*

glandulòsa, Hook & Arn. White Daisy. One-half to 2 ft. tall, the st. hispid, sometimes glandular: lvs. 1–1½ in. long, 2–3 lines broad, linear, the upper ones all entire: rays 8–13, white or sometimes tinged with rose. B.M. 6856. Brit. Col and Idaho to Mex.—Cultivated in California and very desirable on account of its pure white rays.

AA. *Rays yellow, sometimes tipped white.*

B. *Plants hairy.*

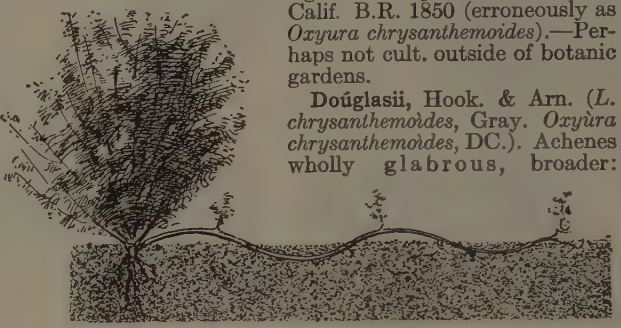
élegans, Torr. & Gray. Tidy Tips. All the upper lvs. entire: rays 10–12, yellow, rarely white-tipped; pappus white or whitish, its copious villous hairs much shorter than the awn-shaped bristles, which are long plumose below the middle. This and the next have a few small, scattered, stalked glands which are wanting from the last two. Calif. Gn. 31, p. 465. G. 30:567. G.W. 17: 464.—Perhaps the best of the genus. Var. **álba,** Hort., is a pure white form

platyglóssa, Gray. Tidy Tips. Some of the upper lvs. pinnatifid: rays light yellow, commonly white-tipped; pappus of stout, awn-like bristles which are upwardly scabrous. Calif. B.M. 3719.

BB. *Plants not hairy or at most minutely pubescent.*

Calliglóssa, Gray (*Calliglóssa Doúglasii,* Hook. & Arn.). Achenes villous-pubescent or partly glabrate: rays yellow, white-tipped; pappus of 10–18 very unequal and rigid awl-shaped awns. Central Calif. B.R. 1850 (erroneously as *Oxyura chrysanthemoides*).—Perhaps not cult. outside of botanic gardens.

Doúglasii, Hook. & Arn. (*L. chrysanthemoìdes,* Gray. *Oxyùra chrysanthemoìdes,* DC.). Achenes wholly glabrous, broader: pappus none. Fls. yellow, only the tips of the rays white. A confused species.



2123. Serpentine layering.

L. gaillardioìdes, Hook. & Arn. Branching rather freely, hispid, 8 in. or more high: heads rather large; rays orange-yellow. G.C. III. 32:61.

N. Taylor.†

LEAD PLANT: *Amorpha canescens.*

LEADWORT: *Plumbago.*

LEATHER FLOWER: *Clematis Viorna.* **L. Jacket:** *Eucalpytus punctata.* **L. Leaf:** *Chamædaphne.* **L. Wood:** *Dirca palustris;* also *Cyrilla.*

LEBIDIERÓPSIS (Greek; *like Lebidiera,* a related genus now included in Cleistanthus). *Euphorbiàceæ.* The genus contains but 1 species, a tree once catalogued in S. Fla., probaby not now in cult. in Amer. Lvs. alternate, simple, entire: fls. small, in axillary clusters; calyx of staminate fls. valvate; petals small; stamens 5, filaments united; ovules 2 in each of the 3 cells of the ovary: seeds globose, cotyledons thick and flat.

orbiculàris, Muell. Arg. (*Cleistánthus collìnus,* Benth.). Lvs. 1½–4 in. long, 1½–3 in. wide, leathery, broadly ovate or elliptic, tip rounded or retuse, glaucous beneath, 5–8 pairs of nerves: fls. silky, 3–6 in a cluster; petals fleshy, narrow: seeds 2 lines thick, chestnut-brown. India.—Variable in lf.-form and hairiness.

J. B. S. Norton.

LÈCYTHIS (Greek for an *oil-jar,* from the shape of frs.). *Lecythidàceæ.* One of a group of interesting Trop. American genera, comprising Couroupita, Grias, Japarandiba, Bertholletia. The species of Lecythis are shrubs or trees, one or two of which have been grown under glass abroad for their showy red fls. *L. Zabucajo,* Aubl., yields the excellent sapucaya nuts, resembling Brazil-nuts and superior to them. *L. Ollaria,* Linn., the monkey-pot, yields a regular urn-shaped fr. or box with a lid or cover. Lecythis is of perhaps 40 species, of the habit of Couroupita but fls. smaller, in Trop. S. Amer.: lvs. alternate, coriaceous, entire or serrate: fls. usually large, in panicles or racemes; calyx with a turbinate tube and 4 or 6 segms.; petals usually 6, sometimes 4, nearly equal; stamens many, united in a hood-shaped body with the fertile anthers beneath: fr. leathery or woody, odd, globose or cup-shaped or urn-shaped with an operculum; seeds few, often large. None of the species seems to be of horticultural importance within our range.

LEDENBÉRGIA (von Ladenberg, mispelled in making the name). *Phytolaccàceæ.* A twining subshrub from Trop. Amer., allied to Rivina, with ornamental foliage: lvs. simple, entire, alternate, slender-stalked, ovate or elliptic-ovate: fls. small and whitish, in long axillary peduncled racemes, on very slender pedicels, perfect; perianth 4-parted, the segms. linear-oblong or linear-obovate and obtuse, enlarging in fr.; stamens 12: fr. a small achene. The plant in cult. is *L. ròseo-ænèa*, Lem. (*L. purpùrea*, Hort.?), which is *Trichostigma peruvianum.* The single species of Ledenbergia is *L. seguierioides*, Klotzsch, of the Antilles and S. Amer., which is a slender-branched shrub with elliptic acuminate alternate lvs. and many small greenish fls. in long drooping very slender racemes. Apparently not in the trade.

LÈDUM (*ledon*, ancient Greek name of Cistus). *Ericàceæ.* LABRADOR TEA. Ornamental shrubs grown for their handsome white flowers and evergreen foliage.

Leaves alternate, short-petioled, entire: fls. rather small, ⅓–½in. across, long-pedicelled, in terminal, umbel-like racemes; calyx-lobes and petals 5, spreading; stamens 5–10: caps. nodding, 5-celled, separating from the base into 5 valves, with many minute seeds.—Four species in the arctic and cold regions of the northern hemisphere, all found in N. Amer. One of the few ericaceous genera with polypetalous fls. The lvs. contain a volatile oil, with narcotic properties; the lvs. of *L. grœnlandicum* are said to have been used during the War of Independence as a substitute for tea, hence the name "Labrador tea."

These plants are low, sometimes procumbent, shrubs with evergreen narrow leaves fragrant when bruised, and with handsome white flowers appearing in early summer. They are all hardy North, and well adapted for borders of evergreen shrubberies or for planting in swampy situations. They thrive as well in sunny as in partly shaded situations, and prefer a moist, sandy and peaty soil. Transplanting is easy, if the plants are moved with a sufficient ball of earth. Propagation is by seeds sown in spring in sandy peat and treated like those of azalea and rhododendron, the young plants growing but slowly; increased also by layers and division.

palústre, Linn. WILD ROSEMARY. One to 2 ft. high: lvs. linear or linear-oblong, revolute at the margin, dark green and somewhat rugose above, densely ferrugineous-tomentose beneath like the young branches, ½–1½ in. long: stamens usually 10: caps. ovate. May, June. Northern hemisphere, in N. Amer., from Newfoundland to Alaska. L.B.C. 6:560. Var. **dilatàtum,** Gray. Lvs. broader, sometimes glabrescent and glaucous below: caps. more oblong. Amurland, Japan. Var. **decúmbens,** Ait. (*L. decúmbens*, Lodd.). With procumbent sts. and shorter lvs. N. E. N. Amer. B.B. (ed. 2) 2:677.

grœnlándicum, Oeder (*L. latifòlium*, Ait). LABRADOR TEA. One to 3 ft., similar to the former, but lvs. broader, ovate to narrow-oblong, 1–2 in. long, tomentum beneath often rather pale at first: stamens 5–7: caps. oblong. May, June. Canada to Brit. Col., south to Pa. and Wis. L.B.C. 6:534 and 11:1049 (as *L. canadense*). J.H. III. 31:20 (as *L. palustre*). Gn. 34, p. 31. M.D.G. 1906:74 (habit). G. 35:349.

L. buxifòlium, Berg=Leiophyllum buxifolium.—*L. columbiànum*, Piper. To 3 ft.: lvs. glabrous and glandular below, revolute: stamens 5–7: caps. oblong, acutish. Wash., Ore.—*L. glandulòsum*, Nutt. Shrub, to 6 ft.: lvs. oblong or oval, glabrous, glaucous and glandular beneath, not revolute: stamens 10: caps. oval, obtuse. July, Aug. Brit. Col. to Calif. B.M. 7610.—*L. Lỳonii*, listed abroad, is undeterminable. It is described as "a lovely shrub for rock-garden, very pretty in bud."

ALFRED REHDER.

LEÈA (James Lee, Scotch nurseryman, 1715–1795). *Vitàceæ.* Tropical small trees or shrubs, some of which are cultivated as young plants in warm conservatories for their colored foliage and stately habit.

Leaves alternate, 1–3 times pinnate or simple, the petiole dilated at base; lfts. entire or serrate; tendrils none: fls. small or large, red, yellow or green, in cymes opposite the lvs.; calyx 5-toothed; petals 5, connate at the base and joined with the tube of stamens; ovary 3–6-celled; cells 1-ovuled: fr. a berry, mostly succulent, nearly globose but flattened at the top.—Species about 65, in tropics of Afr., Asia, Austral. and Pacific. Vitis differs in having the climbing habit, ovary 2-celled; cells 2-ovuled. The first species mentioned seems to be valued particularly for its fls.: the others are foliage plants which are presumably distinct horticulturally, but two of them may not be good botanical species, and cannot be distinguished without a knowledge of the fls.

Leeas are tropical house plants. *L. amabilis* has beautiful silvery vine-like foliage. It makes a handsome plant for pillar-posts, and does exceedingly well planted out; but it should be given a season of rest in winter by a partial drying out, when it will lose most, if not all, its foliage. This practice should be followed in any case. It may also be grown as a trained specimen in pots. Peaty soil is often recommended, but good light loam, with plenty of drainage, does equally well. (T. D. Hatfield.)

A. *Foliage green.*

coccínea, Planch. Lvs. 3-pinnate; lfts. 5 on each main division of the lf., oblong-lanceolate, dentate, margin recurved: fls. 60 or more in a trichotomous, flat-topped cluster about 3 in. across, scarlet in bud, the 5 spreading lobes of the corolla pink above; stamens yellow, exserted, each fl. about ½in. across. Burma. B.M. 5299.—It begins to flower when only a foot high, but the main stalk of the clusters is only an inch or so long.

AA. *Foliage colored or variegated.*

B. *Lvs. marked bright red; veins white.*

Micholítzii, Sander. Intro. by Sander & Co., 1899, from New Guinea: st. slender: lvs. pinnate, sometimes gigantic, arching; lfts. deeply serrate and undulate, rich green strongly marked with bright red and with white veins on the young lvs.

amábilis, Veitch. Lvs. pinnate; lfts. 5 or 7, lanceolate, acuminate, serrate, upper surface velvety, deep bronzy green, with a broad white stripe; veins white at the bases; young lvs. pale pinkish brown. Borneo. G.C. II. 17:493. Gn. 21, p. 352. J.H. III. 43:253. G.Z. 27, p. 145. Var. **spléndens,** Lind., is marked with bright red and has a red st.; very attractive. I.H. 31:518.

BB. *Lvs. flushed bronze; veins rosy.*

sambùcina, Willd. (*L. Rœhrsiàna*, Sander.). Lvs. pinnate or 3-pinnate, very large (often 4 ft. long); lfts. 6½ in. long, 2½ in. wide, oblong, cordate at the base, acuminate, coarsely crenate. India, Malaya, Philippines, Trop. Austral. A very variable species. The above synonymy is the judgment of M. T. Masters in G.C. III. 23:245. F.E. 10:554. A.F. 13:1284. Gng. 6:278. A.G. 21:97.

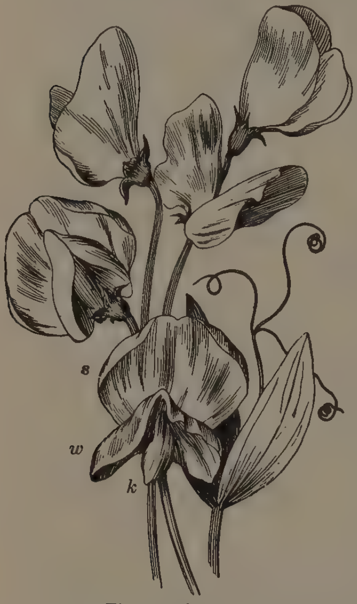
Other leeas may be expected in the choice collections of amateurs, but these plants appear to be little known in the trade. *L. mácropus*, Laut. & Schumann, "with broad lfts.," is a recent introduction.

WILHELM MILLER.

LEEK (*Allium Porrum*), a flat-leaved, bulbous, hardy biennial, is probably a native of the Mediterranean region, where, particularly in Egypt, it has been used for culinary and medicinal purposes since prehistoric time. All parts of the plant possess an offensive pungent odor and acrid taste due to an essential oil also characteristic of its close relative, the onion. In medicine, the bulb, like the onion, is used as a renal stimulant. The blanched stems and leaves are much employed in continental cookery as a flavoring for soups, stews, and so on, boiled and served like asparagus, and in the raw state.

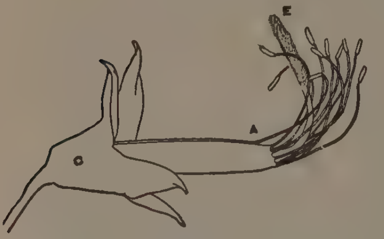
Except in the larger cities and among our foreign population, the leek is little used in America.

Leek, though of the onion family, is differently treated and used. The object in its cultivation is to develop the leaves in such a manner that they become numerous; the flower-stem does not appear before the second year, hence the necessity of growing it to full size the first year.



2124. Flowers of sweet pea, to show structure of a leguminous flower. Banner, standard or vexillum at *s*; wings at *w*; keel at *k*.

Sow the seed in March in a seed-bed (with slight bottom heat), in drills 2 or 3 inches apart; when large enough, thin out to stand 1 inch apart in the row, as they may attain the thickness of a fair-sized straw. In May or early June the seedlings are transplanted in the open ground; they are then cut half-way down and should also be set deep, so they will begin blanching when they attain a fair size. The soil best suited is a rich, moist, light loam; prior to the transplanting it should be well prepared with well-rotted stable manure, if possible. The plants are generally set in drills 12 to 15 inches apart, and 6 to 9 inches apart in the drills. Shortening both roots and stems is often advised. As the plants grow, the soil should be drawn loosely around the stems and lower leaves to insure blanching. They should be well cultivated, and when growing freely should be earthed up slightly with the hand-cultivator or hand-hoe. Some of the successful gardeners still cultivate them on the celery-trenching system; by this means they can be watered more thoroughly and will attain a much larger size; also can be conveniently left in the trench with slight protection, and taken therefrom for winter use. Care must be taken not to cover too early, as they decay easily, beginning at the end of the foliage; this destroys the appearance. The hardier kinds used for this purpose will blanch yellow down to the so-called stem, which is white to the root. Leeks planted out in May are ready for use in September; the sowings can be made earlier and later to suit the time of maturing, and can be sown in August and September in coldframes and wintered over with slight protection, then transplanted to the open ground in April. The varieties best known to American gardeners are London Flag, Large Musselburgh or Scotch Flag, Giant Carentan, and Large Rouen.

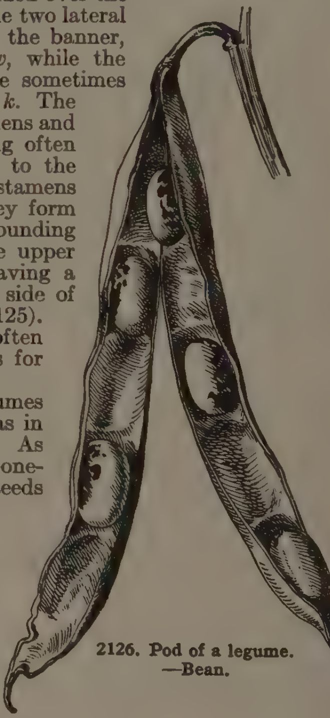


2125. Essential organs of a sweet pea flower. Calyx at *c*; tenth stamen at *a*; stigma at *e*.

When blanched leeks are not desired, the plants may be cultivated like onions; indeed, except for earthing up, the cultural methods employed for these two crops are identical. Leeks are marketed in bunches like young onions and, for winter use, are stored like celery. As a second crop to follow early cabbage, spinach, and the like, they are in general favor with market-gardeners. In soups and stews the rank odor disappears, leaving a mild and agreeable flavor. M. G. Kains and J. Otto Thilow.

LEGUMES. The popular name given to the important group of plants included in the general Order Leguminosæ comprises the herbs, shrubs, vines, and trees of the mimosa family (Mimosaceæ), the senna family (Cæsalpiniaceæ), the krameria family (Krameriaceæ), and the pea family (Fabaceæ; also called Papilionaceæ or Phaseolaceæ). In all, more than 7,000 species of plants are represented here, chiefly herbaceous in character; the arboreal forms occur in the temperate zones and are very frequent in the tropics. Many species are of unusual agricultural importance, both for forage, as cover-crops and green manure, and also for furnishing food for man. Among these may be noted alfalfa (*Medicago sativa*), beans (Phaseolus sp.), clover, (Trifolium sp.), vetch (Vicia sp.), and peas (Pisum sp.).

Most of the native species of legumes, and all those cultivated as farm crops, belong to the Fabaceæ or pea family. In these species the flower is of the pea type (Fig. 2124). The upper larger petal, called the banner, *s*, is exterior and folded over the others in the bud. The two lateral ones, situated below the banner, are the wings, *w*, *w*, while the lower pair, which are sometimes united, form the keel, *k*. The keel incloses the stamens and pistil, the latter being often bent at right angles to the ovary, or coiled. The stamens are either free or they form a tubular sheath surrounding the ovary. Often the upper one alone is free, leaving a slit along the upper side of the sheath (Fig. 2125). These flowers are often dependent on insects for pollination.

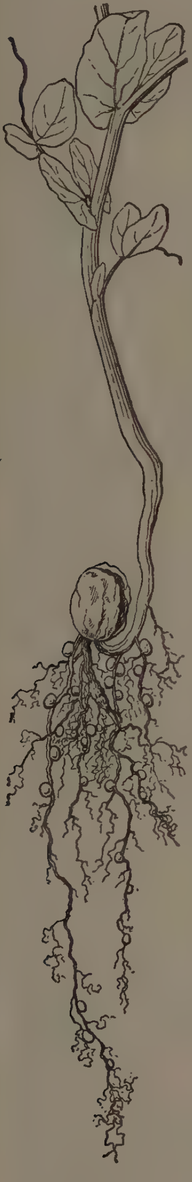

2126. Pod of a legume. —Bean.

The fruit of the legumes is a pod or legume, as in the bean (Fig. 2126). As a rule, the pods are one-loculed, and have the seeds arranged in rows. In some tribes they become several-celled by partitions which arise between the seeds. These pods become constricted at the partitions, and at maturity separate into short joints (see Fig. 1244, Vol. II). The valves of the pods are generally papery or leathery, and open at maturity, often by a sudden snapping of the valves, which scatters the seeds. In other tribes, however, the pods are indehiscent, or do not split at maturity (Fig. 2128).

The use of leguminous crops for soil improvement has long been recognized by good farmers as desirable. Aside from the general benefits of crop-rotation, the actual soil-enrichment is due largely to an accumulation of available nitrogen, and this gain in nitrogen is caused by the presence of minute soil-bacteria which possess the power of growing on the roots of the legumes, and then utilizing or "fixing" the free nitrogen of the air and converting it into food for succeeding crops.

In view of these facts, it is evident that for the most successful growth of alfalfa, clover, vetch, and other legume crops, the proper organisms should be abundantly present in the soil. Certain localities are so supplied, as, for example, southern regions, which contain the cowpea organism naturally, and sections of the Middle West, which usually are inoculated with alfalfa organisms. Introducing new kinds of leguminous crops into a locality requires the introduction also of the proper bacteria for the legume selected, and this is best accomplished by either of the following methods of artificial inoculation:

When a field is known to be well inoculated for a certain legume crop—for example, alfalfa—as indicated by the presence of numerous nodules upon the roots of alfalfa plants growing therein, such soil is very desirable for the inoculation of other fields on the same farm or on nearby farms upon which alfalfa is to be sown for the first time. Two hundred pounds or more of sifted field-soil are sufficient for an acre. Transferring field-soil from any considerable distance is, however, expensive and subject to the danger of introducing troublesome weeds, insects, and plant diseases.



2127. Nodules on the roots of a young plant of garden pea.

Another method is that of seed-inoculation by means of pure cultures. For many years the United States Department of Agriculture has cultivated and distributed liquid pure cultures of the bacteria beneficial to legume crops, and commercial organizations have produced and sold various types of cultures with more or less successful results. The seeds to be treated are placed in a clean bucket, pail, or tub and a pure culture of these beneficial bacteria is applied a little at a time, thoroughly stirring the seeds in order to form a thin, moist coating of the culture on every seed.

A comparison of the nitrogen-fixing nodules found upon the roots of different plants is interesting. The nodules are in reality roots or rootlets which, because of the presence of the nitrogen-fixing bacteria within their cells, have developed abnormally to form the characteristic swollen root tubercles or nitrogen-gathering nodules instead of the ordinary form of root (Fig. 2127). It is to be expected, as each kind of plant has a slightly different root-development, that the root-nodules will develop in a correspondingly typical manner. In fact, the nitrogen-fixing root-nodule of any kind of plant is almost as definite and characteristic for that plant as the shape of the leaves or the arrangement of the leaves on the stem. Karl F. Kellerman.

LEIOCHÌLUS: *Oncidium.*

LEIOPHÝLLUM (from *leios,* smooth and *phyllon;* referring to the smooth foliage). Syn., *Déndrium, Ammýrsine. Ericàceæ.* Sand Myrtle. Ornamental shrubs grown for their handsome evergreen foliage and the profusely produced small white flowers, although not much grown.

Densely branched shrubs, low and sometimes procumbent: lvs. opposite or alternate, crowded, small, short-petioled, entire: fls. in terminal, umbelliform corymbs; sepals and petals 5; stamens 10; anther-cells opening lengthwise; disk 10-lobed: fr. a 2–5-celled dehiscent many-seeded caps.—One species in E. N. Amer. from N. J. to Fla.; allied to Ledum, but the anther-cells opening lengthwise.

2128. An indehiscent or slowly dehiscent leguminous pod—Daubentonia.

The sand myrtles resemble in appearance somewhat the dwarf box and are quite handsome when studded late in spring with the numerous umbels of small white or pinkish flowers. They are hardy or nearly hardy North and well adapted for borders of evergreen shrubberies and also for rockeries. They thrive best in a peaty or very sandy, loamy soil and as well in a sunny as in a partly shaded position. Propagated by seeds sown in pans and placed in a cool frame or by layers put down in fall.

buxifòlium, Ell. (*Lèdum buxifòlium,* Berg. *Déndrium buxifòlium,* Desv.). Fig. 2129. Dense, leafy bush, to 3 ft. high: lvs. short-petioled, thick, oval or obovate, ⅕–⅓in. long: fls. white, pinkish outside, about ⅕in. across, on slender pedicels; petals elliptic, almost twice as long as sepals; stamens usually twice as long as petals: caps. about thrice as long as sepals. April–June. Pine-barrens and mountains, N. J. to Fla. B.M. 6752. Gn. 42, p. 559. B.R. 531. L.B.C. 1:52 (as Ledum). Var. **Hùgeri,** Schneid. (*Déndrium Hùgeri,* Small). Lvs. alternate, ⅓–½in. long: stamens about as long as petals: caps. about twice as long as sepals. High mountains of N. C. Var. **prostràtum,** Gray (*Déndrium prostràtum,* Small). Forming dense depressed tufts: lvs. usually oval, and deep green, very small, mostly opposite. High mountains of N. C. and Tenn. Alfred Rehder.

LEITNÈRIA (after Leitner, a German naturalist, killed in Fla. during the Seminole war). *Leitneriàceæ.* Cork Wood. A small tree or shrub, the only representative of the family which is most nearly related to the Myricaceæ and Salicaceæ; sparingly branched, the sts. swollen at the base, spreading by suckers: lvs. alternate, entire, rather large, without stipules: fls. diœcious in axillary catkins before the lvs.; staminate

2129. Leiophyllum buxifolium. (×⅓)

fls. without perianth, with 3–12 stamens; pistillate consisting of a short-stalked pubescent ovary with small gland-fringed scales at the base; style slender: fr. an oblong pointed compressed, 1-seeded drupe.—One species in Fla. and Texas to S. Mo. The exceedingly light wood is occasionally used for the floats of fishing-nets. Hardy as far north as Mass.; it grows best in peaty, humid or swampy soil. Prop. readily by suckers which are freely produced in established plants.

L. floridàna, Chapm. Occasionally to 20 ft.: lvs. elliptic-lanceolate to lanceolate, acute or acuminate, pubescent below, 4–6 in. long: staminate catkins 1–1¼ in. long; pistillate smaller and slenderer: frs. 1–4, ¾in. long. S. S. 7:330. H.I. 11:1044. Rep. Mo. Bot. Gard. 6:30–44.—The plant has no claim to ornamental qualities, but is botanically interesting.

Alfred Rehder.

LEMAIREOCÈREUS (Lemaire's Cereus). *Cactàceæ.* Usually large trees or shrubs (one species prostrate).

Stems and branches strongly ribbed and with numerous stout spines: fls. diurnal, medium-sized: fr. covered with clusters of spines (finally falling off as the fr. ripens), edible.—Species 13. This is one of the most important genera of the Cereus group. Some, and perhaps all, species are of great economic value; some are widely planted in the tropics for their delicious fr. Some 8 species are in cult.

A. *Plants prostrate: fls. yellow.*

erùca, Brit. & Rose (*Cèreus erùca,* Brandegee). Stout, usually simple sts. prostrate, radiating from a center, dying at one end and advancing at the other, rooting on the under surface, 3–7 in. diam., densely armed with spines: fls. 4–5 in. long, with a slender tube, reported to be yellow: fr. globular, 2 in. diam., somewhat spiny. Common on the sandy plains of S. Low. Calif.—Of very peculiar habit, suggesting large caterpillars creeping along over the ground. This is especially noticed from the way they pass over obstructions or the bodies of other individuals. First the head or growing end is raised up over the object and passes down on the other side; then, by the dying back at the rear, the plant finally seems to have actually passed over the obstruction. This cactus is usually planted wrong in collections since most gardeners insist on placing it erect in a pot; but as it is constantly dying at base, it must sooner or later die. It ought to be laid flat at one end of a long box and allowed to creep toward the other end. There seems to be no record of this species having flowered in cult.

AA. *Plants usually tall and erect.*

B. *Areoles with brown wool, more or less glandular.*

C. *Ribs 12–15.*

Thúrberi, Brit. & Rose (*Cèreus Thúrberi,* Engelm.). Several sts. arising from the same root, becoming 10–15 ft. high; ribs 13–16, very slightly prominent: spines 7–16, slender and rigid: fls. greenish white: fr. globose, 1–3 in. diam. S. W. Ariz. southward throughout Low. Calif., and to Sinaloa.

CC. *Ribs 6–8.*

queretarénsis, Brit. & Rose (*Cèreus queretarénsis,* Web.). Arborescent, with a trunk about 3 ft. high by about 14 in. diam.: the much-branched crown has a diam. of 12–16 ft., the total height of a plant being about 20 ft.: branches dark green, in young growth frequently of a peculiar violet-brown; ribs 6–7, separated by sharp grooves, which later become much flattened, and the st. consequently more cylindrical; areoles depressed, dark brown; radial spines 6–9, the lower ones longest, about 1¼ in. long; centrals 4 (often but 2), reaching 1½ in.: fls. numerous from the upper part of the branches, about 4–5 in. long: fr. yellow to red, about 2 in. long, covered with dark yellow to brown spines, about 1 in. long, and bulbose at the base. Mex.

BB. *Areoles with gray wool, not at all glandular.*

C. *The areoles of the ovary and fl.-tube bearing long flat bristles along with the spines.*

stellàtus, Brit. & Rose (*Cèreus stellàtus,* Pfeiff.). Stout, with few upright branches, 10–15 ft. high: ribs 7–15: areoles ½–1 in. apart; radial spines 8–10; centrals 3–5: fls. from near the ends of the branches, about 2 in. long, light pink: fr. globular, 1½ in. diam., covered with clusters of deciduous spines, edible.—Sold in markets of S. Mex. Rare in collections; often confused with *Rathbunia sonorensis* and *L. Treleasei.*

CC. *The areoles of the ovary and fl.-tube not bearing long bristles.*

D. *Fls. long and slender.*

gummòsus, Brit. & Rose (*Cèreus Cuméngei,* Web. *C. gummòsus,* Engelm. *C. gummòsus,* Hort.). More or less branched, at first erect, then clambering or with some of the branches procumbent: ribs 7–9: spines rigid, 15 or 20: fls. purple, 4–5 in. long: fr. spiny, scarlet, slightly acid, edible. Common in Low. Calif.—This species does not grow easily in hothouses nor does it flower readily. It is a very important fr. to the poor of Low. Calif.

DD. *Fls. rather short.*

E. *Areoles very close together, often running together.*

Dumortièri, Brit. & Rose (*Cèreus Dumortièri,* Salm-Dyck). Often large tree with a trunk 2 ft. diam. and hundreds of upright branches: branches strongly 6-angled: areoles closely set; spines numerous, needle-like, the longer ones 1½ in. long: fls. small for the genus, 2 in. or less long, white. Cent. Mex.—Usually only small plants seen in cult.

EE. *Areoles more distant.*

gríseus, Brit. & Rose (*Cèreus gríseus,* Haw. *C. ebúrneus,* Salm-Dyck). Tall tree, 25 ft. or more high, more or less branched: ribs 7–12, broad: spines 10–15: fls. purplish: fr. globular, covered with deciduous clusters of spines, edible.—Commonly cult. in Trop. Amer. for its frs. It is especially highly prized in Mex.

Wéberi, Brit. & Rose (*Cèreus Wéberi,* Coulter. *Cèreus candelàbrum,* Web.). Trees, 30 ft. or more high, with a regular candelabra form of branching, containing hundreds of erect branches: spines stout, 10 or more on a cluster: fls. lateral, white, about 5 in. long: fr. unknown.—This species, although not the tallest, is probably the largest in the whole cactus family. It is found in the hot valleys of S. Mex. where it literally forms forests. The fr. is not well known and the relationship is still uncertain.

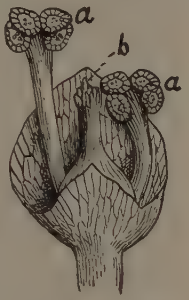
J. N. Rose.

LEMBÓTROPIS NÍGRICANS: *Cytisus nigricans.*

LÉMNA (old Greek name, probably referring to the swampy habitat). *Lemnàceæ.* Duckweed. Duck's-Meat. Minute floating plants, like fragments of green, often found in standing pools and sometimes introduced into aquaria and lawn basins.

The Lemnaceæ comprises the minutest of flowering plants, some 30 species in 4 genera: Lemna, Spirodela, Wolffia, Wolffiella. They are widely distributed in temperate, subtropical and tropical regions. They often cover the water of

2130. Duckweeds, Lemna minor. (Much enlarged) ponds with a mantle of green. The lemnas and spirodelas are most useful because larger and more conspicuous than the wolffias. They are easily gathered for schoolroom and home aquaria, and may be procured from specialists in aquatics and native plants. Ducks and some fish eat these plants. One of the common duckweeds is shown 6 times its natural size in Fig. 2130. The lemnas are without any distinct sts., a whole plant commonly consisting of 1 miniature lf. and 1 unbranched root which has no vascular tissue. These lvs. are called fronds by the botanist. The plants grow separately, or cohere by their edges in 2's or 3's, and multiply by similar fronds, which grow out of the edges of the old ones something like buds. The fls. are minute and appear on the edge of the frond. They consist apparently of a pistil and 2 stamens which are inclosed in a sheath, which botanists have determined is a spathe by reason of the place where it is borne and by homology with related plants. Botanists now consider the 2 stamens as 2 fls. and the pistil a third fl. *L. minor* is said to flower more frequently than any other northern species. Details of its fl. are shown in Fig. 2131, where there seem to be 4 anthers, but there are only 2, each bearing 2 locules. Duckweeds are perennial plants. In the autumn they fall to the bottom of the ditch or pond, but rise again in the spring, and increase in size. The allied genus Wolffia contains the smallest flowering plants. There are about 10 or a dozen species of duckweeds, widely scattered. *L. polyrhiza* is now known as *Spirodela polyrhiza*, but Spirodela is considered by Bentham and Hooker a subgenus of Lemna. The common duckweed occasionally infests the small lily ponds (artificial ones), where it is a pest. The simple remedy is to flush the pond and see that common goldfish or carp are in sufficient numbers to clear off the remainder.



2131. Floral details of Lemna minor. *aa*, **stamens;** *b*, **pistil.** (Enlarged)

A. *Veins 7–11: roots several* (*Spirodela.*)

S. polyrhìza, Schl. Fronds broadly obovate or orbicular, attaining 3 or 4 lines diam., palmately nerved. Common in U. S.

AA. *Veins 1–5: root solitary.* (*Lemna.*)

B. *Fronds oblong, 6 lines long, 3 lines wide.*

L. trisúlca, Linn. Fronds thin, narrow and minutely toothed at one end, thicker and stalk-like at the other, usually with 2 young ones growing from opposite sides near the base. V. 3:200.—Common in U. S.

BB. *Fronds broadly ovate or orbicular, 2 lines long.*

L. mìnor, Linn. Figs. 2130, 2131. Fronds usually cohering in 3's or 4's, rather thick, not minutely toothed, 1–2½ lines long. V. 3:200.

Other species of Lemna are native in N. Amer. Of Wolffia there are also a few speces and of Wolffiella one. The wolffias are seldom collected for lawn ponds.

WILHELM MILLER.

LEMON (*Citrus Limonia*). Prior to 1894, the culture of the lemon in Florida was an industry of considerable importance. An annual output of 140,000 boxes had been reached, but the cold of 1894–1895 injured the trees and marked the beginning of the end of commercial lemon-production in the state for the time at least. Another contributing cause to the extinction of the industry was the development of anthracnose, a fungous disease causing brown spots on the fruit, particularly during curing and after shipment. The nature and control of this disease was not then understood. By 1901–1902 the crop had fallen to only a little over 1,000 boxes.

Since 1894, the citrous industry of Florida has moved southward. In consequence, regions have been opened up, which because of their more favorable location are very free from the blighting effects of cold. There is now a very noticeable awakening of interest in lemon-culture and it would not be surprising if the next ten to twenty years would see the industry once more established in the state. The outlook is further improved by the great advancement made in methods of orchard-heating and the control of the disease above mentioned.

Great care must needs be exercised in the selection of locations for growing lemons. The trees respond readily to increased temperatures and hence are too often in poor condition to withstand the low temperatures which often follow. Particular attention must be given to air-drainage and water-protection. Plantings of some size have been made in the last two or three years and still larger ones are contemplated.

The favorite variety and practically the only one planted is Villa Franca. It has proved to be materially hardier than other varieties such as Genoa and Eureka. The Rough lemon, a variety of uncertain relationship, grows as a wild or semi-wild tree in southern parts of Florida. Occasionally the fruit finds its way into the markets of the state. Its principal use is to furnish seed to grow seedlings on which to propagate different citrous fruits. Everbearing is grown here and there as a home fruit. Ponderosa, a large-fruited variety, is grown as a yard tree. When filled with fruit, the tree is very ornamental and the fruit is valuable for home use. This great fruit may be mistaken for a grapefruit (see *Pomelo*).

Lemon trees in Florida, are grown almost entirely on Sour orange and Rough lemon stocks, choice between these two being governed by the soil type and moisture conditions. It is best that the stocks be budded some distance above the ground. In northern Florida, Villa Franca is sometimes grown on *Poncirus trifoliata* stock and fruit is often secured.

Plantings are usually spaced 20 to 25 feet apart each way and the general care and cultivation is much the same as for other citrous fruits. In general, the plan pursued is to cultivate frequently during the usually dry spring season, March to June, after which a cover-crop of beggarweed, native grasses or cowpeas is given possession of the ground. By the middle of November, this cover-crop should be incorporated with the soil, either by shallow plowing or by cutting it in with a disc-harrow. It has been frequently demonstrated that injury to trees from cold is much less severe if all vegetation is cut into the soil, than if the ground is covered with grass and weeds.

Pruning requires careful attention to keep the trees low and compact. Lemons are very prone to produce long bare branches without fruiting twigs. They must be headed in to cause the development of fruiting spurs well in toward the center of the tree.

Protection of the fruit and trees must be provided. Up to this time the Scheu oil-heater is the best heating device that has been brought forward for this work. The temperature must not be allowed to go below 29° F. for any length of time if there is fruit on the trees. With these heaters there is no question but that the trees can be protected against cold in the southern parts of the state.

H. HAROLD HUME.

The lemon in California.

In general, the culture of lemons in California is similar to that of oranges (which see). Especially is this true in regard to soil requirements, propagation, irrigation, fertilization, and the like. The picking and handling of the fruit and pruning of the trees, however, differ radically from that of the orange.

The commercial lemon areas of California are situated near the coast, chiefly in the counties of San Diego, Orange, Los Angeles, Ventura and Santa Barbara, and in the western corner of San Bernardino. In this region the cool, moist summer climate causes the trees to bear a larger proportion of high-priced summer fruit. In the hot interior valleys some lemons are produced also; but while the trees will grow just as well under desert conditions, the fruit tends to mature mostly in the winter when the price is low. The fruit itself under such conditions is shorter-lived and will not keep so long nor ship so well as that produced near the coast.

Lemons are picked from ten to twelve times a year, each lemon being removed from the tree when it has reached a certain size, namely 2¼ inches in diameter. Each picker carries an iron ring of the above diameter and removes every fruit which will not pass through it, regardless of whether the lemon is ripe and yellow or perfectly green. Great care is taken to avoid the slightest abrasion of the skin. The stems are clipped off even with the "button," and the fruit is handled only in gloved hands and canvas picking-bags. The largest pickings are ready in the winter from December 1 to March 1, and as this is the time when the price of lemons is low, it is necessary to defer picking the main crop till March and April and to store an immense amount of fruit, holding it until the high prices of summer prevail. Sometimes seventy-five or one hundred carloads of lemons are stored in one house and held for three to six months. The smallest pickings come in the summer from June 1 to October 1, at a time when the price is the highest. It is necessary, therefore, to subject the green lemons to such an artificial treatment as will result in a good color in the shortest time possible. Thus the lemon-grower has two problems: one is to be able to retard respiration and the ripening process as much as possible and the other to accelerate these same processes.

For the process of spring storage, large houses are provided which are so constructed as to admit of perfect control of ventilation. On the storage-floor, there are a number of suspended canvas tents, each tent accommodating one carload of fruit. When the fruit is brought from the orchard, it is washed in a solution of one-fiftieth of 1 per cent of copper sulfate in water and piled loosely in boxes which are stacked under the tents. During moist, foggy weather the tents are raised and free circulation of air permitted. Should a dry, hot wind from the desert prevail, the tents are kept closed as tightly as possible in order to retard evaporation.

Lemons picked in September, however, after being run through the copper sulfate solution, are removed to a small fireproof building known as a sweat-house. The sweat-house usually has several rooms, each room accommodating one carload of fruit. The fruit is stacked in these rooms in the picking-boxes, the greenest and most immature in the rear and the lightest-colored fruit next the door. The room is then closed tightly and several kerosene stoves are burned in a basement below. Pans of water are kept on the stoves and the gases arising pass through cracks in the floor into the fruit-room. These gases consist of a mixture of carbon dioxide, carbon monoxide and water vapor. The temperature of the room is held as near 90° as possible and is regulated by the number of burners under the room. Great care is taken to keep the atmosphere saturated with moisture. Lemons are artificially colored in this manner in three to six days, depending on the depth of the green color in the rind.

The curing process causes the lemons to shrink in size slightly and the rind becomes thinner, more pliable, with a texture and general finish greatly desired by the market. During the whole process of picking and curing lemons they are handled very much more carefully than oranges. The grading and sizing is done almost entirely by hand, the washing-machine being the only bit of machinery through which lemons are passed.

For many years the lemon business in California did not flourish. Until fifteen years ago, California lemons had a very bad reputation for decay in the eastern markets, and perhaps justly. California growers did not possess the knowledge and the skill necessary for successful handling. One of the most serious troubles of those days was the brown-rot, which not only destroyed a third or more of the lemons on each tree in the orchard, but continued its ravages in the storage-house. The nature of this and many of the other troubles is now well understood and control methods systematized. The business has been readjusted to conditions until the old bad reputation has been lived down and by 1912 California lemons were selling steadily in the New York City auction at a premium over the European product.

On account of the peculiar troubles to which the lemon is susceptible, the expenses of production are greater than in the case of the orange. Until recently the increased tariff has to some extent offset this difference and at present the acreage of bearing lemons is being increased very rapidly.

Practically all varieties of any value in the Old World were introduced into California and tested out in the early days. Most of them, however, were not suited to our climatic conditions. Fifteen years ago the list had been reduced to six, namely the Eureka, Lisbon, Villa Franca, Genoa, Bonnie Brae and Messina. Five years ago the list had shrunk to three varieties, the Eureka, Lisbon and Villa Franca. Today the Eureka is practically the only variety widely planted, although there are many old orchards of the other varieties still in bearing. The Eureka is a seedling which originated in Los Angeles. During the years of its propagation it has split up into several strains, some of which are very much more desirable than others. The best strain of Eureka is precocious, vigorous, prolific, thornless and almost seedless. The chief objections to the Eureka are its habit of throwing out long, ungainly branches which fruit on their ends, and the thinness of the foliage in the springtime which allows a good many lemons to sunburn.

While the orange requires only a medium amount of pruning, the lemon tree demands almost constant attention. The young tree should be regularly pinched back and built up wholly of short, stocky branches, strong enough to bear a heavy load. All growth is cut off at some arbitrary level, at 8 to 10 feet from the ground. A great many vigorous young shoots will arise from the top and should be removed twice each year, once in the spring and again in late summer. In addition to this, many of the large growers keep a gang of expert pruners occupied the year round cutting out the weak and decadent branches and thinning the fruiting brush. One experienced pruner working continuously will care for 25 to 40 acres of Eureka lemons, and a somewhat less amount of Lisbons, which are very thorny and not easily handled. J. Eliot Coit.

LEMON VERBENA: *Lippia.*

LEMON VINE: *Pereskia.*

LEMÒNIA: *Ravenia;* see *Limonia.*

LENOPHÝLLUM (*trough leaf*). *Crassulàceæ.* A genus established by J. N. Rose in 1904 for *Sedum guttatum* and other species: perennial herbs branching at the base: lvs. a few opposite pairs clustered near the base, very thick and somewhat flattened and more or less concave on upper surface: fls. yellow (or drying reddish) in an erect infl. or solitary; sepals 5, equal, nearly distinct; petals erect, distinct, spreading or recurved at top; stamens 10: carpels narrow and erect. —Species about a half-dozen, Mex. and Texas. They are tufted plants a few inches high, to be treated like cotyledons or echeverias. *L. guttàtum,* Rose, and *L. Weinbergii,* Brit., are the names most likely to appear; both are Mexican. L. H. B.

LÉNS (ancient name of the lentil). *Leguminòsæ.* The lentil is one of the important food plants of the human race, although little grown in North America.

Closely allied to Vicia, from which it is distinguished chiefly by the 2-ovuled ovary and 1–2-seeded pod, Vicia usually having more than 2 seeds. Low erect or partially climbing herbs: lvs. pinnate, the terminal lft. sometimes ending in a bristle or tendril, the lfts. 2 to many pairs and entire: fls. small, bluish white, racemose or solitary, papilionaceous; calyx-lobes nearly equal and elongated; standard broadly obovate or nearly orbicular; wings oblique, obovate, partially adhering to the short keel: pod compressed, 2-valved, 1–2-seeded; seeds lenticular.—Species about a half-dozen, in the Medit. region and W. Asia, apparently only one of economic importance.

esculénta, Moench (*Érvum Léns,* Linn. *Vícia Léns,* Coss. & Germ.). Lentil. Annual, much-branched, 1–1½ ft. high: lvs. with numerous oval or oblong-oval lfts., ending in a tendril: fls. small, white or pale blue, axillary, in pairs: pods short and broad, very flat, and containing 2 flat seeds rounded in outline and convex on both sides. S. Eu.—The lens of the astronomer and physicist was named because it was shaped like one of these seeds. Some varieties have gray seeds, others red. Esau sold his birthright to Jacob for a mess of red pottage made of lentils. The seeds are used chiefly for soups and stews. They are a coarser and cheaper food than fresh peas and beans, and about as palatable as split peas. Lentils rank amongst the most nutritious of vegetables. They are also of the easiest cult., but the seeds are often destroyed by a weevil. There are many cult. varieties. The seed is usually sown in drills in March, 18–30 in. apart. The heaviest crops are produced on rather dry sandy soils. The plants need no special care between seedtime and harvest. The seeds keep better in the pods than after being threshed. The herbage makes good fodder. See Cyclo. Amer. Agric., Vol. II, p. 308. L. H. B.

LENTIL: *Lens.*

LEONÒTIS (Greek, *lion's ear,* which the flowers are supposed to resemble). *Labiàtæ.* Lion's Ear. Lion's Tail. This includes a tender shrub with scarlet-orange, gaping flowers, cultivated outdoors in southern Florida and southern California; and it is an excellent winter bloomer under glass.

Annual or perennial herbs, coarse and tall: lvs. opposite, petiolate, ovate: fls. white or yellow in very dense axillary whorls; calyx 8–10-ribbed, the tube arched and funnel-shaped; corolla-tube as long as calyx; upper lip long and concave, outside hairy; lower lip deflexed, the 3 lobes nearly equal; stamens 4, arched, didynamous; style 2-lobed.—Species about 20 in Trop. and S. Afr., one more widely dispersed.

Leonùrus, R. Br. Branched perennial with hairy sts., shrubby, 3–6 ft. high: lvs. 2 in. long, lanceolate or oblong-lanceolate, obtuse, coarsely serrate, narrowed at the base, pubescent: corolla more than thrice as long as the calyx, red-yellow or orange-red, 1½–1¾ in. long, pilose, the upper lip large and the lower small; stamens not exserted. S. Afr. B.M. 478 (as *Phlomis Leonurus*). R.H. 1857, p. 548. Gn. 53, p. 460. G.C. II. 19:186; III. 43:139. J.H. III. 53:255. G.W. 7, p. 100; 13, p. 14. G. 8:22; 13:313; 36:65. R.H. 1913, p. 92. Var. **globòsa nàna,** is a dwarf form, not exceeding 2½ ft. in all, and with a regular and rounded habit of growth. It is said that *L. Leonurus* has become a menace in S. Afr., with laws to provide for its destruction. In the North, Leonotis cuttings should be started in early spring, the young plants transplanted to the open in May and thereafter frequently pinched to make a symmetrical instead of a straggling bush, and if the plants do not flower before frost, they can be cut back, lifted and brought into a cool greenhouse to flower in Nov. or Dec. A southern enthusiast says that they are as easy to cult. as a geranium. There is a white fld. form.

L. dysophýlla, Benth., has orange-yellow fls., and differs from L. Leonurus also in the broader lvs. and longer calyx-teeth. S. Afr. B.M. 8404.—*L. nepetæfòlia,* R. Br. Annual, 1½–6 ft., with 4-angled st.: lvs. ovate, round-toothed; bracts spinescent: fls. yellow or orange-red, in distant-globose bur-like whorls; corolla 1 in. long. Many tropics; reported as a showy plant in Porto Rico.

Wilhelm Miller.
L. H. B.†

LEONTÍCE (Greek, *lion's foot;* referring to the shape of the leaf). Including *Bongárdia. Berberidàceæ.* Lion's Leaf. Hardy herbaceous perennials, chiefly Asian, of low growth and distinct appearance.

Tuberous: lvs. pinnate or pinnatisect, on the st. small or none: fls. yellow, racemose or in a somewhat dichotomous cyme; sepals petal-like, 3–9; petals 6, often reduced to small nectaries; stamens 6, free: carpel 1, becoming a bladdery nearly or quite indehiscent caps.—Species perhaps a dozen, S. Eu. to Cent. Asia. Likely to be advertised with Dutch bulbs. These plants have a turnip-shaped corm or rhizome about 2 in. thick, and bear yellow fls. in early spring. Bongardia, now included in Leontice, has only one species.

A. *Petals reduced to scales or nectaries.*

B. *Lvs. twice ternately cut.*

Leontopétalum, Linn. Height 1–1½ ft.: lfts. ovate or obovate, rarely subcordate: panicle large, dense, leafy. Italy and the Orient.—Root used in the Holy-land. against epilepsy.

BB. *Lvs. digitately cut.*

C. *Raceme dense, conical.*

Álberti, Regel. Sts. several, stout, each giving off 2 subradical lvs. which are undeveloped at flowering-time: lvs. finally on stalks 4–5 in. long, digitately 5-parted; lfts. pale green, glaucous, elliptic; nerves prominent and parallel beneath: scape 6–8 in. high, robust; raceme as many as 18-fld.; fls. nearly 1 in. across, ochre-yellow, streaked reddish brown on back; petals shorter than the stamens. Turkestan. B.M. 6900. Gt. 1881:1057.

CC. *Raceme loose, oblong.*

altàica, Pall. Lvs. not from the root, digitately cut, only 1 lf. on each fl.-st., the lf. having 3 primary divisions, each of which is petioled and has 5 lfts., 2 of which are smaller than the rest; lfts. elliptical: infl. a raceme, bearing large, more or less roundish leafy bracts; fls. mostly erect, having 6 showy, oblong, not overlapping, entire parts supposed to be sepals, the petals small, yellow, erect, shorter than the anthers. S. Russia, Altai, Siberia. B.M. 3245.

AA. *Petals large and prominent.*

Chrysógonum, Linn. (*Chrysógonum Dioscorìdis,* Rauw. *Bongárdia Raùwolfii,* C. A. Mey). Of the subgenus Bongardia. Lvs. all from the root, pinnate; lfts. 3–8 pairs, or some of the lfts. in whorls of 3–4, wedge-shaped, 3-fid. with a conspicuous triangular crimson mark at the base of each: infl. a panicle, bearing minute, linear bracts; fls. drooping, having 6 showy, wedge-shaped, crenate parts, 3 of which should possibly be considered petals, and the other 3 inner sepals, since there are 3 small, greenish lobes outside which are like an ordinary calyx, and should, perhaps, be called the outer calyx. B.M. 6244. F.C. 3:98. B. 1:50.

Wilhelm Miller.

LEÓNTODON (Greek, *lion's tooth*). *Compósitæ.* A rather weedy group of hardy perennials little grown in Amer. and not unlike the hawkweeds. They are scapose herbs with clustered, basal lvs. much pinnatifid, scapose, with many-fld. heads of rather showy yellow fls.: involucre ovoid or oblong, its bracts in 1 or 2 series; pappus of plumose bristles, differing in this from Hieracium, its nearest horticultural relative.

L. autumnàle, Linn., Fall Dandelion, is sometimes cult. in Amer. It becomes weedy, but its late-flowering yellow heads are attractive to some. Eu., but naturalized in E. N. Amer. N. Taylor.

LEONTOPÒDIUM (Greek, *lion's foot*). *Compósitæ.* Perennial herbs, all tufted and woolly, of which the edelweiss is perhaps the one flower most sought by tourists in the Alps. It is an emblem of purity.

Stems ascending or erect, unbranched except at the very top: st.-lvs. alternate, entire: heads small, crowded into dense cymes surrounded by a sort of leafy involucre.—About 6 widely scattered species. Edelweiss is still catalogued as a Gnaphalium, but in that genus the style is 2-cut, while in Leontopodium it is uncut. Leontopodium is more nearly allied to our common weed, the "pearly everlasting" (*Anaphalis margaritacea*), which lacks the dense cluster of star-like floral lvs., but in the opinion of some has as much beauty as the edelweiss.

The edelweiss is a low plant, 4 to 12 inches high, densely covered with a whitish wool, the attractive portion being the flat star-like cluster of woolly floral leaves surrounding the true flowers, which are small, inconspicuous and yellow. The general impression seems to be that edelweiss cannot be cultivated in America. In 1900, however, it was extensively advertised as a pot-plant, and it has long been cultivated in rock-gardens. J. B. Keller says, "It can be grown to perfection in an elevated position of the rockery, in rather light soil and with full exposure to sun. It also succeeds in an ordinary hardy border where the plants can be kept moderately dry in winter."

Seeds of edelweiss should be sown about February 1, which gives plants large enough to plant out in permanent quarters about May 1. If planted in good well-drained ground, the plants are sure to make a good growth so that by the middle of September there will be an occasional flower. However, it is not until the following year that one gets a full crop of flowers, so many in fact that it seems to exhaust the plants, which should now receive a good deal of care. Old plants divided early in the fall and wintered in coldframes give very good results, or late-sown seedlings carried over winter in the same way do well. (Albert E. Robinson.)

To establish a colony of edelweiss an English writer (Gn. 52, p. 146) advises that a few stray seedlings be firmly planted in a narrow chink of rock so placed that a deep fissure of gritty or sandy loam may be assured for the roots to ramble in. Plants in pots may be grown and flowered when the collar is tightly wedged between some pieces of stone or old mortar. The plant is best propagated by seeds, as division is not always successful.

2132. Edelweiss.—Leontopodium alpinum. (×¼)

alpìnum, Cass. (*Gnaphàlium Leontopòdium,* Linn. *L. himalayànum,* DC.). Fig. 2132. Creeping by stolons: lvs. lanceolate, white-tomentose beneath, floral ones oblong: fl.-heads 7–9 in a cluster; involucral scales woolly at base, blackish at apex. B.M. 1958. Gn. 29, p. 529; 52, p. 146; 60, p. 344; 62, p. 145. G.L. 18:47; 24:181.

sibíricum, Cass. St. simple, bearing numerous oblong-linear, often webby lvs.: fls. borne in a densely corymbose cluster, white, and nearly twice the size of the preceding. Russia.—Can be grown readily at much lower elevations than *L. alpinum.*

L. japónicum, Miq. (Gnaphalium Sieboldianum, Franch. & Sav.). Fls.-heads looser: lvs. shining dark green above, underneath silvery. N. Taylor.†

LEONÙRUS (Greek compound, meaning *lion's tail*). *Labiàtæ.* About 10 species of herbs, some of them weedy and widespread, but scarcely horticultural subjects. *L. Cardìaca,* Linn. (*Cardìaca vulgàris,* Moench. *L. villòsus,* Desf.), is the common motherwort: weed or escape about buildings and in waste places, from Eu.: perennial, tall, with long-petioled lvs., the lower 3-cleft: fls. purple (sometimes white) bearded, in axillary whorls; calyx with prickly teeth. Said to be a good bee-plant.

LÉPACHYS (Greek, *a thick scale;* probably referring to the thickened upper part of the bracts of the receptacle). Including *Ratibida. Compósitæ.* Annual or perennial herbs, the most popular of which is a fine prairie wild-flower, *L. columnaris,* for which, unfortunately, there is no common name.

Lepachys contains 4 species of herbs, all American, 3 perennial: lvs. alternate, pinnately divided or parted: disks at first grayish, their corollas yellowish, becoming tawny; chaffy bracts commonly marked with an intermarginal purple line or spot, containing volatile oil or resin; achenes flattened, sharp-margined or winged. For generic distinctions, see *Rudbeckia.*

Lepachys columnaris grows 2 to 3 feet high, has elegantly cut foliage, and bears flowers something like a brown-eyed Susan, but the disk is finally cylindrical and more than an inch high, with 6 or 7 oval, reflexed rays hanging from the base. In a fine specimen these rays are 1½ inches long and nearly 1 inch broad. There are 5 inches or more of naked wiry stem between foliage and flower. Typically, the rays are yellow, but perhaps the most attractive form is var. *pulcherrima,* which has a large brown or brown-purple area toward the base of each ray. Like the greater number of our native western flowers that are cultivated in the eastern states, the plants have reached our gardens from European cultivators. Meehan says it is perfectly hardy in our northern borders, but the English do not regard it as entirely safe without some winter protection. Moreover, it is one of the easiest herbaceous perennials to raise from seed, flowering the first year, and it is chiefly treated in the Old World as an annual bedding plant, the seeds being known to the trade as *Obeliscaria pulcherrima.* For bedding, the seeds are sown in early spring in a hotbed, the seedlings pricked off into boxes, hardened off, and finally transplanted to the open, only slight care being necessary to obtain compact bushes about 2 feet high. Under such circumstances the plants flower from June to September, and the season may be prolonged by a sowing in the open. This has proved useful in our northern borders, where seed should be thinly sown in the open, where the plants are to stand, with a fair chance of autumnal bloom the same year. The flowers last well in water and should be cut with long stems to get the benefit of the delicately-cut foliage. *L. pinnata* is perfectly hardy at New York and is a serviceable perennial.

A. *Rays oval, scarcely as long as the disk at its longest: lf.-segms. linear.*

columnàris, Torr. & Gray (*Ratíbida columnàris,* D. Don). Fig. 2133. A rough-pubescent perennial, branching from the base, 1–2½ ft. high in the wild, often higher in cult.: st.-lvs. with 5–9 divisions, which are oblong to linear in outline and sometimes 2–3-cleft: fls. solitary, terminating the branches; rays yellow; style-tips short, obtuse. Prairies, Saskatchewan to Texas and Rocky Mts. B.M. 1601. Mn. 1:65.

2133. Lepachys columnaris. (×¼)

Var. **pulchérrima,** Torr. & Gray (*Obeliscària pulchérrima,* DC.), differs only in having the rays partly or wholly brown-purple. The plants in the trade are mostly margined with yellow or have about half of each color. Gn. 51:98. R.H. 1854:421. Var. **tòtus purpùreus,** Hort. D. M. Andrews, is "a variety with dark orange-brown rays, almost black."

AA. *Rays oblong-lanceolate, very much longer than the disk: lf.-segms. lanceolate.*

pinnàta, Torr. & Gray (*Ratíbida pinnàta,* Barnh.). Slender, 3–5 ft. high: lvs. with 3–7 lfts., which are lanceolate, sparsely serrate, sometimes lobed, the uppermost run together, very rough-hairy: rays yellow, often 2 in. or more long. W. N. Y. to Ia., south to La. B.M. 2310. Gn. 47:418; 51, p. 205.—It is at home in a sunny border.

J. H. Cowen.
N. Taylor.†

LEPÁNTHES (*scale flower*). *Orchidàceæ.* Some forty species of the mountains and upper parts of Mex., Cent. Amer., W. Indies and S. Amer., epiphytic, monophyllous, allied to Pleurothallis but differing in bearing club-shaped pollinia and a usually 2-parted lip that is adnate to the column. None is offered, and the species are of little importance horticulturally.

LEPICÝSTIS: *Polypodium.*

LEPIDÁGATHIS (Greek, *scale* and *ball,* in allusion to the curved infl.). *Acanthàceæ.* Tropical herbs and shrubs; one is in horticultural literature as a warmhouse evergreen shrub. It is *L. cristàta,* Willd., in Trop. India, with purplish fls., linear or oblong nearly glabrous lvs. and spinose-acuminate bracts and bracteoles: fls. in globose clusters or heads near the base of the plant; corolla ⅓in long, in bud densely hairy, white with purple or brown spots: sts. 6–24 in., procumbent. Lepidagathis has about 50 species, of which two are in the American tropics and the others in the Old World. It is little known to cultivators.

LEPÍDIUM (from Greek for *little scale,* alluding to the small flat pods). *Cruciferæ.* Cress. Pepper-Grass. Small mostly unattractive herbs (or rarely subshrubs), one of which is a salad plant. See *Cress.*

Annual, biennial or perennial, erect or spreading, with many small white fls.: lvs. very various, simple to more or less bipinnate: fls. mostly racemose, often with leafy bracts intervening; petals small or wanting; stamens 2–6: pod circular, flattened against or contrary to the partition; seed 1 in each cell; cotyledons in most cases incumbent.—Perhaps 100 species in many parts of the world. There are about 20 native species, mostly western, and several intro. weedy species. The foliage and pods have an aromatic-peppery flavor. The herbage of some species is used as salad, and the pods are sometimes fed to tame birds (whence the name "canary grass"). There are no species of much ornamental value.

satìvum, Linn. Garden Cress. Annual, 1–2 ft., glaucous when in fl. and fr., glabrous: fls. small and inconspicuous, in an elongating raceme: pods nearly circular, bifid at the apex, winged: lvs. exceedingly various, but usually the radical ones pinnately divided and subdivided, the central cauline ones 2–3-cleft, nearly to the base and the segms. entire or toothed, the uppermost simple and entire. W. Asia, but widely disseminated as a cult. plant, and sparingly run wild in the northern part of the U. S. and Canada.—Under cult. the foliage varies immensely. The curled sorts have lvs. as finely cut as curled parsley. On Australian cress, which is a golden-lvd. form, there are sometimes on the same plant broad-spatulate, ragged-edged lvs., cut lvs., and simple linear lvs.

Other lepidiums are sometimes eaten, but are not in the trade and are of little importance. One of these is the common *L. virgínicum,* Linn., wild in the U. S., and known as pepper-grass.

L. H. B.

LEPTACTÌNA (Greek, *graceful rays,* referring to the star-like aspect of the flower). Also written *Leptactinia. Rubiàceæ.* Showy shrubs, glabrous or puberulent, leafy: lvs. opposite, glossy; stipules broad-ovate and mostly rather large: fls. in dense terminal cymes, like ixoras, white.—The genus contains about 25 species, all Trop. African shrubs, important generic characters being the large calyx-lobes, very long corolla-tube, 5 included stamens, style-branches free or connate, large lax stipules, and clustered infl.

L. Mánnii, Hook. f. Branching shrub, 6 ft. high: lvs. 5½ in. long, 2½ in. wide and larger in proportion, oval, wavy-margined, obtuse, with gobose green bodies between the insertions of the lvs., which are stipules: calyx-tube 3 lines long, lobes 1 in. or more long, leafy; corolla silky within, lobes lanceolate; stamens 5, included; style hairy above, 2-branched. B.M. 7367.—A very interesting white-fld. shrub for growing under glass, apparently not offered in this country.

L. H. B.

LEPTÁNDRA: *Veronica.*

LEPTARRHÈNA (name refers to the slender or thin anthers). *Saxifragàceæ.* One perennial caulescent herb, *L. pyrolifòlia,* R. Br. (*L. amplexifòlia,* R. Br *Saxífraga pyrolifòlia,* Don), from Kamtschatka and Alaska to Wash., sometimes mentioned in horticultural literature: caudices short and leafy, the lvs. alternate, leathery and evergreen, toothed, narrow to base, the radical ones 1–4 in. long and obovate to oblong or spatulate, those on the fl.-stalks 1 or 2 and clasping: fls. small, white, in bracted panicles, on scape-like sts 8–16 in. high; sepals 5, erect; petals 5, narrow, persistent; stamens 10; ovary of 2 nearly distinct carpels, becoming follicles. Probably a good plant for wild-gardening where proper conditions can be found; recorded as growing "in high mountain marshes."

L. H. B.

LEPTINÉLLA: *Cotula.*

LEPTOCÁRPHA (name refers to the slender scales or chaff). *Compósitæ.* A subshrub from Chile and Peru that has been grown abroad for the yellow fl.-heads. *L. rivulàris,* DC., the only species, has alternate or sometimes opposite ovate, toothed, and scabrid lvs. about 2 in. long, and heads about 1 in. diam. A half-hardy or greenhouse plant allied to Helianthus.

LEPTOCHÌLUS (from the Greek referring to the linear form of the fruiting frond). *Polypodiàceæ.* A group of moderate-sized tropical ferns, allied to Dryopteris, but formerly classified under Acrostichum. The lvs. are pinnately divided; the sporangia are borne very close together so that at maturity they appear entirely to cover the backs of the fertile lvs.

aliènus, Swartz (*Acróstichum aliènum*, Swartz). Sterile lvs. 1–2 ft. long, triangular, with the upper pinnæ decurrent, and the lower at least sinuate or even incised; fertile lvs. smaller, with narrow pinnæ, the upper decurrent. Cuba and Mex. to Brazil.

nicotianæfòlius, C. Chr. (*Acróstichum nicotianæfòlium*, Swartz). Sterile lvs. with 3–7 pinnæ which are 6–12 in. long and 2–3 in. wide, with nearly entire edges; fertile lvs. smaller, with 3–7 pinnæ 3–4 in. long, 1 in. wide. W. Indies to Brazil. R. C. Benedict.†

LEPTOCHLÒA (*slender* and *grass*, from the Greek, referring to the slender spikes). *Gramíneæ*. Annual or perennial grasses with rather showy inflorescence, one species occasionally grown for ornament.

Plants with flat blades and slender unilateral spikes arranged along a main axis: spikelets 2- to several-fld.—Species about 12, in the warmer regions of both hemispheres. Differs from Chloris and other genera of the tribe Chlorideæ, in having racemosely arranged spikes with several-fld. spikelets.

virgàta, Beauv. Erect, glabrous, usually glaucous perennial, 2–4 ft.: spikes numerous, 3–6 in., on an axis 3–6 in. long; spikelets 3–6-fld.; florets awnless or with an awn shorter than the body. Trop. Amer.—Has been advertised under the name of *Chloris gracilis*. A pleasing grass with feathery infl. suitable for borders in the South. A. S. Hitchcock.

LEPTOCÒDON (*slender bell*, from the shape of the flowers). *Campanulàceæ*. Twiner, suitable for the greenhouse. From Campanumæa it differs in bearing a dehiscent caps. rather than a fleshy berry, and from Codonopsis in having a tubular upwardly inflated rather than mostly campanulate corolla. The single species is *L. grácilis*, Hook. f. & Thom. (*Codonópsis grácilis*, Hook. f. *Campanumæ̀a grácilis*, Hort.), of Sikkim (India): glabrous slender perennial with alternate and opposite long-stalked ovate-crenate lvs.: corolla 1–1½ in. long, blue, tubular-curved, shortly 5-lobed, the calyx very deeply 5-lobed; stamens 5, free, with as many glands intervening; fls. terminal and opposite the lvs., single on slender peduncles. L. H. B.

LEPTODÁCTYLON: *Gilia*.

LEPTODÉRMIS (Greek, *leptos*, thin and *derma*, skin, membrane, referring to the thin membranous bractlets connate into a tube.) *Rubiàceæ*. Low shrubs with small foliage, and small tubular white or purplish flowers in usually few-flowered clusters appearing during summer and fall when few shrubs are in bloom.

Slender-branched, with opposite small entire stipulate lvs.: fls. in axillary head-like clusters; calyx 5-toothed, persistent; corolla tubular-funnelform, with 5-lobed limb; stamens 4, included; ovary inferior, 5-celled; style slender, 5-parted at the apex: fr. a caps., the outer wall splitting to the base into 5 valves, the inner net-like, closed, enveloping the seed.—About 10 species in China and Himalayas. Interesting for botanical collections as one of the few woody representatives of Rubiaceæ which are hardy north. A few species have been recently intro. from China, of which the following has proved fairly hardy at the Arnold Arboretum, but appears to be short-lived. Prop. by greenwood-cuttings in summer and by seeds.

oblónga, Bunge. Shrub, to 3 ft.: lvs. oblong or elliptic-ovate, acute, narrowed at the base into the short petiole usually scabrid, ½–¾in. long: fls. in sessile, dense and few-fld. clusters; corolla slender, tubular, with oblong-lanceolate spreading lobes, puberulous outside, violet-purple, ¾in. long; style exceeding the hairy mouth. N. China. July–Oct. Alfred Rehder.

LEPTOLÆLIA. Hybrid of *Leptotes bicolor* (seed parent) and *Lælia cinnabarina*, known as *Leptolælia Veitchii*.

LEPTÓPTERIS (Greek, *cut fern*, alluding to the filmy texture of the lvs.). *Osmundàceæ*. About 6 greenhouse ferns with sporangia like those of Osmunda but with filmy lvs. like those of Hymenophyllum. These sporangia grow on the backs of the lvs. as in ordinary ferns. A group of beautiful ferns which require special cult. All are from the Australasian region. Allied to Todea.

supérba, Presl. With an erect woody st. 12–18 in. high; lvs. 2–4 ft. long, 6–10 in. wide, tripinnatifid, pinnæ close together, narrow, reduced below. New Zeal. R. C. Benedict.

LEPTÓSIPHON (name alludes to the slender flower). *Polemoniàceæ*. A genus founded by Bentham, but now made a section or subgenus in Gilia. *L. densiflòrus*, Benth. (*G. densiflòra*, Benth.), is a common garden annual, by some now separated as *Linánthus densiflòrus*, Benth., native in California. *Leptósiphon aùreus* and *L. hýbridus* are accounted for under *Gilia micrantha* (p. 1337).

LEPTOSPÉRMUM (Greek, *slender seed*). *Myrtàceæ*. Ornamental woody plants grown chiefly for their copiously produced flowers and also for the neat myrtle-like foliage.

Evergreen shrubs or small trees: lvs. alternate, small, rigid, entire, nerveless or 1–3-nerved: fls. short-stalked or sessile, solitary or 2–3, axillary or at the end of short branchlets; sepals short and broad; petals roundish, clawed, spreading; stamens many; ovary inferior, inclosed in the calyx-tube, 3–10-celled; style short: fr. a loculicidal caps., usually protruding above the calyx-tube; seeds numerous, linear, or few and compressed and winged.—There are about 25 species mostly in Australia, few in New Zealand and in the Malay Archipelago.

The leptospermums in cultivation are upright shrubs with slender branches densely clothed with small rigid foliage and covered in spring with numerous white, rarely pink or carmine flowers ½ to ¾ inch across; the capsules are small and insignificant. They are cultivated somewhat outdoors in California, or in the North in the greenhouse and treated like heath and other Cape and Australian hardwood plants. Planted outdoors they stand drought well and *L. lævigatum* has been employed by the hundred thousands in the reclamation of the moving sands on the San Francisco promontory where the Golden Gate Park is now established. For greenhouse culture, *L. scoparium* var. *bullatum* is an exceptionally good plant for those who can grow heaths. It is far better than *L. lævigatum*.

Cuttings taken from well-ripened wood in the fall or from the young growth in summer root freely under the same treatment given erica. For a potting soil, use two parts leaf-mold and one of sand. Plunge the pots outside during the summer in the full sunlight. The plants make a straggling growth, unless trimmed into shape. By fall they will be covered with buds, but it is impossible to force them into bloom for Christmas. Keep the plants in a cool house with ericas or azaleas until the latter part of February or March, and then give them a little more heat, say 55° to 60°. The plants will soon be a mass of white flowers. *L. scoparium* var. *bullatum* does not grow rapidly, but, like epacris, as it grows older it makes fine specimens. It has tough foliage, stands much hard usage, and when in bloom attracts plant-buyers. It deserves greater popularity.

Propagation is by seeds sown in spring and treated like those of erica or rhododendron, but usually by cuttings of young wood in May under glass, or of nearly mature wood in autumn and kept in winter in temperate house.

A. *Ovary usually 10-celled.*

lævigàtum, F. Muell. Tall shrub, attaining 20–30 ft., glabrous and somewhat glaucous: lvs. varying from obovate-oblong to oblong-cuneate or narrow-oblong, obtuse, ½–1 in. long, 3-nerved: fls. white; calyx glabrous: caps. slightly protruding above calyx-tube. Austral. B.M. 1304 (as *Fabricia lævigata*). G.C. II. 25:816; III. 9:45.

AA. *Ovary usually 5-celled.*

B. *Calyx-tube glabrous.*

C. *Lvs. flat or with recurved margins, obtuse or scarcely pointed (except in the large variety).*

flavéscens, Smith. Tall shrub: lvs. usually narrow-oblong to linear-lanceolate or broadly oblong or even obovate, ½–¾in. long: fls. about ½in. across, white. Austral. B.M. 2695. Var. **obovàtum,** F. Muell. Lvs. broadly obovate to obovate-oblong, under ½in. long. Cult. in Eu. under glass. Var. **grandiflòrum,** Benth. & Muell. Lvs. rather larger: fls. larger than in any other variety. L.B.C. 6:514.

CC. *Lvs. flat or concave, sharp-pointed, narrow or small.*

scopàrium, Forst. Attaining 10–12 ft.: lvs. ovate to linear-lanceolate or linear, mostly under ½in. long. Otherwise, almost exactly as in *L. flavescens.* Var. **junipérinum,** Nichols. (*L. junipérinum,* Smith). A narrow-lvd. form with pubescent pendulous branchlets. Var. **bullàtum,** Rehd. (*L. bullàtum,* Hort.). Lvs. larger, narrow: fls. larger, about ¾in. broad. G.C. III. 51:100. G. 30:415. R.H. 1903, p. 375. R.B. 30, p. 44. J.H. III. 30:435. Var. **Níchollii,** Turrill. Fls. carmine: lvs. purple, but green in plants grown under glass. Gn. 77:612. B.M. 8419. R.H. 1912:520. Var. **grandiflòrum,** Hook. Fls. large, pink or nearly white. B.M. 3419. Gn. 51:390. Var. **Chápmannii,** Dorrien Smith. Lvs. brownish: fls. bright rose. New Zeal. Var. **Bóscawenii,** Bois. Fls. 1 in. across, cherry-red in bud, white with reddish center when expanded. New Zeal. R.H. 1912:520. G.C. III. 51, suppl. One of the most desirable forms. It is said to be of relatively easy cult., with compact habit, the branches spreading in all directions. Excellent plants for the amateur, but very slow-growing. *L. scoparium* is the manuka or tea-tree of New Zeal.

BB. *Calyx-tube more or less densely clothed with silky or woolly hairs.*

pubéscens, Lam. (*L. lanigerum,* Smith). Tall shrub or small tree: branchlets villous: lvs. varying from obovate-oblong to elliptic or narrow-oblong, normally ½in. long, silky-villous while young, rarely glabrous: fls. ½–¾ in. across, white. Austral. L.B.C. 8:701; 12:1192. B.M. 1810. I.H. 32:570. G.C. II. 12:427. Gn. 19:42, and 27, p. 145. G. 29:642.—Extremely variable. Long cult. abroad, but not advertised in Amer.

L. flexuòsum, Spreng. (Agonis flexuosa, Schauer). Tall shrub or tree, to 40 ft.: branchlets at first pubescent, finally glabrous: lvs. lanceolate or linear-lanceolate, 3-nerved, ¼–½ in. long: fls. white, over ⅓in. across, in axillary heads; calyx pubescent, stamens 20. Austral.—This species is now generally referred to Agonis which differs from Leptospermum chiefly in the capitate infl. and in the cells of the ovary having only 2–6 ovules ascending from a basal placenta.

Alfred Rehder.†

LEPTÓSYNE (Greek, *slenderness*). *Compósitæ.* Yellow-flowered composites, with much-divided foliage like cosmos.

Smooth and glabrous herbs and subshrubs: lvs. alternate or opposite, usually rather fleshy, and ternately or pinnately divided or dissected. They are the representatives of Coreopsis on the western side of the continent, but have mostly pistillate rays and always a ring on the tube of the disk-fls.—Seven species, all from Calif. except *L. arizonica.* The genus is united with Coreopsis by some authors, including Hoffmann in Engler & Prantl.

In the North these plants are mostly treated as half-hardy annuals. None of them has anything like the popularity of either cosmos or *Coreopsis tinctoria.* The commonest species is *L. maritima,* but *L. Stillmanii* promises to outrank it, although not well known in the trade. *L. Stillmanii* is said to bear flowers 1½ inches across, for 5 or 6 weeks. Its seed germinates quickly and can be sown outdoors. Sandy soil and a sunny position are advised. It is said to bloom in four to five weeks after sowing. *L. maritima* should be started indoors, transplanted in May, and can be brought into flower by July. Two distinct plants are passing in the trade as *L. maritima,* one of which is *L. calliopsidea,* and is considered an inferior plant by some. The seeds of the two plants are easily distinguished.

A. *Rays obovate.*

B. *Seeds having long, soft, villous hairs.*

calliopsídea, Gray (*Agarísta calliopsídea,* DC. *Coreópsis calliopsídea,* Boland.). This is the plant figured in R.H. 1873:330, erroneously as *L. maritima.* Annual, 1–2 ft. high, rather stout and leafy: fls. 3 in. across, long-stalked; rays fewer, shorter and broader than in *L. maritima,* 1¼ in. long, ¾–1 in. wide.

BB. *Seeds having short, rigid bristles.*

Doùglasii, DC. (*L. califórnica,* Nutt. *Coreópsis Doùglasii,* Hall). Annual, 9–12 in. high: lvs. 1–3 times parted: fls. on solitary, long-stalked heads; ring of the disk-fls. distinctly bearded. June, July.

BBB. *Seeds not hairy.*

Stíllmanii, Gray. Stouter than *L. Douglasii* and more leafy below, surmounted by a single long-stalked head: ring of disk-fls. beardless. Gn. 52, p. 461. G.C. III. 22:333. R.B. 23, p. 275. Gt. 46, p. 612. S.H. 2:44. G.L. 23:293.—Intro. 1898, by Benary. Annual with linear (not filiform) lf.-lobes.

AA. *Rays oblong: perennials.*

B. *Sts. low, from a thick base.*

marítima, Gray (*Coreópsis marítima,* Hook. f.). Perennial: lvs. 2-pinnate: fls. 3½ in. across, borne at the ends of branches on peduncles 9–12 in. long; rays 16–20, 1½ in. long; disk 1 in. across: seeds not hairy. B.M. 6241. Gn. 49:272. Not R.H. 1873:330, which is really *L. calliopsidea.*—Makes a good bog-plant.

BB. *Sts. 2–8 ft. high, 1–5 in. thick, somewhat woody, often decumbent.*

gigantèa, Kellogg (*Coreópsis gigantèa,* Hall). Differs in being leafy at the top only, the others being leafy at the base: lvs. 2–3-pinnate: fls. smaller than in *L. maritima,* borne on short corymbose peduncles; disk ½in. across: seeds not hairy. Cult. in S. Calif. Gt. 44, p. 592. G.C. III. 28:319.—The fls. are said to be sweet-scented.

Wilhelm Miller.
N. Taylor.†

LEPTOTÆNIA (*narrow vittæ* or oil-tubes). *Umbelliferæ.* Several N. American tall perennial herbs, allied to Ferula and Angelica: glabrous: roots thick and fusiform: lvs. pinnately compound: fls. yellow or purple, in compound umbels, the involucre and involucels none or of few bracts: fr. oblong or nearly orbicular, much compressed. Two species were once listed, but probably none is in cult. Manuals of the plants of the Rocky Mt. region and west contain descriptions of the species.

LEPTÒTES (from the Greek, referring to the slender parts). *Orchidàceæ.* Small terrestrial or epiphytic herbs of slender habit bearing racemes with few pretty flowers produced in spring.

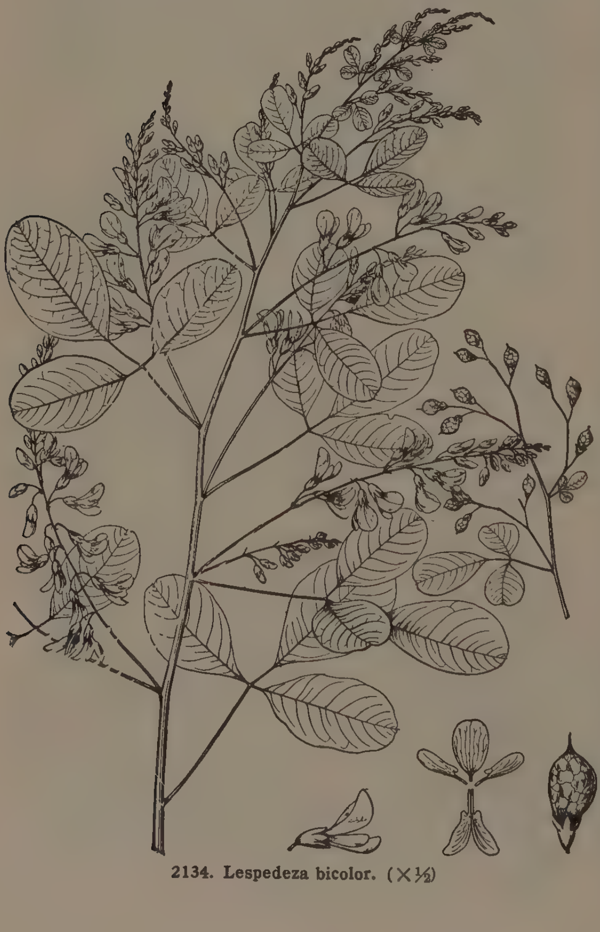
Stems erect, not pseudobulbous, growing from a creeping rhizome and bearing 1–3 fleshy linear lvs. and a slender but rigid, terminal raceme: sepals and petals nearly equal, spreading; labellum joined to the base of the column; lateral lobes large, spreading or small, auricle-like, middle lobe large, entire, contracted at base, column with 2 wide wings; pollinia 4 perfect and 2 imperfect.—Six species in Brazil and W. Indies. Cult. as for lælia.

bícolor, Lindl. (*Tetramìcra bícolor,* Rolfe). Lvs. solitary on the short st., semi-cylindric, with a furrow in front, 3–4 in. long: raceme few-fld., shorter than the lvs.; sepals and petals white, linear-incurved, over 1 in. long; lateral lobes of the lip small, folding over the column; terminal lobe oblong-lanceolate, bright rose, with white tip and margins. A pretty plant. B.R. 1625. A.F. 6:633. Gn. 59, p. 77. Var. **glaucophýlla,** Hook. Lvs. glaucous. B.M. 3734.

L. unícolor, Rodr. Habit pendulous: fls. pale lilac: lvs. fleshy. Brazil.

Heinrich Hasselbring.

LESCHENAÙLTIA (named for L. T. Lechenault, botanical traveler in the far E.). Written also *Lechenaultia. Goodeniàceæ.* About 20 species as understood by the latest monographer (Krause, in Engler's Pflanzenreich, hft. 54, 1912) of herbs and heath-like shrubs of Austral., sometimes grown under glass: glabrous or rarely hirsute: lvs. heath-like, scattered or crowded, narrow and entire: fls. yellow, red, violet or greenish, solitary or corymbed, showy, with a slender tube and large limb; calyx-tube adnate to ovary, the lobes 5 and linear or lanceolate; corolla oblique, the tube usually slit to the base, on the back, the lobes connivent or spreading; anthers mostly cohering around the style; indusium (or dilated top of style) 2-lipped with a partial ring of hairs outside: caps. linear, 4-valved, dehiscent. —The leschenaultias require special care in watering, and an open soil with plenty of fiber and sand. They are very handsome hardwooded plants for greenhouse growing, but seldom seen in this country.



2134. Lespedeza bicolor. (X½)

L. bíloba, Lindl. Shrub, 1–3 ft.: lvs. not greatly crowded, about ¼ or ⅓in. long: fls. blue and handsome, the corolla about ¾in. long, either few on the shoot or corymbed; lobes of corolla longer than tube, spreading, with dark blue veined wings and a point or mucro between. W. Austral.—*L. formòsa,* R. Br. (L. multiflora, Lodd. L. Baxteri, Don). Spreading and much branched, 1–2 ft.: lvs. rather loosely scattered, ⅓in. or less long: fls. solitary, red; corolla-tube split to base, 5 lines or less long; corolla somewhat bilabiate, the upper lobes broad and rounded, erect and connivent and shorter than the large and spreading lower ones. W. Austral. B.M. 2600. B.R. 916. L.B.C. 16:1579.—*L. grandiflòra,* Lindl., is a large-fld. form of L. biloba.—*L. larícina,* Lindl. (L. splendens, Hook.). Much branched, erect, 1 ft.: lvs. fine, rather crowded: fls. white to lilac to red, sessile in upper axils; tube of corolla ½in. long, slit to base; lobes of corolla all similar, usually shorter than the tube. W. Austral. B.M. 4256. F.S. 2:176. H.F. II. 6:14.—*L. spléndens,* Hook.=L. laricina.

L. H. B.

LESPEDÈZA (D. Lespedez was a Spanish governor of Florida, who aided the botanist Michaux). *Leguminòsæ.* Bush Clover. Small shrubs or herbs with pea-shaped flowers in racemes or heads, some of them very ornamental but mostly not showy; one extensively used for forage.

Leaves pinnately 3-foliolate or rarely 1-foliolate, the lfts. entire and wanting stipels: calyx-lobes nearly equal, sometimes subulate; anthers usually 9 and 1: pod short and 1-seeded (and in this differing from Desmodium, which has jointed pods).—Species 40 or more, in N. Amer., Asia and Austral., most of them not known horticulturally. In some of the lespedezas there are 2 kinds of fls.,—petal-bearing and mostly sterile, apetalous and mostly fertile. There are a number of native lespedezas, usually of dry lands, some of which are offered by dealers in native plants, but they are not very showy and are most in place in natural borders and in amateur collections. These species thrive in light, dry soils. Because of the grayish or brownish color of the foliage, they are sometimes useful in landscape gardening work, and they are hardy, and of easiest cult.; perennial. Two or 3 of the oriental species are now becoming popular. *L. striata* is the Japan clover of the S., and is a valuable forage and green-manure plant. *L. bicolor* is a low shrub, with small violet-purple fls., hardy in New England, but little known in cult. The most important ornamental members of the genus thus far well known are *L. Sieboldii* and *L. japonica,* which are hardy herbs or subshrubs sending up many strong wiry shoots each year, and blooming profusely in Sept. and Oct. Their late bloom is very desirable. All lespedezas are of the easiest cult. wherever hardy. Usually increased by division of the clumps. *L. Sieboldii* is readily prop. by greenwood cuttings under glass.

INDEX.

albiflora, 10.
bicolor, 8, 19.
capitata, 2.
formosa, 9.
frutescens, 6.
hirta, 1.
intermedia, 6.
japonica, 10.
Nuttallii, 4.
racemosa, 9.
Sieboldii, 9, 10.
striata, 7.
Stuvei, 5, 6.
violacea, 3.

A. *Occidental or native lespedezas: of upright or erect habit, not showy: stipules and fl.-bracts minute, subulate.*

B. *Fls. whitish or yellowish, all complete.*

1. **hírta,** Ell. Erect, 2–4 ft. tall, silky-pubescent: petioles shorter than the lvs.; lfts. nearly orbicular to long-ovate: fls. in oblong or cylindrical heads on peduncles that usually exceed the lvs.: pod scarcely shorter than calyx, oblong-ovate, pubescent. Dry soils, New England to Fla. and West. Mn. 6:181.—There is a form with oblong lfts.

2. **capitàta,** Michx. Much like the last, but petioles very short, lfts. narrow-oblong or oval, and the fl.-heads dense and short-peduncled (peduncles shorter than lvs.). Range of the above.

BB. *Fls. purple or violet, or some of them apetalous.*

C. *Peduncles slender.*

3. **violàcea,** Pers. Two to 3 ft., only sparsely leafy and slightly pubescent: lfts. broad-oval or oblong: fls. small, in a loose cluster which is on a stalk usually longer than the lvs.: pod ovate. Dry places N. H., west and south.

4. **Núttallii,** Darl. Two to 4 ft., villous: lfts. oval, oblong or nearly orbicular: fl.-clusters dense or even capitate, the stalk mostly exceeding the lvs.: pod oval. New England, west and south, in dry soil.

CC. *Peduncles nearly or quite wanting.*

5. **Stûvei,** Nutt. Mostly unbranched, 2–4 ft., very leafy, velvety-pubescent: petioles very short; lfts. elliptic, firm, woolly or velvety both sides or at least underneath: fls. in nearly sessile, axillary clusters or heads. Vt., south and west.

6. **frutéscens,** Brit. (*L. Stùvei* var. *intermèdia,* Wats.). Less pubescent or almost glabrous: petioles mostly longer; lfts. oval or oblong: clusters very short-stalked. Maine, south and west.

AA. *Oriental lespedeza, grown for forage in the S.: of trailing habit: stipules and fl.-bracts conspicuous.*

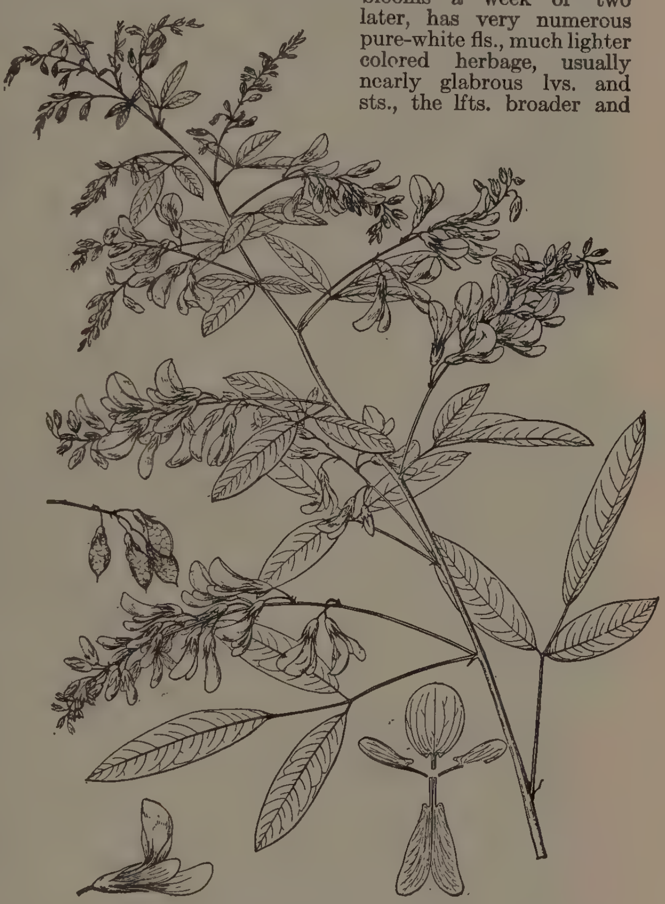
7. **striàta,** Hook. & Arn. JAPAN CLOVER. HOOPKOOP. Annual, somewhat pubescent, decumbent or erect, slender: lvs. small and very numerous, the lfts. oblong or obovate, and the petioles very short: fls. small, pink or purple, in axillary clusters. China and Japan.—The date of introduction to this country is not known; it was collected in Georgia in 1846. It is now extensively naturalized south of Washington and the Ohio River, growing on nearly all kinds of land. On light lands it makes dense mats, but on heavy lands grows 18–24 in. high. It is a good pasture- and hay-plant, and is useful for plowing under as a green-manure. It thrives on land which is indifferently prepared. Seed is sown early in spring, at the rate of 15–25 lbs. to the acre. It often yields 2 tons and more of hay to the acre. For pasturage in the S., it is sometimes sown with oats in the autumn.

AAA. *Oriental lespedezas, grown as ornamental plants for the fls.: erect: stipules and fl.-bracts small: perennials.*

8. **bícolor,** Turcz. Fig. 2134. Shrub, with slender branches, becoming 6–10 ft. tall, slender and graceful, glabrous: lvs. on thin wiry stalks, mostly longer than the glabrous blades; lfts. oval to round-obovate, rounded at the apex, the terminal one 1–2 in. long: fls. small, purple, in simple or compound racemes, which surpass the lvs.: pod ¼in. long, somewhat pubescent. Japan. G.F. 5:114 (where *L. bicolor* and *L. Sieboldii* are contrasted by J. G. Jack, and drawn by Faxon, and here reduced in Figs. 2134, 2135).—Hardy as far north as Boston, blooming in July and seeding freely. A white-fld. variety is advertised.

9. **Sièboldii,** Miq. (*Desmòdium penduliflòrum,* Oudem. *L. racemòsa,* Dipp. *L. formòsa,* Koehne. *L. bícolor* var. *Sièboldii,* Maxim.). Fig. 2135. Herb (shrub in warm regions), throwing up strong, wiry shoots each year from the crown: sts. angled, reddish or brown, hairy (at least above): lvs. dull above and light-colored and hairy beneath, the petiole usually somewhat shorter than the blade; lfts. elliptic-oblong-pointed: fls. twice larger than in the last (nearly ½in. long), rose-purple, drooping in very numerous long racemes, which at the top of the plant are panicled: pod nearly or quite ½in. long, pubescent. Japan. G.F. 5:115. Gng. 1:23. R.H. 1873:210. J.H. III. 30: 15. G.C. II. 20:749. F.S. 18:1888. B.M. 6602 and Mn. 7, p. 69 (as *L. bicolor*).—Blooms in Sept. and hardy in Cent. New England. A very desirable late-blooming plant, making a large specimen with age. Does not often seed in the N.

10. **japónica,** Bailey (*L. Sièboldii* var. *albiflòra,* Schneid. *Desmòdium japónicum,* Hort., not Miq.). Very like *L. Sieboldii* and perhaps a form of it, but blooms a week or two later, has very numerous pure-white fls., much lighter colored herbage, usually nearly glabrous lvs. and sts., the lfts. broader and less pointed.—Hardy as the last, and seems to seed more freely in the N.



2135. Lespedeza Sieboldii. (×½)

Other Japanese and Chinese lespedezas may be expected to appear in the trade. See Franchet, R. H. 1890, pp. 225–227, for an account of W. China ornamental species, with picture of *L. Delavàyi,* Franch., which grows 3–6 ft. high, with elliptic obtuse lfts., and deep violet to purplish black fls. in a terminal panicle.—*L. cyrtobótrya,* Miq. Shrub, to 6 ft. or more, glabrous or somewhat pubescent, with the habit of L. bicolor but less handsome: lvs. of the shoots long-stalked, oval to oval-oblong, rounded or slightly emarginate at the apex, 1–1½ in. long, the middle lft. long-stalked: lvs. of the lateral flowering branchlets short-stalked, crowded and much smaller; lfts. all short-stalked, oval, emarginate, ⅓–¾in. long: fls. purple, ⅓in. long, in dense axillary clusters or racemes not exceeding ½in. length. Japan.—*L. macrocárpa,* Bunge (Campylobotrys macrocarpa, Rehd. Campylobotrys chinensis, Bunge). Shrub, to 6 ft.: lvs. long-stalked; lfts. oval to oblong, emarginate, glabrous above, silky-villous below, ¾–1½ in. long, the middle one long-stalked: fls. purple, ⅓in. long, slender-stalked in axillary many-fld. stalked racemes to 3 in. long: pods glabrous, more than ½in. long. N. and Cent. China.—*L. serícea,* Miq. Suffruticose, to 3 ft. high: lvs. crowded, rather short-stalked; lfts. short-stalked, linear-oblong to linear, rounded at the apex, ⅓–¾ in. long, strigose beneath, minutely so above: fls. white, nearly sessile, ¼in. long, in axillary dense clusters or in dense and short leafy racemes to 1 in. long: pod little over 1 line long. China, Japan.

L. H. B.

LETTSÒMIA (John C. Lettsom, 1747–1815, English physician and botanist). *Convolvulàceæ.* About 30 species of scandent shrubs of Trop. Afr. and E. Asia, which may occur now and then in collections in Fla. Allied to Argyreia, differing in ovary 2-celled rather than 4-celled: lvs. alternate, undivided: fls. mostly purple or rose-color, in cymes or heads; corolla tubular to funnelform, the stamens exserted or included: fr. an indehiscent caps.

capitàta, Miq. (*L. strigòsa,* Roxbg. *Convólvulus capitàtus,* Vahl. *Argyrèia capitàta,* Choisy). A beautiful vine with handsome lvs. and deep pink fls.: strong climber, with hispid branches: lvs. cordate-suborbicular, short-acuminate, somewhat hispid, 5 in. long: fls. hispid without, capitate on peduncles 2–4 in. long; corolla 2 in. long. India, Java. Grown in S. Fla.

L. H. B.

LETTUCE. The lettuce plant is botanically *Lactuca sativa* (which see), which is probably derived from *Lactuca Scariola.* It is an annual with milky juice, and has been greatly developed for its root-leaves. These leaves, much enlarged and modified, comprise the most popular of the plant salads. It has been in cultivation for more than 2,000 years, according to De Candolle. The varieties are many; in 1889, "Annals of Horticulture" listed 119 varieties offered by American dealers. The two general forms are the head lettuces and the cluster or open-leaf lettuces (Figs. 2136, 2137). There are also spring lettuces and summer lettuces, the latter being developed to withstand more heat, for lettuce usually thrives best in the cool weather of spring. Of late years, kinds specially adapted to forcing have been secured, as the growing of the crop under glass has now assumed large proportions. See *Forcing,* Vol. III, p. 1255.

2136. Heading type of lettuce.

The lettuce plant is quite hardy to cold, comes quickly to edible maturity, is not much subject to disease or insect injury and, though it quickly succumbs to dry hot weather, is generally of the easiest culture. Even a farmer's wife, who, because of household cares, cannot take the time to plant a garden or even to gather and prepare a mess of peas or beans, can make and care for a planting of lettuce, and a few heads cut in the early morning and placed where they will be kept cool are a most appetizing addition to the noonday meal. From 1 to 2 yards of row to a person should yield an abundance for as long as a single planting is usable and a family supply may be grown in the smallest village yard or even on the back of a city lot; and, because of coming to the table in better condition, may be superior to any obtainable from the market.

Hundreds of different varieties and strains have been developed, varying greatly in habit of growth and character or product, ranging from those with but a few upright-growing narrow, smooth, thin leaves, and which soon shoot to seed, to those with many thick broad, smooth, crumpled or savoyed leaves, either clustered together, or overlaying each other so as to form a round head like that of a cabbage.

Varieties differ greatly in adaptation to cultural conditions, some giving fine returns when grown under glass but are hardly usable when grown in the open garden. They also differ greatly in color, tenderness and other qualities of the leaf. In some varieties, like the Prize Head, the leaf is mottled with red and brown and so tender that they are often so broken and torn apart by a heavy rain as to be unsalable, while the light green more tender-looking but really tougher leaves of a nearby planting of Grand Rapids are uninjured. There are varieties that form very broad white midribs which, when the green portion of the leaf is cut away, make quite as beautiful salad for table decoration or to eat from the hand as the finest celery or witloof.

There are many forms of Cos lettuce that are seldom grown in this country because they do not thrive in our bright sunny days, but do much better in the cloudy weather of England, where our most popular American sorts are considered coarse and weedy. All varieties require for the best development well-drained but moist cool friable soil, and thrive best in cool moist weather. They cannot be grown to perfection in the heat of midsummer. Even more than with many vegetables, it is essential to the most successful culture of lettuce that the soil be well enriched from previous dressings rather than recent applications, and if only coarse and fresh manure is available that it be well shaken apart, evenly distributed through, and well mixed with the soil. The most experienced Boston growers hardly expect a full crop until after the second or third manuring. Hardwood-ashes and bone-meal usually prove the most profitable artificial manures. Plantings for the first crop can be safely made as early as the soil can be put in friable condition. In many lots of seed the outer seed-coats are very hard, resulting in slow germination, and it may be advantageous to soak the seed for twenty-four hours before planting. Drills about 16 to 24 inches apart and evenly about 2 inches deep should be made and while the soil is still fresh and moist twenty to forty seeds to the foot should be evenly distributed and covered with not to exceed ½ inch of fine earth. Any greater depth, particularly on heavy soils, lessens the chances of a good and even stand. Some varieties are more sensitive than others to deep covering. Many successful growers in planting the Grand Rapids do not cover the seed at all except by washing over a little earth with a watering-pot and then shading with a board supported 1 or 2 inches above the row and removed as the plants germinate and start into growth. As the plants appear they should be thinned so as to prevent crowding and replanting should be made every fifteen to thirty days in order to secure a succession. With common facilities it is impossible to grow good lettuce in the dry heat of midsummer, though plantings in early autumn often furnish that of the very best quality.

In villages, plantings of lettuce for sale in the immediate vicinity often prove very profitable, the great essential to success being a rich well-drained soil, the

LXIV. A good field of lettuce.

2137. Clustering type of lettuce.

use of good seed of a suitable variety, the gathering of the crop in early morning when the leaves are cool and stiff and handling it with as little exposure to sunshine as practically possible.

In the recent years, hundreds of acres from Washington southward have been devoted to growing lettuce for shipment during the late winter and spring. In the northern sections, sash-covered frames with a single hot-water pipe along the front to guard against severe freezing are used. Farther south similar frames without provision for artificial heat but covered during the colder nights with sash and mats are used, and still farther south frames with only canvas curtains; or the crop is grown in sheltered fields with no artificial protection. All such plantings, however, are liable to become unpalatable or even killed by long-continued cold. The great essentials to success are a rich soil, even moisture, the fullest possible exposure to sunlight and first of all the use of pure seed of a variety like the Hubbard Market which is hardy and adapted to that cultural method and will stand shipment long distances and exposure in the market without loss of attractiveness.

The growing of lettuce seed.—In few vegetables is the satisfaction from a planting more dependent upon the varietal character and quality of the seed used, and fortunately the quality of most of that on the market is very dependable. Up to about 1865 most of the seed came from Europe, though comparatively small quantities were grown in Connecticut, New York and Michigan. About that time persons began to grow lettuce seed in California and the amount produced has increased until today not only the greater part of that used in America is grown there but large and constantly increasing quantities are sent to Europe. While small plantings of especial lots, of which little stock seed is available, are grown from started plants which are set in place in the field, the greater part of the crop is grown from seed sown in rows about 30 inches apart and the least typical plants pulled out until three to five plants to the yard are left. Many stocks grow such large and solid heads that they have to be pulled apart in order to let the seed-stalks shoot up, and often the lower leaves of the plant have to be pulled away to prevent the seed-stalk rotting at the base. As soon as the seed begins to ripen, the plants are cut and laid on large sheets onto which the earlier ripening seeds fall and the later ones are threshed off. The yield of seed varies greatly with the variety and the grower's success in securing it with little loss from birds or from shattering in the field and while harvesting, and commonly runs from 500 to 1,000 pounds to the acre. The growing of seed requires special experience and skill.

W. W. Tracy.

LEUCADÉNDRON (Greek, *white tree*). *Proteàceæ.* This genus includes the celebrated silver-tree of the Cape of Good Hope (see Fig. 2138), which has a striking and characteristic habit, and leaves densely covered with white silky hairs.

Shrubs or trees, all of S. Afr., above 60 in number: lvs. mostly narrow, sometimes even needle-like, entire, glabrous or silvery-tomentose, with a hardened apex: fls. diœcious, regular; male fls. usually many, in heads, each subtended by a bract and the head sometimes involucrate, the perianth-segms. separated to the middle or beyond, the anthers oblong or linear and sessile at the base of the perianth-limb; female fls. subtended by woody bracts and aggregated into cone-like heads, the perianth more deeply divided than that of the male fls., bearing narrow staminodia.

argénteum, R. Br. (*Pròtea argéntea*, Linn.). Silver-Tree. Fig. 2138. Branches densely leafy: lvs. sessile, 3–6 in. long, ½–1¼ in. wide, callous and blackish at the apex, lanceolate, acute, silvery white, and silky: involucres spreading, longer than the globular head of fls.: nut ventricose, turgid, wingless, the whole style and calyx persisting with it, obovate. B.R. 979. V. 5:282, 283. G.C. III. 6:725.—This tree grows wild on Table Mountain, Cape Town. In the early part of last century it was much used by settlers for firewood. It is said to grow poorly away from the Cape, except in S. Calif., where it does well outdoors. It is also rarely cult. in the E. in tubs, being protected in a cool greenhouse in winter and placed on the lawn in summer. The silver-tree attains 30 ft. at the Cape, and in S. Calif. it has reached more than that height but is reported to be short-lived (25–30 years at the most). It is a very showy plant because of its silky somewhat compact foliage, and is worth growing for the juvenile state. Not difficult to start from seeds, but seedlings are very liable to damping-off, and the plants are said to transplant with difficulty in Calif. The tree needs good drainage. The dried leaves are sometimes used for decorative purposes. (See G.C. III. 6:714).

L. H. B.

2138. Silver-tree.—Leucadendron argenteum.

LEUCÆNA (probably from Greek, *leukos*, white, referring to the flowers). *Leguminòsæ.* This genus includes a tree known in southern Florida as the white popinac, a rapid grower, with acacia-like foliage and whitish flowers; it is also cultivated in S. California.

Trees or shrubs, usually unarmed, evergreen: lvs. alternate, pinnate, stipellate: fls. usually perfect, in close heads, not papilionaceous, the 5 petals being separate; calyx 5-lobed; stamens 10, not glandular, exserted; ovary stalked and style filiform: pod flat, broad-linear.—Species 9 or 10. Mex., Guatemala, Peru, and Pacific Isls. The trees and shrubs of this genus have the habit of Acacia, but belong to the Mimosa tribe.

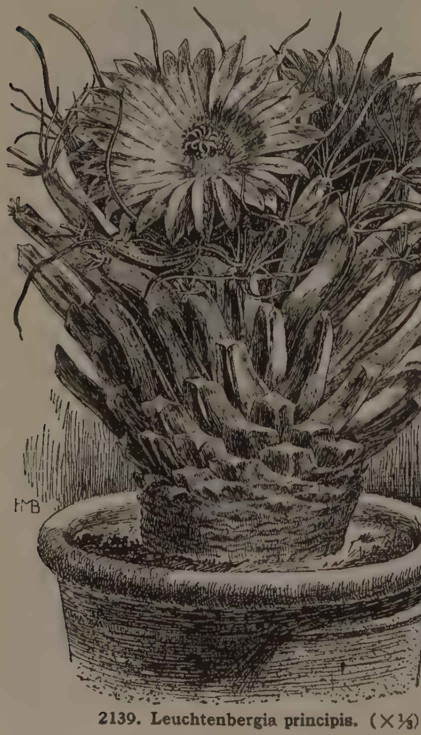
glaùca, Benth. (*Acàcia frondòsa,* Willd. *A. glaùca,* Moench. *A. leucocéphala,* Link. *Mimòsa glaùca,* Linn.). Spineless, tree reaching 30 ft. or more: pinnæ 4–8-paired; lfts. 10–20 paired, oblong-linear to lanceolate, oblique, glaucous below: heads of fls. globose, to 1¼ in. diam., white; petals erect, very narrow, about one-third as long as stamens: pod 5–6 in. long. Trop. Amer., but occurring in Fla. and Texas; naturalized widely in Old World.—It is cult. as an ornamental tree, and the young frs. and seeds are said sometimes to be eaten with rice; reported also to be used in certain regions as a forage plant for some animals.

L. trichòdes, Benth. (Acacia trichodes, Willd.). Tree-like: pinnæ 2–3 pairs; lfts. 3–5 pairs, ovate, acute: fl.-heads twin on axillary peduncles. S. Amer.

L. H. B.

LEUCÁNTHEMUM (*white flower*). *Compósitæ.* An old group-name for certain perennial herbs now included in Chrysanthemum. The most familiar species of the group is the common white-weed or "daisy" of the northeastern states, *Chrysanthemum Leucanthemum* (or *Leucanthemum vulgare* of former works). As distinguished from Chrysanthemum, the genus Leucanthemum differs chiefly in unimportant and inconstant characters of the achene.

LEUCHTENBÉRGIA (after Prince Leuchtenberg). *Cactàceæ.* AGAVE CACTUS. Stems in age forming a trunk 2 in. or more in diam., by the shedding of the lower tubercles: tubercles triangular-acuminate, spreading, 2–4 in. long, ½–¾in. wide, with twisted papery spines: fls. funnelform, widely expanded, borne near the apex of young tubercles: fr. gray, ovate-elliptical, 1 in. long, covered with scales and crowned by the persistent fl.; seeds dark brown, minutely tuberculate.—Only 1 species, closely related to Echinocactus, but of remarkably different form. The plant is readily grown in the manner of Echinocactus and Mamillaria.



2139. Leuchtenbergia principis. (×⅓)

príncipis, Hook. & Fisch. Fig. 2139 (adapted from Botanical Magazine.) Radial spines 6–8, the central one usually solitary, longer, sometimes 8 in. long: fls. yellow. B.M. 4393. A.G. 11:464.

KATHARINE BRANDEGEE.

LEUCOCÓRYNE (*white club,* alluding to the sterile anthers). *Liliàceæ.* About a dozen small bulbous plants of Chile, allied to Milla and Brodiæa, half-hardy in England, rarely planted here; they probably require the treatment given ixias. Plants scapose, with radical lvs., and tunicated bulbs or corms: fls. few, in terminal bracted umbels; perianth with 6 nearly or quite equal spreading oval-oblong or narrow lobes; stamens 6, of which 3 are perfect and the others reduced to staminodia: caps. membranaceous, 3-grooved, dehiscent. The species known to cult. are: *L. ixioìdes,* Lindl. One foot: lvs. about same length: fls. 4–6, white or pale blue. B.M. 2382 (as *Brodiæa ixioides*). B.R. 1293 (as *L. odorata*). *L. alliàcea,* Lindl. Six to 12 in.: lvs. very narrow, 6–8 in. long: fls. pale lilac, ¾in. long.

LEUCÓCRINUM (Greek, *white lily*). *Liliàceæ.* WHITE MOUNTAIN LILY. SAND LILY of Colorado. A bulbous plant growing a few inches high, with narrow foliage and clusters of pure white fragrant flowers borne just above the gound in early spring.

The fls. are funnel-shaped, having a slender tube 2–4 in. long, the greater part of which is below the surface, and 6 lobes, each ¾–1½ in. long, borne in clusters of 4 to many fls., and maintaining a succession for several weeks. They should be desirable for edging walks and bulb beds. They have a deep-seated rhizome and fleshy roots. The bulbs are procurable from Colo. and Calif., either as collected or nursery-grown stock. The genus has a single species. It belongs to an anomalous group, characterized by almost total lack of st. and fls. solitary or clustered among the radical lvs. From the other members of this group it is distinguished by the lvs. not 2-ranked, and an indefinite number of ovules in each locule. Perianth-segms. narrowly lanceolate, persistent; stamens 6; style persistent, slightly 3-lobed.

montànum, Nutt. Lvs. 8–12 or more, flat, rather thick, 4–8 in. long, 1–3 lines wide: pedicels ½–1½ in. long. Sandy soils and in mountain valleys, W. Neb. and S. Dak. to Colo., Ore., and N. Calif.

J. H. COWEN.

LEUCÓJUM (name discussed below). Also written *Leucoium. Amaryllidàceæ.* SNOWFLAKE. Hardy bulbous plants growing a foot or less high and bearing dainty, nodding, 6-parted flowers, which are white, tipped with green, yellow, or a tinge of red.

Perianth-tube none; segms. uniform, ovate or oblong, spreading; stamens epigynous; filaments filiform, shorter than the linear-oblong basifixed anthers; ovary 3-celled; ovules many in a cell, superposed; styles filiform or strumose near the apex; stigma minute, capitate: fr. finally dehiscing loculicidally into 3 valves from the top; seeds subglobose; testa usually black: rootstock a bulb, with membranous tunics: lvs. slender or lorate: fls. 1 or several in an umbel, white, tinged with red or green; spathe-valves usually single.—Eight species, natives of Eu. and the Medit. region, 6 of which are cult. The name Leucojum was given by Linnæus, but he did not explain the application. The old Greek name, *Leuccion,* was given by Theophrastus to a plant now supposed to be a crucifer, like some stock or wallflower. *Leucoion* is from *leukos*, shining, white, and *ion*, violet. Parkinson called it the "great early bulbous violet." Snowflakes appear about the same time as white violets, and sometimes have a delicate odor, resembling that of the violet.

Leucojums are best planted in dense groups, and allowed to remain undisturbed for a number of years. When bulbs are procured in the fall, plant immediately. Suitable for border, rock-garden or grass. Plant in a well-drained soil about 3 inches deep. Give a good winter protection. They are less popular than snowdrops (Galanthus), to which they are closely related, and have larger fls., with all the segms. of equal size.

A. *Blooming in March to early April.*

vérnum, Linn. (*Erinósma vérnum*, Herb.). Spring Snowflake. St. Agnes' Flower. Bulb globose, ¾–1 in. diam.: lvs. strap-shaped, finally 6–9 in. long, 4–6 lines wide: scape ½–1 ft. long, usually 1-fld.; perianth-segms. white, tipped green: seeds with a pale, membranous coat and conspicuous strophiole: fls. appear 1 month later than snowdrop. Cent. Eu., France to Bosnia and Tyrol. B.M. 46. G.C. II. 11:399; 21:341; 23:341. P.G. 5:47. Gn. 25, p. 335; 29, p. 607. V. 8:69. Var. **carpàthicum,** Herb., has perianth-segms. tipped yellow. B.M. 1993. J.H. III. 32:169. G.M. 39:105. A choice form, usually bearing 2–4 fls. Var. **Vàgneri,** Stapf. Early-flowering, with scapes usually bearing 2 fls. of which the green spots are of a darker shade. Hungary.

AA. *Blooming in April and May.*

æstìvum, Linn. Summer Snowflake. Bulb ovoid, 1–1½ in. diam.: lvs. strap-shaped, 1–1½ ft. long, yellowish green: scape 1 ft. long, 4–8-fld.; perianth-segms. white, tipped green: seeds with a black, hard-shelled coat and no strophiole. Cent. and S. Eu. Mn. 9:45. P.G. 1:7. V. 3:342; 8:70. G. 5:185; 25:222. J.H. III. 55:253.

pulchéllum, Salisb. (*L. Hernándezii*, Cambes.). Differs from *L. æstivum* by its smaller fls. and caps., narrower lvs. and fls. a fortnight earlier. Sardinia and Balearic Isles. Var. **màjus** is a selected large-fld. form.

hyemàle, DC. Bulb globose, under 1 in. diam., with several membranous brown tunics: lvs. 2–4, contemporary with the fls., erect, narrow-linear, glabrous, 6–12 in. long: peduncle slender, erect, 1–2-fld.; perianth white; segms. oblong, imbricated, tinged with green on back and laxly many-veined, the 3 inner shorter and rather more obtuse than the 3 outer; stamens bright yellow, styles rather short: seeds black, punctate, furnished with a conspicuous fleshy white caruncula. Maritime Alps. B.M. 6711.—Blooms in April, rather than in winter as the name would imply.

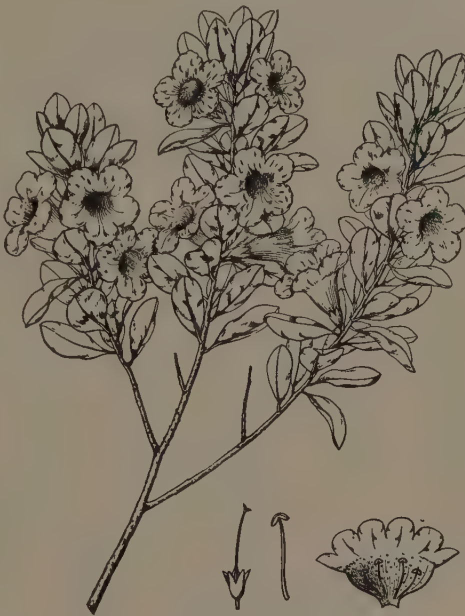
AAA. *Blooming in autumn.*

autumnàle, Linn. (*Àcis autumnàlis*, Salisb.). Autumn Snowflake. Bulb globose, ½in. diam.: lvs. thread-like, usually produced after the fls.: scape very slender, 3–9 in. long, 1–3-fld.; perianth-segms. white, tinged with red; stamens half as long as segms. Portugal and Morocco to Ionian Isls. B.M. 960.—Not satisfactory in northern gardens. Prefers a sandy soil.

ròseum, Martin. Bulb globose, ¼–½in. diam.: peduncle shorter and usually 1-fld.; perianth-segms. ⅓in. long, rose-red, oblanceolate; stamens ⅙in. long. Corsica.—Usually difficult to grow, and little known horticulturally.

Wilhelm Miller.
A. C. Hottes.†

LEUCOPHÝLLUM (Greek, *white leaf*). *Scrophulariàceæ.* Three spreading shrubs in Texas and N. Mex. with small alternate, elliptic to obovate entire lvs. covered beneath with silvery white wool: fls. axillary; calyx 5-parted; corolla campanulate or funnelform, with 5 rounded spreading lobes; stamens 4, didynamous, included, fixed at the base of the corolla; ovary 2-celled: caps. 2-valved; seeds many, oblong, wrinkled. Only the following species is cult. in S. Fla., and deserves cult. everywhere in the S. According to C. S. Sargent, "There is no shrub of the desert portions of the valley of the lower Rio Grande more generally distributed, and certainly there is not one of them which more delights the traveler in the early spring months, when the large, violet-purple flowers of this plant heighten the effect of its brilliant silvery foliage." G.F. 3:488.



2140. Leucophyllum texanum. (×½)

texànum, Benth. Fig. 2140. Loose-growing, straggling shrub, 4 or 5 ft. high in the wild, 8–10 ft. high in cult.: lvs. ½–1 in. long, obovate, narrowed to the nearly sessile base: fls. violet-purple, campanulate, 1 in. long and as much across, hairy within. Spring and summer. G.F. 3:489 (adapted in Fig. 2140).

Alfred Rehder.†

LEUCÓPHYTA (*white plant*, a Greek compound). *Compósitæ.* One species, **L. Bròwnii,** Cass., is offered abroad among coolhouse plants and is used in carpet-bedding for the white herbage. It is a much-branched rigid little white-woolly shrub (about 1 ft. high) from Austral.: lvs. alternate, linear, obtuse, very short and small (seldom ⅙in. long): heads small and collected in globular clusters ⅓–½in. diam., the clusters surrounded by a few floral lvs.: pappus of 8–10 plumose-ciliate scales which are slightly united at the base. The plant is of easy cult.; prop. by cuttings. It may be wintered in a frame or coolhouse.

The genus Leucophyta, with its single species, is usually united with Calocephalus, the above plant then becoming *C. Bròwnii*, F. Muell. The two genera were founded by Robert Brown at the same time (Trans. Linn. Soc. XII:106), but Calocephalus occurs first on the page. He separated Leucophyta because it differs in having a general involucre consisting of a few short bracts, in having the scales of the partial involucres concave and bearded at top, and in the pappus being plumose throughout its entire length.

L. H. B.

LEUCOSTÈGIA (Greek, *white roof;* alluding to the indusia). *Polypodiàceæ.* A small group of Indian ferns of small stature allied to Davallia, the indusium small, narrow, thin, attached by its base, with the apex and sides free. The lvs. are mostly tri-quadripinnate. For cult., consult *Davallia.*

pârvula, Wall. Rootstocks wide-creeping, scaly: lvs. nearly sessile, deltoid, less than 1 in. long, half as wide, usually tripinnate. Singapore and Borneo.

L. M. UNDERWOOD.

LEUCÓTHOË (*Leucothoë;* daughter of Orchamus, king of Babylonia). Including *Agarísta. Ericàceæ.* Ornamental shrubs grown chiefly for the handsome rather large usually evergreen leaves and the white flowers.

Evergreen or deciduous: lvs. alternate, short-petioled, serrate: fls. in axillary or terminal racemes; calyx 5-parted, imbricate; corolla ovate or cylindrical; stamens 10; anthers obtuse or 2-awned or 4-awned at the apex: caps. 5-lobed, with the sutures not thickened, separating into 5 valves; seeds minute, irregular. —About 35 species in N. and S. Amer., Madagascar, Himalayas and Japan, formerly often united with Andromeda, which differs like Lyonia chiefly in its valvate calyx.

The leucothoës, and particularly the evergreen species, are very handsome shrubs with rather large lustrous leaves and with white, rarely pink or scarlet, usually nodding flowers, appearing mostly in spring. The South American species, which are very rare in cultivation, though they surpass the others in beauty of the flowers, are hardy only South, while the other species can be grown as far north as Massachusetts and western New York, the evergreen ones in sheltered positions or with slight protection during the winter. They are very handsome for borders of shrubberies or as undergrowth in open woods. They thrive best in somewhat moist peaty or sandy soil, and prefer shaded or partly shaded situations, but also grow in full sun if the soil is not too dry.

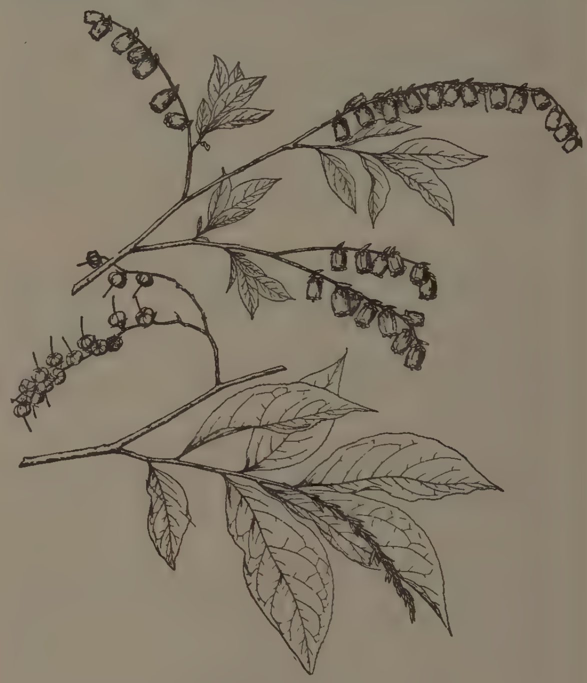
Of the leucothoës, *Catesbæi* is one of the most ornamental and popular hardy broad-leaved evergreens. It is used for massing in connection with rhododendrons, kalmias, and the like, serving as a base for these taller plants. The shiny dark green leaves are borne with regularity on a recurved stem often 2 to 3 feet long, and sometimes color brilliant bronze and claret shades in autumn when exposed to the direct rays of the sun. Leucothoë sprays are largely used by florists in making up designs and in connection with galax leaves, usually, however, in the more informal pieces. They were introduced to the trade about 1890. The fragrant flowers are in the leaf-axils, borne along the stem in early spring, and are usually conspicuous, considering the fact that the leaves are persistent. It is this graceful evergreen spray effect, with the good color and dense habit, that makes leucothoë so desirable as a plant for massing, and also the fact, perhaps, that it is fairly easy to transplant. Seeds are produced freely, and can be sown in sphagnum moss and sand under glass, as rhododendrons and azaleas are grown, pricked off in flats and planted outdoors in early spring, when the plants are a few inches high. Leucothoë is also propagated by division, underground runners and cuttings, the latter being plunged in sand on the bench and given moderate bottom heat. It is usually collected, however, in its native habitat, in small plants, transplanted to nursery rows and grown for several seasons. (Harlan P. Kelsey.)

A. *Lvs. evergreen: racemes axillary, sometimes clustered, shorter than the lvs.; anthers awnless.*

B. *Racemes dense, sessile, many-fld.: pith of branches solid.*

axillàris, Don (*Andrómeda axillàris,* Lam.). Shrub, to 5 ft., with spreading and usually recurving branches, puberulous when young: lvs. with short pubescent petioles, oval to oblong-lanceolate, shortly acuminate, serrulate toward the apex, glossy above, pale and sparsely pubescent beneath when young, 2–4 in. long: racemes 1–2 in. long; sepals broadly ovate; corolla white, usually greenish in bud, ⅕in. long. April, May. Va. to Fla. and Ala. G.O.H. 114. B.B. (ed. 2) 2:687. G.W. 6, p. 279. Var. **longifòlia,** Pursh. Lvs. linear-lanceolate. B.M. 2357.

Càtesbæi, Gray (*Andrómeda axillàris,* Michx. *A. Càtesbæi,* Walt.). To 6 ft., similar to the former, with glabrous, slender and more arching branches: lvs. longer-petioled, ovate-lanceolate to lanceolate, ciliately appressed-serrate, glossy above, usually light green beneath, glabrous, 3–7 in. long: racemes larger; sepals narrower; corolla over ¼ in. long: white, usually reddish in bud. April, May. Va. to Ga. B.M. 1955. L.B.C. 14:1320. R.H. 1905, p. 577. G. 34:487. Gn.M. 2:18. —This species is handsomer than the former, and also somewhat hardier: lvs. and fl.-buds assume a beautiful purple hue late in fall which is retained through the winter.



2141. Leucotnoë recurva. (×½)

BB. *Racemes peduncled, with rather few, slender-pedicelled fls.: pith lamellate.*

populifòlia, Dipp. (*L. acuminàta,* Don. *Andrómeda acuminàta,* Ait. *A. populifòlia,* Lam.). Shrub, to 12 ft., with spreading branches: lvs. short-petioled, ovate-lanceolate, acuminate, entire or obscurely serrulate, glabrous, 2–4 in. long: pedicels as long as corolla; calyx very short; corolla cylindrical, over ⅓in. long. June. S. C. to Fla.

AA. *Lvs. deciduous: racemes mostly terminal, secund, longer than the lvs.; anthers awned.* (*Subgenus Eubotrys.*)

racemòsa, Gray (*Andrómeda racemòsa,* Linn. *L. spicàta,* Don. *Lyònia racemòsa,* Don). Shrub, to 10 ft., with mostly erect branches: lvs. oblong to ovate, acute, serrulate, pubescent beneath, at least on the veins, 1–3 in. long: racemes erect, 2–4 in. long; corolla cylindrical, ⅓in. long; anthers with 4 awns. April–June. Mass. to Fla. and La. Em. 423. G.O.H. 57.

recúrva, Gray. Fig. 2141. Similar to the last, but lower and more spreading: lvs. elliptic-ovate to elliptic-lanceolate, acuminate: racemes spreading and recurved; anthers with 2 awns: caps. depressed and strongly lobed. April–June. Va. to Ala. G.F. 9:225 (adapted in Fig. 2141). I.T. 1:40.—It grows in drier situations; the foliage of this and the preceding species assumes a splendid scarlet color in fall.

L. Dàvisiæ, Torr. Evergreen shrub, to 5 ft.: lvs. oblong, obtuse, crenately serrulate: racemes slender, many-fld., clustered in terminal panicles. May, June. Calif. B.M. 6247.—*L. Grayàna*, Maxim. Half-evergreen: lvs. large, broadly oval, appressed-pilose: racemes terminal, slender; fls. rather small. June. Japan. Tender.—*L. neriifòlia*, DC. (Agarista neriifolia, Don). Evergreen, glabrous shrub, with ovate-oblong, acuminate lvs. and bright scarlet fls. in erect, slender racemes at the end of the branches. Brazil. B.M. 4593. J.F. 2:155.—*L. púlchra*, DC. (Agarista pulchra, Don). Evergreen shrub, 2 ft. or more high, glabrous: lvs. ovate, mucronate, about 1 in. long: fls. white, in spreading, peduncled, slender racemes, much longer than the lvs. Caracas. B.M. 4314.

Alfred Rehder.

LEÚZEA (De Leuze, friend of DeCandolle, who founded the genus). *Compósitæ*. A few perennial or biennial herbs with simple 1-headed sts., one of which is sometimes planted in herbaceous borders or rock-gardens. By some the genus is referred to Centaurea, becoming a section of that genus distinguished by the feather-like pappus in several rows and which is connate at base and falls as a ring. Plants unarmed: lvs. radical, or alternate if cauline, dentate or pinnatifid, white-tomentose beneath: fls. purple, in large and showy heads, the corolla regular or slightly oblique, the tube long and slender; style-branches very short; involucre ovoid or subglobose, the bracts in many series: heads homogamous.—Species probably 5 or 6, widely distributed; Eu., N. Afr., Austral.

conífera, DC. (*Centaurèa conífera*, Linn.). Small plant, 4–12 in. high, blooming in June and July, sometimes described as biennial and sometimes as perennial: lvs. lanceolate, tomentose beneath, entire or pinnatifid: involucre-scales glabrous: st. simple, 1-headed. S. Eu.

L. H. B.

LEVÍSTICUM (origin of name obscure; thought to be a corruption of Ligusticum). *Umbellíferæ*. Lovage. Perennial grown for its aromatic seeds, which are used in confectionary. The genus has only one species, and is distinguished by having a conspicuous involucre of narrow deflexed bracts, prominent involucels with connate bractlets, strongly ribbed fr. with solitary oil-tubes, obscure calyx-teeth, green-yellow petals, and large bipinnate lvs.

officinàle, Koch (*Hipposelìnum Levísticum*, Linn.). Lovage. Tall: lvs. dark green, shining; segms. wedge-shaped at the base, cut toward the apex: fr. 3-ribbed, hollow and boat-shaped or else flattish on one side, convex on the other. S. Eu., sometimes escaped in N. Amer.—The lf.-stalks were formerly blanched and eaten like celery. It is a tall, hardy perennial herb, with large, 2–3 times divided radical lvs. The plant may be prop. by seed sown as soon as ripe, but when plants are already established root-division is less troublesome and risky. Division may be made in the autumn, but better in the spring. The divided plants and the seedlings, when 2 or 3 in. tall, should be set in checks 3 ft. apart in deep, rich soil. When well established the plants remain profitable for many years, demanding but little attention.

L. H. B.

LEWÍSIA (named by Pursh for Capt. Meriwether Lewis, of the Lewis and Clark transcontinental expedition). *Portulacàceæ*. Fleshy-leaved low perennials, bearing showy white, rose or red flowers.

Plants acaulescent or nearly so, with thick and farinaceous caudex and root: lvs. narrow, mostly clavate or spatulate or oblong, entire, rosulate at the apex of the short caudex (or corm in one species): fls. 1 to many, on scapes, often large and handsome; sepals 2–8, persistent; petals 3–16; stamens 5 to numerous, the anthers oblong to linear; style-branches slender, 3–8, with long stigmatic surfaces: fr. a circumscissile caps.; several- to many-seeded.—Species about a dozen, from Colo., Wyo., and Mont. westward. The genus has been variously defined; as here characterized, it includes Oreobroma and species that have been described under Calandrinia and Talinum. From Calandrinia, the genus is separated by style-branches often more than 3, and caps. circumscissile near the base rather than 3-valved from the apex. The cultivator's interest in lewisias centers chiefly in *L. rediviva*, which is grown in collections of succulents. The other species are very little known as cult. plants, although there appears to be an accelerated interest in them in recent years. They should make good rock-garden and alpine subjects. See *Succulents*.

INDEX.

columbiana, 10.
Cotyledon, 7.
Howellii, 8.
Leana, 9.
minima, 3.
oppositifolia, 5.
pygmæa, 6.
rediviva, 1.
triphylla, 2.
Tweedyi, 4.

A. *Sepals, or sepal-like bracts, 4–8.*

1. **redivìva,** Pursh. Bitter-Root. Lvs. linear-oblong and nearly terete, densely clustered, glaucous and smooth: scapes little longer than the lvs., jointed at the middle where there are verticillate bracts; fls. rose-color or white. June–Aug. Mont. and north, to Ariz. and west.—It is the state flower of Montana. The bitter-root has an interesting history. It has been tested in the E., and is desirable for rockeries, needing perfect drainage, a sunny position and careful watering while in flower. It is one of those perennials that should be planted in groups for best effect, and also as a precaution to prevent loss by oversight in careless weeding during flowerless period. The starchy root is dug by the Indians in spring, and eaten. The bark is ordinarily very bitter, but at flowering time it is said to slip off easily, and the root when boiled has little of the bitter taste. The roots from which the plant was first described showed signs of life after being in the herbarium for several years. Pursh planted them, and they grew for a year. This event suggested the name *rediviva*. The fl. figured in B.M. 5395 came from a root which has been immersed in boiling water in order to make an herbarium specimen. The root is called spatulum or spatlum by the Indians. A full account of this plant is given by Pailleux & Bois in Le Potager d'un Curieux. Also in R.H. 1892, p. 298. B.M. 5395. V. 2:306. Mn. 2, p. 85.

AA. *Sepals 2, without subtending bracts.* (*Oreobroma.*)

B. *Root a small corm.*

2. **triphýlla,** Rob. Sts. slender, 1 to several from a globular corm ¼in. or less thick (differing from Claytonia in the circumscissile caps.), the plant 4 in. or less high: st.-lvs. 2 or 3, linear and sessile: fls. white, in an umbel of 3–20 or more, the scape partly underground. Subalpine, Colo., west and north.—Apparently not offered.

BB. *Root-part a more or less vertical caudex.*

C. *Lvs. narrowly linear.*

3. **mínima,** Nels. Lvs. few to several, 2 in. long, more or less, narrow-linear, usually exceeding the scape: fls. white; sepals about oval, with a short point and sometimes 1 or 2 lateral teeth; scape with a pair of small bracts toward the base. Yellowstone Park.—Offered in Colo.

CC. *Lvs. broader than narrowly linear, usually more or less spatulate (perhaps an exception in No. 9).*

D. *Scape 1–4-fld.*

4. **Tweèdyi,** Rob. (*Calandrìnia Tweèdyi*, Gray. *Oreobròma Tweèdyi*, Howell). Lvs. 2–4 in. long, obovate, mostly shorter than the 1–3-fld. scapes: fls pink, 2–3 in. across; sepals orbicular, entire: stamens

10 or 11: seeds granulate and arillate. Alpine, Wash. B.M. 7633. Gn. 59, p. 387; 64, p. 28. G.M. 46:335. G. 36:444. F.S.R. 1, p. 145.

5. **oppositifòlia,** Rob. (*Calandrìnia oppositifòlia,* Wats. *Oreobròma oppositifòlia,* Howell). Lvs. linear-oblanceolate to linear, 1–3 in. long, sometimes 1 or 2 pairs on the lower part of the scape: fls. 2–4, white or pale pink, on long pedicels; sepals roundish, denticulate at apex; stamens about 12. Calif., Ore.

6. **pygmæ̀a,** Rob. (*Calandrìnia pygmæ̀a,* Gray. *Oreobròma pygmæ̀a,* Howell). Lvs. broad-linear to spatulate or lance-oblong, mostly shorter than the scapes: fls. 1–2, rose-red; sepals somewhat truncate and erose; petals 6–8, and stamens about the same number. Alpine, Rocky Mts., Sierra Nevada, and Cascades.

DD. *Scape mostly several- to many-fld.*

7. **Cotylèdon,** Rob. (*Calandrìnia Cotylèdon,* Wats. *Oreobròma Cotylèdon,* Howell). Lvs. obovate-spatulate to orbicular, in a dense rosette: scapes several, to 10 in. high, bearing a panicle; fls. white, the 7–10 obovate or oblanceolate petals pink-veined down the middle; sepals roundish, denticulate; stamens 6–9. Mountains, N. Calif. B.M. 8220. G.C. III. 43:342; 49:337. Gn. 72, p. 290. G. 36:445.—Attractive, with its basal rosette and its red-lined fls. standing well above the lvs.; produces offsets.

8. **Hòwellii,** Rob. (*Calandrìnia Hòwellii,* Wats. *Oreobròma Hòwellii,* Howell). Lvs. oblong to ovate, flat, with thin crisped margins, forming a rosette: fls. deep rose-color, in short racemose cymes; sepals orbicular to broad-ovate; petals 7–10, oblong-lanceolate, emarginate or entire; stamens 7. S. W. Ore. G.C. III. 51:349. Gn. 78, p. 400. G. 36:445.

9. **Leàna,** Rob. (*Calandrìnia Leàna,* Porter. *Oreobròma Leàna,* Howell). Lvs. linear, somewhat terete, sometimes subspatulate, 1–2½ in. long, glaucous, tufted: fls. many, in a panicle, the scapes bearing a few scattered bracts; fls. red to white, with darker veins; sepals ovate or roundish, fimbriate; petals 5–7; stamens 4 or 5. Mountains, N. Calif., Ore.

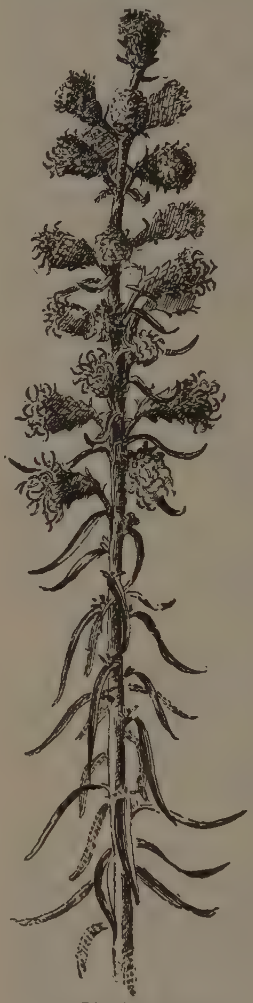
10. **columbiàna,** Rob. (*Calandrìnia columbiàna* and *Oreobròma columbiàna,* Howell). Lvs. numerous, linear-spatulate, flat, not glaucous, 1–2 in. long: fls. white or pink with dark red veins, few to many in a panicle; sepals rounded or truncate; petals 4–7, oblong, toothed, emarginate or entire. Columbia River and Cascades.
L. H. B.

LEYCESTÈRIA (Wm. Leycester, judge in Bengal). Including *Pentapýxis. Caprifoliàceæ.* Himalayan and Chinese small shrubs with whorled small flowers, suitable for mild climates.

Deciduous: lvs. opposite, simple, the stipules very small or none: fls. in erect or drooping verticillate leafy-bracted spikes; calyx persistent, unequally 5-lobed; corolla funnelform, nearly equally 5-lobed and swollen at the base; stamens 5, on the corolla-tube; ovary 5–8-celled, the stigma capitate: fr. a berry, sometimes eaten by birds.—Species about 4, only one of which appears to be in the trade; prop. by seeds and by cuttings. The genus is allied to Lonicera, from which it differs in its nearly regular corolla, and fr. with more locules; and to Diervilla, which differs in 2-loculed caps.

formòsa, Wall. (*L. élegans,* Hort.?). Strong-growing, with fistular (hollow) branches, 6 ft.: lvs. broadly ovate to ovate-lanceolate, acuminate, entire or toothed, more or less puberulous beneath: fls. purplish, fascicled in whorls in drooping leafy spikes or spike-like racemes: fr. dark red, subglobose. Himalaya, 5,000–10,000 ft., to W. China. B.M. 3699. G.W. 7, p. 355. B.R. 25:2. M.D.G. 1908:330. Gt. 28, p. 181. R.H. 1857, p. 109. Grown in England and apparently in Calif. Var. **variegàta,** Hort., has variegated foliage. Var. **ròsea,** Hort., has rose-colored fls.
L. H. B.

LHÓTZKYA (Dr. John Lhotzky, botanical traveler in Australia. and elsewhere). *Myrtàceæ.* Heath-line Australian evergreen shrubs of 10 species, rarely grown under glass. Lvs. small, scattered or opposite, entire and rigid: fls. sessile or nearly so, solitary or in leafy heads, white, yellow, pink or purple; calyx with an elongated ribbed tube and 5 broad very obtuse lobes; petals 5, entire and spreading; stamens many, in several rows. *L. acutifòlia,* Lindl., has white or yellowish fls. and linear mucronate lvs. ⅓–½ in. long. *L. ericoìdes,* Schauer, has white or whitish fls. and slender short linear 3-angled lvs.: erect, nearly glabrous, the fls. being in fascicles midway of the leafy branchlets. B.M. 7753. *L. violàcea,* Lindl., has purplish fls. and oblong very obtuse short lvs.


2142. Liatris spicata var. montana. (×½)

LIÀTRIS (a name of unknown derivation). Syn. *Lacinària. Compósitæ.* Blazing Star. Button Snakeroot. Hardy perennials, confined to eastern and southern North America, best adapted to the wild-flower border.

They are erect often resinous herbs, simple or branched, and arising from a tuber: lvs. alternate, narrow, 1–5-nerved: fls. in racemose or spicate heads; receptacle flat, or slightly convex, naked; corolla regular, its tube slender and 5-lobed.—Twenty-five or more species.

The most showy are *L. elegans* and *L. pycnostachya.* All produce flowers in wand-like spikes or racemes, the petaloid coloring of the involucral bracts often adding to the effect of the usually bright rose-red or purple flowers. Their flowers are produced in late summer and autumn. They multiply by offsets from their corm-like base, or may be grown from seed, which should be sown in autumn. They will grow and produce flowers in poorer soil than most garden plants, but thrive best in good, rich garden soil, and require no special care. When grouped in masses they give best results. They are scarcely domesticated as yet.

INDEX.

Chapmanii, 11.
cylindracea, 7.
elegans, 8.
gracilis, 3.
graminifolia, 5.
intermedia, 6.
lævigata, 4.
lanceolata, 3.
montana, 2.
pauciflosculosa, 3.
pumila, 2.
punctata, 9.
pycnostachya, 10.
scariosa, 1.
spicata, 2.
squarrosa, 6.
tenuifolia, 4.

A. *Involucre-bracts obtuse.*

B. *Heads hemispherical, ½–1 in. broad, 15–45-fld. and peduncled.*

1. **scariòsa,** Willd. St. stout, 1–5 ft. high: lower lvs. spatulate or oblong-lanceolate, 4–6 in. long, ½in. wide; upper narrowly lanceolate: heads large, numerous, in a relatively loose spike; involucral bracts often tinged with purple; fls. purple; pappus bristles minutely bar-

bellate. Throughout the U. S. and Canada, east of the Rocky Mts. B.M. 1709. B.R. 590 and 1654. G.C. III. 14:593. P.M. 5:27 (as *L. borealis*).—Next to *L. elegans* and *L. pycnostachya*, perhaps the most desirable species for ornamental purposes.

BB. *Heads oblong, 3–4 lines broad, 5–15-fld.*

C. *Bracts not punctate.*

D. *The heads sessile.*

2. **spicàta,** Willd. St. stout, rather tall, 2–5 ft., and very leafy: lvs. all linear, the lower larger and broader than the upper, which are gradually reduced to the linear-subulate bracts of the spike: heads 8–13-fld., ½in. long, closely sessile, and forming a dense spike from 6–12 in. long; involucral bracts rounded obtuse, with usually purplish margins. In the Atlantic and Gulf States, from Mass. to La. G.W. 14, p. 299. B.M. 1411.—Useful for low situations or along streams.

Var. **montàna,** Gray (*L. pùmila,* Lodd.). Fig. 2142. Lower, 10–20 in. high: lvs. broader, the lower ones ½–¾in. broad, and obtuse at apex: spike proportionately short and heads larger, the fls. blue-purple. Va. and N. C., in the mountains. L.B.C. 2:147.

DD. *The heads distinctly pedicelled.*

E. *Lvs. oblong-lanceolate, relatively short.*

3. **gràcilis,** Pursh (*L. pauciflosculòsa,* Nutt. *L. lanceolàta,* Bertol.). St. slender, 1–3 ft. high: lower lvs. oblong-lanceolate, upon distinct petioles, upper reduced to small linear bracts: heads in a loose raceme, 3–5-fld., purple; bracts of the involucre few and rather loose. Ga., Ala. and Fla.

EE. *Lvs. attenuate-linear, the radical 8–12 in. long.*

4. **tenuifòlia,** Nutt. (*L. lævigàta,* Nutt.). St. slender, 2–4 ft. high: lvs. without distinction of blade and petiole, only a line or two wide: heads in a strict raceme, a foot or more long, about 5-fld., purple; pappus strongly barbellate. N. C. to Fla.—Suitable for dry sandy borders.

CC. *Bracts punctate: heads peduncled.*

5. **graminfòlia,** Pursh. St. comparatively slender, 2–3 ft. high, striped with light green lines: lvs. ciliate toward the base, with scattered hispid hairs: spike less dense, often becoming racemose; head ½in. long; bracts of involucre punctate, rounded at the apex. Atlantic States, Va. to Fla.—Adapted to a light dry soil. Considered by some to be a mere form of *L. gracilis*

AA. *Involucre-bracts acute or mucronate.*

B. *Heads 15–60-fld., cylindrical or turbinate.*

C. *Bracts with lanceolate, spreading, rigid tips.*

6. **squarròsa,** Willd. St. stout, 6–20 in. high: lvs. linear and rigid, the lower elongated and grass-like: spike variable in length, bearing few to many heads, the larger heads 1 in. long; fls. bright purple; involucral bracts lanceolate, rigid, and usually bearing pointed tips, squarrose. E. U. S., as far west as Neb. and Texas. B.R. 948 is var. **intermèdia,** of this species.

CC. *Bracts with closely appressed, mucronate tips.*

7. **cylindràcea,** Michx. St. 1 ft. high: lvs. and spike as in last species: heads few, 16–20-fld.; bracts of involucre abruptly mucronate. Upper Canada to Minn. and Mo.

BB. *Heads 3–6-fld., oblong or narrowly campanulate.*

C. *Inner bracts much longer than the fls.*

8. **élegans,** Willd. St. 2–3 ft.: lvs. linear, the upper soon reflexed: spike dense and wand-like, 3–20 in. long; heads ½in. long; inner involucral bracts prolonged into spreading, petaloid appendages, which surpass the fls. and pappus; fls. and petaloid appendages purple, showy. Va., to Fla. and Texas. B.R. 267.—Especially adapted for dry sandy situations.

CC. *Inner bracts not longer than the fls.*

D. *Pappus bristles very plumose: bracts appressed.*

9. **punctàta,** Hook. St. stout, 10–30 in. high: lvs. and involucral-bracts punctate and rigid: spike long and wand-like, dense and leafy; heads 4–6-fld., the fls. purple, ¾in. long; bracts of involucre oblong, rather abruptly cuspidate, ciliate on its margins; pappus plumose. Sask. and Minn. to Texas and Mex.

DD. *Pappus bristles merely barbellate.*

E. *Involucral-bracts spreading.*

10. **pycnostàchya,** Michx. St. stout, 3–5 ft. high: lvs. crowded throughout, the lower lanceolate, the upper narrowly linear: spike densely fld. 5–18 in. long; heads about ½in. long, all sessile; involucre with squarrose tips acute, purplish; pappus copious, minutely barbellate. Ill. and Iowa, to Ark. and Texas. R.H. 1883:324. Gn. 55:238. G.W. 6:169.—One of the choicest and boldest species.

EE. *Involucral-bracts appressed.*

11. **Chápmanii,** Torr. & Gray. St. a foot or two high, strict and rigid, white-velvety: lvs. short, the lower oblong-linear, the upper small and awl-shaped: spike densely fld., often 1 ft. long; heads about 3-fld.; fls. large for the size of the head, purple; pappus grayish, the bristles minutely barbellate, about ½in. long. Fla.

L. ligulistylis, A. Nelson. St. 16–20 in. high: lvs. bright green, glabrous, the lower lance-oblong: heads few to several, in a long raceme; fls. 50–70, purple; exserted style-branches conspicuous, flattened, as long as corolla, light purple. Colo., Wyo. to Dakotas.

W. W. Rowlee.
N. Taylor.†

LIBÉRTIA (Marie A. Libert, a Belgian woman, who wrote on liverworts about 1820). *Iridàceæ.* Tender mostly white-flowered plants classed as bulbs and procurable from Dutch dealers.

Perennial herbs with a short creeping rhizome and long fibrous roots: lvs. linear, equitant: perianth without any tube above the ovary; segms. obovate, the 3 outer usually shorter, firmer and less showy than the inner, more or less green or brown; stamens inserted at the base of the segms.; filaments free or connate toward the base; ovules many, superposed: caps. small, leathery, loculicidally 3-valved; seeds 3-cornered.—The genus has 8 or 10 species, in Austral., New Zeal., Tasmania and Chile. Botanically it is near Diplarrhena, but in the latter the inner segms. are shorter than the outer ones and connivent. Libertia belongs in the same subtribe with the blue-eyed grass (Sisyrinchium), but in the latter case all the perianth-segms. are about equal in size. One species is blue-fld. The libertias should be acceptable outdoor subjects in the milder parts of the country. Prop. by division and seeds. They require plenty of moisture at the roots.

A. *Fls. white.*

B. *Clusters lax: pedicels longer than the bracts.*

pulchélla, Spreng. Lvs. not rigid, 3–6 in. long, entirely green: st. ½–1 ft. long: infl. of 1 or few clusters, which are 2–3-fld.; segms. ⅙in. long, nearly equal, white. S. Austral., Tasmania, New Zeal.

ixioìdes, Spreng. Lvs. 1 ft. or more long, with a broad pale midrib: st. 1–2 ft. long: infl. an ample panicle with numerous peduncled, 2–6-fld. umbels; inner segms. orbicular-cuneate, white, the outer shorter tinged greenish brown: caps. broadly oblong or obovoid, ⅓–½in. long. New Zeal.

grandiflòra, Sweet. Lvs. rigid, linear, 1–2½ ft. long, with pale midrib: st. 2–3 ft.: fls. rather larger than in *L. ixioides*, the inner segms. much larger and broader than the outer, white: caps. larger than in last, about the same shape. New Zeal. G.C. III. 43:2.—An excellent free-flowering plant.

BB. *Clusters dense: pedicels shorter than the bracts.*

formòsa, Graham. Lvs. rigid, 1–1½ ft. long: st. 2–3 ft. long: infl. of many sessile and many-fld. umbels; inner segms, obovate-cuneate, ½–¾in. long, white; outer segms. half as long and oblong, greenish brown; filaments connate toward the base: caps. globose. Chile. B.M. 3294. B.R. 1630. Gn. 45, p. 192 (fine habit sketch); 40, p. 441; 70, p. 175; 75, p. 545. G.M. 51:797; 55:92. G. 29:687.

AA. *Fls. blue.*

cærulêscens, Kunth. Lvs. linear, rigid, 12 in. or more long: st. 1–2 ft., with a few reduced lvs.: infl. 6 in. or less long, of very many umbels, each many-fld.; fls. blue; inner segms. ¼in. long, oblong, the outer much shorter and greenish brown: caps. globose, very small. Chile.

L. nívea, offered abroad, may be one of the white-fld. species above: described as having iris-like foliage and spikes of white fls.: 2 ft.

Wilhelm Miller.
L. H. B.†

LIBOCÉDRUS (*libas*, drop, tear, and *Cedrus;* alluding to the resinous character of the trees). Syn. *Heydèria. Pinàceæ.* Incense Cedar. Ornamental trees chiefly grown for their handsome evergreen foliage and good habit.

Branchlets flattened, rarely quadrangular, frond-like in arrangement: lvs. scale-like, with decurrent base, with or without glands: fls. monœcious or diœcious, terminal, similar to those of Thuya: cones oblong to ovate, with 4, rarely 6, woody scales, the lower pair sterile, small and short, the second one much larger and fertile, each scale bearing 2 long-winged seeds, the third pair, if present, connate into a woody septum.—Eight species in W., N. and S. Amer., Austral. and S. W. China. Allied to Thuya which differs chiefly in the more numerous cone-scales with 2 pairs fertile.

The incense cedars are of pyramidal habit, clothed with small scale-like leaves, and rather small, ovate or oblong cones. None of the species is quite hardy North, but *L. decurrens* thrives in the vicinity of the city of New York, and even in sheltered places in eastern Massachusetts. It is a valuable park tree, forming a symmetrical narrow pyramid, with bright green foliage. It is also an important timber tree, the wood being light, soft, close and straight-grained, is very durable in the soil, and is used for fencing, for shingles, for the interior finish of houses, and also for ship- and boat-building. The other species are hardy only South, and, though very ornamental trees, they are hardly cultivated in this country; they are all important timber trees in their native countries. The incense cedars thrive best in a well-drained soil, and prefer open situations; they are liable to lose their lower branches rather early. Propagate by seeds sown in spring; also by cuttings under glass in late summer or fall, which root rather slowly; sometimes grafted on thuya and chamæcyparis.

decúrrens, Torr. (*L. Craigàna,* Low. *Thùya Craigàna,* Murr. *T. gigantèa,* Carr., not Nutt.). White Cedar. Tree, to 100, occasionally to 200 ft., with erect or spreading, short branches, forming a rather narrow, feathery head: bark bright cinnamon-red: branchlets much flattened, bright green on both sides: lvs. oblong-ovate, adnate, with long decurrent base, free at the apex and acuminate, glandular on the back: cones oblong, ¾–1 in. long, light reddish brown; scales mucronate below the apex, a third connate pair separating the 2 fertile ones. Ore. to Calif. and W. Nev. S.S. 10:534. F.S. 9, p. 19. Gn. 29, pp. 266, 267; 60, p. 250; 75, p. 296; 78, p. 586. G.C. III. 36:284; 44:338. M.D.G. 1905:129.—In cult. the young trees are conspicuous by their bright and deep green foliage, while the trees in their native localities are mostly of a light yellowish green. Var. **compácta,** Beissn. Dwarf compact form of globose habit. Var. **glaùca,** Beissn. With glaucous foliage. Var. **aùreo-variegàta,** Schwerin. Foliage variegated with yellow.

L. chilénsis, Endl. Tree, to 60 ft., with compact, pyramidal head: branchlets much compressed: lvs. glaucous green, small, erect-spreading, obtuse, with a silvery line beneath: cones ovate-oblong, ½in. long. Chile. G.C. 1850, p. 439. R.H. 1867, p. 410. Gn. 30, p. 552.—*L. cupressoìdes,* Sarg. (L. tetragona, Endl.). Tree, to 100 ft., with compact, pyramidal head, sometimes shrubby: branchlets almost tetragonal: lvs. ovate or ovate-lanceolate, with slightly spreading and acute apex: cones ovate; scales with a large, curved spine on the back. Chile to Patagonia. G.C. 1850, p. 439. Gn. 30, p. 552.—*L. Doniàna,* Endl.=L. plumosa.—*L. macrólepis,* Benth. & Hook. Tree, to 100 ft.: branchlets compressed, green on both sides: lvs. acute, the lateral strongly keeled, the middle ones obovate, apiculate: cones obovate-oblong, 1 in. long, consisting of 6 truncate scales. W. China. Gn. 62, p. 183 (habit). G.M. 47:860. J.H. III. 57:91.—*L. plumòsa,* Sarg. (L. Doniana, Endl.). Tree, to 100 ft., with dense, pyramidal head: similar to the former, but lvs. larger, more closely set and more spreading, without any silvery line beneath: scales of the cone with a large, curved spine on the back. New Zeal. This species is the most tender of this genus.—*L. tetragòna,* Endl.=L. cupressoides.

Alfred Rehder.

LIBÒNIA: *Jacobinia; Libonia floribunda=J. pauciflora,* page 1715.

ĹICUÀLA (Molucca name). *Palmàceæ.* Showy, dwarf fan palms, grown for their peculiar habit and handsome foliage.

Stems solitary or in groups, never very tall, and usually slender: lobes of the lvs. long, wedge-shaped, plicate, truncate and variously lobed or split, deeply and irregularly divided, appearing but not truly peltate; rachis very short; ligule short; sheaths fibrous: fls. large, hermaphrodite, in a loose panicle which appears among the lvs.—Species 50 or more, from Trop. Asia to Trop. Austral. Allied genera in cult. are Brahea, Serenoa, Erythea, Pritchardia, Livistona, Trachycarpus, Rhapis. From these Licuala is distinguished by the carpels of the ovary 3-angled, slightly coherent; style single, filiform: albumen equable: embryo dorsal. Desirable in cultivation. G.C. II. 25:139.

2143. Licuala peltata.

Licualas are very handsome warmhouse palms of moderate growth, several species of which have been grown to some extent commercially. They delight in a tropical temperature and abundant moisture, and should also be shaded from strong sunshine in order to produce foliage of the deep, rich shade of green that is common to this genus. Some advise treating them as semi-aquatic. The most attractive species is *L. grandis,* which has been until recent years a costly species owing to its comparative rarity in cultivation. It is probably within twenty-five years that the first consignment of seeds of this species was received in America. The large fan-shaped leaves of licualas are somewhat tender and easily injured, which makes them of less value for house decoration, but as exhibition plants there are few palms more striking than *L. grandis* and *L. elegans. L. spinosa* and *L. peltata* are also well worth cultivation, though objection is sometimes found to the strong hooked spurs with which their leafstalks are armed.

Propagation is by fresh seeds, over brisk bottom heat, preferably in pans. (W. H. Taplin.)

A. *Lvs. with lobes more or less grown together; lobes very broad.*

B. *Marginal teeth very large, the upper edges bent under.*

Rúmphii, Blume. Not unlike *L. spinosa,* but the petiole spiny below: segms. 12–15, the inner ones 2 ft. long and 1 ft. wide at the apex, the lateral ones 16 in. long and 4 in. wide, oblique; marginal teeth broadly ovate, obtuse, shortly bifid. Celebes and Borneo.—Cult. in S. Fla.

BB. *Marginal teeth with upper edges not bent under.*

grándis, Wendl. (*Pritchárdia grándis,* Bull). Erect palm, the sts. clothed above with dead sheaths: lvs. very many, erect-spreading; petiole 3 ft., slender, glabrous, with stout, short, straight or curved spines along the margins below the middle; blade orbicular or semi-orbicular, very closely plicate, wedge-shaped or truncate at the base, concave, the margins with many short lobes which are obtusely 2-fid; ligule thick, short, acute, broadly ovate. New Britain Isl., north of New Guinea. I.H. 28:412 and 41, p. 82. G.C. II. 1:415. B.M. 6704. A.F. 7:1145. F.E. 7:982. S.H. 1:344. G. 10:439. R.B. 37, p. 24.

AA. *Lvs. digitately divided; lobes narrow.*

B. *Lobes less than 12.*

Jeanénceyi, Sander. A dwarf, rapidly growing palm: lvs. deep shining green; lobes blunt, 5–8. New Guinea. Gn. 55, p. 71. F.E. 11:291. G.M. 41:341. A.G. 22:651.—This palm is known only in its sterile, young condition, and its relationship is in doubt. The name "Jeanenceyi" appears to be unknown in botanical literature. The plant is an attractive addition.

BB. *Lobes 12 or more.*

C. *Petioles without spines in the upper part.*

élegans, Blume. Sts. thick as a man's body, 4 ft. high, prominently scarred: petioles 3–4½ ft. long, the margins with brown hooked spines to just above the middle; lvs. orbicular; lobes very graceful, the linear-lanceolate lateral ones gradually decreasing to 11 in., obliquely truncate, with acute teeth, the middle lobes 16 in. long, truncate, with broader obliquely ovate obtuse teeth, lobes with only 2 or 3 folds. Sumatra.

CC. *Petioles spiny throughout.*

D. *Lvs. ascending.*

peltàta, Roxbg. Fig. 2143 (redrawn from Martius). Lvs. 3–5 ft. diam., orbicular; lobes very variable in length and width, many-toothed at the apex, the teeth ½–2 in.; petiole stout, 3–4 ft. long. The lobes of the lvs. droop very gracefully. India. G.C. 1872:1657.

ámplifrons, Miq. Lvs. 2½ ft. long, the tip ascending: blade usually about 12-parted, many of the divisions 2-lobed at the apex: spadix long and stiff, reddish brown: fls. and fr. unknown. Sumatra.—Not common in cult.

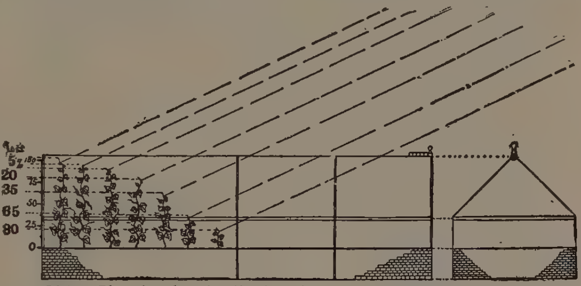
DD. *Lvs. horizontally spreading.*

spinòsa, Thunb. (*L. hórrida,* Blume). Lvs. 3 ft. or more diam., orbicular-reniform; inner lobes 18–22 in. long, 4½–5 in. wide at the apex, 10–11-toothed; outer lobes 15 in. long, 1½–2 in. wide, 4–6-toothed; teeth rather large, triangular-ovate, bifid; petioles obtusely 3-angled, 4–5 ft. long, with brownish hooked spines. Java, Moluccas.

JARED G. SMITH.
N. TAYLOR.†

LIDBÉCKIA (Eric Gustavius Lidbeck, Swedish botanist; published about 1750–1760). *Compósitæ.* Two S. African subshrubs or semi-herbaceous plants, sometimes grown in greenhouses and suitable for the open far S. Lvs. alternate, lobed or pinnatifid: peduncles 1-headed, the disk yellow and rays white; ray-florets neuter; disk-florets perfect, tubular; receptacle flattish; bracts of involucre in 2–3 series: achene glabrous, wingless and without pappus but crowned by a cylindrical nectary. Prop. by seeds when procurable, and by cuttings. *L. lobàta,* Thunb. (*Cótula lobàta,* Hort. *C. quinquéloba,* Linn. f.), is silky villous, 1–2 ft. high: lvs. petiolate, 3–5-lobed, the lobes broad-oblong and mucronate: involucre very hairy. *L. pectinàta,* Bergius, is glabrate or sparingly pubescent, 2–3 ft. high: lvs. nearly sessile, oblong, pinnatifid, glaucous beneath: heads larger than in the last, resembling *Chrysanthemum Leucanthemum,* the peduncles 1–3 in. long.

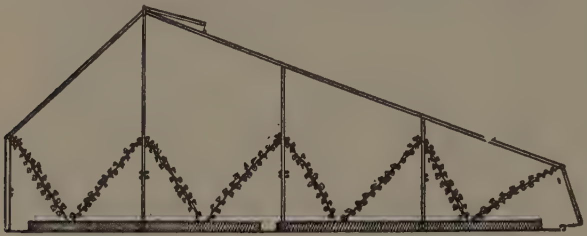
LIGHT. The various manifestations of energy which we term heat, light, electricity, gravitation, and the like, play an important rôle on living matter, and none is more important than light. Photosynthesis or carbon-assimilation, a characteristic plant function, constitutes one of the fundamental processes in nature; indeed this process, which in remote ages may have been developed secondarily as a protoplasmic function, is as wonderfu as life itself, and a thorough comprehension of photosynthesis would appear to be as difficult as that of life. However, no form of energy affects plant configuration more than light, and in the growing of crops, whether out-of-doors or in the greenhouse, the factor, light, must always be given consideration.



2144. Showing longitudinal and cross sections of a greenhouse with partitions running north and south, and illustrating the effect of poor light conditions. The oblique lines represent the path of the sun's rays.

Light is regarded as a form of radiant energy and is composed of various wave-lengths of exceedingly small size. Those which are especially active in photosynthesis or carbon-assimilation in our common green plants are in the red half of the spectrum, while the blue-green pigment organisms (marine algæ, and the like) utilize the more highly refrangible rays of the spectrum. Briefly, photosynthesis is the building up of carbohydrates from carbon dioxide and water through the chemical action of light on the chlorophyll, and since plants obtain most of their energy by means of this process, it is not difficult to realize its fundamental significance and importance. The ultimate product of photosynthesis is starch, but the complex chemical changes taking place in chlorophyll grains through the action of light and the building of starch from carbon dioxide and water is not definitely known, and there are doubtless many intermediate steps.

In any examination of flora is found much variation and adaptability to conditions, the result of innumerable generations existing under varied conditions. The light conditions in one section differ greatly from those in another part of the earth, but it is known from actual observation that some plants require much more light than others for their normal development. Even in the same location, such as the tropics, remarkable differences may be found in the light requirements. Many tropical plants require little light, and even when grown in northern latitudes in conservatories they require shading throughout the year. Palms, geraniums and other plants will develop normally under far less light than such plants as the cucumber or lettuce, but the latter grow much more rapidly and may perhaps for this reason alone show the ill effects of poor light regardless of their photosynthetic requirements. Within certain limits, however, it can be stated that photosynthesis or carbon-assimilation is proportionate to light intensity, and furthermore, that growth and development are correlated with photosynthesis.



2145. Showing cross section of an east and west house, about 36 x 200 feet, showing method of growing cucumbers. The light is much superior in a house of this sort.

The relation between photosynthesis and light intensity may be shown by using strong contrasting photographic negatives on leaves exposed to sunlight. By specially treating the exposed leaves, a positive can be produced which will show that little starch was formed under the thicker portions of the negative, and more under the thinner portions; in other words, the formation of starch under such conditions would be proportional to the amount of light received by the chlorophyll grains through the negative.

The general effect of light on growth is to retard it, though Blaauw, McDougal and Vogt have been able to discover a stimulation of growth under certain conditions, while, on the other hand, lack of light or darkness accelerates growth. The yellow rays of the spectrum are more active in inhibiting growth than the violet rays, the latter having a similar effect on plants to that of lack of light. Plants grow the most in the night, the growth curve gradually rising during the night and falling in the daytime. While lack of light stimulates growth, plants grown entirely in the dark or under poor light conditions are abnormal. Etiolated plants, or those grown in the dark, are devoid of chlorophyll, possess thin stems, elongated internodes and very poorly developed leaves. The mechanical or supportive tissue is little developed, and such plants possess small power of resistance. Light, on the other hand, develops mechanical tissue and induces firmness of texture. Moreover, without light there may be no increase in the weight of dry matter, hence seedlings grown in the dark may increase in size, but lose weight from respiration or loss of carbon dioxide.

Light is a factor in the dwarfing of alpine and arctic plants and in the development of hairs on some algæ as a protection against too intense illumination. Some plants grown in a weak light fail to produce flowers. (Insects attracted by the warmth of the sun are more likely to visit flowers growing in sunshine than in the deep shade.) Many fungi (Pilobolus) do not produce fruiting bodies (sporangia) until they reach the light. Wiesner, who has made a thorough study of the light requirements of plants, has classified some of our common species as follows:

(*a*) Light-requiring: Alfalfa, red clover, wild carrot and so on.

(*b*) Light-loving: Dandelion, plantain, lychnis and so on.

(*c*) Indifferent: Blueberry, poet's narcissus, the common brake, and the like.

(*d*) Light-shunning: Forget-me-not, violet, anemone and the like.

(*e*) Light-fearing: Wild strawberry, water violet, and the like.

Wiesner found that the beech, for example, reaches its normal development in one-tenth part of the light intensity required by the larch and other sun-loving plants.

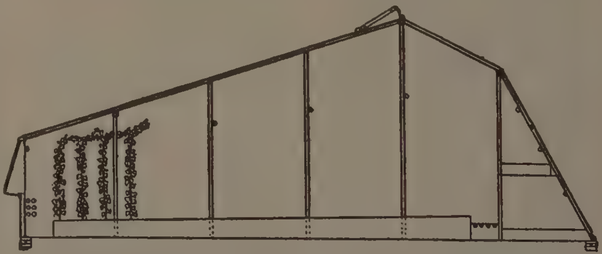
Light requirements are affected by a decrease in temperature: e.g., the maple in Norway requires ten times as much light as in Vienna for its normal development, and in general one may say, the farther north or the higher above sea-level a certain plant grows the greater becomes its light requirement.

The size of leaves is very much influenced by light. Too intense light as well as etiolation tends to reduce the size of the leaves, which reach their maximum in a medium light intensity. This is shown in the growth of such crops as cucumbers under glass during the winter.

Phototropism.

Phototropism or heliotropism is the term applied to the response of plants to a light stimulation from one side which causes movements toward or away from source of light. Phototropic movements are of much biological significance to the organism. Most aërial parts of plants (stems and branches) are positively phototropic, i.e., they bend toward the source of light, while roots are usually negatively phototropic, i.e., they bend away from light. For a clear understanding of the processes of plant response to light stimulation from one side, it is best to consider the reaction of a simple orthotropic plant such as the cotyledon of an etiolated oat seedling. This plant, which is remarkably sensitive, has been studied extensively by Darwin, Rothert, Fitting, Blaauw and others. It has been found in this plant that the apex of the cotyledon is the most sensitive to light stimulus, thus demonstrating, as in other forms of response, the localization of the perceptive or sensitive zone.

The bending toward the source of light as the result of the light stimulus begins at the apex, and it proceeds toward the base until the cotyledon coincides with the incident ray of light. The reaction time or latent period following stimulation is one-half to one hour in most cases, and the rate of transmission of the stimulus is from 0.7 centimeters to 1 centimeter an hour. The minimum time of exposure necessary to induce a reaction to a light stimulus is called the "presentation time," and this is dependent on the amount of light applied, which is a product of the light intensity, the exposure and distance from the plant. For example, an exposure to a light of high intensity (26,520 meter candle power) for one-thousandth of a second produced the same reaction as an exposure of forty-three hours to a light of very low intensity (0,00017 meter candle power).



2146. Showing cross section of a greenhouse used for lettuce and cucumbers. The slanting side toward the right (north) is boarded and used for forcing rhubarb. The cucumber plants are trained vertically.

An organ may be positively phototropic at one period of its development, and negatively phototropic at another, and it has been found that an oat seedling will respond positively and negatively or remain indifferent, depending upon the amount of light used. Many complicated forms of phototropism are observed in the movements of leaves and flowers (begonia and sunflower) which adjust themselves to certain angles as regards the source of light.

Phototaxis and photonastic.

The reacting or orientating response of motile (bacteria, swarm spores, and the like) or free-moving organs (chloroplasts) to a unilateral light stimulation is called phototaxis. This is a common mode of light reaction in plants. Plant movements which are not dependent upon the direction of light stimulus but are due to changes in the intensity are called photonastic movements. Under this category may be placed the movements of stomata which open under illumination and close in the darkness, also certain movements of etiolated seedlings when subjected to light.

The pathological effects of light.

The pathological effects of light on plants are a much more important factor than is generally realized. Many pathological conditions of plants are brought about by lack of light, and in some cases excess of light may produce injurious effects. This is shown in the case of sun-scald, which occurs on various trees. Some plants are so perfectly adapted to forest conditions that they cannot endure direct sunlight without injury. When they are exposed to direct light such as is caused by forest thinning, they are likely to sun-scald badly, but more often difficulties arise from lack of light. Tissue developed under poor light conditions is more likely to be affected with winter-killing due to non-ripening of the wood, and burning from fumigation with gases is induced by lack of light in poorly lighted greenhouses. Lack of light during the dark months often develops inferior tissue, which, when exposed to the more intense light of spring, becomes susceptible to wilting. The exclusion of light from part of the plants resulting from crowding, often gives rise to various stem-rots such as are characteristic of parsley, water-cress, lettuce, and the like, and there are a large number of leaf-blights and spots such as occur on cultivated plants which are induced by insufficient light. Lack of light induces the formation of various mildews on plants and is conducive to damping-off in many cases. It often causes disease of plants growing in dry soil as a result of excessive transpiration; in short, every greenhouse grower must regulate the growth of his crops according to light conditions in order to eliminate the possibility of disease.

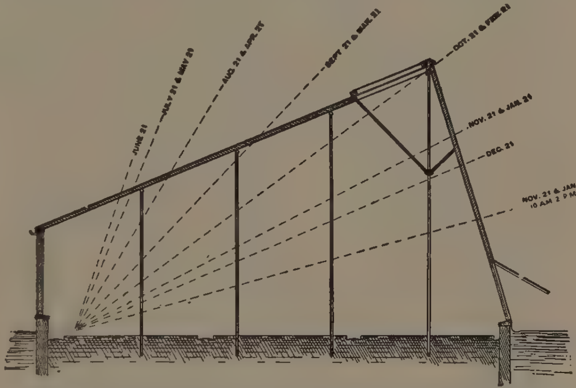
Light as a factor in greenhouse construction and management.

In the growing of plants under glass, which constitutes a large and constantly increasing industry, the problem of light is intimately associated with the location, construction of the greenhouses, management, and so on. Improvements in the line of greenhouse construction have been based very largely on the effects of light. The early houses in the United States were very crudely constructed, and in the modern, improved types of houses some crops are grown in one-half the time formerly employed, a fact due largely to improvement in methods of greenhouse construction. The old type of houses were chiefly sash-houses cumbered with shadow-producing material and glazed with small glass of inferior quality and often dirty, and widely lapped. The houses were in some cases so poorly constructed that they excluded from 40 to 60 per cent or more of light-rays. The modern house need not exclude more than 12 to 20 per cent. Some of the more or less modern types of houses which have been built for a number of years exclude as much as 30 per cent of light. Poor light conditions alone greatly retard growth, not to mention the frequent losses in poorly constructed houses from pathogenic organisms which find most favorable conditions for their development.

The amount of light to be found in any particular location depends upon the latitude, but more particularly upon the meteorological conditions which may prevail, and the variation in this respect throughout the United States is quite notable. Numerous meteorological observatories, without actually measuring the light intensity or amount of light, have given data as to the number of hours of sunshine, which is valuable in comparing light conditions in various localities. These records have been gathered for a considerable period of time and reliable averages are at hand. The average total number of hours of sunshine during the year based upon data covering a long period of time is as follows:

	Hours.
Chicago, Illinois	2,617
Cleveland, Ohio	2,000
Milwaukee, Wisconsin	1,865
Boston, Massachusetts	2,493
Nashua, New Hampshire	1,948
Ithaca, New York	2,273
New York, New York	2,510
Philadelphia, Pennsylvania	2,575
Phoenix, Arizona	3,742
Modena, Utah	3,354
Los Angeles, California	3,219

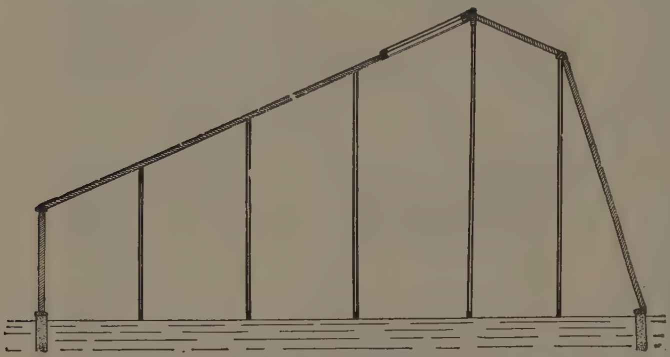
This data shows great variation in the hours of sunshine which cannot be attributed to latitude alone. It should be pointed out, however, that elevation constitutes a very important factor as regards light intensity, the higher the elevation the better the light conditions, and even the light intensities at an elevation of 500 to 600 feet are better than those at the surrounding low country, at least during the early parts of the day, but this difference gradually decreases toward night. From the commercial florist's point of view, the critical months in the year are November, December, January and February, and even a few days of cloudy weather when the crop is maturing often make much difference in the financial returns. Much more variation in light intensity exists in the dark winter months than in other seasons of the year. This is true as regards the differences existing between morning and afternoon light, for during the darker months the light may average 30 per cent more intense during the morning than in the afternoon. The percentage of possible sunshine recorded during November, December, January and February averages 22 per cent for Cleveland, 44 per cent for Chicago, 54 per cent for New York, and 75 per cent for Los Angeles. From such variations in the amount of sunshine found in the various territories during the critical months, it is evident that there must be corresponding differences in the period of development of the crops, the growth of a crop being in general proportional to the amount of light it receives.



2147. Showing type of greenhouse constructed for obtaining the maximum amount of light in the short winter days. Dotted lines indicate position of sun at different periods of the day and year (at noon unless otherwise indicated). House 34 feet wide and 20 feet maximum height.

In the construction of greenhouses, therefore, it is important they should be designed to produce the maximum results during the critical light seasons. Theoretical diagrams are shown in Figs. 2144–8.

From a study of the light conditions in greenhouses, it has been found that large glass is superior to small glass because of the smaller amount of light-obstructing framework, but with present methods of construction there is a limit to the size of glass that can be safely employed. Moreover, high-angled roofs are much superior to low roofs from the light point of view, but their practical utility is somewhat limited. Experiments with different types of glass have shown that there may exist 18 per cent difference in the light-transmitting properties of No. 1 and No. 2 quality glass, and third quality glass is 33 per cent less effective than No. 1 quality. A slight annual deterioration in greenhouse glass must be expected owing to the formation of a film of oil, but this can be obviated to some extent. The nature of the reflecting surface of the greenhouse, degree of lapping, and other factors influence light. In the modern large house more uniform light conditions are obtained than in the early, smaller houses.



2148. Showing type of greenhouse constructed to obtain the maximum amount of light in short winter days. Modification of type shown in Fig. 2147. Obstructs more light than Fig. 2147, but could be built wider.

As regards the direction of the greenhouse, for most purposes the east and west house is preferable for obtaining light, but some crops are able to thrive better, especially in the spring months, in a house running north and south. Morning light being superior to afternoon light, an east and west house should be tilted somewhat toward the northeast, thus exposing the plants more directly to the morning light and making it possible to syringe with less liability to fungous infection of the plants.

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LIGHTFOÒTIA (Rev. John Lightfoot, 1735–1788, author of a flora of Scotland). *Campanulàceæ.* Undershrubs or herbs (annual, biennial, perennial), of Afr. and Madagascar, with very small blue, white or pink fls.: lvs. usually alternate (sometimes fascicled or opposite), entire or toothed, small, narrow and rigid: fls. variously arranged; calyx-tube adnate to ovary, the lobes persistent; corolla deeply 5-lobed or parted nearly to base, the stamens free: fr. a caps. dehiscing at the top. Species 40–50, Trop. Afr. to the Cape region. Two or three species are more or less mentioned in garden writings for greenhouse culture, but apparently none is in the trade. *L. tenélla,* Lodd. (*L. ciliàta,* Sond.), of the Cape, has erect woody branches and bluish racemose fls.: lvs. ovate-lanceolate, somewhat reflexed: 9 in. L.B.C. 11:1038. *L. subulàta,* L'Her. (*L. sessiliflòra,* Sond.). Lvs. very narrow, more or less spreading: st. ascending or erect, somewhat woody: fls. many, blue: 12–18 in. Cape. L. H. B.

LIGULÀRIA (name refers to the strap-shaped more or less bilabiate rays). Including *Farfùgium* and *Erythrochæte. Compósitæ.* Perennial herbs, some grown in the open for the striking flower-heads and leaves, but mostly indoors for the large and interesting foliage, or in summer bedding.

From Senecio, to which it is often referred, this genus differs largely in the character of the involucre, the scales or bracts of which are in one series at the insertion but of two forms so that the narrow outer ones overlap the edges of the broader inner ones; also in technical characters of the style. Lvs. mostly long-petioled, broad or even orbicular or reniform, sometimes palmate, those on the st. smaller and bearing large sheaths: heads large, reflexed or nodding, in corymbs or racemes; ligules or rays mostly long and narrow, usually yellow: achene glabrous, bearing soft pappus.—Species about 30, as now defined, from W. Eu. to Siberia, Himalayas and China-Japan. The plants impose no special difficulties in cult. They are prop. mostly by division.

Kaémpferi, Sieb. & Zucc. (*L. Farfùgium,* C. Koch. *Farfùgium Kaémpferi,* Benth. *Senècio Kaémpferi,* DC.). Rhizomatous perennial sending up many lvs. on slender flocculent-woolly petioles: lvs. large (often 6–10 in. across), orbicular to nearly reniform, cordate at base, angular-toothed, green: fl.-sts. 1–2 ft. tall, flocculent-woolly, branched, with only small, bract-like lvs.: heads large, with light yellow rays spreading 1½–2 in. across; pappus white and copious. Japan. Var. **aùreo-maculàtus,** Hort. (*Farfùgium gránde,*

2149. Leopard plant, or Farfugium—Ligularia Kaempferi var. aureo-maculatus. (×⅙)

Lindl. *F. maculàtum*, Hort.). Leopard Plant. Fig. 2149. Differs in having the lvs. blotched with yellow or white and sometimes with light rose. B.M. 5302. The variety *aureo-maculatus* is the only form in general cult. It was intro. to England in 1856 "from the garden of a mandarin in the north of China" by Fortune. Years ago this was a common plant in conservatories and window-gardens, but of late years it has been neglected. It is, however, a most worthy plant, not only for the house but for bedding in the open in shady places. The plant is hardy as far north as Washington when set permanently in the open. One form has yellow-spotted lvs. (the commoner) and another has white-spotted lvs. Another form (var. *argénteus*) has lvs. glaucous-green edged with creamy white. Easily prop. by division.

japónica, Less. (*Árnica japónica*, Thunb. *Senècio japónicus*, Schultz. *Erythrochæ̀te palmatífida*, Sieb. & Zucc.). Strong perennial herb, growing 5 ft. high (said to reach 15 ft. in S. Japan), and grown for its massive foliage effect: radical lvs. very large, 1 ft. or more across, deeply palmately cut into 7–11 narrow-lobed and notched divisions: fl.-sts. branched, bearing heads on rather long, naked sts.; rays orange, spreading, 3 in. from tip to tip. Japan. Summer. Gn. 22, p. 139. J.H. III. 54:276.—Intro. into this country about twenty-five to thirty years ago. It is a bold plant, hardy in N. Y., and well adapted to planting where strong foliage effects are desired, provided the place is moist.

sibírica, Cass. (*Cinerària sibírica*, Linn. *Senècio sibíricus*, Clarke. *Ligulària racemòsa*, DC. *Senècio Ligulària*, Hook. f.). Very variable, native from France to Japan: stout and erect, 3 to 4 ft.: lvs. to 1 ft. across, somewhat triangular to reniform or cordate-sagittate in outline, the basal sinus sometimes deep and sometimes shallow, obtuse or acute, the margin coarsely toothed, the petiole of the st.-lvs. winged and sheathing: heads many, each many-fld., somewhat secund in a terminal raceme; bracts of involucre 8–10; rays or ligules yellow, very long (½–¾in.); pappus reddish.—May be planted in the herbary. Said to be a showy marsh plant.

macrophýlla, DC. (*Senècio Lédebourii*, Schultz). Stout and erect, 3–6 ft.: lvs. very large, elliptic or oval-oblong, not sagittate or cordate at base, strongly toothed, long-petioled, sometimes 2 ft. long with petiole, those on the st. more or less clasping: heads yellow, in a long dense terminal spike or crowded panicle. Caucasus. —A striking and vigorous perennial. See *Senecio*, for another entry of this species.

L. H. B.

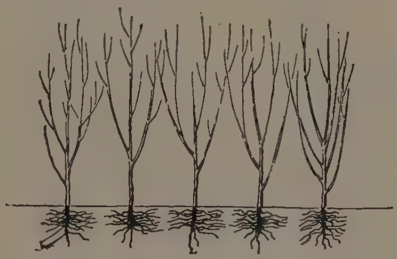
LIGÚSTICUM (Latin, referring to the ancient province of Liguria). *Umbellíferæ*. This includes a native hardy herb suitable for naturalizing with aquatics and bog-plants; offered by dealers in native plants. The ligusticums are glabrous perennials, with aromatic roots, large ternately compound lvs., mostly no involucre, involucels of narrow bractlets and white fls. in large, many-rayed umbels: fr. oblong or ovate, flattened laterally or not at all; oil-tubes 2–6.—Species about 20, in the northern hemisphere, of no horticultural prominence.

canadénse, Brit. (*Férula canadénsis* Linn. *L. actæifòlium*, Auth.). St. stout, 3–6 ft., branched above: lvs. 3–4-ternate; lfts. 2–5 in. long, coarsely serrate, broadly oblong: umbels 10–20-rayed: fruiting rays 1–2 in. long. July, Aug. Rich ground, S. Pa. to Ga. and Ala.

Wilhelm Miller.

LIGÙSTRUM (ancient Latin name). Including *Visiània*. *Oleàceæ*. Privet. Prim. Ornamental woody plants grown chiefly for their handsome foliage and the profusely produced white flowers; some species are excellent hedge plants.

Deciduous or evergreen shrubs, rarely trees: lvs. opposite, short-petioled, entire, without stipules: fls. perfect, in terminal panicles; calyx campanulate, obscurely 4-toothed; corolla funnel-shaped, with mostly rather short tube and with 4 spreading lobes; stamens 2: fr. a 1–4-seeded berry-like drupe.—About 50 species, chiefly in E. Asia and Himalayas, distributed south to Austral., one in Eu. and N. Afr.

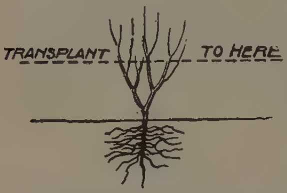


2150. Common method of making privet hedge. (Scale ½in. to 1 ft.)

The privets are much-branched shrubs or rarely small trees with usually medium-sized leaves and with large or small panicles of small, white, usually fragrant flowers followed by small black, or in some varieties greenish or yellowish white, berry-like fruits, often remaining on the branches through the whole winter. Some deciduous species, as *L. vulgare*, *L. Ibota*, *L. acuminatum*, and *L. amurense*, are hardy North, while others, like *L. ovalifolium*, *L. sinense* and *L. Quihoui*, can not be considered quite hardy north of Long Island. The evergreen species are only half-hardy or tender, but *L. japonicum* may be grown as far north as Philadelphia. They are all very valuable for shrubberies, with their clean, dark green foliage, which is rarely attacked by insects and keeps its green color mostly unchanged until late in fall, though *L. acuminatum* sheds the leaves rather early and *L. Ibota* and sometimes *L. ovalifolium* assume a pretty purplish hue; in mild winters some of the deciduous species hold part of their foliage until almost spring. *L. vulgare*, *L. ovalifolium* and others stand dust and smoke well and are valuable for planting in cities. *L. ovalifolium* is one of best shrubs for seaside planting, growing well in the very spray of the salt-water (known as California privet). Some are handsome in bloom, especially *L. sinense*, *L. Massalongianum*, *L. Ibota*, *L. japonicum*, *L. lucidum* and most of the other evergreen species; all are conspicuous in autumn and winter from the black berries, or in some varieties of *L. vulgare*, whitish, greenish or yellowish. *L. vulgare*, *L. ovalifolium* and *L. amurense* are well adapted for ornamental hedges; also *L. sinense* is used as a hedge plant, particularly in the South. The privets grow in almost any kind of soil, and even in rather dry situations and under the shade and drip of trees. Propagate by seeds sown in fall or stratified, sometimes not germinating until the second year; usually increased by cuttings of hardwood or by greenwood cuttings in summer under glass; varieties are sometimes grafted on *L. vulgare* or *L. ovalifolium*.

California privet for hedges. (Henry Hicks.)

First method.—Cuttings 8 to 14 inches of one-year wood are made in fall or winter, preferably the former, as they are occasionally damaged by the winter, even as far south as Alabama. These are tied in bundles and buried during winter. In the spring they are stuck in rows 2 to 6 inches by 2 to 3½ feet, and kept cultivated. They are sold at one year, when 1 to 2½ feet high, or at two years, when 2 to 4 feet high. If not sold at two years the plants are sometimes cut back to 3 inches to sprout again. They are dug by spade or tree-digger. These closely grown plants will make a hedge, as shown in Fig. 2150, especially if dug with spade and given short roots. If three-year plants, not cut back, are used, the base is open, as the old wood at the lower part of the plant has had its side branches weakened or killed by crowding and they do not readily branch out. Plants grown by this method are frequently planted in a double row.

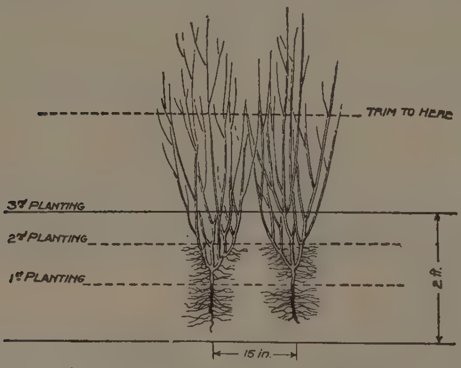


2151. California privet from short cuttings, transplanted deep. (Scale ½in. to 1 ft.).

Second method.—Cuttings of 5 to 6 inches of stout one-year wood, are made in November. The cuttings are made short so that the roots will not be cut off by the tree-digger. The leaves are stripped off, and the cuttings tied in small bundles, as large bundles mold. These are buried, tops up, over winter. In the spring, before growth starts, they are planted in rich mellow land 4 inches apart, with rows 8 inches apart. To plant, a back furrow is plowed in the center of the block, the top raked off, a line stretched and pegged down. The cuttings can then be inserted nearly full length. The trampling of the row settles the soil enough to expose the top buds. With a one-horse plow the bottom of the furrow is loosened where the planters have packed the soil, and new furrows are made around the strip planted. The cuttings are tilled during summer with a wheel-hoe or hand-plow. To make wide plants, the tips of the shoots are pinched when they are about 3 inches long. This is repeated at intervals of about three weeks during the summer. Nitrate of soda may be used to hasten growth. This method produces a plant as shown in Fig. 2151.

The plants may be dug in the fall and heeled-in to prevent possible winter-killing. They are then sorted into grades and planted in the spring 1½ to 2 feet apart in rows 3 to 4 feet apart against the landside of a deep furrow, and a little soil kicked over the roots. The filling is completed with a one-horse plow. Before filling, fine manure may be spread near the plants.

The plants should be straightened up and trampled firm. When finished, they should have the lower branches covered and the lower end of the cutting not below the level of the tree-digger. The pinching-back process may be continued, or the tips may be cut with a sickle during the early part of the season, especially on plants of the smaller grade. To get more roots on the branches the plants may be hilled-up. They are cultivated with a one-horse cultivator or a two-horse riding cultivator. At two years these will make plants 2½ to 3½ feet high and 1½ to 2 feet wide at the base.



2152. The privet hedge at final transplanting.

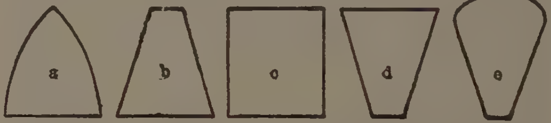
Dig with a tree-digger that operates on one or both sides. The plants may be set 12 to 15 inches apart, 4 to 6 inches deeper than before, and produce a hedge as shown in Fig. 2152. A smaller number of plants is required than when plants grown by the first method are used. As there are numerous vigorous buds near the ground, the growth is very dense at the base. After planting, the tops may be cut off to an even eight.

Various forms of hedge are used, as shown in Fig. 2153. No. *a* is used on Long Island; *b* is used at Newport. At Newport, by repeated clipping, the leaves become very small and the growth dense, resembling a wall. Nos. *d* and *e* frequently result from using narrow plants and allowing them to grow at the top.

Third method.—At Biltmore Nursery, North Carolina, the privet cuttings are run through a stalk-cutter and the pieces sown in a furrow.

INDEX.

acuminatum, 2.
albo-marginatum, 10.
Alivonii, 7.
amurense, 3, 11.
angustifolium, 1.
auréo-marginatum, 5, 7.
aureum, 7, 10.
brachystachyum, 12.
californicum, 5.
buxifolium, 10.
chlorocarpum, 10.
ciliatum, 2 and suppl.
coriaceum, 8.
excelsum, 7.
Fortunei, 11.
glabrum, 6.
glaucum, 10.
Ibota, 3, 4.
italicum, 10.
japonicum, 5, 6, 7, 8.
Kellerianum, 6.
Kellermannii, 6.
latifolium, 7.
leucocarpum, 10.
longifolium, 1 and suppl. list.
lucidum, 7, 8.
lutescens, 10.
macrocarpum, 2.
macrophyllum, 7.
magnoliæfolium, 7.
Massalongianum, 1.
meadia, 2.
medium, 2, 5.
multiflorum, 5.
myrtifolium, 1.
nepalense, 9.
nitidum, 11.
obtusifolium, 4.
ovalifolium, 5.
pendulum, 10.
pyramidale, 10.
Quihoui, 12.
Regelianum, 4.
robustum, 5, 7,
rosmarinifolium, 1.
sempervirens, 10.
Sieboldii, 6.
sinense, 7, 11.
spicatum, 1, 6, 7, 9
Stauntonii, 11 and suppl. list.
syringæflorum, 6.
tricolor, 5, 7.
variegatum, 5, 10.
villosum, 11.
vulgare, 10.
xanthocarpum, 10.



2153. Conventional forms of California privet hedges.

A. *Corolla with the tube 2 or 3 times longer than the limb.*

B. *Lvs. linear-lanceolate or linear, evergreen.*

1. **Massalongiànum,** Vis. (*L. longifòlium, L. angustifòlium, L. myrtifòlium, L. rosmarinifòlium,* and *L. spicàtum*, Hort.). Erect shrub, to 3 ft., with warty and pilose branchlets: lvs. tapering at both ends, glabrous, 1½–3 in. long: panicles much branched, many-fld., with rather small pedicelled fls., 2½–3½ in. long. July, Aug. Himalayas. G.C. II. 16:149.—Graceful half-hardy shrub, one of the most floriferous.

BB. *Lvs. oblong to ovate or oval.*

C. *Young branchlets and infl. pubescent: lvs. deciduous.*

D. *Calyx glabrous or pubescent only at the base: habit upright or upright-spreading.*

2. **acuminàtum,** Koehne (*L. ciliàtum*, Rehd., not Blume. *L. mèdium*, Hort., not Franch. & Sav.). Shrub, to 6 ft., with erect and spreading branches: lvs. rhombic-ovate or ovate-lanceolate, acute at both ends, appressed pubescent near the margin and finely ciliate and pubescent on the midrib beneath, 1–3 in. long: panicles small, erect, 1–2 in. long; fls. almost sessile; calyx glabrous: fr. shining black, ovoid, ⅓in. long. June. Japan. S.T.S. 1:71. M.D. 1904, p. 73.—This species has been intro. under the erroneous denomination of *L. medium*, which is sometimes misspelled *L. meadia*. It is the first to lose its lvs. in autumn. Var. **macrocárpum,** Schneid. (*L. macrocárpum*, Koehne). More upright: lvs. larger: fr. larger, ½in. long. M.D. 1904, p. 75.

3. **amurénse,** Carr. (*L. Ibòta* var. *amurénse*, Hort.). Shrub, to 15 ft., with upright branches: lvs. oval or oblong, usually obtuse, somewhat glossy above, glabrous except the midrib beneath, 1–2½ in. long: pani-

cles erect, often rather many-fld., 1–2½ in. long; fls. short-pedicelled; calyx glabrous or slightly pubescent near the base: fr. slightly bloomy, ovoid, ⅓in. long. June, July. Japan, China. R.H. 1861, p. 352. S.T.S. 1:72. M.D. 1904, p. 72.—Similar in habit to *L. ovalifolium* and almost half-evergreen.

DD. *Calyx pubescent: habit wide-spreading.*

4. **Ibòta,** Sieb. (*L. obtusifòlium,* Sieb. & Zucc.). Fig. 2154. Shrub, to 10 ft., with spreading and curving branches: lvs. elliptic to oblong-obovate, acute or obtuse, usually only pubescent on the midrib beneath, 1–2 in. long: panicles nodding, small, 1–1½ in. long, numerous along the branches on short branchlets; fls. short-pedicelled; calyx pubescent: fr. with slight bloom, subglobose, ⅓in. long. June, July. Japan, China. G.F. 6:425. M.D.G. 1899:218. M.D. 1904, p. 71. S.I.F. 1:83. C.L.A. 3:180 (as var. *Regelianum*).—Graceful shrub, hardy N. Var. **Regeliànum,** Rehd. (*L. Regeliànum,* Koehne). Low, dense shrub with almost horizontally spreading branches and oblong or obovate, usually more pubescent lvs. M.D. 1904, p. 70. R.H. 1904, pp. 434, 435. F.E. 20:811 (as *L. amurense*).

CC. *Young parts glabrous: lvs. half-evergreen.*

5. **ovalifòlium,** Hassk. (*L. califórnicum,* Hort. *L. japónicum,* Hort., not Thunb. *L. mèdium,* Franch. & Sav.). CALIFORNIA PRIVET. Shrub of upright habit, to 15 ft., quite glabrous: lvs. cuneate at the base, elliptic-ovate or elliptic-oblong, acute, dark green and glossy above, yellowish green beneath, 1½–2½ in. long: panicles erect, many-fld., rather compact, to 3 in. long; fls. almost sessile. July. Japan. F.E. 33:1223. S.I.F. 1:84.—A very handsome shrub, but of somewhat stiff habit; well adapted and much used for hedges (see Mn. 6, p. 9). Var. **aùreo-marginàtum,** Hort. Lvs. edged yellow. Var. **variegàtum,** Hort. (var. *robústum variegàtum,* Hort.). Lvs. variegated with yellow. Var. **trícolor,** Hort. Lvs. variegated with yellowish and white, pinkish when young (Mn. 2, p. 42). Var. **multiflòrum,** Hort. Very free-flowering. G.C. III. 50:237.

AA. *Corolla with the tube as long as the limb or shorter.*

B. *Young growths glabrous: lvs. evergreen.*

6. **japónicum,** Thunb. (*L. glàbrum,* Hort. *L. Kelleriànum,* Vis. *L. Kéllermannii, L. Sièboldii, L. spicàtum,* and *L. syringæflòrum,* Hort.). Bushy shrub, to 10 ft.: lvs. roundish ovate to ovate-oblong, acute or obtusish, with reddish margin and midrib, veins beneath not distinctly marked, 2–3½ in. long: panicles broad, rather loose, to 4½ in. long; corolla-tube usually somewhat longer than calyx. July, Aug. Japan. R.B. 25:84. S.I.F. 1:82. G.W. 2, p. 567.—Very handsome evergreen shrub, but in colder climates often losing the lvs. in fall; often confounded with the following, and also with the preceding.

7. **lùcidum,** Ait. (*L. japónicum macrophýllum, L. magnoliæfòlium, L. sinénse latifòlium robústum* and *L. spicàtum,* Hort.). Large shrub or tree, to 20 ft., with somewhat spreading branches, similar to the former: lvs. larger, ovate to ovate-lanceolate, acute or acuminate, distinctly veined beneath, 3–5 in. long: panicles less loose, with almost sessile fls.; tube about as long as calyx. July, Aug. Japan, China. B.M. 2565; 2921 (as *L. nepalense glabrum*). G.C. II. 10:753.—Larger lvd. than the former, but more tender. It yields the white wax, an exudation of the branches, caused by an insect, Coccus Pe-lah; therefore cult. in China. Var. **Alivònii,** Arb. Kew. (*L. japónicum* var. *Alivònii,* André). Lvs. ovate-lanceolate, to 8 in. long, acuminate, sometimes with yellowish variegation when young. Var. **aùreo-marginàtum,** Hort. (*L. excélsum aùreum,* Hort.). Lvs. margined yellow. Var. **trícolor,** Arb. Kew. (*L. japónicum trícolor,* Hort.). Lvs. with yellowish variegation, pink when young.

8. **coriàceum,** Carr. (*L. lùcidum* var. *coriàceum,* Decne. *L. japónicum* var. *coriàceum,* Makino). Dwarf, dense shrub, with short, rigid branches, to 6 ft., very leafy: lvs. orbicular or orbicular-ovate, convex, dark green and shining above, 1½–2½ in. long: panicle compact, 2–4 in. long, with sessile fls. July. Cult. in Japan, not known wild. B.M. 7519. R.H. 1874, p. 418; 1888, p. 440. F. 1876, p. 65. G.C. III. 53:265.

BB. *Young branchlets and infl. pubescent or puberulous.*

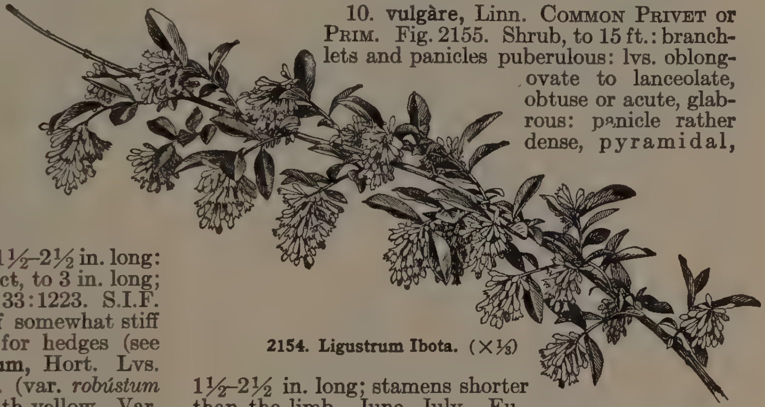
C. *Lvs. evergreen, 2–5 in. long.*

9. **nepalénse,** Wall. (*L. spicàtum,* Don). Evergreen shrub or tree, with pubescent branchlets: lvs. oblong or oblong-ovate, acuminate, pubescent beneath, 2–5 in. long: panicles rather large and broad, interspersed with petioled bracts. July, Aug. Himalayas.

CC. *Lvs. deciduous or half-evergreen, 1–2½ in. long.*

D. *Fls. pedicelled.*

10. **vulgàre,** Linn. COMMON PRIVET OR PRIM. Fig. 2155. Shrub, to 15 ft.: branchlets and panicles puberulous: lvs. oblong-ovate to lanceolate, obtuse or acute, glabrous: panicle rather dense, pyramidal, 1½–2½ in. long; stamens shorter than the limb. June, July. Eu., N. Afr., W. Asia. Naturalized in some places, chiefly in the E. B.B. (ed. 2) 2:729. F.E. 33:1273. H.W. 3:122.—Many garden forms. Var. **buxifòlium,** Nichols. Lvs. ovate or oblong-ovate, obtuse, half-evergreen. Var. **glaùcum,** Hoefker (var. *glaùcum álbo-marginàtum,* Spaeth). Lvs. bluish green, with narrow white margin. G.W. 2; p. 495. Var. **sempérvirens,** Loud. (*L. vulgàre* var. *itálicum,* Kirchn. *L. itálicum,* Mill. *L. sempérvirens,* Pieri). Lvs. linear-lanceolate, almost evergreen. Var. **péndulum,** Hort., with pendulous branches. Var. **pyramidàle,** Spaeth, with strictly upright branches. There are also varieties with frs. of different colors, as var. **chlorocárpum,** Loud., with greenish, var. **leucococárpum,** Loud., with whitish, and var. **xanthocárpum,** Loud., with yellowish frs. Variegated forms are: var. **aùreum,** Hort., with yellow foliage, and var. **variegàtum,** Hort., with the lvs. blotched yellow. Var. **lutéscens,** Hort., has deep cream-yellow fls.

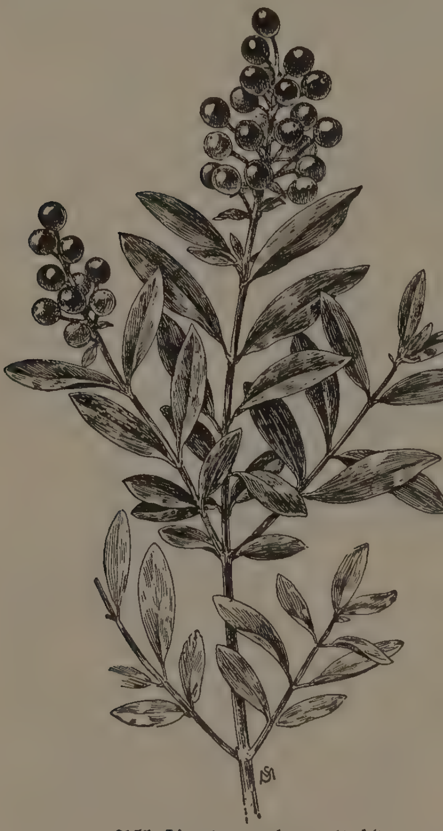


2154. Ligustrum Ibota. (×⅓)

11. **sinénse,** Lour. (*L. Fórtunei,* Hort. *L. villòsum,* May). Shrub, to 8 ft., with slender spreading branches. branchlets pubescent: lvs. elliptic to ovate-lanceolate, usually acute, pubescent along the midrib beneath, at least when young, 1–3 in. long: panicles pubescent, loose, to 4 in. long, with distinctly pedicelled fls.; stamens longer than the limb. China, Korea. G.C. 1858: 621. Var. **Staùntonii,** Rehd. (*L. Staùntoni,* DC.). Less high and more spreading: lvs. oval to ovate, usually obtusish, pubescent on midrib beneath: panicle broader and more loose. G.C. II. 10:365. G.F. 3:213. Var. **nítidum,** Rehd. Branchlets puberulous or minutely pilose: lvs. ovate-oblong to ovate-lanceolate, acute or acuminate, lustrous above. Cent. and W. China.—In some southern nurseries *L. sinense* has been offered under the name of *L. amurense*.

DD. *Fls. sessile.*

12. **Quihòui,** Carr. (*L. brachystáchyum,* Decne.). Shrub, to 6 ft., with spreading branches: branchlets and panicles finely pubescent: lvs. elliptic-oblong or narrow-oblong, obtuse, glabrous, somewhat coriaceous, 1–2 in. long: fls. sessile, in small clusters, forming at ends of the branches long, panicled spikes. Sept.–Oct. China. G.C. II. 18, p. 277. Gn. 66, p. 292.



2155. Ligustrum vulgare. (×½)

L. acutíssimum, Koehne. Allied to L. Ibota. Lvs. lanceolate, acuminate, ½–2½ in. long: panicle about 1 in. long; calyx glabrous; anthers shorter than limb. Cent. China.—*L. ciliàtum,* Sieb. Allied to L. acuminatum. Lvs. rhombic-ovate, acute, ciliate: panicle dense, small, about ½in. long, 4–8-fld. Japan.—*L. compáctum,* Hook. f. & Thoms. (L. lancifolium, Carr. L. longifolium and L. lineare, Hort., and L. Simoni, Carr.). Evergreen shrub, quite glabrous: lvs. lanceolate, to 6 in.: panicle large, compact; tube short. Himalayas. R.H. 1902, p. 500.—*L. Delavayànum,* Hariot (L. Prattii Koehne). Low evergreen shrub with spreading or nearly prostrate, pubescent branches: lvs. ovate to ovate-oblong, glabrous, ½–1½ in. long: panicles narrow, leafy at the base, 1–1½ in. long; corolla-tube longer than the limb. W. China. R.H. 1901, p. 496 (habit).—*L. Hénryi,* Hemsl. Evergreen shrub, to 12 ft.: branchlets pubescent: lvs. orbicular-ovate to ovate-lanceolate, obtusely acuminate, dark green, glabrous, ¾–2 in. long: panicles terminal, short-stalked, 1½–4 in. long; corolla-tube longer than limb; calyx glabrous. W. China.—*L. insulàre,* Decne. (L. Stauntonii, Hort., not DC.). Shrub, to 6 ft., allied to L. vulgare: lvs. elliptic-ovate to linear-lanceolate, yellowish green, often pendulous, 2–3 in.: panicles rather large. Origin uncertain.—*L. lancifòlium,* Carr., *L. longifòlium,* and *L. lineàre,* Hort.=L. compactum.—*L. pekinénse,* Hort. =Syringa pekinensis.—*L. Práttii,* Koehne=L. Delavayanum.—*L. Sìmoni,* Carr.=L. compactum.—*L. Staùntonii,* Hort.=L. insulare.—*L. strongylophýllum,* Hemsl. Evergreen shrub or small tree, almost glabrous: lvs. orbicular or obovate, ½–1 in.: panicle rather loose. Cent. China. B.M. 8069.—*L. Wálkeri,* Decne. Allied to L. nepalense: lvs. ovate to lanceolate, glabrous, to 3 in.: panicle large, to 6 in. Ceylon, Neilgherries. G.C. III. 24:282. G.M. 41:683.—*L. yunnanénse,* L. Henry. Shrub, to 12 ft.: branches glabrous: lvs. subcoriaceous, deciduous, oblong-lanceolate, glabrous, 2–5 in. long: panicle loose, 5–7 in. long; corolla-tube short. Yunnan. R.H. 1902, pp. 498–500.

ALFRED REHDER.

LILAC: *Syringa.*

LÍLIUM (Latin, from the Greek name, said to be derived from the Celtic word *li,* meaning whiteness, referring to *L. candidum*). *Liliàceæ.* LILY. Noble plants for outdoor bloom, and a few of them grown under glass. They comprise one of the distinctive flower forms, and the name lily is applied to many other plants.

Herbaceous perennials with scaly bulbs: sts. unbranched, smooth or pubescent, usually bright green, sometimes tinged purple or brown and generally clothed with lvs. their entire length: lvs. (except in only 2 species, *L. cordifolium* and *L. giganteum*) always linear or lanceolate, either scattered or verticillate, usually bright green and quite sessile, but in a few species with short petioles: fls. terminal, solitary, racemose or umbellate, perfect, with 6 perianth-segms., 3 like sepals or calyx-lvs. and 3 like petals or corolla-lvs., the parts erect or variously spreading or reflexed (Figs. 2156, 2157), usually with a honey-bearing gland at the base of each; each fl. has 6 prominent stamens and 1 long pistil; each stamen consists of a filament or stalk and an anther balanced on its end and attached by its back, while the ovary bears a style and a 3-lobed stigma: the fr. or seed-vessel is an oblong caps. borne above the base of the perianth-segms.; it is 6-ribbed, divided into 3 cells, each cell closely packed with flattened, brown, soft-coated seeds. The genus is divided into 7 groups or subgenera, distinguished from each other chiefly by the shape and arrangement of the fls. These groups are:

I. Eulirion (true lilies, trumpet- or funnel-flowered lilies).
II. Archelirion (open-flowered lilies).
III. Martagon (Turk's-cap or turban-shaped lilies).
IV. Pseudo-Martagon (bell-flowered lilies).
V. Isolirion (erect- or upright-flowered lilies).
VI. Cardiocrinum (heart-shaped-leaved lilies).
VII. Notholirion (fritillaria-like lilies).

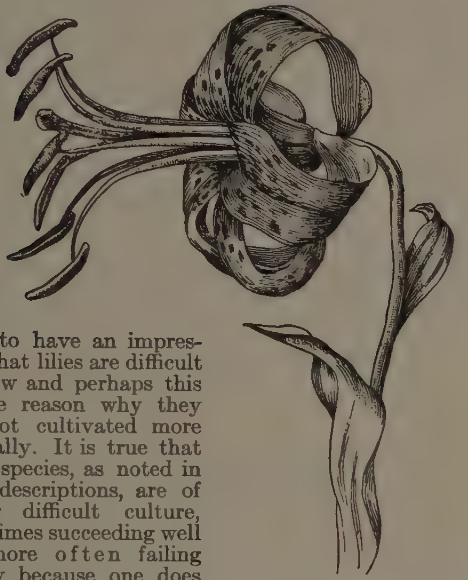
From 300–400 species have been described, but there are probably considerably less than 100 entitled to rank as such. They are all natives of the northern hemisphere, extending around the world. Their northern limit is southern Canada and Siberia; their southern, Florida and the Neilgherry Mts. of India. Many of them are in California and China-Japan.

The genus Lilium is very closely allied to Fritillaria; the latter genus differs in the corolla being more uniformly campanulate, with nectar-bearing cavities at the base of the inner segms. or of all of them, and the anthers attached by the base. *Lilium roseum* is by some referred to Fritillaria, but it is probably better kept in Lilium. *L. oxypetalum* is a similar case.

For further botanical information, the reader is referred to "The Botanical Gazette," 27:235 (1899), where a botanical review of the genus will be found. The most notable monograph on lilies is entitled "A Monograph of the Genus Lilium," by H. J. Elwes, published in 1880 and containing superb colored plates. It is referred to below by the abbreviation El. It covers the ground fully up to the date of publication. Unfortunately there is no book yet published which combines the botanical and horticultural points of view, but much valuable cultural information may be obtained by reading the following four books: Wallace's "Notes on Lilies," 2nd edition; "Lilies for English Gardens," by Miss Jekyll; "The Book of the Lily," by Wm. Goldring, and "Lilies," by Adams and one by A. Grove. Many portraits have been made of species of Lilium, some of the most important and accessible of which are cited in the following account. The author cannot vouch for the authenticity of these portraits, however.

The general cultivation of lilies.

The various lilies are unequaled by any other plant in their unique combination of beauty, gracefulness and stately magnificence; yet they are entirely unknown in many gardens, while in others only a few of the commoner species, like *L. candidum*, *L. speciosum* or *L. tigrinum* are seen. Their culture has been entirely too much neglected in this country, but we are confident that, as their merits become better known, they will be much more largely grown. Many persons seem to have an impression that lilies are difficult to grow and perhaps this is one reason why they are not cultivated more generally. It is true that a few species, as noted in their descriptions, are of rather difficult culture, sometimes succeeding well but more often failing simply because one does not fully understand their needs. It must be remembered that, in their native habitats, the different lilies are found under widely varying conditions of soil, climate and environment, and some kinds are so delicate and capricious that they will not succeed well under cultivation unless the peculiar conditions under which they are found in a wild state can be closely imitated. But, on the contrary, most lilies are robust, long-lived and of easy culture under a variety of soil and climatic conditions. The beginner in lily-culture should always select these easily grown kinds, choosing them according to his own individual taste. There are enough of these to satisfy any ordinary cultivator, unless he becomes an enthusiast or specialist, desirous of securing as large a collection as possible of different species and varieties. In that case, and if space, time and means will permit, he may attempt the culture of the more capricious sorts. The following is a selection of twelve of the best easily grown lilies for general cultivation: *L. candidum*, *L. regale*, *L. auratum* var. *platyphyllum*, *L. speciosum* var. *magnificum*, *L. tigrinum* var. *splendens*, *L. monadelphum*, *L. superbum*, *L. testaceum*, *L. Martagon* var. *glabrum*, *L. tenuifolium*, *L. croceum*, *L. dauricum* var. *incomparabile*.



2156. A lily form.—One of the turban or Turk's-cap group, Lilium superbum.

By using care and judgment, suitable lilies may be chosen for almost any location or purpose. Nearly all species are desirable for planting in combination with other hardy perennial plants or scattered among dwarf-growing shrubs in such a manner that the flowers will rise above their foliage, thus imitating nature, for in a wild state the lower part of the stem of many species is thickly surrounded with grass or dwarf undergrowth, while the upper part and flowers rise free. Many lilies also produce a charming effect when planted in front of large shrubs, such as magnolias and rhododendrons, the flowers showing up well against the background of green. For large beds or massing, only such kinds as produce a showy display of flowers should be chosen. *L. candidum*, *L. dauricum*, *L. elegans*, *L. speciosum*, *L. tigrinum* and their varieties are especially desirable for this purpose. Sometimes different species or varieties are planted together in the same bed, but, unless space is limited, it is usually better to keep them separate. Any of the strong-growing permanent lilies, *L. superbum*, *L. tigrinum*, and many others, are excellent for naturalizing in wild or uncultivated ground. Some of the smaller-growing kinds, like *L. concolor*, *L. elegans*, *L. tenuifolium*, are desirable for planting in rock-gardens with other plants. In the northern states the capricious sorts, like *L. japonicum* and *L. Leichtlinii*, often succeed better when grown in coldframes or pots than in the open ground, and if their culture is attempted this method is recommended.

The flowers of all lilies, with the exception of a few ill-smelling species, are excellent for cutting. Only the upper part of the stem should be cut off, however, leaving the foliage on the lower part, so the bulb may complete its growth. If the stem is cut off right down to the ground when in active growth, the bulb will be injured or perhaps destroyed.

Soils and location.

Most lilies will succeed in any light, sandy or loamy soil. Decayed peat or leaf-mold may be added with advantage, as the American species are especially partial to a peaty soil. Some species, like *L. candidum*, *L. croceum*, *L. elegans*, *L. Hansonii*, *L. monadelphum*, *L. tigrinum* and most of the European Turk's-cap lilies will also do well in a heavier soil, even clay if it is well drained. Good drainage is an essential point, for no lilies, with the possible exception of *L. canadense* and *L. superbum*, will live in a wet or swampy soil, where stagnant water stands around the bulbs. Whenever possible, a slightly sloping location with a porous gravelly subsoil should be chosen. Several species, like *L. candidum*, *L. chalcedonicum*, *L. carniolicum*, *L. Hansonii*, *L. monadelphum*, *L. Martagon*, *L. pomponium*, *L. testaceum* and a few others will thrive in a calcareous or limestone soil, but lime is poison to most lilies and with these exceptions they should never be planted in soils containing it. Of whatever nature the soil, it should be fairly rich and if not naturally so a liberal quantity of thorougly decayed cow- or sheep-manure should be mixed in before planting the bulbs. In after years, additional nourishment may be provided by top-dressings of decayed manure. Fresh manure of any kind should never be used, as it attracts worms and causes the bulbs to decay.

Although, as noted above, good drainage is necessary, yet lilies like plenty of moisture when in active growth. Frequent shallow cultivation or mulching will help to conserve the moisture already in the soil, but in periods of drought artificial watering may be necessary.

Some lilies, as *L. candidum*, *L. croceum*, *L. elegans*, *L. Martagon*, *L. monadelphum* and *L. tigrinum*, will often succeed very well in full sunshine and exposure. Others, however, like *L. auratum*, *L. Hansonii*, *L. Henryi*, *L. japonicum*, *L. Parryi*, *L. washingtonianum*, often fail or the flowers bleach or fade quickly in such situations. As a rule, however, it may be said that all lilies will thrive better in partial shade, and the flowers will last longer. The ideal location is under trees or large shrubs, but far enough away so that their roots will not rob the lilies of moisture and

2157. A lily form.—One of the Archelirion kinds. Form of L. speciosum.

nourishment. In such places, they will receive a free circulation of light and air, but the the full force of the hot midday sun cannot reach them.

Protection from cold and wind.

In cold climates, the bulbs of all lilies should be protected from freezing during winter by a heavy covering of leaves, hay or straw. Some species, as *L. bulbiferum*, *L. candidum*, *L. elegans*, *L. tigrinum*, are apparently not greatly injured if the bulbs freeze, but frost is fatal to many, especially the Californian and Indian species, and even the hardiest kinds will do better if the bulbs are protected from it. Frost sometimes also injures the tender young growth of *L. auratum*, *L. chalcedonicum*, *L. Hansonii*, *L. longiflorum*, *L. speciosum*, *L. testaceum* and others which appear above ground very early in spring. This can be prevented by covering the plants with old sheets, or something similar, on cold nights when frost is expected.

To prevent the stems of lilies from being broken by high winds, each plant or clump should be supported with a stick or stake, preferably of bamboo, tying them together with soft yarn or twine. It is better, however, wherever possible, to plant lilies in such a way that they will not require staking, as this deprives them of their natural gracefulness of swaying with the breeze.

The planting.

The best time to plant lily bulbs is soon after the flowers fade or seeds ripen. They cannot always be obtained at that time, however, imported ones often not being received until late in autumn or winter. In the northern states, the places intended for these late-received bulbs should be prepared previously and covered with 5 or 6 inches of leaves or litter, to prevent the ground from freezing. This should be removed and the bulbs planted as soon as received, afterward replacing it as a winter mulch. Or, if preferred, the bulbs may be packed in boxes of sand, leaf-mold or sphagnum moss and stored in a cool dark frost-proof cellar, closet, or shed until spring, when they should be planted. The material they are packed in must be kept constantly moist, neither too wet nor too dry. In this connection it might be well to add a few words of advice in regard to the purchase of lily bulbs. Whenever possible, freshly dug home-grown bulbs should be secured or at least those which have been shipped only short distances, which have not been deprived of their roots, and whose scales have not become dried or shriveled. Such bulbs, although they may cost more than imported ones, which have often been kept out of the ground for several months, are well worth the difference.

No definite rules can be given in regard to the proper depth and distance apart to plant the bulbs, but usually they should be set so that their top or apex will be three times as deep as their greatest diameter. The smaller-growing species, as *L. concolor*, *L. elegans*, and *L. tenuifolium*, may be planted about 6 inches apart, while from 12 to 18 inches is not too much space for the largest species, like *L. auratum*, *L. tigrinum*, and so on. When planting the bulbs, it is a good plan to surround each one with sand or fine gravel, which helps to drain away surplus moisture and also tends to repel worms. Some growers also place a handful of fresh sphagnum moss under each bulb, thinking it induces a better root-growth.

It is the nature of many lilies to throw out annual fibrous roots from the underground stem above the bulb (called stem-roots), in addition to the large permanent ones at its base (called basal or bulb-roots). The following species and their varieties belong to this class: *L. auratum*, *L. Batemanniæ*, *L. Brownii*, *L. bulbiferum*, *L. concolor*, *L. croceum*, *L. dauricum*, *L. elegans*, *L. Hansonii*, *L. Henryi*, *L. japonicum*, *L. Leichtlinii*, *L. longiflorum*, *L. Maximowiczii*, *L. medeoloides*, *L. odorum*, *L. regale*, *L. rubellum*, *L. Sargentiæ*, *L. speciosum*, *L. sulphureum*, *L. sutchuenense*, *L. tigrinum* and *L. Wallacei*.

The following species and their varieties produce but few, if any, stem-roots: *L. Bolanderi*, *L. callosum*, *L. canadense*, *L. candidum*, *L. carniolicum*, *L. caroliniаnum*, *L. chalcedonicum*, *L. columbianum*, *L. giganteum*, *L. Grayi*, *L. Humboldtii*, *L. Kelloggii*, *L. maritimum*, *L. Martagon*, *L. monadelphum*, *L. pardalinum*, *L. Parryi*, *L. parviflorum*, *L. parvum*, *L. philadelphicum*, *L. pomponium*, *L. pyrenaicum*, *L. Roezlii*, *L. superbum*, *L. tenuifolium*, *L. testaceum* and *L. washingtonianum*.

The bulbs of these non-stem-rooting species, when not received or planted until late autumn or spring, often remain dormant until the second summer, because the basal roots, on which the flower-stem must depend entirely for its support, have been cut off or dried up by exposure to the air, and consequently the bulbs are so weakened that it takes them a year or more to recover and form new roots. Sometimes, however, a small weak stem develops the first summer, which soon perishes without flowering. On the contrary, the stem-rooting species usually bloom well the first summer after planting, because, even if the bulbs do not produce roots they are formed at the base of the stem, which is nourished and supported by them.

Propagation.

Lilies are propagated by division of the offsets, by bulbils, by scales or by seeds. The best and easiest method with most species is by division of the offsets, which form at the base of the parent bulb, on the underground stem above the bulb, or on the end of a rhizome. The best time to do this dividing and replanting is from two to four weeks after the flowers fade or immediately after seeds ripen, as that is the only time the bulbs are really dormant and many species greatly dislike to be disturbed when the roots are in active growth. The clumps should be carefully dug up and the large flowering bulbs planted immediately where they are to remain permanently, while the smaller ones may be planted in beds by themselves, removing them to their permanent location when they become large enough to bloom, which will usually be in two or three years.

Sometimes, when separating and replanting the bulbs, fresh healthy scales become detached. If these are planted in rows 2 inches apart and 1 or 2 inches deep, in light sandy soil, either in boxes, coldframes or the open ground, one or more tiny bulbs will usually form at the base of each scale, where it was broken off. These will become large enough to bloom in two or three years.

L. bulbiferum, *L. Sargentiæ*, *L. suphureum* and *L. tigrinum* and its varieties usually produce small dark green or purple bulbils or bulblets in the upper leaf-axils. If these are removed before they drop to the ground and planted, like the detached scales, they will bloom in two or three years.

Raising lilies from seeds is very interesting, but it requires time, care and patience. Under favorable conditions, most lilies will produce seeds, but a few species often remain sterile, unless the flowers are hand-fertilized. Among these may be mentioned *L. Brownii*, *L. candidum*, *L. Hansonii*, *L. longiflorum*, *L. speciosum*, *L. sulphureum*, *L. testaceum*, *L. tigrinum*, *L. Wallichianum* and some varieties of *L. elegans*. Freshly-gathered seeds, sown soon after they ripen, will germinate more quickly than those which have been kept until they become hard and dry, but in all cases the period of time required for germination varies greatly with the species. For example, fresh seeds of *L. tenuifolium* will often germinate in a month, or even less, while those of *L. auratum* and many others will seldom germinate until the following spring and often not until a year later. Similarly, the time required for the seedlings to become large enough to bloom varies greatly. *L. philadelphicum*, *L. tenuifolium* and a few others will often bloom the second summer after the seeds germinate, while *L. giganteum* seldom blooms before five or six years have passed. Most species, however, require three or four years. The seeds should be sown thinly in boxes of light sandy soil, in rows about 2 inches apart and covered about ½ inch deep with finely sifted sphagnum moss. The boxes should be kept in the house or greenhouse until the seedlings appear, when they may be set outdoors, in a shady place, during the summer. When the young plants are 2 or 3 inches high, they should be transplanted into coldframes or prepared beds in the open ground, later removing them to their permanent location.

Insects and diseases.

Lilies are seldom troubled by insect foes of any kind. Worms will sometimes eat the bulbs, but if they are surrounded with sand, as previously suggested, and fresh manure is never used, they will not be likely to be attacked. Mice will also eat the bulbs and the only way to get rid of them is by poisoning or trapping. Aphis or green-flies occasionally attack the plants, especially when under glass, but they may be readily destroyed by spraying the plants with kerosene emulsion.

There are several fungous diseases that are very destructive to lilies. Probably the worst and most common one is a species of Botrytis. It attacks all kinds of lilies, without any exception, either wild or cultivated, and may appear at any stage of their growth. It is first noticed as buff or rust-colored spots or blotches on the leaves or buds, which soon become covered with a grayish mold. When the disease first appears, all affected parts should be cut off and burned, while the attacked plants, as well as healthy ones growing near them, should be sprayed with some good fungicide, like bordeaux mixture. Then, if the disease persists in spreading, the only thing to do is to dig up the plants, bulbs, roots and all, and burn them.

Another fungous disease, known as *Rhizopus necans*, is very destructive to imported Japanese bulbs, especially those of *L. auratum*. It attacks the base of the scales, causing them to decay, and the bulbs, if left exposed to the air for a few days, become soft and rotten and covered with a long white silky fungous growth. As soon as the bulbs are received, they should be carefully examined and those that show the least signs of the disease burned at once, as they seldom recover. Those which appear perfectly sound are often covered with the spores of the fungus and to destroy them the bulbs should be soaked for several hours in a solution of one part carbolic acid to forty parts water. Another method, practised by some growers to prevent the disease from being introduced into their gardens, is to plant the apparently sound bulbs singly in pots or tin cans, and later, those which are healthy and well-rooted should be transplanted to the open ground, while diseased ones should be burned and the soil in the pots sterilized.

The American florists' lily trade. (David Lumsden.)

The lily has become one of the popular plants of the American trade. Its popularity is due not alone to the fact that *Lilium longiflorum* is the acknowledged Easter lily of commerce, but it is a plant particularly well adapted for church, wedding and other decorations at any season of the year. Lilies are also exceptionally useful as cut-flowers for design work and for Memorial Day trade.

Many million bulbs of *L. longiflorum* and its varieties are imported from Japan, Formosa and Bermuda each year. It is an exceedingly important commercial crop, and several of the larger eastern and western growers force as many as 200,000 bulbs in a single season.

Lilium longiflorum var. *eximium*, which is grown under the trade name of *L. Harrisii*, was for years the principal variety grown for early blooms and for Easter sale. Unfortunately, the variety is attacked by a bacterial disease, and healthy stock is almost impossible to obtain. The lily disease is prevalent in all sections and countries from which the bulbs are imported, and growers find, under forcing conditions, that from 3 per cent to 33⅓ per cent of the bulbs are affected. *L. longiflorum* var. *eximium* is especially susceptible to the disease, but all varieties are now attacked to a greater or less degree. Within the last few years, however, more careful propagation and better cultural conditions have eliminated the disease to a considerable extent, and as a result, there has been an improvement in the crop.

During the earlier period of forcing Easter lilies, they were placed on the market only in the late winter or early spring months. Within recent years, improved methods of cold storage have made possible the production of blooms of the so-called Easter lilies at any season of the year. However, the larger number of blooms are placed on the market in Easter week, for in the minds of the flower-loving public no other flower is so suggestive of the Easter spirit.

The species of lilies forced under glass may be divided into three groups:

GROUP I. *Lilium longiflorum*, Easter lily.

- (*a*) *Lilium longiflorum*.
- (*b*) *Lilium longiflorum*, Formosa type.
- (*c*) *Lilium longiflorum* var. *eximium* (*L. Harrisii*).
- (*d*) *Lilium longiflorum* var. *giganteum*.
- (*e*) *Lilium longiflorum* var. *multiflorum*.

Lilium longiflorum var. *giganteum* is now the most popular for Easter trade; it is also the lily used almost exclusively for cold storage. *L. longiflorum*, Formosa type, *L. longiflorum* var. *multiflorum*, and *L. longiflorum* var. *eximium*, are used more especially for earlier flowering.

GROUP II. *Lilium speciosum* (*L. lancifolium*).

- (*a*) *Lilium speciosum* var. *album*.
- (*b*) *Lilium speciosum* var. *rubrum*.
- (*c*) *Lilium speciosum* var. *roseum*.
- (*d*) *Lilium speciosum* var. *Melpomene*.

Lilium speciosum ranks next to *L. longiflorum* as the most valuable for forcing. The varieties *album*, *roseum*, and *rubrum* are the most in demand. They are now forced in winter and spring by using bulbs that have been retarded in the cold storage. The natural blooming period of this species is July and August, and the flowers are then useful for floral designs and cut-flowers.

GROUP III. *Lilium candidum* (Madonna lily).

There are two forms of *L. candidum;* one with thin, star-like petals, not much recurved; the other having the broad, stoutly ribbed petals strongly recurved. This latter type is the one most commonly used for forcing. Bulbs of *L. candidum* are now imported from northern France. Recently, the lily disease has been so prevalent in the Marseilles district that the stock from that section has been less used for forcing purposes.

Forcing of lilies under glass.

When the bulbs are received, they should be potted into suitable-sized well-drained flower-pots, using a compost of three parts of good fibrous loam to one part of well-decayed horse- or cow-manure. There is a difference of opinion as to potting methods. Some growers prefer to place the bulbs first in 4-inch flower-pots, and when a strong root-system has developed, they are shifted into 6- or 7-inch flowering pots. Other growers place the bulbs directly in 6-inch pots, filling them about one-half full of compost, and at a later date when active growth has begun, a rich top-dressing of equal parts loam and cow-manure is added.

When the lilies are first potted, they are placed in a coldframe, watered thoroughly and covered with sphagnum moss, straw, or cinders. Wooden shutters are placed over the frames to keep the bulbs dark and to protect them from rain and heavy freezing. Under such conditions the bulbs will root readily. Before hard frosts, they are removed to a greenhouse and given a temperature of 45° to 50° F. at night for a week or ten days. When top-growth commences, a steady night temperature of 60° F. is maintained, raising the temperature to 70° during the day. Lilies should be given abundant ventilation and the plants should be freely syringed on bright mornings, but the foliage should be dry during the night.

It will require approximately thirteen weeks from the time that the plants are brought into the house to get them into flower, provided a temperature of 60° F. is maintained. It should be remembered, however, that weather conditions are dominant factors in lily-forcing; therefore, allowance must be made for a longer period for forcing if the weather is exceptionally dark or cloudy. Sometimes a slightly increased temperature shortens the period of forcing, and such an increase is not detrimental to the value of the flowers. If the buds are forced into flower at too high temperature, however, the keeping qualities of the flowers may be considerably injured. In order to have lilies in their prime for Easter, the buds should show about six weeks previous to that date. They may then be gradually developed, and if they advance too rapidly, they may be placed in a cooler temperature. No group of lilies will develop evenly, and it often requires excellent judgment so to shift the plants into different temperatures that the blooms will open at the proper date. If lilies are too advanced, retarding should not begin until the buds have lost their green color, for when once retarded, it is difficult to start them into growth again. A temperature of 45° to 50° F. at night, with a light shading on the glass, is recommended for developing the flower-buds.

For best success in forcing lilies, the water used for both watering and syringing should be warmed to about 70° F. Soil moisture extremes, caused by over-watering or by neglect, should be avoided.

When the lilies begin to show the buds, a weekly application of liquid manure may be given, using one bushel of cow-manure to fifty gallons of water. If the growth is very slow, three pounds of sodium nitrate may be added to the liquid manure, or it may be used separately in liquid form, using one ounce to one gallon of water.

If the plants are tall, they should be tied erect to neat stakes. Under forced conditions, the lily seems particularly susceptible to attacks of green aphis; therefore, fumigations and spraying with nicotine should be practised regularly throughout the period of growth. If young plants are kept free from aphis, they will be less likely to gain a foothold on the buds. They are particularly injurious to developing buds, for their attacks result in a malformation of the tissue.

Cold-storage lilies.

These are used for planting only from March 1 to September 1, the regular stock being depended on for the remainder of the year. The culture of cold-storage lilies differs from that pursued in the growing of lilies for Easter, as they may be placed in the forcing-house with a temperature of 60° F. immediately after potting. During the warm months, they will bloom in ten weeks from the time started. Those started earlier will require from ten to thirteen weeks.

Lilium speciosum and its varieties are easily grown. The method of culture does not vary much from that of *L. longiflorum.* They are grown either singly in 6-inch pots or planted in boxes. These boxes are 6 inches deep, and the bulbs are placed about 6 inches apart. The box method of culture is recommended because the roots of the lilies are not so liable to dry out as when pots are used.

Lilium candidum differs from *L. longiflorum* and *L. speciosum* in its temperature requirements. Too high temperature is disastrous to it, and a temperature of 50° or 55° F. suits it best. This species is seldom forced except for Easter and Memorial Day trade.

Notes on lily culture.

Allow thirteen weeks from the time the lilies are brought into the greenhouses, to get them into flower. A temperature of 60° F. at night, and 70° F. during the day, will be required.

It will take six weeks from the time the buds show, to the flowering period.

The best cold-storage temperature for lily bulbs is 34° F.

One of the most satisfactory lilies for Christmas is *Lilium longiflorum* var. *giganteum.* The bulbs should be potted September 15. *L. longiflorum* var. *giganteum* to be in flower for Easter should be potted in November.

By weekly plantings and proper culture, it is possible to have lilies in bloom throughout the year.

Early shipments of lilies arrive in time to follow the last of the cold-storage bulbs.

INDEX.

albiflorum, 18.
album, 17, 18, 27.
alternans, 52.
alutaceum, 52.
andinum, 48.
angustifolium, 22.
armeniacum, 52.
atrosanguineum, 52, 53.
aurantiacum, 51, 52, 53.
auratum, 17.
aureum, 35, 51, 52.
autumnale, 21.
avenaceum, 28.
Bartrami, 14.
Batemanniæ, 55.
bicolor, 52, 53.
biligulatum, 52.
Bloomerianum, 24.
Bolanderi, 43.
brevifolium, 52.
Brownii, 6, 10.
bulbiferum, 50.
Burbankii, 22.
Buschianum, 56.
byzantinum, 8.
californicum, 22.
callosum, 38.
canadense, 42.
candidum, 8.
carniolicum, 32.
carolinianum, 21.
Catesbæi, 49.
Cattaneæ, 27.
Chaixii, 51.
chalcedonicum, 33.
chloraster, 10.
citrinum, 52.
coccineum, 42.
colchesterense, 9.
Colchesteri, 9.
colchicum, 31.
columbianum, 25.
concolor, 56.
cordifolium, 58.
coruscans, 52.
croceum, 51.
cruentum, 17, 18.
Dalhansonii, 29.
dalmaticum, 27.
dauricum, 53.
elegans, 52, 54, 55.
erectum, 53.
excelsum, 33, 41.
eximium, 2.
flavum, 35, 42.
flore-pleno, 8, 16, 27.
floribundum, 2.
foliis albo-marginatis, 2, 8.
formosum, 2.
Fortunei, 16.
fulgens, 52.
giganteum, 2, 57.
glabrum, 27.
gloriosoides, 18.
grandiflorum, 52, 53.
Grayi, 45.
hæmatochroum, 52.
Hansonii, 29.
Harrisii, 2.
Hartwegii, 23.
Henryi, 19.
hirsutum, 27.
Horsmannii, 52.
Humboldtii, 24.
humile, 50.
immaculatum, 53.
incomparabile, 53.
insulare, 2.
Isabellinum, 41.
Jamesii, 2.
Jankæ, 35.
japonicum, 12.
jocundum, 16, 37.
Kaempferi, 18.
kansuense, 10.
Kelloggii, 26.
Kikak, 52.
Krætzeri, 18.
Krameri, 12.
lanceolatum, 48.
lancifolium, 18, 52.
lateritium, 52.
latifolium, 50.
Ledebouri, 31.
Leichtlinii, 36.
Leopoldii, 16.
leucanthemum, 10.
leucanthum, 6.
linifolium, 39.
Lishmannii, 16, 37.
liukiuensis, 2.
Loddigesianum, 31.
longiflorum, 2.
luteum, 22, 42, 46, 53, 56.
macranthum, 17, 18.
maculatum, 8, 33, 47.
magnificum, 18, 24.
majus, 33, 36.
Marhan, 29.
maritimum, 44.
marmoratum, 52.
Martagon, 27.
Mawi, 52.
Maximowiczii, 37.
medeoloides, 47.
Melpomene, 18.
Metzii, 4.
Michauxianum, 21.
Michauxii, 21.
minus, 14, 22.
monadelphum, 31.
monstrosum, 8.
montanum, 48.
multiflorum, 2, 18, 53
myriophyllum, 7.
neilgherrense, 4.
neilgherricum, 4.
nepalense, 11.
nigro-maculatum, 52.
nitidum, 25.
novum, 18.
ocellatum, 24.
ochroleucum, 11.
odorum, 9.
oregonense, 25.
pallidifolium, 22.
pardalinum, 22.
pardinum, 52.
Parryi, 15.
parviflorum, 22.
parvum, 46.
penduliflorum, 42.
pendulum, 42.
peregrinum, 8.
philadelphicum, 48.
philippinense, 1.
pictum, 17, 52.
platyphyllum, 10, 17
plenescens, 16.
polyphyllum, 30.
pomponium, 34, 35.
præcox, 18.
pseudo-tigrinum, 37.
puberulum, 22, 24.
pulchellum, 56.
pumilum, 39.
punctatum, 18, 30, 53.
puniceum, 39.
purpuratum, 18.
purpurascens, 14.
purpureum, 14.
pyrenaicum, 35.
regale, 7.
Robinsonianum, 22.
robustum, 52.
Roezlii, 23.
roseum, 12, 18, 59.
rubellum, 13.

LXV. Lilium speciosum in an attractive setting.

INDEX, CONTINUED

rubens, 53.
rubescens, 14.
rubro-pictum, 17.
rubro-vittatum, 17.
rubrum, 18, 33, 34, 42.
sanguineum, 52.
Sargentiæ, 6.
Sayi, 22.
Schrymakersi, 18.
semi-plenum, 52.
sinense, 16.
sinicum, 56.
speciosum, 8, 18.
spectabile, 53.
spicatum, 8.
splendens, 16, 52.
staminosum, 52.
stenophyllum, 38.
striatum, 8.
sulphureum, 5.
superbum, 5, 20, 21.
sutchuenense, 40.
Szovitzianum, 31.
Takesima, 2.
Tashiroi, 17.
tenuifolium, 39.
testaceum, 41.
Thomsonianum, 59.
Thunbergianum, 52.
tigrinum, 16, 37.
Tottenhamii, 53.
umbellatum, 48, 53.
unicolor, 32, 35.
Van Houttei, 52.
venustum, 52.
verum, 34.
vestale, 18.
virginale, 17.
viridulum, 10.
Wallacei, 54.
Wallichianum, 3, 5.
washingtonianum, 14.
wausharaicum, 48.
Wilsonii, 2, 52.
Wittei, 17.
yunnanense, 57.

KEY TO THE SUBGENERA.

Perianth trumpet- or funnel-shaped, horizontal or nearly so, with oblanceolate segms., broadest near the end, smooth inside, falcate only at the tip or apex; stamens slightly curved, parallel with the style. I. EULIRION. Species 1–15.

Perianth broadly funnel- or bell-shaped, but without any tube, horizontal or becoming pendulous; segms. ovate-lanceolate, broadest near the base, papillose inside and becoming deeply falcate; stamens diverging widely from the curved style: lvs. scattered, 5–7-nerved. II. ARCHELIRION. Species 16–19.

Perianth broadly bell-shaped, pendulous or nearly so; segms. usually lanceolate, broadest near the middle, sometimes slightly ovate-lanceolate, becoming deeply recurved or reflexed, and, unless noted, smooth inside; stamens diverging on all sides from the curved or almost straight style. III. MARTAGON. Species 20–41.

Perianth bell- or thimble-shaped, with oblanceolate segms., smooth inside, slightly or not at all reflexed; stamens diverging from the almost straight style: lvs. verticillate, usually 3–5-nerved. IV. PSEUDO-MARTAGON. Species 42–46.

Perianth erect, broadly funnel-shaped; segms. lanceolate or nearly so, usually spathulate or clawed at the base and, unless noted, papillose or lamellate inside; stamens diverging on all sides from the straight or slightly curved style: lvs. usually 3–5-nerved. V. ISOLIRION. Species 47–56.

Perianth trumpet- or funnel-shaped, with oblanceolate segms., smooth inside, falcate only at the apex; stamens slightly curved, parallel with the style: lvs. cordate or heart-shaped with long petioles, many nerved. VI. CARDIOCRINUM. Species 57–58.

Perianth campanulate-funnelform, with distinct and separate segms., horizontal or declined; stamens slightly declined, equaling or somewhat exceeding the curved style; stigma prominently 3-lobed. VII. NOTHOLIRION. Species 59.

SUBGENUS I. EULIRION.

A. *Tube scarcely widened from base to middle.*
  B. *Lvs. scattered, 1–3-nerved*.......... 1. **philippinense**
  BB. *Lvs. scattered, 3–5-nerved.*
    C. *Fls. pure white*.................. 2. **longiflorum**
    CC. *Fls. white or yellow, tinged brown or purple.*
      D. *St. entirely green.*
        E. *Plant erect from the bulb*.... 3. **Wallichianum**
        EE. *Plant with parts creeping along under ground*....... 4. **neilgherrens**
      DD. *St. tinged brown-purple.*
        E. *Bearing bulblets.*
          F. *Burmese species*.......... 5. **sulphureum**
          FF. *Chinese species*.......... 6. **Sargentiæ**
        EE. *Not bearing bulblets* .... 7. **regale**
AA. *Tube gradually narrowing from base to neck.*
  B. *Lvs. scattered, with 3–5 or more nerves.*
    C. *Fls. pure white*................. 8. **candidum**
    CC. *Fls. white or yellow, tinged purple.*
      D. *Anthers reddish brown.*
        E. *Bulb globular*................ 9. **odorum**

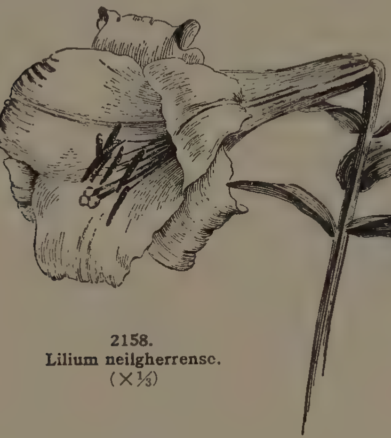
        EE. *Bulb oblate*................10. **Brownii**
      DD. *Anthers yellow*...............11. **nepalense**
    CCC. *Fls. pink.*
      D. *Anthers red*...................12. **iaponicum**
      DD. *Anthers yellow*...............13. **rubellum**
  BB. *Lvs. mostly verticillate, several nerved.*
    C. *Fls. white, pink or purple*........14. **washingtonianum**
    CC. *Fls. yellow*....................15. **Parryi**

1. **philippinénse,** Baker. Bulb globular or slightly oval, 1–2 in. diam., white, often tinged yellow: st. smooth, slender, 1–2 ft. high, green, sometimes dotted purple: lvs. 30–40, horizontal, 3–5 in. long, ⅛–⅙in. wide, upper ones slightly recurved: fls. usually solitary, rarely in pairs, 6–9 in. long, 4–6 in. wide, pure waxy white, tinged green near the base, delicately fragrant; anthers yellow. Late June, July. Philippine Isls. El. 3. B.M. 6250. I.H. 41:16. G.C. III. 30:47; 36:211. A.F. 23:907. Gng. 15:9. G.Z. 28, p. 145. Gn. 50:492.—Rather tender and capricious under cult.; in the northern states best suited for pots.

2. **longiflòrum,** Thunb. JAPANESE EASTER LILY. LONG-TUBED WHITE LILY. TRUMPET LILY. Bulb 2–4 in. diam., sometimes nearly globular, but more often of a peculiar oblate form, all the scales terminating together at the top or apex, which is flattened, while the base is narrower or constricted, color white or yellow: st. stout, smooth, 1–3 ft. high, bright green, sometimes tinged reddish brown near the base: lvs. 20–40, horizontal, or the upper ones semi-erect, 3–5 in. long, ⅓–½ in. wide: fls. 1–10, 4–6 in. long, nearly as wide, pure waxy white, often tinged green near the base; deliciously fragrant; anthers yellow. July to early Aug. China, Formosa, Liu Kiu Isls. and other parts of Japan. El. 7. B.R. 560. L.B.C. 10:985. Gn. 48, p. 386; 60, p. 44; 71, p. 495. G.C. III. 50:462; 51:43. A.F. 11:1311; 12:1104. A.G. 19:709. Gn. M. 10:112. C.L.A. 12:533. G. 35:827. G.W. 3, p. 43. Var. **fòliis álbo-marginàtis,** Hort., is similar, except the lvs. are paler green, edged creamy white, very rare. Var. **exímium,** Nichols. (*L. exímium*, Court., *L. floribúndum*, Hort., and *L. Hárrisii*, Carr.). BERMUDA EASTER LILY. A larger, stronger grower than the type, sometimes 4 ft. high, with 15–20 fls., 6–8 in. long. A.G. 18:297. A.F 12:143. Gn. 30:124; 43, p. 165; 45, p. 215; 46, p. 73; 47, p. 172; 49, p. 481; 52, p. 217; 60, p. 99; 66, p. 369; 68, p. 26. F.R. 1:679. G.C. III. 22:91; 43:180. R.H. 1883, p. 211; 1912, p. 456. G. 15:727; 17:29; 22:257; 23:613. Gn.M. 3:30; 5:73. J.H. III. 69:233. G.M. 47:375. Var. **insulàre,** Hort., is similar, but the perianth is said to be even longer. Magelhaes Archipelago, south of Japan. Gn. 61: suppl. Jan. 4. Var. **Wílsonii,** Hort. G. 11:131, var **multiflòrum,** Hort., A.F. 27:437; 35:477, and var. **gigantèum,** Hort., G.M. 52:65, are all nearly the same as var. *eximium*, but the sts. of the latter are heavily tinged reddish brown. Var. **Jàmesii,** Hort., a cross between the type and *L. Harrisii*, is not sufficiently distinct from either. Var. **Takésima,** Hort. (*L. Takésima*, Sieb.), sometimes called a distinct species, is evidently allied to *L. Brownii* and differs from the type in the st. being more heavily tinged and dotted brown, while the lvs. are longer and narrower and the fls. longer and not so widely expanded; when first opened there is a purplish brown midrib through the outside of each segm., while the 3 outer ones are also shaded chocolate. G.W. 15, p. 387. Var. **formòsum,** Hort., G. 4:187; 36:325, G.Z. 26; p. 195, from the island of Formosa, and var. **liukiuénsis,** Hort., from the Liu Kiu Isls., are similar, if not identical.—Although extensively grown as pot-plants for forcing, *L. longiflorum* and its vars. are seldom cult. in the open ground in the northern states. They are rather tender and, moreover, are not so permanent and long-lived as many others. After once flowering, the bulbs often have the exasperating habit of splitting up into 3 or 4

smaller ones, which require 2 or 3 years to bloom, or else they decay entirely, leaving a few small offsets.

3. **Wallichiànum,** Schult. Bulb globular or slightly oval, 2–3 in. diam., with broad, thick, reddish purple or brownish scales slightly notched at the edges: st. smooth, green, 4–6 ft. high: lvs. 50–60, erect or semi-horizontal, lower ones 6–9 in. long, ¼–½ in. wide, upper ones shorter and wider: fls. usually solitary, sometimes 2–3 together, 6–9 in. long, nearly as wide, deliciously fragrant, with waxy, creamy white segms., tinged golden yellow at the base inside and green outside; anthers yellow. Aug., Sept. Himalaya region from Nepaul to N. Burma. El. 4. B.M. 4561. Gn. 10:426. J.F. 1:105, 106, and p. 55. G.C. III. 28:10.—A magnificent species, but seldom cult. in this country.



2158. Lilium neilgherrense. (×⅓)

4. **neilghérrense,** Wight (*L. Métzii*, Steud. *L. neilghérricum*, Lem.). Fig. 2158. Bulb globular, 2–3 in. diam., with broad, thick scales, white or yellow, tinged purple or brown: st. smooth, 2–4 ft. high, the underground part often creeping along horizontally a foot or more before coming to the surface: lvs. 30–40, erect, 2–4 in. long, ½–1 in. wide: fls. 1–3, 6–8 in. long, nearly as wide, with waxy segms. of a rich buff color inside, fading to cream, almost white on the edge, outside faintly tinged purple; anthers yellow; the fragrance is delicately aromatic and distinct from that of any other lily. Aug., Sept. Neilgherry Mts. of S. India. El. 6. F.S. 22:2266, 2267. B.M. 6332. Gn. 27: 342. F.M. 1876:237. G.C. III. 30:53.—A beautiful species, but almost unknown in this country.

5. **sulphùreum,** Baker (*L. Wallichiànum* var. *supérbum*, Hort.). Bulb similar to that of *L. Wallichianum* but with smooth edges: st. smooth, 4–8 ft. high, green, tinged and dotted purple, bearing bulbils in the upper lf.-axils: lvs. 100–150, thickly scattered, horizontal, 2–4 in. long, ½–1 in. wide: fls. 1–4, 5–7 in. long, nearly as wide, deliciously fragrant, with waxy segms. of a sulfur-yellow color, fading to creamy white and tinged purple outside with purple midribs; anthers reddish brown. Aug., Sept. N. and E. Burma. B.M. 7257. Gn. 54, p. 259 (as *L. ochroleucum*); 66, p. 229; 71, p. 528; 72, p. 523. R.H. 1895, p. 541; 1913:180. G.C. III. 40:190; 51:19. J.H. III. 43:83; 59:37.—A magnificent, stately species, but rarely cult. Succeeds best in pots.

6. **Sárgentiæ,** Wilson (*L. leucánthum*, Hort. *L. Bròwnii* var. *leucánthum*, Hort.). Bulb similar to that of *L. sulphureum:* st. stout, smooth, 4–8 ft. high, green, tinged and dotted purple, bearing bulbils in the upper lf.-axils: lvs. 100 or more, thickly scattered, horizontal, 2–4 in. long, ½–1 in. wide: fls. 1–10 (usually 3–6), 5–6 in. long, nearly as wide, fragrant, waxy white inside, tinged yellow near the throat, outside heavily suffused reddish purple with deeper midribs; anthers reddish brown. Late July, Aug. W. China. Closely related to *L. sulphureum;* often confused with *L. Brownii* var. *leucanthemum*, to which it bears no resemblance. G.C. III. 51:385 (desc.) Gn. 77, p. 442; 69:234. J.H. III. 68:537. G.M. 48:579. Gn. W. 22: suppl. Oct. 21.—A magnificent lily, hardy as far north as Boston.

7. **regàle,** Wilson (*L. myriophýllum*, Hort., not Franch.). Bulb similar to that of *L. sulphureum:* st. 3–6 ft. high, smooth, stout, deep green, tinged and dotted purple: lvs. thickly scattered, 100 or more, deep green, horizontal, recurved, 3–6 in. long, ¼–½ in. wide: fls. 1–7 or more, 4–6 in. long, nearly as wide, deliciously fragrant, with waxy segms.; about a third of each one, near the base, inside, is bright canary-yellow, while the remainder of the interior is pure white, often suffused pink; outside they are white, tinged yellow at the base and with purple midribs, while the 3 outer ones are also heavily shaded purple; anthers reddish brown. July to early Aug. W. China. B.M. 8102. G.C. III. 38:328; 51:273; 53:416, 417. G.M. 55:416. Gn. 73, p. 397; 79, p. 27. F.S.R. 3, p. 331. C.L.A. 23:57. G. 32:57, 693; 35:537.—One of the most beautiful of all known lilies, the exquisite blending of tints and colors forming a charming contrast with the rich, deep green foliage. Highly recommended for general cult. both for pots and the open ground, where it is hardy, strong-growing and permanent as far north as Boston. *L. myriophyllum*, Franch., which is not in cult., differs in its oblate white bulb, its 3-nerved lvs., suberect nearly tubular fls., short pedicels and glabrous filaments.

8. **cándidum,** Linn. ANNUNCIATION LILY. BOURBON LILY. LENT LILY. MADONNA LILY. ST. JOSEPH'S LILY. Bulb globular or nearly so, 2–4 in. diam., white, tinged pale yellow: st. 2–4 ft. high, smooth deep green: lvs. 60–100 or more, lower ones horizontal, 6–9 in. long, 1½–2½ in. wide, appearing in autumn, upper ones gradually becoming smaller, those just below the infl. only 1 in. long, ½in. wide: fls. 3–20, 3–4 in. long and as wide, delicately fragrant, pure waxy white; anthers yellow. Late June, July. S. Eu. and S. W. Asia, from the island of Corsica to the Caucasus Mts. and N. Persia. El. 9. Gn. 45, p. 281; 53, p. 188; 56, p. 255; 66, p. 226; 71, p. 466; 74, p. 474; 79, p. 16. G.C. III. 21:161. G.M. 44:145; 51:698. Gng. 6:369; 13:5. F.E. 19:612. Gn. W. 14:41. G. 4:545. Gn.M. 4:28; 12:9.—Considered by many to be the lily of the Bible. It is of easy cult. in almost any soil or location and is also largely used for forcing. There are several varieties, all of which are rare, however, and none of them is superior to the type. Var. **fòliis álbo-marginàtis,** Hort., has the lvs. broadly edged pale yellow. Var. **flòre-plèno,** Hort. (var. *monstròsum*, Hort., var. *spicàtum*, Hort.), produces abortive fls. with white, dilated bracts; it is worth growing only as a curiosity. Var. **maculàtum,** Hort. (var. *striàtum*, Hort.), produces fls. which are streaked and veined purple on the outside; sometimes the lvs. also show the same variegation. Var. **peregrìnum,** Linn. (var. *byzantìnum*, Hort.), is of more slender growth than the type, with purple-tinged sts., narrower lvs. and narrower, longer perianth-segms. Var. **speciòsum,** Hort., is of smaller growth than the type, with purple-tinged sts. and comes into bloom about 2 weeks later; otherwise it is similar.

9. **odòrum,** Planch. (*L. Cólchesteri*, Hort. *L. colchesterénse*, Wallace). Fig. 2159. Bulb globular, 2–3 in. diam., white or pale yellow: st. smooth, 1–3 ft. high, glaucous-green, spotted purplish brown, darker at the base: lvs. 12–20, horizontal or semi-erect, 3–4 in. long, ⅔–1 in. wide, glaucous-green, tinged brown when young: fls. usually solitary, sometimes 2–3 together, 6–8 in. long, nearly as wide, with waxy segms., golden yellow inside, fading to creamy yellow, while the outside is tinged reddish brown; anthers reddish brown; the fragrance is rich

and delicious, similar to that of the Cape jasmine. July to early Aug. Japan, Korea and China. El. 14. B.M. 1591. L.B.C. 5:438. G.C. III. 43:316; 48:175. Gn.M. 2:174. Gn.W. 26:187. G.M. 44:467. G. 22:199. Also J. H. III. 62:221; G. 28:467; G.M. 50:58 (all as var. *Colchesteri*). Also G.C. III. 30:64; Gn. 66, p. 244 (as var. *colchesterense*). G.C. III. 30:54, and J.H. III. 43:63 (as var. *Alexandræ*). (See supplementary list.)—A lily of many names, often confused with *L. Brownii*, *L. japonicum*, and so on. It is quite rare, but is of easy cult., both in pots and open ground.

10. **Bròwnii,** Poit. Bulb of the same size and peculiar oblate form as that of *L. longiflorum*, but usually tinged and dotted reddish purple: st. smooth, 2–3 ft. high, deep reddish brown at the base and bare of lvs. for 6–8 in., upper part deep green, tinged and spotted reddish brown: lvs. 25–50, horizontal or semi-erect, recurved, 3–5 in. long, ½–¾in. wide, green, edged brown when young: fls. usually solitary, sometimes 2–4 together, 6–8 in. long, nearly as wide, delicately fragrant, with waxy segms. creamy white inside, fading to pure white and tinged yellow at the base; outside they are white, with purple midribs, while the 3 outer ones are also heavily tinged purple; anthers reddish brown. July, to early Aug. W. China. El. 8. Gn. 29:350 (as *L. japonicum*); 38, p. 173; 47, p. 97; 60, p. 201; 62, p. 299; 76, p. 552; 77, p. 94; 79, p. 15. G.C. III. 42:67. G. 10:161. Gn.W. 20:661. Gng. 4:193. F.S. 21:2248, 2193 (as *L. japonicum Colchesteri*).—Hardy and of easy cult., but the bulbs, like those of *L. longiflorum*, are very liable to decay if surplus water collects in the peculiar cup-like depression at the base of the scales. Especially good for pots. The var. **chloráster,** Hort., has narrower lvs. and the fls. are tinged green, not purple. Gn. 47:97 (as var. *leucanthum*). Var. **leucánthemum,** Hort., has entirely green sts. and yellow-tinted fls. B.M. 7722. G. 28:567; 31:561. G.C. III. 49:264. Both of these are very rare, while the vars. **platyphýllum,** Hort., and **virídulum,** Hort., which have been mentioned, are not in cult. Var. **kansuénse,** Hort., is mentioned in recent horticultural literature.

11. **nepalénse,** D. Don (*L. ochroleùcum*, Wall.). Bulb similar to that of *L. neilgherrense:* st. smooth, 2–4 ft. high: lvs. 30–50, erect or nearly so, 2–4 in. long, ½–¾in. wide: fls. 1–7, semi-horizontal or nearly pendulous, 4–5 in. long, nearly as wide, delicately fragrant, about half of each segm. at the base, inside, is bright, reddish purple, while the remainder of the interior is pale citron-yellow, next to the solid purple there are usually a few spots of the same color on the yellow background; anthers yellow. Aug., Sept. Himalaya Mts. from Nepaul to N. Burma. El. 5. B.M. 7043. R.B. 22:3. Gn. 35:54; 78, p. 159. G.W. 2, p. 93. J.H. III. 54:349. Gn.W. 12:785.—Rarely seen in cult. except by specialists, and only suitable for pots.

12. **japónicum,** Thunb. (*L. Kràmeri*, Hook., f.; see B. M. 7634. *L. japónicum* var. *ròseum*, Hort.). Bulb globular or slightly spherical, 1–2 in. diam., white or pale yellow sometimes tinged red or purple: st. smooth, 2–4 ft. high, green, tinged and dotted deep purple, lower part bare of lvs.: lvs. 15–20, horizontal or semi-erect, 6–9 in. long, ½–¾in. wide: fls. 1–7, 5–7 in. long and as wide, deliciously fragrant, usually of a bright pure rose-pink color, both inside and out, but sometimes deepening to rose-purple or fading to pale blush, nearly white; anthers red. June to early July. Japan. B.M. 6058. F.M. 1874:105. F. 1874:13. F.S. 20:2061-62. G. 18:95. Gn. 60, p. 45. G.Z. 18:113.—A beautiful lily, thought by some authorities to be a wild or natural hybrid between *L. auratum* (which the bulb and plant somewhat resembles) and another species, probably *L. odorum*. Unfortunately, it is delicate and capricious under cult., the bulbs decaying very easily from surplus moisture; although quite hardy, they can rarely be established in the open ground for any length of time and are best grown in pots or coldframes.

13. **rubéllum,** Baker. Bulb quite similar to that of *L. japonicum*, but more oval in shape: st. 1–2 ft. high, smooth, green, spotted and tinged purple, lower part bare of lvs.: lvs. 15–20, horizontal, 4–5 in. long, ¾–1 wide: fls. 1–8, 3–4 in. long and as wide, fragrant, of the same color variations as *L. japonicum;* anthers yellow or orange. June to early July. Japan. Gn. 54:410; 60, p. 43; 77, p. 95. G.C. III. 23:335; 30:42; 46:168. G.M. 41:477; 44:466. A.G. 20:31. Gn.W. 20:854. Gn.M. 2:175. G. 28:245. F.R. 8:97.—Allied to *L. japonicum* but possesses a better constitution, being rather more robust and permanent.

14. **washingtoniànum,** Kellogg (*L. Bártrami*, Nutt.). Bulb semi-rhizomatous, oblique, prolonged laterally to a length of 6–8 in., scales large, broad, loosely arranged, grayish white or pale yellow, sometimes tinged and dotted purple: st. stout, smooth, 3–6 ft. high: lvs. horizontal or semi-erect, glaucous-green, 3–4 in. long, ⅔–1 in. wide, usually in 6–9 whorls, each containing 5–12 lvs., with a few scattered ones above: fls. in racemes of 2–20, 2½–4 in. long, nearly as wide, deliciously fragrant, white, slightly tinged and dotted reddish purple or lilac inside and more heavily suffused purple outside; anthers yellow or orange. Late June, July. Calif., along the Sierra Nevada Mts. and Coast Range. El. 10. Gn. 20:484; 27, p. 344; 61, pp. 54, 55; 71, p. 139. J.H. III. 33:113.—A beautiful and stately species when well grown, but in the N. E. is rather capricious and often fails to succeed in the open ground. The var. **purpùreum,** or var. **purpuráscens,** Hort. (*L. purpùreum*, Mast.), is of more slender growth and smaller in every way, 2–3 ft. high, with lvs. 1–2 in. long, while the fls. are semi-erect and borne in umbels of 4–8; color white, faintly tinged lilac and spotted purple internally when first opened, soon changing to uniform lilac-purple. El. 11. F. S. 19:1975-76. G.C. III. 30:59. C. L. A. 5:43. Var. **rubéscens,** Hort. (*L. rubéscens*, Wats.), has a smaller, more globular bulb than the typical species, a more slender st. 3–5 ft. high, narrower lvs. and a raceme of 4–12 smaller, semi-erect fls., with more reflexed segms.; color white, tinged rose-pink, unspotted, changing to uniform rose-purple. Both these varieties are perhaps entitled to rank as distinct species. Var. **mìnus,** Hort., is mentioned. G. 29:137.

2159. Lilium japonicum. (×⅓)

15. **Párryi,** Wats. Bulb a scaly rhizome, 2–4 in. long, often irregular in shape, thickly covered with small scales, which are sometimes jointed and of a white or pale yellow color, rarely tinged pink or purple: st. slender, smooth, 2–5 ft. high: lvs. horizontal, 4–6 in. long, ⅓–½ in. wide, lower ones usually whorled, upper ones scattered: fls. 1–10, 2–4 in. long, as wide, delicately fragrant, of pure lemon-yellow color, more or less spotted internally purplish brown; anthers orange-red. Late June, July. San Bernardino Mts. of S.

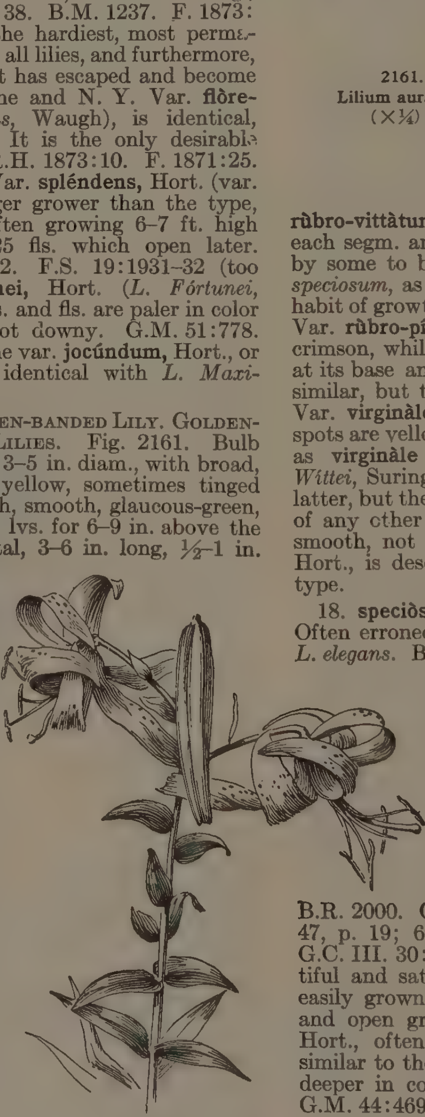
Calif. El. 12. B.M. 6650. I.H. 33:595. Gn. 18:652 (not typical); 49, p. 410; 60, p. 337. G.C. III. 18:209 (habit not correctly shown); 30:57; 55:217. G. 19:133. —A beautiful species, rather capricious and tender under cult., but usually succeeding well under the same conditions as *L. canadense* and *L. superbum.*

SUBGENUS II. ARCHELIRION.

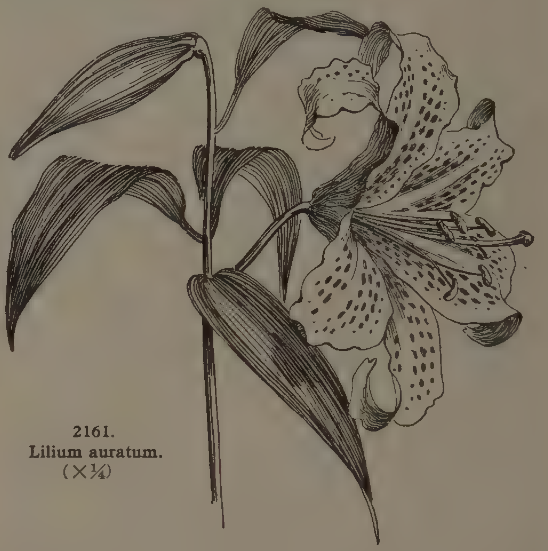
A. *Lvs. sessile*........................16. **tigrinum**
AA. *Lvs. shortly stalked.*
  B. *Fls. white or pink.*
    C. *Borne horizontally*..............17. **auratum**
    CC. *Becoming nearly pendulous*......18. **speciosum**
  BB. *Fls. reddish yellow*..............19. **Henryi**

16. **tigrìnum**, Ker-Gawl (*L. sinénse*, Hort.). TIGER LILY. Fig. 2160. Bulb spherical, 2–4 in. diam., white or pale yellow, sometimes tinged red or purple: st. stout, 2–4 ft. high, deep purplish brown, covered with white or grayish cobweb-like down and producing deep purple bulbils in the upper lf.-axils: lvs. 75–100 or more, deep green, 2–4 in. long, ¼–½in. wide: fls. 1–15, 3–5 in. diam., with bright salmon-red segms.; spotted purplish black and reflexed to the st.; anthers red. Aug., Sept. China and Japan. El. 38. B.M. 1237. F. 1873: 13. G.M. 44:468.—One of the hardiest, most permanent and most easily grown of all lilies, and furthermore, one of the most beautiful. It has escaped and become naturalized in parts of Maine and N. Y. Var. **flòre-plèno,** Hort. (var. *plenéscens*, Waugh), is identical, except the fls. are double. It is the only desirable double-fld. lily in cult. R.H. 1873:10. F. 1871:25. F.S. 19:1995. G.Z. 20:17. Var. **spléndens,** Hort. (var. *Lèopoldii*, Hort.), is a stronger grower than the type, and larger in every way, often growing 6–7 ft. high and bearing as many as 25 fls. which open later. Gn.W. 20:907. Gn. 27:152. F.S. 19:1931–32 (too dark-colored). Var. **Fórtunei,** Hort. (*L. Fórtunei*, Lindl.), is similar, but the lvs. and fls. are paler in color and the sts. are smooth, not downy. G.M. 51:778. Gn. 74, p. 586, 77, p. 73. The var. **jocúndum,** Hort., or var. *Líshmanii*, Moore, is identical with *L. Maximowiczii.*

17. **auràtum,** Lindl. GOLDEN-BANDED LILY. GOLDEN-RAYED LILY. QUEEN OF LILIES. Fig. 2161. Bulb spherical or nearly globular, 3–5 in. diam., with broad, thick scales, white or pale yellow, sometimes tinged red or purple: st. 3–6 ft. high, smooth, glaucous-green, often tinged purple, bare of lvs. for 6–9 in. above the surface: lvs. 20–50, horizontal, 3–6 in. long, ½–1 in. wide: fls. 1–15, 6–10 in. diam., deliciously fragrant, white spotted crimson, with a yellow band or midrib extending the whole length of each segm.; anthers red. Blooms late July, Aug. Japan. El. 15. Gn. 16:212; 39, p. 455; 50, p. 148; 60, p. 48; 64, p. 196; 65, p. 41; 70, p. 125; 71, pp. 395, 515, 550; 72, p. 443; 75, p. 138; 79, p. 4. G.C. III. 25:303; 54:269. G.M. 44:464, 593; 55:91. G. 20:503; 35:597. J.H. III. 53:37; 68:43. A.F. 7:43; 35:105. C.L.A. 12: 532; 14:45. H.F. II. 6:104. G.W. 6, p. 158. G.Z. 9:2. R.B. 21:25. F.M. 1871:514. R.H. 1867:371; 1875:10. B.M. 5338. A.G. 20:525.—Rather capricious under cult., often disappearing in a year or two, but so gorgeously beautiful that it should be generally grown, even if frequent renewal is necessary. One of the best lilies for pots. Var. **platyphýllum,** Hort. (var. *macránthum*, Hort.), is superior to the type, being a larger, stronger grower, sometimes 8–10 ft. high, with fls. a foot or more across, of the same color, but only slightly spotted. G. 30:609; 35:645; 36:715. Gn. 63, p. 95. Gn.W. 20:1027. Var. **rùbro-vittàtum,** Hort., has a wide crimson band through each segm. and numerous crimson spots; it is thought by some to be a hybrid between *L. auratum* and *L. speciosum,* as it resemble the latter more in bulb and habit of growth. Var. **cruéntum,** Hort., is quite similar. Var. **rùbro-píctum,** Hort., produces white fls. spotted crimson, while the band through each segm. is yellow at its base and red at the end. Var. **píctum,** Hort., is similar, but the yellow portion of the band is absent. Var. **virginàle,** Hort., resembles the type, except the spots are yellow; there is also an unspotted form, known as **virginàle álbum,** Hort. Var. **Wíttei,** Hort. (*L. Wíttei*, Suring.), produces fls. of the same color as the latter, but the segms. are shorter and broader than those of any other variety, and, unlike all others, they are smooth, not papillose, inside. El. 16. Var. **Tashíroi,** Hort., is described as a dwarf, large-fld. form of the type.



2160. Lilium tigrinum. (×¼)



2161.
Lilium auratum.
(×¼)

18. **speciòsum,** Thunb. SHOWY LILY. Fig. 2162. Often erroneously called *L. lancifolium,* a synonym of *L. elegans.* Bulb globular, 3–4 in. diam., reddish purple or brownish, rarely yellow or orange; scales broad and thick: st. 2–4 ft. high, smooth, green, often tinged and dotted purple: lvs. 12–25 or more, horizontal, 3–6 in. long, ½–1½ in. wide: fls. 1–10, 4–6 in. diam., delicately fragrant, with segms. often reflexed to the st.; they are white, suffused rose-pink in the center and spotted blood-red, with a green stripe at the base; anthers red. Late Aug., Sept. Japan. El. 13. B.M. 3785. B.R. 2000. Gn. 25:82; 33, p. 289; 45:90, and p. 91; 47, p. 19; 60, p. 408; 63, p. 108. R.H. 1843:492. G.C. III. 30:241. G. 5:457.—One of the most beautiful and satisfactory of all lilies, robust, permanent, easily grown and highly recommended for both pots and open ground. Vars. **ròseum,** Hort., and **rùbrum,** Hort., often catalogued as distinct, are really very similar to the type, but the fls. of the latter are rather deeper in color. Gn. 36:434; 60, p. 313; 70, p. 187. G.M. 44:469. Gn.M. 2:115. Gn.W. 15:7. G.W. 15, p. 596. Var. **Kaèmpferi,** Hort., var. **purpuràtum,**

Hort., and var. **Schrymákersi,** Hort., are all similar to var. *rubrum.* Var. **macránthum** and var. **multiflòrum,** Hort., are also similar, but are of larger, stronger growth and more free-flowering. Var. **Melpómene,** Hort., is of somewhat different habit of growth than the type and has much deeper-colored fls. which are of a rich carmine-crimson, spotted blood-red and narrowly edged white. Var. **magníficum,** Hort., is closely allied to var. *Melpomene,* but is larger in every way, of stronger growth and comes into bloom a little earlier. J.H. III. 68:125. G. 27: 469; 33:689, 692. Var. **cruéntum,** Hort., is a dwarfer form of var. *Melpomene,* flowering two weeks later. Var. **gloriosoìdes,** Baker, differs from the type in its narrower lvs., much twisted gloriosa-like segms. and scarlet spots. Var. **álbum,** Hort. (var. *albiflòrum,* Hook.), has deep brown bulbs, brown-tinged sts. and buds and unspotted white fls. slightly suffused pink; anthers reddish brown. P.M. 8:127. Gn.W. 23, suppl. May 19. Var. **álbum nòvum,** Hort., has pure white fls. with yellow anthers. Var. **Kraëtzeri,** Duch., often sold as var. *album,* is quite distinct, differing in its yellow bulbs, entirely green st., more pointed, brighter green lvs. and green-tinged buds; the fls. are pure white with a pale green stripe halfway down the center of each segm. and reddish brown anthers. G. 11:69; 15:97. Var. **vestàle,** Hort., is similar. Var. **punctàtum,** Lem., has yellow bulbs, entirely green sts. and white or pale blush fls. spotted rosy crimson. It is of more delicate constitution than the other varieties. Var. **prǽcox,** Hort., is similar, if not identical. There are also several other horticultural forms, but they are not sufficiently distinct to be recognized.

2162. Lilium speciosum. (×⅓)

19. **Hényri,** Baker. Fig. 2163. Bulb similar to that of *L. speciosum,* but often larger, deep reddish purple: st. smooth, 4–8 ft. high, deep green, heavily tinged and spotted purplish brown: lvs. 60–100, horizontal, 3–6 in. long, ¾–1½ in. wide, upper ones shorter and recurved: fls. 1–20, 3–4 in. diam., inodorous, bright orange-yellow, slightly spotted reddish brown and with a green band at the base of each segm.; anthers orange-red. Aug., Sept. Cent. China. B.M. 7177 (too light-colored). Gn. 40:422; 55, p. 233; 60, p. 336. G.C. III. 8:380. J.H. III. 42:131. R.H. 1903:232. G. 35:655.—One of the very best of all lilies for general cult., hardy, robust, long-lived and easily grown in almost any soil and situation. Sometimes called the yellow *L. speciosum;* although it resembles that species in bulb and form of fls., it is entirely distinct in habit of growth.

SUBGENUS III. MARTAGON.

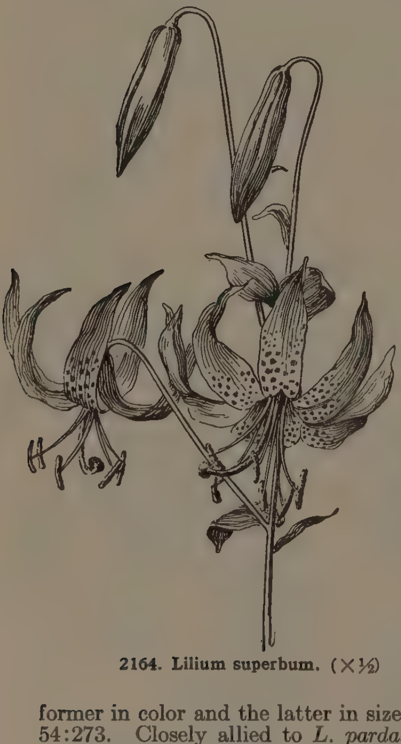
A. *Lvs. mostly verticillate, usually 3–5-nerved.*
  B. *Species American.*
    C. *Bulbs rhizomatous.*
      D. *Eastern species*..............20. **superbum**
      DD. *Southern species*..............21. **carolinianum**
      DDD. *Western species.*
        E. *Broad-lvd.*..............22. **pardalinum**
        EE. *Narrow-lvd.*..............23. **Roezlii**
    CC. *Bulbs not strictly rhizomatous.*
      D. *Form oblique*..............24. **Humboldtii**
      DD. *Form globular.*
        E. *Fls. yellow*..............25. **columbianum**
        EE. *Fls. pink*..............26. **Kelloggii**
  BB. *Species Old World.*
    C. *Fls. purple or white*..............27. **Martagon**
    CC. *Fls. yellow.*
      D. *St. 2 ft. or less high*..............28. **avenaceum**
      DD. *St. 3 ft. or more high*..............29. **Hansonii**
AA. *Lvs. scattered.*
  B. *The lvs. many-nerved.*
    C. *Himalayan species*..............30. **polyphyllum**
    CC. *Persian species*..............31. **monadelphum**
    CCC. *European species*..............32. **carniolicum**
  BB. *The lvs. 1- or few-nerved.*
    C. *Species European.*
      D. *Fls. red.*
        E. *From Greece*..............33. **chalcedonicum**
        EE. *From Alpine regions*..............34. **pomponium**
      DD. *Fls. yellow*..............35. **pyrenaicum**
    CC. *Species Asiatic.*
      D. *Fls. yellow*..............36. **Leichtlinii**
      DD. *Fls. red.*
        E. *From Japan.*
          F. *St. often 5 ft. high*..............37. **Maximowiczii**
          FF. *St. not over 2 ft. high*..............38. **callosum**
        EE. *From Siberia*..............39. **tenuifolium**
        EEE. *From China*..............40. **sutchuenense**
    CCC. *Species hybrid*..............41. **testaceum**

20. **supérbum,** Linn. AMERICAN TURK'S-CAP LILY. SWAMP LILY. Fig. 2164. Bulbs rhizomatous, borne an inch or two apart on stout rhizomes, globular or nearly so, 1–2 in. diam., white, often tinged red or pink; scales small, thick, sometimes jointed: st. stout, smooth, 3–8 ft. high, green, sometimes tinged purple, usually bare of lvs. for 5–6 in. above the surface: lvs. horizontal, 2–5 in. long, ½–¾ in. wide, usually in 3 or 4 whorls of 4–10 lvs. each, with a few scattered ones above: fls. 1–40, 3–4 in. diam., with segms. reflexed to the st., of a brilliant orange-scarlet, shaded yellow and spotted purplish brown at the base; anthers red. Late July to early Sept. New Bruns. to Ont., Minn., Mo., and Ga. El. 26. B.M. 936. L.B.C. 4:335 (as *L. autumnale*). Gn. 30:8 and p. 9; 38:506. Gn.W. 22, suppl. Nov. 4. —The most magnificent and showy of native North American species, well worthy of extensive cult. It is considerably variable and there are intermediate forms between *L. superbum* and *L. canadense.*

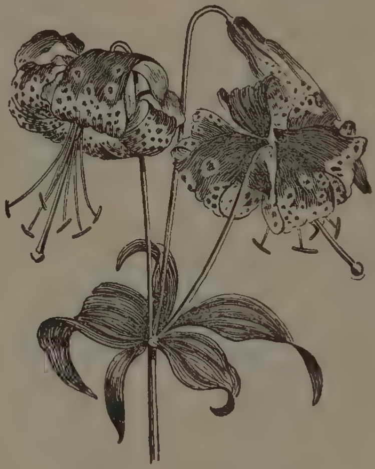
21. **caroliniànum,** Michx. (*L. autumnàle,* Lodd. *L. Michaùxii,* Poir. *L. Michauxiànum,* Schult. *L. supérbum* var. *caroliniànum,* Chapm.). SOUTHERN SWAMP LILY. Allied to *L. superbum,* but the bulbs more nearly resemble those of *L. pardalinum:* st. smooth, slender, 2–4 ft. high: lvs. horizontal, deep green, 2–3 in. long, ¾–1 in. wide, usually in 5–6 whorls, with a few scattered ones above and below: fls. 1–3, 3–4 in. diam., delicately fragrant, of the same color as *L. superbum,* but with a paler, almost white throat. Late July, Aug. Va. to Fla. and La.—Of easy cult., but rather more tender and not so desirable as *L. superbum.*

2163. Lilium Henryi. (×¼)

22. **pardalìnum,** Kellogg. Leopard Lily. Panther Lily. Fig. 2165. Bulb a scaly rhizome, quite similar to that of *L. Parryi*, but more branching and irregular in form: st. 3–6 ft. high, smooth, pale green: lvs. horizontal, 3–4 in. long, ¾–1 in. wide, usually in 3 or 4 whorls of 9–15 lvs. each, with a few scattered ones above and below: fls. 1–30, 2–4 in. diam. with segms. reflexed to the st., about half of each one, at the base, is bright yellow, spotted brownish purple, while the remainder, at the end is bright orange-scarlet; anthers red. Late June to early Aug. Sierra Nevada Mts. of Calif. El. 28, 29. F.M. 1872:33 (as *L. washingtonianum*). Gn. 20:526. G. 32:463. J.H. III. 49:147; 51:79. Gn. M. 9:236. —This lily is the best and most easily grown Calif. species for general cult.; hardy, robust, and permanent. Var. **angustifòlium,** Kellogg, is identical, except the lvs. are much narrower, and it is of more slender growth: it is sometimes confused with *L. Roezlii*. Var. **califórnicum,** Hort. (*L. califórnicum*, Lindl.), has smaller lvs., mostly scattered, and larger, more richly colored fls. G.C. III. 30:43. Var. **pallidifòlium,** Baker (var. *pubérulum*, Leicht.), has paler green lvs. and smaller, paler-colored fls. than those of the type, not so thickly spotted. Var. **Robinsoniànum,** Moore, is a stronger grower than the type, sometimes 8–9 ft. high, with mostly scattered lvs. and larger, more richly colored fls. Var. **lùteum,** Hort., produces pure yellow fls., spotted brownish purple; in other respects it is the same as the type.—There are also several other rather indistinct so-called vars. and an unnamed hybrid between *L. pardalinum* and *L. Humboldtii*. Another hybrid between *L. pardalinum* and *L. Parryi*, called *L. Búrbankii*, Hort., produces fls. resembling those of the former in color and the latter in size and shape. G.M. 54:273. Closely allied to *L. pardalinum* is *L. parviflòrum*, Hook. (*L. Sàyi*, Nutt., *L. pardalìnum* var. *mìnus*, Hort.), but the fls., which are of the same color, are smaller and are solitary or 2 or 3 are borne together. June, July. Vancouver Isl. to N. Calif. along the seacoast. Rather capricious under cult.



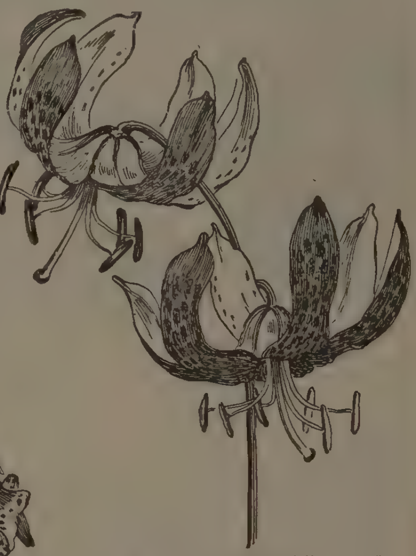
2164. Lilium superbum. (×½)



2165. Lilium pardalinum. (×⅕)

23. **Roèzlii,** Regel (*L. Hártwegii*, Baker). Bulb similar to that of *L. pardalinum:* st. smooth, 2–5 ft. high: lvs. horizontal, 2–5 in. long, ¼–⅓in. wide, usually scattered, sometimes a few of the upper or middle ones whorled: fls. 1–10, 2–3 in. diam., bright orange-yellow tipped red or scarlet and spotted brownish purple; anthers red. Late June to early Aug. Santa Cruz Mts. of Calif.—Allied to *L. pardalinum* and of the same easy cult.

24. **Húmboldtii,** Roezl & Leicht. (*L. Bloomeriànum*, Kellogg). Fig. 2166. Bulb semi-rhizomatous, oblique, somewhat similar to that of *L. washingtonianum*, but with larger, broader scales: st. stout, 4–6 ft. high, smooth or slightly pubescent, deep green tinged and spotted purplish brown, clothed with lvs. from the ground upward: lvs. horizontal, glaucous-green, 3–5 in. long, ¾–1 in. wide, usually in 4–5 whorls of 10–15 lvs. each: fls. 1–30, 4–5 in. diam., bright orange-yellow, spotted deep purple-brown; anthers red. Late June to early Aug. Sierra Nevada Mts. of Calif. El. 32. F.S. 19:1973–34. Gn. 20:568. J. H. III. 42:177; 62:167. G. 2:243; 33:121. C.L.A. 5:45.—A magnificent species, very stately and beautiful; although rather capricious under cult., it usually succeeds fairly well. Var. **magníficum,** Hort., is even superior, being a stronger, more robust grower, often 8 or 9 ft. high, with larger, more richly colored fls., often tinged reddish purple. Var. **pubérulum,** Hort. (*L. pubérulum*, Duch.), is identical with the type, except the st. and under side of the lvs. are more densely pubescent. Var. **ocellàtum,** Kellogg, from the island of Santa Rosa, has a smaller, more globular bulb and brighter green lvs. than the type: the fls. are of the same color, but each purple spot is surrounded with a red circle or eye.



2166. Lilium Humboldtii. (×⅕)

25. **columbiànum,** Hanson (*L. nítidum*, Hort. *L. oregonénse*, Hort.). Bulb similar to that of *L. Humboldtii*, but smaller and more globular: st. smooth, 2–4 ft. high: lvs. horizontal, 1½–3 in. long, upper ones scattered, lower ones in whorls of 4–5: fls. 1–12, 2–3 in. diam., bright orange-yellow, spotted purplish brown; anthers red. Late June to early Aug. Ore., Wash., and Brit. Col.—Smaller in every way, but closely related to *L. Humboldtii* and perhaps should only be ranked as a variety of it.

26. **Kélloggii,** Purdy. Bulb similar to that of *L. columbianum:* st. smooth, slender, 2–4 ft. high: lvs. mostly verticillate, partly scattered: fls. 1–15, 1½–2 in. diam., delicately fragrant, with segms. reflexed to the st.; color pink, spotted purplish black, changing to deeper rosy purple; anthers orange or red. Late June, July. N. W. Calif. Gn. 59, p. 330; 62, p. 200; 64, p. 16.—Very dainty and graceful.

27. **Mártagon,** Linn. European Turk's-Cap Lily. Turban Lily. Fig. 2167. Bulb oval, 2–3 in. long, 1–2 in. wide, bright yellow; scales thick, narrow, sharply pointed: st. 3–6 ft. high, smooth, or upper part slightly pubescent, green, often spotted purple: lvs. horizontal, deep green, 3–6 in long, 1–1½ in. wide, usually in 2–4 whorls of 6–9 lvs. each, with a few scattered ones above: fls. 3–20, 2–3 in. diam., dull claret-purple, spotted purplish black; segms. thick, waxy, reflexed to the st. and slightly papillose at the base; anthers red; the fls. emit a nauseous, disagreeable odor. Late June, July. Cent. and S. Eu. from Spain to S. W. Siberia. Fl. 33. B.M. 872 (as *L. pennsylvanicum*); 1634. F.S. 20:2127. F.M. 1874:136. Gn. 23:32; 38, p. 393; 44:260 (as *L. Dalhansonii*). Var. **hirsùtum,** Hort., is identical, except the sts. are more densely pubescent. Var. **flòre-plèno,** Hort., produces double or semi-double fls. Var. **dalmáticum,** Hort. (*L. dalmáticum,* Malay), from Dalmatia, often grows 6–7 ft. high, with 5–7 whorls of lvs.: and 12–40 fls. which are of a deeper, richer purple, almost black, and only slightly spotted; the buds are enveloped in white, cottony down. Var. **Cattáneæ,** Hort., is almost identical, but the fls. are slightly paler in color. Var. **álbum,** Hort. (var. *glàbrum,* Spreng.), produces pure white fls. with yellow anthers; the sts. are smooth and the lvs. brighter green than those of the type. G.C. III. 54:63.—There are also varieties with flesh- and lilac-colored fls. All the forms of *L. Martagon* are hardy, robust and of the easiest cult., but var. *album* and var. *dalmaticum* are far superior to the type.

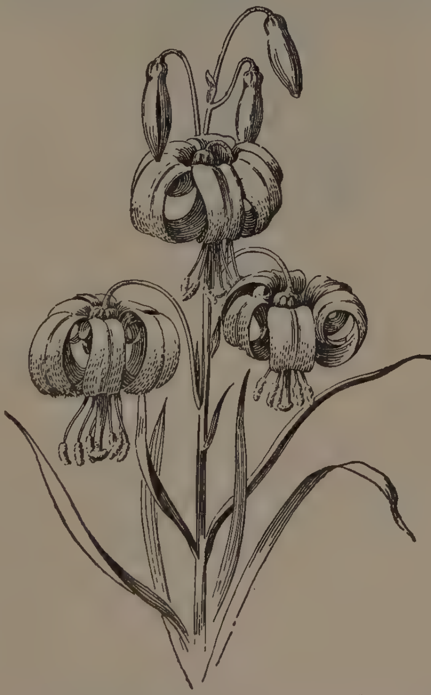
2167. Lilium Martagon. (×⅓)

28. **avenàceum,** Fisch. Bulb globular, 1–1½ in. diam., bright yellow, rarely tinged pink or purple; scales long, narrow, sharply pointed and jointed, the upper part, when broken off, resembling oats, whence the specific name: st. 1½–2 ft. high, smooth, bare of lvs. near the base: lvs. horizontal or semi-erect, 3–4 in. long, ½–1 in. wide, usually in 1 or 2 whorls of 6–9 lvs. each near middle of st. with a few scattered ones above: fls. 2–10, slightly fragrant, bright orange-yellow shaded red and more or less spotted deep purple; anthers red. June, early July. Manchuria, Kamchatka, Kurile Isls. and N. Japan. Gn. 24, p. 85.—Very rare and only desirable for collectors or specialists. The bulbs are delicate and easily break to pieces when handling.

29. **Hánsonii,** Leicht. Golden Turk's-Cap Lily. Japanese Turk's-Cap Lily. Fig. 2172. Bulb nearly globular, 2–3 in. diam., white or pale yellow, often tinged purple: st. smooth, 3–5 ft. high: lvs. horizontal, 4–5 in. long, ¾–1 in. wide, usually in 1–3 whorls near middle of st. with a few scattered ones above and below: fls. 1–10, 1½–2½ in. diam., slightly fragrant, with thick, waxy segms. of a bright golden yellow, spotted purplish brown; anthers orange-red. June, early July. Japan. El. 34. B.M. 6126 (as *L. maculatum*). Gn. 29, p. 287. R.H. 1883, p. 296. Gn.W. 22, suppl. April 8.—One of the best and most beautiful lilies for general cult., easily grown, robust and permanent. *L. Márhan,* Hort., is a garden hybrid between *L. Martagon* var. *album* and *L. Hansonii;* it resembles the former in habit of growth, but the fls. are of the same shape, size and thick, waxy texture as those of the latter; color bright orange-yellow, veined, shaded and spotted reddish brown. A similar hybrid between *L. Martagon* var. *dalmaticum* and *L. Hansonii* is known as *L. Dalhánsonii,* Hort. The fls. are not so bright in color, however.

30. **polyphýllum,** D. Don (*L. punctàtum,* Jacquem.). Bulb oblong, 2–3 in. long, 1–1½ in. wide, with long, narrow, white scales, closely clasped together: st. smooth, 2–4 ft. high: lvs. 40–60, scattered, or the lower ones rarely whorled, erect, 4–5 in. long, ½–¾ in. wide: fls. 1–10, 1½–2 in. diam., deliciously fragrant, pale creamy yellow, tinged and dotted purple; anthers red. June, July. W. Himalayas. I.H. 32:565.—Very rare and only suitable for specialists.

31. **monadélphum,** Marsh & Bieb. (*L. cólchicum,* Stev. *L. Loddigesiànum,* Roezl & Schult.). Bulb quite similar to that of *L. Martagon,* but often larger and tinged purple: st. stout, 3–6 ft. high, usually slightly pubescent: lvs. 30–40, horizontal or semi-erect, 2–4 in. long, ½–1 in. wide: fls. 1–30, 3–5 in. diam., with waxy segms. of a rich golden yellow sometimes tinged purple and slightly, or not at all, spotted deep purple; anthers greenish or orange; the odor is rather disagreeable. June, early July. Caucasus Mts. and N. Persia. El. 36, 37. B.M. 1405. Gn. 75, p. 320. G.C. III. 16: 129. Gn.W. 22:528. J.F. 2:204.—One of the most stately and beautiful of all lilies, succeeding well in almost any soil or situation and highly recommended for general cult. Var. **Szovitziànum,** Hort. (*L. Szovitziànum,* Fisch. & Lall.). Produces larger fls. with broader, less reflexed segms. of a lemon- or canary-yellow color, more thickly dotted purple and with reddish brown anthers; the filaments are entirely free or separate, whereas in the type they are supposed to be joined or united at their base, although this is not always the case. Gn. 9:204; 39:242; 59, p. 407; 64, p. 316. G.C. III. 48: 37. Gn.W. 21:522. G. 4:295; 27:373; 32:783. Var. **Lédebouri,** Baker, resembles the type, but is dwarfer, with 80–100 narrower lvs. and narrower perianth-segms.


2168. Lilium pomponium. (×½)

32. **carniólicum,** Bernh. Bulb oval, 1½–2 in. long, 1–1½ in. wide, white or pale yellow, tinged red or

purple; scales broad, closely imbricated: st. 2–3 ft. high, green, slightly pubescent: lvs. 30–40, erect or nearly so, 2–3 in. long, ½–¾ in. wide: fls. 1–10, 1½–2 in. diam., orange-red dotted purple-black; segms. waxy, reflexed to the st. and papillose inside; anthers orange; the odor is rich and heavy but not unpleasant. June, early July. Carniolia, Bosnia, Dalmatia and vicinity. El. 45.—An easily grown species, but rarely seen in cult. There is also an unspotted variety, var. **unícolor,** Hort.

33. **chalcedónicum,** Linn. (*L. rùbrum,* Parkin.). Scarlet Turk's-Cap Lily. Bulb similar to that of *L. monadelphum:* st. 2–4 ft. high, green, tinged purple, covered with white down: lvs. 100 or more, lower ones horizontal, 2–6 in. long, ⅙–¼ in. wide, upper ones smaller and more erect: fls. 3–6 or more, 2–3 in. diam., brilliant vermilion-scarlet, rarely slightly dotted purple; segms. thick and waxy, reflexed to the st. and papillose at the base; anthers scarlet; the odor is rather disagreeable. July, early Aug. Greece and the Ionian Isls. El. 43. F.S. 21:2160. B.M. 30. F.W. 1876:193. Var. **maculàtum,** Hort. (var. *excélsum,* Hort., var. *màjus,* Hort.), is a larger, stronger grower, while the fls. are usually solitary and more thickly dotted purple; very rare. Both are hardy and of easy cult. and should be more generally grown.

2169. Lilium canadense. (×⅓)

34. **pompònium,** Linn. (*L. rùbrum,* Lamb.). Little Turk's-Cap Lily. Fig. 2168. Bulb similar to that of *L. Martagon:* st. 1½–3 ft. high, furrowed or striated: lvs. 100 or more, lower ones horizontal, 2–4 in. long, ⅙–⅓in. wide, upper ones smaller and more erect: fls. 1–15, 1½–2 in. diam., brilliant scarlet, dotted purplish black; segms. thick and waxy, reflexed to the st. and thickly papillose at the base; anthers scarlet. June, early July. Alps of S. France and N. Italy. El. 46. Gn. 20:420. G.C. III. 8:51. Gn.W. 20:675. G.W. 3, p. 356.—A graceful handsome species of easy cult., but the strong, nauseous odor of the fls. is a factor against its popularity. The var. **vèrum,** Hort., is similar, but the lvs., when first unfolding are twisted or curled like a sickle and slightly edged white.

35. **pyrenàicum,** Gouan (*L. flàvum,* Lamb. *L. pompònium* var. *lùteum,* Hort. *L. pompònium* var. *pyrenàicum,* Baker). Yellow Turk's-Cap Lily. Resembles *L. pomponium,* to which it is closely related, but often grows 4 ft. high, with larger bulbs, wider lvs. and larger fls. of a pale lemon-yellow, dotted purplish black; anthers red. June, early July. Pyrenees Mts. of S. France and N. Spain. El. 47. There is an unspotted var. **unícolor,** Hort., and also another var. **aûreum,** Hort., with spotted fls. of a brighter, deeper golden yellow color.—*L. Jánkæ,* Kern., although found in Transylvania, 1,000 miles from the habitat of *L. pyrenaicum,* is very similar to it, but often grows taller, with slightly larger fls. and greenish yellow anthers, while the odor, instead of being nauseous, is quite agreeable, resembling honey.

36. **Leìchtlinii,** Hook. Bulb similar to that of *L. tigrinum,* but smaller and never tinged red or purple: st. 2–4 ft. high, smooth, green shaded brownish purple, the underground part often running along horizontally a foot or more before coming to the surface: lvs. 30–40, horizontal or semi-erect, 2–5 in. long, ¼–⅓in. wide: fls. 1–20, 3–4 in. diam., with segms. reflexed to the st., of a bright lemon-yellow, spotted purple-black; anthers reddish brown. Late July, Aug. Japan. El. 39. F.W. 1869:65. G. 15:319. Gn.W. 20:908.—A very beautiful lily, but is rather capricious and often difficult to establish in the open ground. The var. **màjus,** Wilson, is of larger growth, often 5 ft. high, with lvs. 6–7 in. long.

37. **Maximòwiczii,** Regel (*L. pseùdo-tigrìnum,* Carr. *L. tigrìnum* var. *jocúndum,* Hort. *L. tigrìnum* var. *Líshmannii,* Moore). Bulb similar to that of *L. Leichtlinii:* st. 3–5 ft. high, green, slightly tinged and spotted purple, smooth or slightly pubescent: lvs. 100 or more, horizontal, 2–4 in. long, ¼–⅓in. wide: fls. 1–12, 3–4 in. diam., soft salmon-red spotted purplish black; segms. reflexed to the st. and papillose at the base; anthers red. Aug., early Sept. China, Japan and the Liu Kiu Isls. El. 40. B.M. 5673. F.S. 17:1736 (yellow variety). I.H. 15:540. R.H. 1867:410. Gn. 21:236 (yellow variety); 42, p. 193 (not typical). Gn. W. 25:649 (as *L. Leichtlinii* var. *Maximowiczii*).—Often called the red *L. Leichtlinii* and thought by some authorities to be a natural hybrid between that species and *L. tigrinum.* Unlike the former, the st. rises erect from the bulb and no bulbils are borne in the lf.-axils, as in *L. tigrinum.*

38. **callòsum,** Sieb. Bulb globular, 1–2 in. diam., white or pale yellow: st. smooth, 1–2 ft. high: lvs. 30–40, erect, 2–4 in. long, 1/12–⅙in. wide: fls. 1–8, 1½–2 in. diam., bright scarlet, usually slightly dotted purple-black; anthers red or scarlet: at the junction of each fl.-bearing st. or pedicel with the main st., there are 2 thick, blunt, callous bracts, whence the specific name. June, early July. Japan and the Loo Choo Isls.—Very rare and only desirable for specialists. *L. stenophýllum,* Baker, from E. Siberia, resembles *L. callosum,* but the bulb is more oval, the st. stouter and taller, the lvs. larger and broader and the perianth-segms. narrower.

39. **tenuifòlium,** Fisch. (*L. linifòlium,* Hort. *L. pùmilum,* DC. *L. puníceum,* Sieb. & De Vr.). Coral Lily. Fern-leaved Lily. Tom Thumb Lily. Tiny Lily. Bulb oblong, 1–2 in. long, ½–1 in. wide, white or pale yellow sometimes tinged pink; scales few, large, closely clasped together: st. 1–2 ft. high, slender, smooth, bare of lvs. for 2–3 in. above the surface: lvs. 40–60, erect or semi-horizontal, 1–2 in. long, 1/12–⅙in. wide: fls. 1–15, 1½–2 in. diam., with waxy segms. reflexed to the st. and of a brilliant scarlet, rarely slightly dotted purple and lighter at the base; anthers scarlet or red. June, early July. S. Siberia and N. China. El. 42. B.M. 3140. L.B.C. 4:358. G.M. 45:443. J.H. III. 62:572.—A handsome, graceful species and the brightest in color of all. Although easily grown it is not very long-lived, as a rule, and must be frequently renewed. Good for rock-gardens and pots. The var. Golden Gleam, Hort., is a taller grower, often 3 ft. high and the fls. are bright, pure golden yellow; it is said to be a hybrid between *L. Martagon* var. *album* and *L. tenuifolium,* but resembles the latter in growth,

and the two form a splendid contrast when planted together.

40. **sutchuenénse**, Franch. Bulb globular, 1–2 in. diam., with white, closely imbricated scales: st. 3–5 ft. high, the underground part running along horizontally before coming to the surface: lvs. thickly scattered, linear, deep green: fls. 1–20, pendulous, with reflexed orange-red segms. spotted purplish black; anthers red. June, July. Sutchuen, W. China. B.M. 7715. G.C. III. 38:90; 54:115. G.M. 48:501. G.W. 11, p. 114. J.H. III. 51:130. G. 31:243. A.F. 29:154. F.S.R. 3, p. 329.—Said to be allied to *L. tenuifolium.*

41. **testàceum**, Lindl. (*L. excélsum*, Hort. *L. Isabellìnum*, Kunze). Nankeen Lily. Bulb similar to that of *L. candidum:* st. 3–6 ft. high, green, tinged purple-brown, slightly pubescent: lvs. 60–100, lower ones horizontal or nearly so, 3–4 in. long, ¼–⅓in. wide, upper ones smaller and more erect: fls. 1–12, 2–3 in. diam., deliciously fragrant, of a pale, delicate creamy buff or nankeen-yellow, often flushed pink and rarely slightly dotted red, segms. reflexed to the st. and slightly papillose at the base; anthers red. Late June, July. Unknown in a wild state; probably a garden hybrid between *L. candidum* and *L. chalcedonicum.* El. 44. B.R. 29:11 (too highly colored). P.M. 10:221. Gn. 60, pp. 46, 153; 62, p. 322; 66, p. 399; 71, p. 519. G.C. III. 55:33. G. 28:713. Gn.W. 16:27; 21:667.—One of the most beautiful and graceful of all lilies, hardy, robust, permanent and highly recommended for both pots and open ground.

SUBGENUS IV. PSEUDO-MARTAGON.

A. *Perianth widely expanded, pendulous*. . 42. **canadense**

AA. *Perianth narrow.*

  B. *Fls. pendulous or nearly so.*

    C. *Color of fls. reddish purple*. . . . . . . 43. **Bolanderi**

    CC. *Color of fls. orange-red.*

      D. *Californian species*. . . . . 44. **maritimum**

      DD. *Eastern species*. . . . . 45. **Grayi**

  BB. *Fls. horizontal or nearly erect*. . . . . . 46. **parvum**

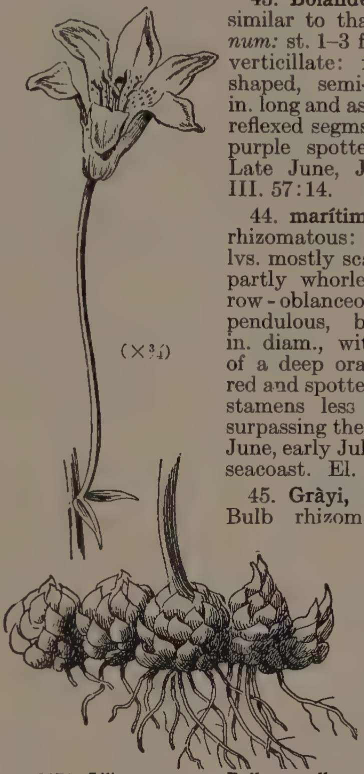
42. **canadénse**, Linn. (*L. penduliflòrum*, DC. *L. péndulum*, Spaeth). Meadow Lily. Wild Yellow Lily. Fig. 2169. Bulb rhizomatous, similar to that of *L. superbum*, but usually smaller: st. 2–5 ft. high, smooth, slender, bare of lvs. for 6–8 in. above the surface: lvs. horizontal, 2–4 in. long, ⅓–¾in. wide, usually in 4–8 whorls of 4–10 lvs. each, with a few scattered ones above and below: fls. 1–10, 2–3 in. long and as wide, bright orange-yellow spotted purplish brown; anthers red. Late June to early Aug. New Bruns. to Ont., Minn., Mo., Ga. and Ala. El. 27. B.M. 858 (poor). Gn. 29:426; 34, p. 182. J.H. III. 42:131. Gn. M. 9:236. A.G. 8:249.—Our commonest native species; although not so handsome or showy as *L. superbum* which it resembles in habit of growth, or *L. philadelphicum*, it is more graceful than either and is well worthy of cult. Var. **flàvum**, Kunth (var. *lùteum*, Hort.), produces lemon-yellow fls. spotted purplish brown. B.M. 800. Var. **coccíneum**, Kunth (var. *rùbrum*, Hort.), produces larger fls. of a bright orange-red, spotted purplish brown and heavily tinged deeper red on the outside.

2170. Lilium Grayi. Flowers usually more pendulous. (×½)

43. **Bolánderi**, Wats. Bulb similar to that of *L. columbianum:* st. 1–3 ft. high: lvs. mostly verticillate: fls. 1–3, thimble-shaped, semi-pendulous, 1½–2 in. long and as wide, with slightly reflexed segms. of a deep reddish purple spotted purplish black. Late June, July. Calif. G.C. III. 57:14.

44. **marítimum**, Kellogg. Bulb rhizomatous: st. 2–5 ft. high: lvs. mostly scattered, sometimes partly whorled, linear to narrow-oblanceolate: fls. 1–12, pendulous, bell-shaped, 1½–2 in. diam., with reflexed segms. of a deep orange-yellow, tipped red and spotted brownish purple; stamens less than 1 in. long, surpassing the style; anthers red. June, early July. Calif., along the seacoast. El. 12.

45. **Gràyi**, Wats. Fig. 2170. Bulb rhizomatous, similar to that of *L. canadense*, but smaller: st. 2–4 ft. high, slender, smooth, bare of lvs. near the base: lvs. horizontal or nearly so, 1½–3 in. long, ½–¾ in. wide, usually in 4–8 whorls of 3–8 lvs. each, with a few scattered ones above and below: fls. frequently solitary, sometimes 2–6 together, 1½–2 in. long, nearly as wide, orange-yellow inside, tipped and tinged dull red and thickly spotted deep purplish brown, outside deep reddish brown; anthers red. Late June, July. Va. and N.C. B.M. 7234, F.S.R. 1:262. G. 29:475. G.C. III. 30:69. G.M. 49:142. G.F. 1:19 (adapted in Fig. 2170).—Not a showy species, but very graceful and of easy cult. Excellent for both pots and open ground.



2171. Lilium parvum. Bulbs usually more clustered.

46. **párvum**, Kellogg. Fig. 2171. Bulb a scaly rhizome, 2–3 in. long, covered with small, thick, white scales, often jointed 1–3 times: st. 2–5 ft. high, slender, smooth: lvs. horizontal, 1–3 in. long, ¼–¾in. wide, the upper and lower ones scattered with a few whorls between: fls. 1–15, 1½–2 in. long and as wide; ends of segms. bright orange-scarlet, while the base is bright yellow, spotted purplish brown; anthers red. June, early July. Sierra Nevada Mts. of Calif. El. 30. B.M. 6146. F.S. 21:2192. J.H. III. 31:113.—A graceful pretty species of easy cult., but not showy. Var. **lùteum**, Hort., produces clear bright yellow fls. spotted purplish brown and with orange anthers.

SUBGENUS V. ISOLIRION.

A. *Lvs. mostly whorled.*

  B. *Japanese species* . . . . 47. **medeoloides**

  BB. *American species* . . . . 48. **philadelphicum**

AA. *Lvs. scattered.*

  B. *Style longer than ovary.*

    C. *American species*. . . . . 49. **Catesbæi**

    CC. *European species.*

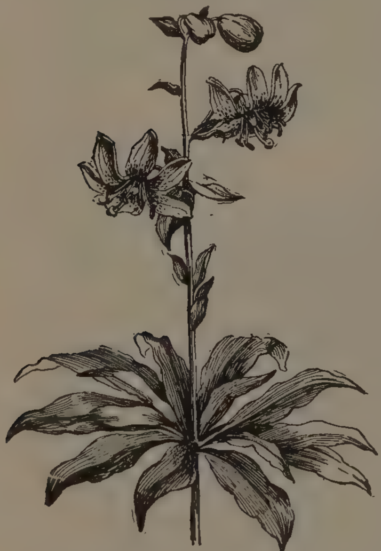
      D. *St. bulblet-bearing*. . . . . 50. **bulbiferum**

      DD. *St. not bulbiferous*. . . . . 51. **croceum**

CCC. *Asiatic species.*
D. *Early-flowering.*
E. *St. not over 2 ft. high*.......52. **elegans**
EE. *St. 2 ft. or more high*........53. **dauricum**
DD. *Late-flowering.*
E. *St. not over 2 ft. high*.......54. **Wallacei**
EE. *St. 2 ft. or more high*........55. **Batemanniæ**
BB. *Style shorter than ovary or of the same length*....................56. **concolor**

47. **medeoloìdes,** Gray (*L. maculàtum,* Thunb.). Wheel Lily. Spotted Lily. Bulb very similar to that of *L. avenaceum:* st. 1–2 ft. high, smooth or slightly furrowed, lower part bare of lvs.: lvs. 4–6 in. long, ¾–1½ in. wide, usually in 1–2 whorls of 7–14 lvs. each near middle of st. with a few scattered ones above: fls. 1–6, smooth inside, bright orange-red slightly dotted purple; anthers red. Late June, July. Korea and N. Japan.—Very rare, and recommended only for specialists.

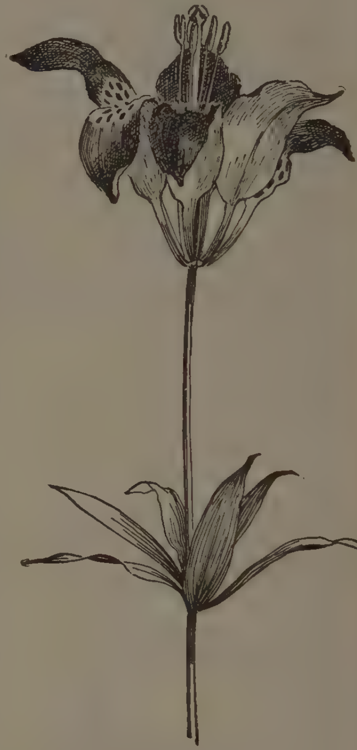
48. **philadélphicum,** Linn. Wild Red Lily. Wood Lily. Fig. 2173. Bulb globular or nearly so, 1–1½ in. diam., white or pale yellow; scales small and thick, sometimes jointed: st. 1–3 ft. high, slender, smooth, lower part bare of lvs.: lvs. horizontal, 2–4 in. long, ¼–½ in. wide, usually in whorls of 3–8 lvs. each, with a few scattered ones above: fls. 1–5, 3–4 in. diam., smooth inside, bright orange-red tinged yellow in center and spotted deep purple; anthers red. Late June, July. Maine to Minn., Mo. and N. C., also Canada, as far west as Sask. El. 17. B. R. 594. L.B.C. 10: 976. B.M. 872 (as *L. pennsylvanicum*); 519. C. L. A. 17: 544.—Our most beautiful native lily, but indifferent to cult., the best specimens usually being found in a wild state. Var. **andìnum,** Nutt., the Western Red Lily, is a stronger grower, with larger, more richly colored fls. and mostly scattered lvs. Ohio to Mont., Col. and Ark. Var. **wausharaìcum,** Leicht., originally found in Waushara Co., Wis., is very similar, if not identical. So also are *L. lanceolàtum,* Fitzp., *L. montànum,* Nelson, and *L. umbellàtum,* Pursh.


2172. Lilium Hansonii. No. 29. (×⅓)

49. **Catésbæi,** Walt. Southern Red Lily. Bulb oblong, 1–2 in. long, ¾–1 in. wide, composed of a few long, narrow, white scales: st. 1–2 ft. high, slender, smooth: lvs. semi-erect or nearly horizontal, 1–3 in. long, ⅓–½in. wide: fls. 1–3, 3–4 in. diam., smooth inside, of the same color as those of *L. philadelphicum;* anthers red. Late June, July. N. C. to Fla. and Ala. El. 25. B.M. 259. L.B.C. 9:807. R.H. 1868:431 (poor). —Rather tender and capricious, and in the North best grown in pots.

50. **bulbíferum,** Linn. Bulb globular or slightly spherical, 2–4 in. diam., white or pale yellow, often tinged red or purple: st. 2–4 ft. high, furrowed, green, tinged and spotted purplish brown, upper part covered with white down and producing bulbils in the lf.-axils: lvs. 50–75, horizontal or semi-erect, 3–4 in. long, ¼–½ in. wide: fls. 1–4, 3–4 in. diam., bright orange-red spotted deep purplish black and tinged or blotched yellow in center; anthers red. June, early July. Cent. Eu. and S. E. Scandinavia. El. 23. B.M. 36.—A hardy, long-lived species of the easiest cult., but not often seen. Var. **latifòlium,** Hort., is a larger, stronger grower with wider lvs. Var. **hùmile,** Hort., is of smaller growth, with narrower lvs.

51. **cròceum,** Chaix (*L. aùreum,* Parkin. *L. aurantìacum,* Hort.). Bulb similar to that of *L. bulbiferum:* st. stout, 3–6 ft. high, furrowed or striated, deep green, lower part spotted deep purple, upper part and buds covered with white down: lvs. 50–100, horizontal or semi-erect, 2–4 in. long, ¼–⅓in. wide: fls. 1–20, 3–4 in. diam., bright orange-yellow spotted purplish black in center and sometimes tinged red; anthers red. Late June, July. Alps Mts. of Switzerland, France and N. Italy. L.B.C 8:784 (poor). Gn. 71, p. 43. —A handsome, showy lily, hardy, vigorous, long-lived, of the easiest cult. and highly recommended. Var. **Chàixii,** Hort., is of much smaller growth, only 1–1½ ft. high, with 1–3 fls. and comes into bloom earlier. El. 22.


2173. Lilium philadelphicum. (×⅓)

52. **élegans,** Thunb. (*L. lancifòlium,* Thunb. *L. Thunbergiànum,* Roezl. & Schult.). Fig. 2174. Bulb spherical or nearly globular, 1–2 in. diam., white or pale yellow, often tinged red or purple: st. 1–1½ ft. high, smooth or slightly furrowed, green, upper part slightly pubescent: lvs. 20–40, horizontal or semi-erect, 2–4 in. long, ¼–½in. wide: fls. 1–4, 4–6 in. diam., orange-red, slightly spotted purplish black; anthers red. June, early July. Japan. El. 19, 20. Gn. 38:440; 47, p. 415; 62, p. 359; 67, p. 204. F.1868:121. F.S. 16:1627. I.H. 12:459 (as *L. formosum*). G.W. 3, p. 355. H.U. 4, p. 201.—There are innumerable varieties and the origin of some of them is difficult to trace, but they probably have some blood of related species, such as *L. croceum, L. bulbiferum* and *L. dauricum,* in their make-up. Var. **alutàceum,** Baker & Dyer (var. *aùreum nìgro-maculàtum,* Hort.; var. *Kìkak,* Hort.), grows only 6–9 in. high, blooms earlier and produces solitary, pale apricot-colored fls. spotted purple-black. F.S. 22:2319. A form of this, var. **grandiflòrum,** is a larger, stronger grower. Var. **armeniàcum,** Baker & Dyer (var. *venústum,* Kunth), blooms later than the type, producing 1–2 bright orange-scarlet, unspotted fls., smooth inside: the lvs. are peculiarly twisted. Var. **atrosanguíneum,** Baker & Dyer (var. *corúscans,* Hort.), produces solitary deep blood-red fls., spotted purple-black. Var. **Alice Wilson,** Hort., produces pure lemon-yellow spotted fls. Var. **aurantìacum,** Hort., produces unspotted salmon fls. P.M. 6:127. Var. **bícolor,** Hort. (var. *pìctum,* Hort.), has narrower lvs. than those of the type and broader perianth-segms.: fls. 2–4, yellow,

edged and tipped bright red, spotted purple-black. Var. **brevifòlium,** Baker & Dyer, has shorter lvs. than the type and blooms earlier, producing solitary fls. of a pale orange-red, spotted purple-black and flaked yellow at base of segms. Var. **citrìnum,** Wilson, is a stronger grower than the type, 2–2½ ft. high, and blooms later, producing 2 or 3 unspotted citron-yellow fls. Var. **fúlgens,** Morr., has narrower lvs. than the type and produces 4–6 deep orange-red fls., very slightly, or not at all, spotted. A semi-double form of this, of little value, is known as var. **semi-plènum,** Hort. (var. *staminòsum,* Hort.). G.M. 46:597. Var. **álternans,** Sieb., is similar to var. *fulgens,* but the fls. are suffused or flaked yellow. Var. **hæmatóchroum,** Lem. (var. *Hórsmannii,* Hort.), produces deep blood-red fls. thickly spotted purple-black. Var. **Màwi,** Hort., produces orange fls. flaked crimson and spotted purple-black. Var. **marmoràtum,** Hort., blooms earlier than the type, producing 2–4 rich crimson fls. flaked and tipped orange-yellow and slightly spotted. Var. **marmoràtum aùreum,** Hort. (var. *robústum,* Hort.), produces orange-yellow fls., edged, flaked and tipped crimson and more thickly spotted. A.F. 35:105. Var. **Orange Queen,** Hort., produces 1–3 bright orange fls. which are larger and with broader segms. than those of the type. Var. **Prince of Orange,** Hort., is dwarfer than the type, blooms earlier and produces soft buff fls., spotted purple-black. Var. **sanguíneum,** Lindl., also blooms earlier, producing 1–2 blood-red fls. slightly tinged orange and spotted purple-black. Var. **biligulàtum,** Hort. (var. *lateritium,* Hort.), is similar, but with deeper chestnut-red, spotted fls. Var. **spléndens,** Hort., is a larger, stronger grower than the type, often 2½ ft. high, with broader, paler lvs. and blooms earlier producing rich apricot-yellow, spotted fls. Var. **Van Hoùttei,** Hort., produces deep crimson-scarlet fls. with a yellow blotch near the center of each segm. Var. **Wílsonii,** Hort. (var. *pardìnum,* Morr.), is a stronger grower than the type, 2–3 ft. high, with shorter, curved lvs. and blooms later, producing apricot-colored fls., spotted deep purple and with a yellow band through the center of each segm.—All the above varieties, as well as the type, are of the easiest cult. in almost any soil or location and are highly recommended for general planting. They are excellent for rock-gardens, pots or naturalizing.

2174. Lilium elegans. (×⅙). No. 52

53. **daùricum,** Ker-Gawl. (*L. spectábile,* Fisch. & Mey. *L. umbellàtum,* Hort.). Candlestick Lily. Bulb similar to that of *L. elegans* but usually larger: st. 2–3 ft. high, smooth or slightly furrowed, green, sometimes tinged purple or brown; upper part slightly pubescent: lvs. 20–50, horizontal or nearly so, 3–5 in. long, ¼–⅓in. wide: fls. 1–5, 3–5 in. diam., orange-red slightly spotted purplish black and tinged yellow in center; anthers red. June, early July. S. E. Siberia.—Of the same easy cult. as *L. elegans,* succeeding almost anywhere. Var. **atrosanguíneum,** Hort., is of stronger growth with deeper blood-red fls. tinged or blotched yellow in the center and spotted purple-black. Vars. **incomparábile,** Hort., **grandiflòrum,** Hort., **multiflòrum,** Hort., are all similar, if not identical. Var. **Dìadem,** Hort., produces bright crimson fls. with a yellow band through each segm. Var. **eréctum,** Hort., produces yellow fls. tipped orange-red, slightly, or not at all spotted. Var. **bícolor,** Hort., is similar. Var. **lùteum,** Hort., produces bright yellow fls. thickly spotted. G. 36:431. Gn. 79, p. 39. G.C. III. 51, suppl. June 1. Var. **punctàtum,** Hort. (var. *rùbens,* Hort.), produces orange-yellow, spotted fls. Var. **immaculàtum,** Hort. (var. *Vúlcan,* Hort.), is similar but the fls. are unspotted. Var. **Sáppho,** Hort., is a dwarfer grower than the type, with orange-yellow fls. tipped and splashed red and spotted purple-black. The following four varieties appear to be related to *L. croceum* and *L. elegans,* as they resemble them in certain respects. Var. **aurantìacum,** Hort., with orange-yellow fls.; var. **Cloth of Gold,**. Hort., also with bright orange-yellow fls.; var. **Sensation,** Hort., orange-red fls.; and var. **Tóttenhamii,** Hort., with bright pure yellow fls.

54. **Wállacei,** Wallace (*L. élegans* var. *Wállacei,* Hort.). Bulb cespitose, globular or nearly so, 1–1½ in. diam., composed of a few broad, white scales, often tinged pink or purple: st. 1–2 ft. high, smooth, green, tinged purplish brown: lvs. 50–75, horizontal or semi-erect, 1½–3 in. long, ¼–⅓in. wide: fls. 1–10, 4–5 in. diam., smooth inside, pale orange-red or apricot, spotted purplish black; anthers red; segms. only slightly, or not at all, clawed at the base. Late July, Aug. Japan. Gn. W. 21:739.—Thought by some authorities to be a hybrid between *L. tigrinum* or *L. Maximowiczii* and *L. concolor.* Easily grown and deserving of more general cult., both for pots and open ground.

55. **Bàtemanniæ,** Wallace (*L. élegans* var. *Bàtemanniæ,* Hort.). Bulb, quite similar to that of *L. tigrinum:* st. 2–4 ft. high, smooth, green, lower part shaded brown: lvs. 100 or more, horizontal, 2–5 in. long, ¼–¾ in. wide, upper ones slightly recurved: fls. 1–12, 3–5 in. diam., pale orange-red or apricot, sometimes tinged pink, unspotted; anthers red; segms. smooth or nearly so inside, only slightly, or not at all, clawed at the base. Late July, Aug. Japan. G. 28:455.—Perhaps a hybrid between *L. Leichtlinii,* or *L. Maximowiczii* and some variety of *L. elegans.* It is strong, hardy, easily grown and highly recommended for general cult.

56. **cóncolor,** Salisb. Star Lily. Bulb cespitose, similar to that of *L. Wallacei:* st. 1–1½ ft. high, green, tinged purple, slightly pubescent: lvs. 20–30, erect or semi-horizontal, 1½–3 in. long, 1/12–⅛in. wide: fls. 1–4, 2–3 in. diam., bright crimson-scarlet, slightly, or not at all, dotted purple-black; anthers red. Late June, July. Japan. El. 18. B.M. 1165. F.W. 1873: 289.—A graceful, handsome lily of easy cult., excellent for both pots and open ground. Var. **Parthenèion,** Sieb. & De Vr., is very similar, if not identical. Var. **Corìdion,** Sieb. & De Vr., produces slightly larger fls. of a rich yellow, flaked brown.—**L. pulchéllum,** Fisch. & Mey. (*L. Buschiànum,* Lodd.), is allied to *L. concolor,* but differs from it in the bulb being solitary and more oval, the lvs. slightly wider and of a deeper green, the fls. appearing earlier, slightly smaller and more thickly spotted. S. E. Siberia and Manchuria. Var. **lùteum,** Hort., from Mongolia, produces rich yellow, spotted fls.—**L. sínicum,** Lindl., resembles *L. pulchellum,* but grows 2–3 ft. high and produces 4–6 larger fls. China and S. Siberia. B.M. 6005. L.B.C. 17:1628 (as *L. Buschianum*).

SUBGENUS VI. CARDIOCRINUM.

A. *Fls. horizontal or slightly pendulous*. . .57. **giganteum**
AA. *Fls. erect or nearly so*. . . . . .58. **cordifolium**

57. **gigantèum,** Wall. Bulb oval, 6–8 in. long, 4–6 in. wide, deep green tinged brown; scales few, very broad and thick, closely clasped together and blunt at the ends: st. 4–12 ft. high, stout, smooth, 1½–3 in. diam. at base: lvs. 12–20, scattered, deep green, lower ones horizontal or nearly so, 12–18 in. long, nearly as

wide, upper ones smaller and more erect: fls. in racemes of 6–12, 5–6 in. long, nearly as wide, deliciously fragrant, with waxy segms., which, when first opening, are citron-yellow inside, soon changing to pure white tinged purple near the base and with purple midribs, outside often shaded green; anthers yellow. July, early Aug. Himalaya Mts. from Kumaon and Gurwhal to Khasia and Sikkim. El. 2. B.M. 4673. F. 1874, p. 79. R.H. 1861, p. 310. I.H. p. 11. G.C. III. 8:47; 16:754; 30:51; 38:296. Gn. 8:504; 34, p. 269; 52, p. 226; 60, p. 47; 69, p. 199; 71, p. 439; 74, p. 142; 77, p. 35. J.H. III. 46:336; 53:347; 65:113. G.M. 48:787. G.W. 5, p. 67; 7, p. 412. J.F. 4:409–11. A.F. 22:5. G.F. 6:376.—A beautiful, stately lily, rarely cult. in this country, but hardy as far north as Boston, and easily grown in light, well-drained soil; should be heavily mulched during the winter; also excellent for greenhouse benches or large tubs. After once flowering, the old bulb decays and disappears, leaving several offsets. Var. **yunnanénse,** Hort., from China, is said to produce larger, better-colored fls.

58. **cordifòlium,** Thunb. Bulb similar to that of *L. giganteum*, but smaller: st. 3–4 ft. high, stout, smooth, bare of lvs. for a foot or more above the surface, then a whorl of 6–8 lvs. appears, with a few scattered ones above; they are pendulous, 12–18 in. long, nearly as wide, deep green, lower ones tinged deep red: fls. in racemes of 4–10, 4–6 in. long, nearly as wide, fragrant, of the same color as those of *L. giganteum*. July, early Aug. Japan and the Kurile Isls. El 1. G.C. III. 8:41. B.M. 6337.—Very rare and not so easily grown as *L. giganteum*, to which it is inferior in every respect; only suitable for collectors or specialists.

SUBGENUS VII. NOTHOLIRION.

59. **ròseum,** Wall. (*L. Thomsoniànum*, Lindl. *Fritillària Thomsoniàna*, Royle). A peculiar plant, suggesting Hosta, Anthericum, Ornithogalum, and similar things: st. erect, about 1½ ft.: lvs. like a Hemerocallis, linear-acuminate and grassy, mostly crowded at the base of the st.: fls. as many as two dozen, pale mauve, about 1½ in. long, and nearly as broad at the mouth, bell-shaped, the 6 segms. free to the base; anthers deep purple, oblong; stigma 3-lobed. W. China to N. India (Himalaya). B.M. 4725. B.R. 31:1. J.H. III. 64:279. Gn. 76, p. 158; 67, p. 302 (var. *multiflorum*, Leicht.).—Little cult. abroad; may be desirable in milder parts of this country.

L. albánicum, Griseb. Very similar to L. Jankæ. Albania.—*L. Alexándræ*, Baker (L. japonicum var. Alexandræ, Hort.). St. 2–3 ft. high: lvs. scattered, 5–6 in. long, ½–¾in. wide: fls. trumpet-shaped, usually solitary, semi-erect, 5–6 in. long, nearly as wide, delicately fragrant, with waxy, pure white segms., shaded green at the base. Late June, July. Liu Kiu Isls. Possibly a hybrid between L. auratum and L. longiflorum.—*L. Bàkeri*, Purdy (L. Purdyi, Waugh). Bulb similar to that of L. columbianum: st. 2–5 ft. high: lvs. mostly verticillate: fls. 1–10, horizontal or semi-pendulous, slightly fragrant, with reflexed orange-red segms. spotted deep purple. Wash. and Brit. Col.—*L. Bakeriànum*=L. Lowi.—*L. Bérensii*, Hort. A garden hybrid between L. testaceum and L. chalcedonicum: st. 3–4 ft. high: fls. fragrant, similar to those of L. testaceum in size and shape, but brighter, and richer in color. Aug., early Sept.—*L. Bióndii*, Hort. Resembles L. Maximowiczii: st. 3–4 ft. high: lvs. scattered, linear: fls. several, pendulous, 2½ in. across, with reflexed segms., orange-red spotted deep purple-black with reddish brown anthers. G.M. 57:693.—*L. claptonénse*, Hort.=L. primulinum.—*L. Dàvidii*, Duch. Allied to L. concolor; st. 2–3 ft. high, with narrow, scattered lvs.; fls. erect, solitary, star-shaped, orange, spotted purple. Thibet. El. 24.—*L. Delavàyi*, Franch. Fls. rosy crimson; belongs in subgenus Archelirion. China.—*L. Dòei*, Hort. A garden hybrid, resembling L. longiflorum. J.H. III. 51:27, desc.—*L. Duchártrei*, Franch. St. about 3 ft. high, smooth: lvs. lanceolate, acuminate, 2½ in. long, ½in. wide: fls. 1–7, pendulous, 3 in. diam., white, tinged rose outside, finely spotted inside. W. and S.W. China. B.M. 8072.—*L. Fárgesii*, Franch. A Martagon with small yellow fls. China.—*L. Fárquhari*, Hort.=L. Sargentiæ. F. E. 33:492.—*L. formòsum*, Franch. Fls. erect, white, similar to those of L. elegans. China.—*L. Gléhnii*, F. Schmidt. Differs only slightly from L. cordifolium. Japan.—*L. Heldreìchii*, Baker. Intermediate between L. carniolicum and L. chalcedonicum: st. 2–3 ft. high, with narrow, scattered lvs. and 1–4 bright orange-red fls. tinged yellow outside. Late June, July. Greece.—*L. kewénse*, Hort. A garden hybrid between L. Henryi and L. Browni var. Chloraster; resembles a small L. auratum in habit of growth and form of fls., but the lvs are similar to those of L. Henryi; fls. rich cream-color, fading to nearly white and with a deep creamy-yellow band through the center of each segm. July, Aug. G.C. III. 29:116. Gn. 58, p. 99.—*L. lankongénse*, Franch. Fls. purple, spotted black. Belongs in subgenus Martagon. Yunnan, China.—*L. lophóphorum*, Franch. A Martagon about 1 ft. high, with canary-yellow fls. Western China.—*L. Lòwi*, Baker (L. Bakerianum, Coll. & Hemsl.). St. 2–3 ft. high: lvs. scattered, narrow, erect: fls. 1–3, pendulous, bell-shaped, 3–4 in. long, nearly as wide, with slightly recurved ivory-white segms. spotted or blotched purple near the base inside and tinged green outside. Yunnan and N. Burma. J. H. III. 43:55. G. 27:645. G.C. III. 14:121; 30:45; 38:75. Gn. 45:278. B. M. 7232.—*L. Màsseyi*, Hyams. A southern form of L. philadelphicum, differing but slightly. N. C.—*L. Miqueliànum*, Makino. Said to be an improved form of L. medeoloides. Japan.—*L. miràbile*, Franch. Similar to L. cordifolium. China.—*L. occidentàle*, Purdy. Resembles L. maritimum, but the segms. of the fls. are more reflexed: bulb rhizomatous: st. 2–4 ft. high: lvs. usually verticillate, lower ones sometimes scattered: fls. 1–15, orange-yellow, tipped red, spotted purple. Calif.—*L. ochráceum*, Franch. A yellow-flowered Martagon resembling L. monadelphum. China.—*L. oxypétalum*, Baker. 1–1½ ft. tall: lvs. 20–30, scattered, lanceolate-linear: fl. wide funnel-shaped or nearly rotate, purplish, tinged with green beneath, somewhat dotted inside. W. Himalayas. El. 5.—*L. papillíferum*, Franch. A dwarf L. Maximowiczii, with orange-red fls. China.—*L. Párkmannii*, T. Moore. A hybrid between L. auratum and L. speciosum: st. slender, 2–4 ft. high: lvs. scattered, alternate: fls. 8–12 in. diam. of the same shape as those of L. auratum, but colored like those of L. speciosum. G.C. III. 30:52.—*L. pónticum*, Koch. Resembles L. monadelphum, but is smaller, seldom over 2 ft. high. Asia Minor.—*L. primúlinum*, Baker (L. claptonense, Hort.). Fls. pure primrose-yellow, trumpet-shaped, intermediate in form between those of L. neilgherrense and L. nepalense. N. Burma. B.M. 7227.—*L. Púrdyi*=L. Bakeri.—*L. Rósthernii*, Diels. Belongs in subgenus Martagon. China.—*L. taliénse*, Franch. A tall-growing Martagon with white fls. China.—*L. Thàyeræ*, Wilson. Bulb 2–2½ in. diam., ivory-white: st. 4–4½ ft. high, clothed with long, linear lvs. and usually bearing 16 or 17 fls. W. China. G.C. III. 54:116. Intro. as L. sutchuense.—*L. tubiflòrum*, Wight. Closely resembles L. neilgherrense, except the lvs. and perianth-segms. are narrower. Himalaya Mts.—*L. Wàrei*, Purdy. Said to be intermediate in character between L. pardalinum and L. Parryi: fls. fragrant, bright yellow, spotted deep purple. Calif.—*L. Willmottiæ*, Wilson (L. warleyense, Hort.). St. about 4 ft. high: lvs. numerous, spirally arranged, linear, 3–5 in. long: fls. 20 or more, pendulous, 3 in. diam., recurved, orange-red, spotted reddish brown. China. G.M. 55:513.—*L. Yóshidaii*, Leicht. Fls. fragrant, resembling those of L. Brownii. Philippine Isls. Gn. 68, p. 238.—*L. yunnanénse*, Franch. St. 1–3 ft. high: fls. 1–3, small, pendulous, pink or nearly white. Yunnan, China.

JOHN H. TILTON.

LILY, in the narrowest sense, is restricted to the genus Lilium, but the popular names given below also include plants outside the family Liliaceæ. Many of them belong to the Amaryllis family. **African Blue L.,** *Agapanthus umbellatus*. **African Corn L.,** *Ixia*. **Amazon L.,** *Eucharis grandiflora*. **American Turk's-Cap L.,** *Lilium superbum*. **Atamasco L.,** *Zephyranthes Atamasco*. **Barbados L.,** *Hippeastrum equestre*. **Belladonna L.,** *Amaryllis Belladonna*. **Bengal L.,** *Crinum*. **Bermuda L.,** *Lilium Harrisii*. **Black L.,** *Fritillaria camtshatcensis*. **Blackberry L.,** *Belamcanda chinensis*. **Bourbon L.,** *Lilium candidum*. **Brisbane L.,** *Eurycles sylvestris*. **Calla L.,** *Zantedeschia æthiopica*. **Cape L.,** *Crinum longifolium*. **Checkered L.,** *Fritillaria meleagris*. **Climbing L.,** *Gloriosa* and *Littonia*. **Common White L.,** *Lilium candidum*. **Day L.,** the blue and white ones are *Hostas;* the yellow and orange ones *Hemerocallis*. **Easter L.,** *Lilium Harrisii*. **Fairy L.,** *Zephyranthes rosea*. **Fayal L.,** *Ornithogalum arabicum*. **Golden-banded L.,** *Lilium auratum*. **Golden-rayed L.,** *Lilium auratum*. **Guernsey L.,** *Nerine sarniensis*. **Jacobean L.,** *Sprekelia formosissima*. **Kaffir L.,** *Schizostylis coccinea*. **Mariposa L.,** *Calochortus*. **Martagon L.,** *Lilium Martagon*. **Orange L.,** *Lilium croceum*. **Peruvian Swamp L.,** *Zephyranthes candida*. **Plantain L.,** *Hosta*. **Pond L.,** *Nuphar advena*. **Sacred L. of China,** *Narcissus Tazetta* var. *orientalis*. **Spider L., St. Bernard's L.,** *Anthericum Liliago*. **St. Bruno's L.** *Paradisea Liliastrum*. **St. James' L.,** *Sprekelia formosissima*. **St. Joseph's L.,** *Lilium candidum*. **Swamp L.,** *Lilium superbum*. **Sword L.,** *Gladiolus* in general. **Tiger L.,** *Lilium tigrinum*. **Turban L.,** *Lilium pomponium*. **Turk's-Cap L.,** *Lilium Martagon*. **Valley, L. of,** *Lily-of-the-valley*, p. 1879. **Water L.,** *Nymphæa*. **White L.,** *Lilium candidum*.

LILY-OF-THE-INCAS. *Alstrœmeria Pelegrina*. See, also, *Hymenocallis* (Ismene).

LILY-OF-THE-PALACE. *Hippeastrum aulicum*.

LILY-OF-THE-VALLEY (*Convallaria majalis*, which see) is forced in large quantities in the United States all the year round. It is native in Europe, where it grows wild in the woods. It is grown and cultivated in large quantities in Germany for the export trade and is shipped to every country, millions reaching the United States every season.

The growing of lily-of-the-valley roots for the trade is an important branch and is done in Germany by experts. No effort and pains are spared to develop the pips and to produce superior stock. They are planted out in the open in the fall after the fields have been well prepared, deeply plowed and heavily manured. Every fall a certain field is planted and another taken up. The average "valley" is grown three years in the open field; but the best product is derived from a two-year crop. The man who assorts his planting stock carefully and does his growing better, raises the finest "valley" in two years and gets the highest prices.

Lily-of-the-valley propagates itself through runners or suckers. In taking up a field in the fall, the pips are assorted. The best ones are used for shipping, the seconds and culls for home consumption and are forced during the winter season. The runners are carefully sorted out and are used for planting stock the next year. They are planted in furrows about 1 foot apart, covered with about 2 inches of soil. Later in the season they should receive a top-dressing of rotted horse- and cow-manure. However, when the soil is heavy, a top-dressing of clean river sand should be applied. The soil of the northern part of Germany is so fertile that an application of sand acts as an amendment. These top-dressings are repeated every winter.

During the summer, the fields should be kept free from weeds by hoeing and cultivating. In dry seasons motor watering-wagons are used for sprinkling. The utmost care should be given during the planting season to protect the roots and keep them fresh and free from mold. The many complaints in this country about poor forcing results are usually traced to careless handling at the time when the "valley" is harvested and the stock is spoiled in storage. Good "valley" pips should be strong and have plenty of fine fibrous roots. This is very essential for forcing purposes, as the "valley" does not root in the forcing-bed. If the roots are spoiled or affected through mold, the plants become worthless. The successful growing of lilies-of-the-valley in the open field requires large acreage. Different crops should be grown for three or four years before lilies-of-the-valley are again planted in the same field. It can not be grown successively on the same ground, as the stock deteriorates and becomes practically worthless.

The forcing of lilies-of-the-valley is done mostly by specialists in this country, where a steady supply is kept up every day in the year for the cut-flower trade. The importing is done in the fall, and on arrival in this country the pips are placed in cold storage. They keep best in a temperature of 28°. After resting two or three months, they are taken out as desired. Cold storage lilies-of-the-valley are much more satisfactory and should be grown at all times. They do not require any special management nor strong forcing, and do best at a temperature of 65°. It hardly pays a florist to force lilies-of-the-valley in small quantities unless it is for home trade for the holidays, for basket-work and in pots. The commercial success depends on many things, and much money has been lost in this country on lilies-of-the-valley. A successful grower must know where his stock comes from and when to grow the different kinds as grown abroad. For early forcing it is best to have "valley" grown on light soil, which forces easier; for late forcing and cold-storage purposes, "valley" grown on heavier soil is to be preferred.

The specialist devotes separate houses to the forcing of lilies-of-the-valley, where he is able to give the right atmosphere and ideal conditions for successful growing. Plant right in the benches, which are about 3½ feet wide. Fill benches about 5 inches deep with clean sand, not too fine. After planting, keep them well watered all the time. For the first ten to fourteen days keep them dark. For this purpose, the benches are boxed in and covered with boards or cloths. Give light gradually after the stalks are well up, and finally remove the shade entirely in order properly to develop the flowers, give them more substance, and color to the foliage. It requires about three weeks properly to force lilies-of-the-valley in a temperature of 68°. New "valley" requires a good bottom heat of about 70° to 75°. Cold storage "valley" does not need any bottom heat. After cutting, the flowers are placed in the cooler over night and put up in bunches of twenty-five for the market. They are mostly used for wedding and corsage bouquets, and also for baskets and table-decoration.

Lilies-of-the-valley are hardy and are easily grown in the garden. They require no special attention. They are adapted for planting around shrubbery, porches or shady places, where they come up every season and bring an abundance of beautiful flowers.

H. N. BRUNS.

LIMATÒDES (perhaps from the Greek for *meadow*, referring to the habitat of the plants). *Orchidàceæ.* Similar to Calanthe, but the spurred labellum is not adnate to the column but closely wrapped around it. In Phaius, and in Calanthe also, the leaves are not articulated to the stem and therefore wither on the plant instead of falling.—One species in India.

After resting season of limatodes is over, say from February to May, shake off the old potting material. If plants are large, divide them and pot them moderately tight. For the American climate, chop finely some good turfy loam well mixed with old rotten cow-manure and a little leaf-mold and sharp sand and place in a shaded house, temperature 70° to 90°. Do not water till roots are well out, and sparingly till leaves are well started. After that and during flower-sheath growth, they will enjoy profuse waterings and spraying; water with weak liquid at intervals of ten days or so, and every plant will be a marvel of beauty. (Wm. Mathews.)

ròsea, Lindl. (*Calánthe ròsea*, Benth.). Pseudobulbs 4–8 in. long, pyriform or fusiform, grooved: lvs. 8–18 in. long, elliptic-lanceolate, acuminate, plicate: scape from the base of the pseudobulb, 12–18 in. long, slender, bearing a many-fld. villous raceme; fls. large, rosy, 1½ in. across; sepals ovate-lanceolate; petals oblong, acute; lip 1½ in. long, with a large obovate-oblong midlobe; base yellow, edged with scarlet. Jan. Burma. B.M. 5312.—A hybrid of this species and *Calanthe vestita*, Lindl., is common in cult. under the name *Calanthe Veitchii*, Lindl., which see. It has been said that *L. rosea* bore fls. as large as those of *Calanthe Veitchii*, and more brilliant in color.

HEINRICH HASSELBRING.

LIME. The use of lime in agriculture antedates the Christian era. In modern times it has been an indispensable adjunct to potassic, phosphatic, and nitrogenous manures in restoring and maintaining the fertility of immense areas of soil derived from sandstone, granite, mica schist and certain shales and slates. Even limestone soils sometimes become so lacking in lime near the surface that they stand in great need of its application.

Without the use of lime, the wonderful transformation of Limousin in France, the sandy regions of Germany, and particularly the reclamation of the sour peat (Hoch-moor) soils of northern Germany would have been difficult or impossible. Its great value has also long been known in Scotland.

It is now recognized that lime is greatly lacking in parts of New England, New York, New Jersey, Pennsylvania, Maryland, Ohio, Illinois, Wisconsin, and in many of the southern and western states.

The chief function of lime is to correct the chemical reaction of acid soils.

The necessity of lime as a direct plant-food for the higher orders of plants has been indisputedly demonstrated and its physiological rôle is of the greatest significance.

Lime is of indirect service in various ways: (1) It aids in transforming the nitrogen of organic matter and ammonium salts into nitric acid, which, in combination with potash, soda, lime, and magnesia, furnishes most plants the major portion of their nitrogen. (2) It serves as an indirect food by transforming or setting free other soil ingredients which plants require. (3) It appears probable that liming favors symbiosis and the consequent assimilation of atmospheric nitrogen in the case of clovers, alfalfa and certain other legumes, while it may have an opposite effect upon others, among which may be mentioned serradella and certain lupines. (4) Lime attacks certain more or less inert combinations of potash and of phosphoric acid which exist in soils, thereby rendering their manurial constituents more readily assimilable. (5) Noxious iron compounds in soils are so acted upon by lime as to overcome their poisonous tendency. (6) The presence in soils of carbonate of lime and of silicates highly charged with lime prevents the formation of "sour" humus and toxic aluminum compounds, and hence injury to a large class of agricultural plants. (7) Liming makes clays more friable and sandy soils more compact, thus improving the texture of each. By the flocculation of the small particles of the former, water passes into them more readily and the danger of serious washing is thus diminished. (8) Soluble phosphates are less liable to be lost or changed into unassimilable forms in soils containing lime. (9) Lime lessens the danger of the destruction of nitrates, especially in soils which are in bad physical condition.

Large quantities of lime should not be employed on sandy soils in a single application, although there is less danger in using ground limestone than in the employment of either burned or slaked lime.

The repeated use of highly magnesian lime is fraught with possible danger, although if applied only occasionally in the place of ordinary lime the magnesia may sometimes prove highly beneficial.

The use of lime, whether in wood-ashes, burned lime, slaked lime, ground limestone, or combined with organic acids, increases the tendency to alkalinity of the soil, and hence makes it more favorable to the development of at least the common potato-scab, provided the fungus, which is the direct cause of the disease, is already in the soil or is introduced into it on the "seed" tubers.

The "root-rot" of tobacco, chlorosis of pineapples and the "dry spot" of oats may be promoted by excessive liming.

The disease which develops upon turnips and upon certain other plants, known as "club-foot," or "club-root" and "finger-and-toe," is lessened to a marked degree by large applications of lime. For this purpose burned and slaked lime are the most efficient forms to apply.

Slaked lime is usually applied to land, for ordinary purposes, at rates ranging from half a ton to two and a half tons to the acre, and at intervals of four to six years. Slaked lime usually contains 65 to 70 per cent of lime and magnesia; burned lime before slaking contains 90 to 98 per cent of lime and magnesia, whereas ground limestone and high grade marl contain from 48 to 52 per cent. The quantities of each of these forms to employ should be varied in accordance with their analysis, bearing in mind, however, that it is usually safer on light soils to make the applications of burned and slaked lime relatively smaller than those of ground limestone and marl. On all light, sandy, and gravelly loams which are likely to become dry, ground limestone or marl should always be used if possible, but for flocculating heavy clay soils, burned or slaked lime is usually more quickly effective.

Lime should be thoroughly worked into the surface soil after plowing. Slaked lime can be applied with much greater safety on sandy soils if it is first composted with vegetable matter. Its beneficial effects in connection with composting have long been known. If lime is mixed with layers of loam, weeds, muck, coarse stable manure and other vegetable and animal matter, it forms in a few months, if kept moist, an excellent material for the use of gardeners. If worked over a few times, at intervals, the fermentation is materially hastened. The introduction of a little common salt or of muriate of potash facilitates the process by virtue of the formation of carbonate of soda or carbonate of potash. In order to prevent the loss of ammonia, compost heaps should be kept covered with a layer of moist earth.

The influence of lime on plant growth is often astounding. Lettuce, spinach, beets, onions, muskmelons, asparagus, clovers, timothy, Kentucky bluegrass and certain poppies are almost failures on very acid soils until lime is applied. Watermelons, lupines, serradella, cranberries, rhododendrons, azaleas and other plants might be cited, some of which are known to be indifferent, injured, or even ruined by heavy applications of lime. Their natural home is on a sour soil. The Early Richmond and Black Tartarian cherries are both helped by liming. The Delaware grape seems to be helped by liming in a greater degree than the Concord. The Blackcap raspberry does not respond to liming on a very acid soil whereas the Cuthbert, a red variety, responds favorably to the treatment. The quince is more in need of lime on an acid soil than the apple, pear, or peach. The American linden and American elm are helped by lime on acid soils whereas the white birch may show utter indifference to it. The success of the beech on the limestone soils of Europe indicates its natural home. Chestnut trees are said not to thrive well on limestone soils, and the heavy liming of certain spruces and pines is often injurious, although it is reported from France that the light liming of certain soils which were presumably exceedingly acid has sometimes been found helpful. Goose-

2175. Acid lime.—Citrus aurantifolia. (×½) berries and currants are often helped by liming on soils where liming is detrimental, or of little or no aid, to the strawberry.

The state of Rhode Island owes its fame as the home of the Rhode Island bent to the fact that this grass can persist on very acid soils whereas many other grasses fail. On such soils there is but little likelihood that the common poppy will ever become a pernicious weed as it has in many of the wheat-fields of Europe. Such soils are, however, the natural home of the common sorrel. Among the cereals, Indian corn and rye are best adapted to acid soils, and these are followed in turn by oats, wheat, and barley.

The following table compiled from the results obtained at the Rhode Island Agricultural Experiment Station shows, numerically, some of the striking contrasts between different kinds of plants as concerns their response to liming.

Name of plant		Very acid soil		Moderately acid soil	
		Unlimed	Limed	Unlimed	Limed
Flowering plants.					
Galega officinalis, Goat's Rue	Height, inches	10.0	39.0	22.0	50.0
Salvia splendens, Scarlet Sage	Height, inches	6.0	6.0	6.0	6.0
Silene orientalis, Catchfly	Height, inches	30.0	25.0	30.0	24.0
Lathyrus odoratus, Sweet Pea	Number of blooms	780.0	3,433.0	2,777.0	3,591.0
Trees.					
Elm, American	Average gain in diameter in four years	2.1	2.6	2.6	3.0
Peach, Early Crawford	Average gain in diameter in four years	2.7	3.1	3.0	2.8
Plum, Burbank, Japanese	Average gain in diameter in four years	1.1	1.6	1.6	1.9
Spruce, Norway	Average gain in diameter in four years	1.5	1.1	1.7	1.4
Small fruits.					
Blackberry, Snyder	Pounds of fruit	30.2	52.1	30.2	17.5
Currant, Prolific	Pounds of fruit	1.3	5.2	2.5	8.5
Cranberry, American Bell	Pounds of vines	1.7	0.3	1.5	0.3
Raspberry, Blackcap	Pounds of fruit	5.1	3.2	7.0	2.9
Raspberry, Cuthbert	Pounds of fruit	6.0	12.8	7.0	8.8
Vegetables.					
Asparagus	Pounds	0.0	9.2	2.1	14.3
Beet, Eclipse Table	Pounds	0.2	164.2	70.1	196.0
Lettuce, Butterhead	Pounds	0.02	44.4	5.3	50.8
Cantaloupe, Netted Gem	Pounds	0.0	88.8	30.8	116.0
Watermelon, Phinney	Pounds	223.8	166.3	364.1	230.5
Onion, Large Red Wethersfield	Pounds	0.3	41.5	24.0	44.3

It is of interest to note the poorer result with *Silene orientalis* where the soil was made more nearly neutral or alkaline, and the almost fatal effect of liming on the cranberry vines. This result should be compared with that with the sweet peas and beans. H. J. Wheeler.

LIME (Fruit). The acid lime (*Citrus aurantifolia;* see volume II, page 782), Fig. 2175, is found in most parts of the tropics, and is commonly cultivated or found growing in a semi-wild state in India, Ceylon, the Malay Archipelago, West Indies, tropical Mexico, and to a lesser extent on the Keys and in the warmer parts of Florida. The West Indian Islands, Montserrat and Dominica, are noted for their commercial production of lime fruit, lime juice and citrate of lime. In California, the lime is grown as a home fruit in some parts, but as it does not possess the hardiness of the orange or lemon, it is of no commercial importance. The sweet lime (*C. limetta*) is perhaps a hybrid, worthless as a commercial fruit in America, though grown and used in other countries.

In the eastern United States, the limes so largely used at the soda fountains are secured mostly from the West Indies, packed in barrels and imported via New York, although part of the supply comes from the Florida Keys. The supply of the western states comes from Mexico, for the most part. These limes, the product of seedling trees, are variously referred to as Mexican, West Indian or Key limes. In tropical countries, where limes may be secured at all seasons of the year, they are used almost entirely in place of lemons, and each year it is becoming a more important fruit throughout America. There is no doubt but that it will eventually occupy a much larger place in our markets.

The cultivation of the lime is confined to regions where frosts are practically unknown. In the dormant or winter season, the trees respond very readily to rising temperatures, new and very tender growth starts and if a drop in temperature sufficient to cause frost follows, as it so often does in many regions where its culture has been tried, the trees suffer severely. Attempts are being made to secure a hardy fruit by crossing with the kumquat (see *Limequat*).

Of the varieties in cultivation, Tahiti and Persian are much the same. The fruits are as large as ordinary lemons. These are somewhat hardier than the smaller-fruited seedling Mexican limes. Palmetto and Everglade are two varieties of Mexican limes, originated, named and described by H. J. Webber, (Yearbook United States Department of Agriculture, pages 279–281, plate XX, 1905). These have neither been introduced nor planted commercially. Their merits in a large way are therefore unknown. There is no question but that the careful selection, and propagation by budding, of Mexican limes would be well repaid. Thornless is a recently introduced variety from Dominica of the Mexican type. The absence of thorns is a desirable feature. Bearss and Imperial, of the same general type as Tahiti, are grown in California. In the colder citrous sections the true limes may be replaced by the calamondin (*Citrus mitis*), a very prolific citrus which produces a small acid fruit of excellent flavor, resembling a small tangerine in color, shape and rind. Rangpur is an acid fruit, the size of a small lemon, round or oblate, orange-red in color, with deep orange-colored flesh, high quality and excellent flavor. It is often referred to as a lime from which it is distinct. Bonavia refers it to the Suntara orange group of India. It is hardier than the true limes, in fact it ranks with the sweet oranges in this respect and is worth planting where the true limes cannot be grown.

The Mexican lime, grown as seedlings, is not particular in its soil-requirements. It grows and seems to flourish on poor sandy soils, or on rocky soils. It will grow and bear fruit in considerable quantities even when neglected and left unfertilized and uncultivated. These limes are produced in Florida on the lower East Coast and on the Keys, where an association has been formed for handling the crop. In other parts of South Florida, Tahiti and Persian have been planted in groves, in considerable numbers, and the fruit thus far has sold at good prices for local consumption.

Limes may be grown as seedlings or they may be propagated by budding on sour orange or rough lemon seedlings.

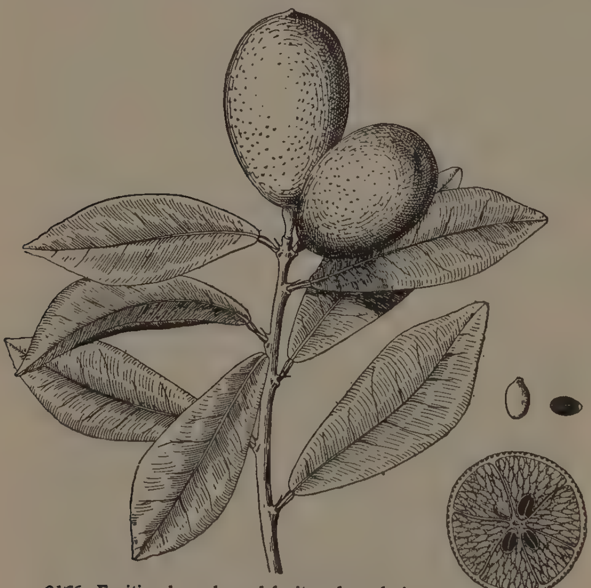
In orchard plantings, the seedlings are set 12 to 15 feet apart each way and the budded trees about 20 feet. The cultivation, fertilizing and general care are the same as for other citrous fruits.

The fruit is gathered when full grown, but while still green, packed and shipped immediately. Carefully handled, they keep well, but do not usually stand up so long as processed or cured lemons. It is sometimes stated that the Tahiti lime is a poor keeper. This is often due to the attacks of fungous diseases which can be guarded against.

They are attacked by the ordinary citrous insects. Anthracnose or wither-tip is the most serious fungous pest. This destroys the smaller twigs and branches and produces hard wart-like spots on the Mexican lime fruit. It may be held in check by careful pruning out of dead and diseased wood and by spraying with bordeaux mixture.

H. Harold Hume.

LIMEQUAT (from lime and [kum] quat). Fig. 2176. Hybrids between the common lime (*Citrus aurantifolia*) and the oval or round kumquats (*Fortunella margarita, F. japonica*). This new and promising citrous fruit was originated by the writer in 1909 by crossing the common West Indian lime with the kumquat. While the lime is the tenderest of all commonly grown citrous fruits and is frequently frozen to the ground even in southern Florida, the kumquat, because of its remarkable winter dormancy, is one of the hardiest of the evergreen citrous fruit trees. The limequat possesses in large measure the cold-resistance of the kumquat and can be grown in regions too cold for the lime. The limequat also shows resistance to citrus canker, a destructive bacterial disease, caused by *Pseudomonas citri*. Limequats vary in size, some being no larger than a large kumquat, while others are the size of a lime. The skin is thin and has an agreeable aroma and flavor; the pulp is juicy and pleasantly acid. This hybrid, which fruited for the first time in 1912, is a vigorous grower and a heavy bearer. It is being tested in the South.



2176. Fruiting branch, and fruit and seeds in cross-section, of an oval limequat. (×½)

Walter T. Swingle.

LIMNÁNTHEMUM: *Nymphoides.*

LIMNÁNTHES (Greek, *marsh flower*). *Limnanthàceæ.* A few species of American annuals growing near the water. Low, diffuse, rather fleshy: lvs. pinnately dissected: fls. white, yellow or rosy, solitary on axillary peduncles, regular, the parts in 4's–6's; sepals valvate in the bud; glands alternating with the petals; stamens usually 10: carpels distinct or nearly so, at first fleshy, at length hard and wrinkled, indehiscent, separating from the short axis; ovule solitary. By some authors this genus is kept in Geraniaceæ, but this and Floerkea are by others separated in a small family Limnanthaceæ. The two genera are sometimes combined, but Floerkea is 3-merous and Limnanthes is commonly 5-merous, and there are other differences.

Doúglasii, R. Br. (*Floérkea Doúglasii,* Baill.). Meadow Foam. Spreading, branched and glabrous yellow-green low herb with handsome white-yellow fragrant fls. nearly 1 in. across, cult. as a garden annual: about 1 ft. high: lvs. pinnate; lfts. sharply lobed or parted: petals oblong-spatulate, notched at apex, more or less yellow, white toward the tip: fr. smooth or slightly corrugated. Calif., Ore. B.M. 3554. B.R. 1673. Gn. 72, p. 611. G. 4:3.—The fls. vary somewhat in color: usually the petals are white with yellow toward the base; sometimes roseate and yellow. *L. grandiflòra* (fls. larger) and *L. sulphùrea* are garden names. The plant is easy of cult.

L. H. B.

LIMNÒBIUM (*living in pools,* from the Greek). *Hydrocharitàceæ.* American aquatic herbs, one of which is in the trade.

Stemless plants, spreading by means of runners, the large lvs. floating: monœcious, the fls. arising from spathes borne on the rootstock, the pistillate single from a spathe and the staminate 2–4 from a spathe, all with 6 white segms. or petals, the inner ones being very narrow; stamens in a column, bearing anthers at unequal heights; ovary with several (6–9) locules and as many stigmas, ripening into a many-seeded berry. As defined by some writers, the genus comprises a single species, *L. Spongia;* others unite with it the diœcious Hydromystria (incl. Trianea), 2 or 3 species of Trop. Amer.

Spóngia, Rich. (*Hydrócharis Spóngia,* Bosc. *L. Bósci,* Rich.). American Frogbit or Frog's-bit (the European Frogbit is Hydrocharis). A neat floating plant, with purplish, hanging, hairy roots and long-stemmed, orbicular, cordate or ovate lvs. 1–2 in. long and purplish beneath. Lake Ontario to Fla. and Texas.—Good for the aquarium. According to William Tricker, its mottled foliage and silky rootlets are very attractive and make it valuable in small areas or tanks, but when grown out-of-doors in summer in tubs or pools, it is very vigorous and soon becomes crowded; the lvs. instead of floating, then appear in an erect state, the spongy condition of floating lvs. having disappeared; it is really a floating plant, prop. by division of runners, and should not be placed in shallow water, where it can readily root into the soil.

L. stoloniferum, Griseb. (Hydromystria stolonifera, Mey. Trianea bogotensis, Karst.), is more sturdy in habit, of a lighter color—especially in winter—does not make such long runners, and forms more compact and attractive rosettes of lvs. Mex. to Paraguay; Trinidad.

L. H. B.

LIMNÓCHARIS (from Greek, referring to marsh habitat). *Butomàceæ.* Water plants, suitable for aquaria and for plunging in pools in summer.

Perennial aquatic herbs, stoloniferous, with lanceolate or ovate, petiolate, emersed lvs.: fls. perfect; sepals 3, persistent; petals 3, thin, fugacious; stamens numerous, the outer ones sterile: carpels 15–20, verticillate, style none, stigma sessile and extrorse.—Two species are admitted by Buchenau, (Engler's Pflanzenreich, hft. 16. 1903), both tropical American. From Hydrocleis it differs in its more numerous verticillate carpels, no style and different stigmas.

flàva, Buchen. (*L. Plumièri*, Rich. *L. emarginàta*, Humb. & Bonpl. *Alísma flàvum*, Linn.). Sts. erect, angled, 10–16 in. high in bloom: lvs. erect, standing out of the water, the blade from lanceolate to broad-ovate, cuneate or cordate at base: fls. in umbel-like clusters of 2–12, the peduncle 3-angled and toward the top 3-winged; sepals broadly ovate and obtuse, greenish; petals broadly ovate or orbicular, yellow: carpels 15–20, scarcely cohering. W. Indies and S. Amer. B.M. 2525.—*Limnocharis flava* is entirely distinct from *Hydrocleis nymphoides* (which see). The light green oblong, blunt lvs. are very characteristic and ornamental; petiole triangular, 1–2 in. high: the fls., produced on a scape, are pale yellow bordered white. Seed is produced very freely, and as the seed matures the scapes fall to the water, the seed ripens and sinks to the bottom, and when grown out-of-doors, sometimes renews itself the following season. The fl.-scape, as soon as it rests on the water, throws up a shoot, which produces another plant in a short time, which again produces fls., seeds and shoots, and so on. The plant may be grown in pots or tubs or planted out in shallow water in early summer.

William Tricker.
L. H. B.

LIMODÒRUM (*meadow gift*, from the Greek). *Orchidàceæ*. A name adopted by some authors for what has been known as Calopogon, comprising a half-dozen species of scapose cormous herbs bearing attractive rose or purple (rarely white) fls. in a spike or raceme. Transferred to this genus, the grass-pink (*Calopogon pulchellus*) is given the name *L. tuberòsum*, Linn. All the species are found in E. N. Amer., from Newfoundland to Cuba and the Bahamas. *L. tuberosum* is sometimes transferred to bog-gardens; see Calopogon for cult. A southern species, *L. multiflòrum*, Mohr, growing in Fla., is recommended for bog-planting S. The single lf. is linear: scape to 16 in. tall, bearing deep purple fls.; lateral sepals ovate, acute; petals ovate or obovate; middle lobe of lip broad-cuneate, about ⅓in. wide.

L. H. B.

LIMÒNIA (derivation uncertain). *Rutàceæ*. An invalid generic name usually misapplied to *Hesperethusa crenulata*, which see. A number of species belonging to very diverse genera were formerly placed in Limonia. See *Feronia*.

L. acidíssima, Linn.=Feronia Limonia.—*L. acidíssima*, Auct. (not Linn.)=Hesperethusa crenulata.—*L. angulòsa*, Wight & Arn.=Merope angulata.—*L. biloculàris*, Roxbg.=Severinia buxifolia.—*L. crenulàta*, Roxbg.=Hesperethusa crenulata.—*L. Demeùsei*, De Wild.=Citropsis Preussei (?).—*L. Engleriàna*, Perkins=Chætospermum glutinosa.—*L. gabonénsis*, Engler=Citropsis gabonensis.—*L. glutinòsa*, Blanco=Chætospermum glutinosa.—*L. Lacourtiàna*, De Wild.=Citropsis gabonensis(?).—*L. monophýlla*, Roxbg.=Atalantia monophylla.—*L. pentaphýlla*, Retz.=Glycosmis pentaphylla.—*L. Póggei*, Engler=Citropsis Schweinfurthii(?).—*L. Preùssei*, Engler=Citropsis Preussei.—*L. scándens*, Roxbg.=Lavanga scandens.—*L. Schweìnfurthii*, Engler=Citropsis Schweinfurthii.—*L. spinòsa*, Spreng.=Merope angulata.—*L. trichocárpa*, Hance=Poncirus trifoliata.—*L. trifòlia*, Burm.=Triphasia trifolia.—*L. trifoliàta*, Linn.=Triphasia trifolia.—*L. ugandénsis*, Baker=Citropsis Schweinfurthii.—*L. Warnéckei*, Engler=Balsamocitrus paniculata.

Walter T. Swingle.

LINÁNTHUS (*flax flower*). *Polemoniàceæ*. By Gray, Peter and others included in Gilia as a section or subgenus, but by some authors kept distinct. *L. densiflòrus*, Benth., is described on page 1337 as *Gilia densiflora*. It is advertised as "California phlox." It is an old garden annual, very attractive when sown thickly as it makes a mass of lilac bloom. The plant is native in the Coast ranges and valleys of Calif.

About a dozen West American gilias are now included in this genus by some writers, one other of which, *L. androsàceus*, Greene (*Gilia androsàcea*, Steud., p. 1337), is sometimes grown as a flower-garden annual.

L. H. B.

LINÀRIA (*Linum*, flax, which the lvs. of some species resemble). *Scrophulariàceæ*. Low herbs, sometimes subshrubs, several species cultivated for the oddly irregular flowers and others for the festooning foliage.

Annual, biennial, perennial: lvs. alternate, or sometimes subverticillate, in the erect-growing species mostly narrow and entire: fls. solitary in the axils, or in terminal racemes, yellow, white, blue or purple; corolla personate or grinning, 2-lipped, usually 1-spurred at the base (in rare or so-called peloria states 5-spurred); stamens 4, ascending in 2 pairs, slender; style 1: fr. a dry caps., opening by slits or pores near the summit, many-seeded.—Widely distributed, mostly in temperate parts of the northern hemisphere, of more than 100 species and with many hybrids. Occasionally the fls. of the common toad flax (*Linaria vulgaris*) are regular. When Linnæus discovered this form, he took the plant to be of another kind and used for it the genus Peloria. This word Peloria is now used generically for the regular state of any normally irregular fl. Such monstrosities occur now and then, particularly in the Scrophulariaceæ.

In America, linarias are little known as garden plants, although they are worthy greater attention. They are of two general classes,—the hardy perennials (sometimes evergreen) and the annuals. The perennials are propagated by seeds and by division, usually the latter. All the species are of easiest culture in any ordinary soil and exposure, and are largely able to shift for themselves when once established. The annuals may be started indoors; or in warm situations they may be sown where the plants are to stand. Some of the trailing and cespitose species are good for rock-gardens.

INDEX.

æquitriloba, 2.
alba, 1, 8, 11.
alpina, 6.
aparinoides, 14.
bipartita, 11.
Cymbalaria, 1.
dalmatica, 5.
globosa, 1 (and suppl. list).
heterophylla, 14.
hybrida, 5.
Macedonica. 4.
maroccana, 12.
maxima, 1.
nana rosea, 6.
origanifolia, 10.
pallida, 1.
purpurea, 9.
repens, 8.
reticulata, 13.
rosea, 1, 12.
speciosa, 4.
splendens, 14.
splendida, 11.
striata, 11.
triornithophora. 7.
vulgaris, 3.

A. *Plant completely trailing: lvs. palmately veined and lobed. Subgenus Cymbalaria.)*

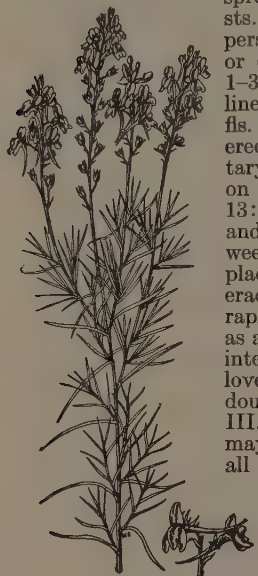
1. **Cymbalària,** Mill. (*Antirrhìnum Cymbalària*, Linn.). Kenilworth Ivy. Mother-of-Thousands. Perennial tender glabrous herb, but sowing itself freely from seeds, long-trailing and rooting at the joints: lvs. cordate-orbicular or reniform, 5–7-rounded-lobed, on slender stalks longer than the blades: fls. solitary on the axils, on slender sts., small but pretty, lilac-blue with a yellowish throat: caps. globular, splitting from the top. Eu. Var. **álba,** Hort., has white fls. Var. **rósea,** Hort., has pale pink fls. Var. **máxima,** Hort. (*L. pállida*, Hort.), has large light-colored fls. Var. **globòsa,** Hort., forms a compact globular plant: fls. lilac.—The Kenilworth ivy is one of the most familiar of trailers on greenhouse bottoms and in odd corners; also as a trailing basket-plant in greenhouses and dwelling-houses. It is of the easiest cult., particularly in a moist and partially shaded place. Prop. by division of the long sts. or by seeds. It will not stand frost, but the plant will spring up year after year from seed, becoming essentially annual. It has become established in the open in many parts of the E. It is a good basket-plant for poorly lighted places and is a continuous bloomer. By some botanists, it is made the type of the genus Cymbalaria

2. **æquitríloba,** Spreng. Close-growing creeping evergreen, perennial, with long trailing branches: lvs. small, roundish or reniform, fleshy, mostly opposite, entire or with 3–5 short mucronate lobes: fls. pale mauve on pedicels nearly equaling the lvs.; palate large, reddish purple; calyx-segms. very narrow. S. Eu. B.M. 2941.

AA. *Plant erect or nearly so (sometimes decumbent at base): lvs. long.*

B. *Fls. yellow.*

3. **vulgàris,** Mill. (*Antirrhìnum Linària,* Linn.). TOAD-FLAX. BUTTER-AND-EGGS. Vigorous perennial, spreading freely by underground sts. and in time forming large and persistent patches: sts. strict, nearly or quite simple, slightly glaucous, 1–3 ft. high: lvs. many, scattered, linear, somewhat narrowed below: fls. in a terminal spicate raceme, erect-spreading, with hanging nectary spur, sulfur-yellow, but orange on the bearded palate. Eu. A.G. 13:469.—Extensively naturalized, and commonly regarded as a bad weed; but it infests chiefly waste places, and although difficult to eradicate it does not spread very rapidly. Now and then it appears as an ornamental plant. It is more interesting to the general plant-lover than to the gardener. A double-fld. form is figured in G.C. III. 18:554. The peloria forms may have 5 spurs, or no spurs at all (R.H. 1851:433).


2177. Linaria bipartita. (×⅙)

4. **macedónica,** Griseb. Robust perennial (perhaps sometimes annual): 2–3 ft. high, branching, grayish green: lvs. narrow-ovate or the upper ones lanceolate, somewhat cordate at the base, nearly or quite sessile, entire: fls. bright yellow, with deeper color on the palate, in long wand-like terminal racemes. Macedonia; perhaps a broad-lvd. form of *L. dalmatica.* Gn. 45:110. J.H. III. 30:469.—A good hardy plant, bearing its snapdragon-like fls. most of the season. Var. **speciòsa,** Hort., is a showy form or strain with large lemon-yellow fls. bearing an orange-yellow mark on lower lip: 2–3 ft.: blooms the first year from early-sown seeds, giving excellent cut-bloom.

5. **dalmática,** Mill. Stout erect perennial, 3–4 ft., forming a large clump: lvs. glaucous, oblong-lanceolate to linear-lanceolate, acute: fls. large, bright yellow, borne at the tops of the branches in a long loose spike; spur straight, much exceeded by the corolla. S. E. Eu. —It is probably to this species or to the last (No. 4) that *L. hybrida* and other garden yellow-fld. forms belong.

BB. *Fls. blue or purple (running to white in some cases).*

C. *Perennial border plants.*

6. **alpìna,** Mill. Compact-tufted plants, 6 in. or less high, with weak and spreading fl.-sts.: lvs. linear or lanceolate, mostly in 4's: fls. in short racemes or heads, blue with an orange-colored palate, the straight or slightly curved, sharp spur as long as the corolla. Alps. F.S. 20:2128. G.C. II. 14:105.—A pretty little alpine, blooming in July and Aug. Var. *nàna ròsea,* Hort., is said to be a dwarf and very distinct form.

7. **triornithóphora,** Willd. (*Antirrhìnum triornithóphorum,* Linn.). Fig. 2178. Glaucous, 2–3 ft. tall: lvs. ovate-lanceolate, in 3's or 4's: fls. about 3 in a whorl (hence the name, *bearing three birds*), rather large, slender-stalked, violet- and purple-striped, with orange palate, about 1 in. long, the spur inflated above and exceeding the lobes. Spain, Portugal. B.M. 525. F.S. 22:2297. H.U. 3:100.—A handsome and interesting plant, rarely seen in American gardens.

8. **rèpens,** Mill. Erect, or decumbent at base, bushy, 1–2 ft. or more, glabrous, with slender creeping rootstock: lvs. whorled or crowded near the base but scattered above: fls. not large, fragrant, in short racemes, forming a terminal panicle, nearly white but striped with purplish veins; corolla less than ½in. long; spur variable, usually short and conical. Eu.—The *L. repens alba* of lists may belong here. *L. repens* is sometimes adventive in this country.

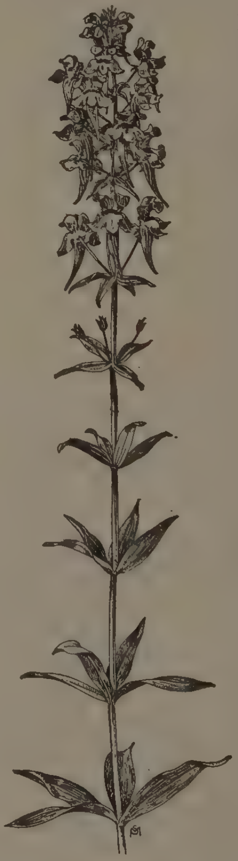
9. **purpùrea,** Mill. (*Antirrhìnum purpùreum,* Linn.). Erect, branched glabrous perennial, 1–3 ft.: lvs. linear or linear-lanceolate, mostly whorled: fls. bright purple, in long racemes, the throat bearded with white hairs, the tube striped; spur about the length of corolla, curved; calyx-lobes linear-acute. S. Eu. B.M. 99.

10. **origanifòlia,** DC. Perennial (sometimes described as annual), ascending, 8–10 in.: lvs. oblong or obovate, short-stalked, the upper alternate and lower opposite: fls. pale purple, rarely white, yellow in the throat, in a slender loose raceme; calyx-lobes linear or linear-spatulate, villous. S. Eu.

CC. *Annual plants of the fl.-garden.*

(See R. H. 1896, pp. 371–4.)

11. **bipartìta,** Willd. Fig. 2177. A foot high, erect, branching, with scattered or verticillate linear lvs.: fls. large, in a long racemose spike, violet-purple, with the palate orange-colored above and whitish toward the base, the spur curved, about as long as the corolla, standing oblique or horizontal; upper lip parted. Portugal, N. Afr.—Old-time annual, but it has never been popular in N. Amer. Var. **álba,** Hort., has yellowish white fls. Gn. 74, p. 203. Var. **spléndida,** Hort., has handsome deep purple fls. There is also a var. **striàta,** Hort. The Excelsior forms probably belong here or with No. 12.


2178. Linaria triornithophora, an old-fashioned plant. (×½)

12. **maroccàna,** Hook. f. Plant annual: spike much shorter and denser than in *L. bipartita:* fls. bright violet or rose, with a whitish palate, the spur long, pointed, as long as the pedicel and usually hanging nearly parallel with the axis of the spike: lvs. many, linear, scattered or whorled, hairy. Morocco. B.M. 5983. A var. **ròsea,** Hort., is mentioned, with deep carmine-rose fls.

13. **reticulàta,** Desf. Fls. pubescent, purple, reticulated with purple, the palate yellow or copper-yellow, the spur pointed and shorter than the corolla and pointing downward: spike short: lvs. linear, scattered or verticillate. Portugal. J.F. 3:260.—An old garden plant, but little known in Amer. Runs into two or three forms.

14. **heterophýlla,** Desf. (*L. aparinoìdes,* Dietr.). Annual, erect, 2–3 ft., with scattered linear or lanceolate, somewhat fleshy, lvs.: fls. straw-colored, with a yellow palate, in spicate racemes more or less branching at base; calyx-lobes linear and obtuse or somewhat acute. Morocco, Sicily, etc. B.M. 6041. Var. **spléndens,** Hort., with violet-bronze fls., is mentioned, possibly a hybrid.

L. Broussonnéttii, Chav. (L. multipunctata, Hoffmgg.). Low annual, with yellow, black-spotted fls., orange on the palate, and lanceolate or linear lvs.: 5–8 in. high, mostly upright. Spain.—*L. canadénsis,* Dum., is a weedy native plant, of no value to the garden, although sometimes making a considerable show in fields in spring: it is annual or biennial, strict, 1–2 ft., with very small blue fls.—*L. globòsa*, Hort. Described as making close rounded masses, with glaucous-green lvs. and lilac fls. L. Cymbalaria(?).—*L. hepaticæfòlia*, Steud. A good alpine, making a very low mat: fls. purple: lvs. cordate or reniform, lobed. Corsica, Sardinia.—*L. multipunctàta*, Hoffmgg.=L. Broussonettii.—*L. Pancici*, Hort. (not Janka), is said to be a beautiful dwarf species with large canary-yellow fls. and narrow-lanceolate lvs., from the Orient.—*L. petræa*, Jord. Low plant, with rose-colored fls. tinged violet and yellow on the tip. Eu.—*L. saxátilis*, Hoffmgg. & Link. Rockwork perennial, trailing, with thickish lanceolate lvs., and yellow fls. in short clusters. Spain.

L. H. B.

LINDELÒFIA (Friedrich von Lindelof, a German patron of botany). *Boraginàceæ.* Two species of erect hardy herbaceous perennials from the high Himalayas, one cultivated for the flowers resembling forget-me-not.

This genus has the habit and nutlets of Cynoglossum, but the stamens of Cynoglossum are included, while those of Lindelofia are exserted: lvs. radical and cauline, the latter alternate and ovate to linear-lanceolate: fls. blue or purple, often very dark, in long dense racemes; sepals somewhat enlarged in fr.; corolla with cylindrical tube and cone-like scales in the throat, the lobes obtuse; stamens 5, with large linear-oblong anthers; ovary 4-lobed: nutlets with hook-tipped bristles.

longiflòra, Gürke (*L. spectábilis*, Lehm. *Cynoglóssum longiflòrum*, Benth.). Pilose: lvs. oblong-acuminate, the upper ones heart-shaped or clasping at the base: fls. deep blue; tube ¼in. long and lobes shorter. B.R. 26:50. J.H. III. 31:235. Var. **afghânica**, Hort., is offered, 1 ft., of spreading habit. G.W. 10, p. 90.—The species is variable, particularly in size of corolla. It usually grows about 2 ft., flowering freely in May and later. The racemes are about 6 in. long, and have 8–12 fls. The plant is likely to be winter-killed unless given a sheltered place, good drainage and winter covering. It is not fastidious as to soil. Easily prop. by division. It seeds freely and flowers the second year from seed.

Wilhelm Miller.
L. H. B.†

LINDEN: *Tilia.*

LINDENBÉRGIA (J. B. W. Lindenberg wrote on the liverworts, 1829). *Scrophulariàceæ.* About 16 annual or perennial herbs of tropical or warm parts of Asia and Afr., differing from Mimulus in having a campanulate rather than tubular calyx and the anther-cells separate: corolla 2-lipped, the tube cylindrical; upper lip short and broad, emarginate or lobed; lower lip larger, 3-lobed and spreading; stamens 4, didynamous, included: caps. oblong or ovoid, dehiscent: plant decumbent or ascending, sometimes woody at base, with opposite dentate lvs. (or the upper ones alternate): fls. nearly sessile, solitary or in terminal racemes or spikes, the bracts leafy. **L. grandiflòra**, Benth., has recently been mentioned in horticultural literature abroad. It is a good greenhouse plant in England, with yellow fls.: soft-hairy, somewhat scandent: lvs. ovate, acuminate, coarsely serrate: fls. 1 in. long, in terminal leafy spikes. Himalaya, to 6,000 ft. altitude. B.M. 7738. G.C. III. 32:213; 53:27. G.M. 45:616; 56:41. G. 24:671.—Mentioned sometimes as annual, but it is perennial in cult. It is a valuable winter-blooming plant, keeping in good condition 3 months, and may be grown in compact bushy form by being cut back.

L. H. B.

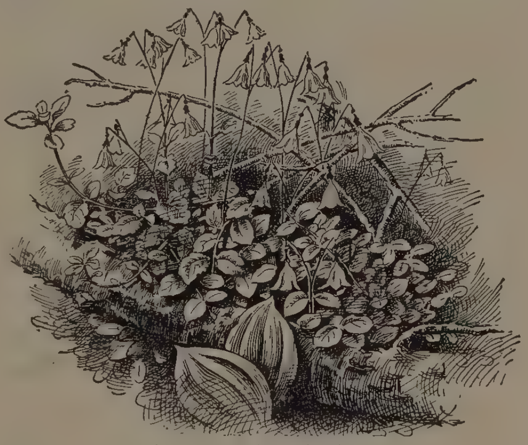
LINDÈRA: *Benzoin.*

LINDSÀYA (Archibald Lindsay, early English botanist). Sometimes spelled *Lindsæa*. *Polypodiàceæ.* About thirty species of tropical ferns, of both hemispheres, none of which is advertised in Amer. They are very difficult of cultivation, and are apparently adapted only as fancier's plants. Schneider, in his "Book of Choice Ferns," says they usually die soon after importation, even if apparently in good condition on arrival. In their native habitat, he says, these ferns usually creep about in poor, stony soil, which is frequently drenched and washed away by rain. They need a high temperature and humid atmosphere. Some success has been attained by placing lindsayas in pots nearly filled with crocks, in which they are firmly held by two or three pieces of turfy loam, and by imitating in other ways the natural conditions described above.

LINNÆA (named after Linnæus, at his own request; it was his favorite flower). *Caprifoliàceæ.* Twin-Flower. Ornamental hardy plant grown sometimes for its delicate pink or purplish flowers.

Evergreen trailing subshrub: lvs. opposite, small, crenate, petioled, without stipules: fls. in pairs on slender upright peduncles; calyx 5-parted; corolla campanulate, 5-lobed; stamens 4; ovary 3-celled: fr. dry, indehiscent, 1-seeded.—Only one species in the colder regions of the northern hemisphere. There is an interesting monograph of this variable species by Wittrock in Acta Hort. Berg. 4, No. 7, 187 pp., 13 pl. (1907), where about 150 varieties are described and figured.

The twin-flowers are half-woody plants with trailing slender thread-like stems, small, usually roundish persistent leaves and slender-stalked, nodding, pinkish or nearly white, campanulate twin flowers. They are hardy North and are graceful, dainty plants for rockeries, preferring a shaded moist position and porous, peaty or humous soil. Propagation is usually by division or by cuttings of soft or half-ripened wood under glass.



2179. Linnæa borealis. (×¼)

boreàlis, Linn. Fig. 2179. Sts. slender, slightly pubescent: lvs. short-petioled, roundish or obovate, with few crenate teeth, usually ciliate and with scattered hairs above, ¼–¾in. long: fls. pedicelled in 2's at the top of slender, upright peduncles; corolla rose-colored or white, ⅓–½in. long, fragrant, in the typical form campanulate, with the constricted portion at the base much shorter than the calyx. June–Aug. N. Eu. and N. Asia. Gn. 24, p. 177. G. 1:536. M.D.G. 1910:138. Var. **americàna**, Rehd. (*L. americàna*, Forbes). Differs chiefly in the corolla being distinctly tubular at the base, the tubular part exceeding the calyx: lvs. usually glabrous, but ciliate near the base. N. Amer., Lab. to Alaska, in the mountains south to Md. and Calif. B.B. (ed. 2) 3:276. Var. **longiflòra**, Torr. (*L. longiflòra*, Howell). Fls. more funnelform, ½in. long or slightly longer; peduncles 2–3 in. long: lvs generally somewhat larger. Wash. to Calif. A var **màjor** is listed. In Fig. 2179, the two large lvs. in the foreground do not belong to Linnæa.

For *L. floribúnda*, Braun & Vatke, and other species, see Abelia.

Alfred Rehder.

LINNEÀRA (named apparently for Linnæus). *Orchidàceæ.* The Rules of Horticultural Nomenclature adopted by the subsection of Nomenclature at the International Horticultural Congress at Brussels, 1910, provide that "multigeneric hybrids receive a conventional generic name, preferably that of a distinguished man, to which is added the termination *ara.* A distinct generic name will be formed for each different combination of genera. Thus all combinations of the genera Brassavola, Cattleya, Lælia and Epidendrum, no matter in what order they may be intercrossed, receive the same generic name which would be, for example, *Linneara.*" The Royal Horticultural Society (London) had proposed to the Congress that "Future multigeneric hybrids (combining three or more genera) should be given a conventional name consisting of the name of some person eminent as a student or as a grower of orchids, followed by the termination 'ara'." "A separate generic name should be coined for each distinct combination of genera. Thus, Brassocattleya × Epilælia, and Brassodendrum × Brassocattleya, and Brassolælia × Epicattleya, and Brassolælia × Epidendrum, and all other possible combinations of those four genera would be designated by one name, e.g., *Adamara,* while a second generic name, e. g., *Linneara,* would need to be coined for Dialælia × Brassocattleya, and this would stand for all combinations of the four genera Diacrium, Lælia, Brassavola, and Cattleya."

The Congress adopted Linneara for the hybrids of the genera Brassavola, Cattleya, Lælia, Epidendrum. The name Adamara was not adopted. Neither name has become current; see also *Lowiara.* L. H. B.

LINOSPÀDIX (Greek, *linear spadix*). *Palmàceæ.* Dwarf unarmed palms varying considerably in foliage.

Flowers monœcious, spirally arranged on the erect spadix which appears among the lvs.: lvs. terminal, flabelliform, deeply 2-cut, the apex of the lobes sometimes cut and thread-like.—Eight species all from New Guinea. The genus is allied to Bacularia, but Bacularia has premorse lf.-segms. and erect anthers fastened at the base, while Linospadix has acuminate lf.-segms. and versatile anthers fastened on the back. Linospadix is distinguished from Howea (which see) by the stamens 6–9; pistillate fls. with 6–9 staminodes: ovule parietal. The best known species, *L. Petrickiana,* is of uncertain botanical affinity. The name does not appear in botanical literature. This is a handsome pinnate-lvd. palm of compact growth and well furnished with foliage, at least while in a young state. In its juvenile condition, the lvs. of *L. Petrickiana* are simply bifid, the pinnate form gradually appearing as the plant attains age. It was intro. in 1899 by Sander & Co., who say: "The slender, alternate pinnæ are slightly arched. The base is netted with brown fiber, small, hair-like glumes of the same color being apparent on the younger fronds and leafstalks. The young fronds are colored similarly to those of *Areca Ilsemannii,* and when developing have the luster and brilliancy of new copper." Cultural conditions suited to the needs of calamus and dæmonorops will be most likely to succeed with linospadix, and include a temperature of 70°, plenty of water, and some shade throughout the year.

Petrickiàna, Hort. Sander. Pinnæ once cut from the apex to a third or fourth the length of the pinna; laterally cut about six-sevenths of the way from the tips of the segms. to the rachis: premature basal lvs. cut once from the apex to half their length, the 2 lobes uncut. G.C. III. 24:299.

L. Leopóldii, Hort. Sander. Uncertain as to botanical affinity, perhaps the preceding. Name never published in botanical literature. Shown at Ghent in 1903. G.C. III. 33, suppl. to April 25. —*L. Micholítzii,* C. H. Wright. A low, stemless palm, with a densely crowded cluster of 2-cut, flabelliform, plicate lvs.: spadix slender, nodding, about 1–2½ ft. long, bearing numerous attractive, pale yellow fls. New Guinea. B.M. 8095. Not in cult. in Amer., but an attractive little plant. N. TAYLOR.

LINÓSYRIS (*Linum* and *Osyris,* which genera it resembles). *Compósitæ.* One species, **L. vulgàris,** Cass., GOLDILOCKS, of Eu., is a good hardy perennial, growing ½–2 ft. high, and bearing numerous small pale yellow usually rayless heads: sts. strict (from a hard root), striate, glabrous, bearing many alternate, small, linear, entire lvs.: involucre imbricated, the numerous narrow bracts shorter than the florets and pappus: achene compressed and silky. The plant grows natively in rocky and stony places and along gravelly banks of rivers in England, Wales, and through Cent. and S. Eu. to the Caucasus. It is an excellent late summer and fall bloomer, thriving well in any good garden or border. Prop. by division.

The genus Lynosyris is referred to Aster by many botanists, the above species then becoming *Aster Linosyris,* Bernh. It is also known as *Chrysocoma vulgaris,* Linn. Horticulturally, it is distinct, with its yellow heads and peculiar habit. From Aster it differs technically in the absence of rays and in yellow flowers, but rayed heads are sometimes found. In this work, the yellow-flowered asters are kept distinct in this genus and Calimeris. As usually separately defined, Linosyris contains several species. L. H. B.

LÌNUM (classical name). Including *Cathartolìnum. Linàceæ.* FLAX. Ornamental flowering plants, annual and perennial; one is the fiber-yielding flax.

Erect-growing plants, bearing tough cortex, with narrow alternate (rarely opposite) and mostly entire lvs., and showy 5-petaled fls. which open in the sunshine: stamens 5 and alternate with the petals, usually united at the base, staminodia sometimes present: ovary single, 3–5-loculed, bearing as many styles as locules, and ripening into a dry caps. which may or may not be dehiscent: fls. red, blue, yellow, white, borne in terminal racemes or cymes, and, although each fl. may be short-lived, the continuity of bloom makes the plant showy.—Species 90–100, in temperate and warm regions about the globe, about one-fourth of which are in the U. S.. There are two horticultural sections,—the annuals and perennials. All are of easy cult. in an open and warm place, fully exposed to the sun. Seeds of the annuals may be sown where the plants are to bloom or they may be started under glass. The perennials often bloom the first year from seed, and seeds are often used to prop. them; but the plants may be divided. The species with capitate stigma and glandular sepals, mostly yellow-fld., are by some authors separated as Cathartolinum.

INDEX.

album, 8.
alpinum, 11.
angustifolium, 2.
arboreum, 5.
austriacum, 10.
coccineum, 1.
flavum, 3.
grandiflorum, 1.
humile, 2.
kermesinum, 1.
Lewisii, 9.
monogynum, 6.
narbonnense, 12.
perenne, 8, 9, 10, 11.
rubrum, 1.
salsoloides, 7.
sibiricum, 8.
usitatissimum, 2.
virginianum, 4.

A. *Plant annual: fls. red or blue.*

B. *Bloom of the red series.*

1. **grandiflòrum,** Desf. FLOWERING FLAX. Fig. 2180. Erect, branchy, 1–2 ft., glabrous: lvs. many, alternate, broadly lanceolate to oblong, sessile or nearly so: fls. terminating very slender pedicels which are 1–3 in. long, the obovate petals wide-spreading (fl. 1–1½ in. across, and something like a single-fld. pink) and much exceeding the pointed scarious-edged sepals. N. Afr. B.M. 4956. R.H. 1848:401.—Very serviceable garden annual, and popular for its glossy bright fls. The color varies in the shades of red. Var. **rùbrum** has bright red fls. Var. **kermesìnum** is crimson. Var. **coccíneum,** Hort., is a scarlet-fld. form.—In a warm, sunny place, the flowering flax makes a very satisfactory plant of long period of bloom. It is not adapted to cutting, since the fls. are not durable. Will not stand frost.

BB. *Bloom blue.*

2. **usitatíssimum,** Linn. Flax. Much cult. for linseed and for fiber, and running wild along railroads and in fields: 2–3 ft. high, very slender-branched, glabrous: lvs. small, linear or lanceolate, acute, alternate: fls. about ½in. across, light blue, soon withering: pod large, mostly exceeding the scarious-edged sepals, nearly or quite indehiscent, the septa not ciliate. *L.* **hùmile,** Mill., also cult. and sometimes escaped, is lower and has a dehiscent caps. with ciliate septa. It is probably only a form of the above, and it has run wild in this country.—Flax has been cult. from time immemorial, and it is unknown in an originally wild state. Some authorities consider it to be a modified form of *L. perenne;* others think it to be derived from *L. angustifolium,* Huds., an annual or perennial species with small fls., short linear lvs., and decumbent st., growing from England to W. Asia.

2180. Linum grandiflorum. (Natural size)

AA. *Plant perennial: fls. yellow, white, or blue.*

B. *Bloom yellow* (*L. trigynum, which may be sought here, will be found under the genus Reinwardtia*).

3. **flàvum,** Linn. Erect from a somewhat woody base, glabrous, 1–2 ft.: lvs. lanceolate or linear, alternate: fls. golden yellow, in a much-branching cyme, the showy petals much exceeding the glandular-ciliate sepals. Eu. B.M. 312.—A good half-hardy perennial, but not popularly known in this country.

4. **virginiànum,** Linn. (*Cathartolìnum virginiànum,* Reichb.). Perennial, producing suckers, 1–2 ft., glabrous, branched above: lvs. thin and deep green, elliptic-lanceolate to narrow-oblong or the lower spatulate, 1-nerved: fls. yellow, about ⅓in. broad, scattered; sepals ovate, short-pointed, entire or nearly so; styles distinct: caps. depressed-globose, 10-celled. Maine to Ga. and Ala.—Offered as a good garden perennial.

5. **arbòreum,** Linn. Small shrub, spreading: lvs. wedge-shaped, obtuse, recurved: fls. few and large, clear yellow, in close clusters; sepals acuminate. Crete. B.M. 234. Gn. 77, p. 435.

BB. *Bloom white.*

6. **monógynum,** Forst. Variable glabrous perennial 1–2 ft. high, sometimes woody at base, the sts. simple or branched, erect or spreading: lvs. many, scattered, 1 in. or less long, linear-oblong to linear-subulate, 1–3-nerved: fls. white, often 1 in. diam., in terminal corymbs; sepals acute, ovate to ovate-lanceolate; styles united at base: caps. broadly ovoid, large. New Zeal. B.M. 3574. J.H. III. 57:13.—An attractive species.

7. **salsoloìdes,** Lam. Perennial, evergreen, 1 ft., woody at base, the sts. branched and somewhat twisted: lvs. small, setaceous: fls. white with purple eye; sepals ovate, acuminate, with glandular hairs at middle. Mediterranean Alps. G.C. III. 54:42. G. 36:681 (var. *nanum*).—A showy species.

BBB. *Bloom blue* (*running into white varieties*).

8. **perénne,** Linn. Fig. 2181. Erect-growing and branchy, glabrous, 1–2½ ft. tall: lvs. linear and acute, alternate: fls. rather small, azure-blue (there is a white-fld. form; var. **âlbum,** Hort.), on the ends of slender pedicels, the styles and stamens of different lengths (fls. heterogonous) in different fls.: caps. ovoid, dehiscent, on inclined pedicels. Eu.—Worthy hardy perennial, summer-blooming, often flowering the first year from seed. *L. sibíricum,* DC., belongs with this species.

9. **Léwisii,** Pursh (*L. perénne* var. *Léwisii,* Eaton & Wright). Prairie Flax. The W. American representative of the above, and scarcely distinguishable from it except that the fls. are not heterogonous, pedicels more erect in fr.; calyx-nerves not evident: fls. 1½ in. across, clear sky-blue, very pretty. Wis., west and south.

10. **austrìacum,** Linn. (*L. perénne* var. *austrìacum,* Voss.). Lvs. linear, punctate: fls. rather small, violet-red or light blue: fruiting pedicels horizontal or reflexed. Austria.—Hardy N., growing 1–2 ft. high and blooming all summer.

11. **alpìnum,** Linn. (*L. perénne* var. *alpìnum,* Voss). Low, about 6 in., with erect shoots: lvs. small, crowded below, pellucid-dotted, linear-subulate: fls. few, large, blue; inner sepals obtuse, the outer ones somewhat acute. Eu.

12. **narbonnénse,** Linn. One to 2 ft. high, forming a spreading clump, glabrous and slightly glaucous, and very handsome for rockwork: lvs. linear-lanceolate, pointed, alternate: fls. 1½ in. across, on slender pedicels in loose panicles, azure-blue, with white eye and white stamens. Eu. G.C. III. 50:468. Gn. 52, p. 401. G. 26:460.—Blooms in late spring and early summer: a good hardy species.

2181. Linum perenne. (×½)

L. campanulàtum, Linn. Perennial yellow-fld. species from S. Eu., 1–1½ ft., glaucous: lvs. on st. oblanceolate, acuminate, alternate. L.B.C. 13:1254.—*L. Chamissònis*, Schiede (L. Macraei, B.M. 5474, not Benth.). Perennial, woody at base, with scarlet buds and yellow fls.: lvs. stiff, lanceolate, acuminate: sepals ovate, acuminate: 1 ft. Chile.—*L. pubéscens*, Soland. Perennial, with large pink fls. shaded with dark purple lines, the petals 3 times as long as calyx: lvs. oblong and obtuse to lanceolate and acute. Asia Minor.—*L. trígynum*, Roxbg.=Reinwardtia trigyna.

L. H. B.

LÍPARIS (Greek, *fat, shining*). *Orchidàceæ.* Erect little plants with stems in some species 1 foot high, bearing one or several leaves and a terminal raceme of small, rarely medium-sized flowers.

Herbs, terrestrial or epiphytic: sts. sometimes thickened at the base into a small pseudobulb, sheathed by scales: lvs. few, broad, contracted into sheathing petioles: fls. whitish, greenish yellow or purplish; sepals and petals nearly equal, linear, spreading; column long; lip nearly plane, often with 2 tubercles above the base.—A large genus, containing over 100 species, distributed over the warm and temperate regions of the entire earth. By some, the name Leptorchis is used for this genus, but Liparis is retained by the "nomina conservanda" of the Vienna Congress.

L. liliifolia should be planted in well-drained soil; a shady bank is preferable. *L. Lœselii* delights in a wet situation, just at the edge of the water.

liliifòlia, Rich. Twayblade. Plants 4–10 in. high: lvs. oval or ovate, 5 in. long: raceme with many purplish fls.; labellum large, wedge-obovate. Succeeds in well-drained soil on shady banks; woods and thickets, E. N. Amer. B.B. 1:476. A.G. 12:153 and 13:517.—Procurable from Dutch bulb-dealers and dealers in native plants.

Lœsélii, Rich. Plants 2–8 in. high: lvs. elliptic-lanceolate, 2–6 in. long: raceme with few greenish fls.; lip obovate pointed. In wet thickets, N. Amer. and Eu. B.B. 1:477. G.C. II. 21:144.

L. atropurpùrea, Lindl. Plants 1 ft. or more high: lvs. 2–4, nearly round, acuminate plicate, near together at the upper part of the st.: raceme many-fld.; fls. chocolate-purple; lip oblong, obtuse, recurved. June. Ceylon. B.M. 5529.—The most ornamental of the genus.—*L. Càillei*, Finet. Dwarf: racemes several-fld.; scape 4-winged: lvs. membranous, not plicate. French Guinea.—*L. laceràta*, Ridl. Racemes about 8 in. long; sepals and petals yellowish, oblong, obtuse; lip orange-red. Borneo.—*L. nàna*, Rolfe. Plant very small: fls. dark purple, remarkable in having a very broad, nearly straight column. Annam.—*L. rhodochìla*, Rolfe. Scape many-fld.; sepals and petals light green; lip reddish crimson. Java.—*L. tabulàris*, Rolfe. Raceme lax; fls. purple; dorsal sepal oblong-lanceolate, the lateral oblong; petals filiform; lip reniform, denticulate. Penang. B.M. 8195.—*L. tricallòsa*, Reichb. f. Raceme loosely many-fld., the rachis red; sepals strap-shaped, lemon-yellow; petals filiform, arched, red; lip nearly orbicular, golden yellow, red-striped. Malay Penin. B.M. 7804.—*L. Wárpuri*, Rolfe. Only a few inches high: scape 1- or 2-fld.; fls. light green, with dark green disk. Madagascar.

Heinrich Hasselbring.
George V. Nash.†

LÍPPIA (Dr. Auguste Lippi, French traveler, 1678–1703). Including *Aloýsia. Verbenàceæ.* Herbs and shrubs, grown for the ornamental bloom, and one as a ground-cover; the lemon verbena of florists is one of them.

Mostly shrubby, with opposite or 3-whorled (rarely alternate) lvs., which are entire, dentate or lobed: fls. small and often lantana-like, in heads or spikes, mostly white, rose or purplish; corolla 4-lobed, oblique or 2-lipped, the tube cylindrical and straight or curved, the lobes broad and usually retuse; calyx 2–4-toothed or -cleft, inclosing the dry fr. which becomes 2 separate nutlets: stamens 4, didynamous, attached at the middle of the corolla-tube, included or very nearly so; ovary 2-celled, each cell 1-ovuled.—Species about 125, nearly all in Trop. Amer., but 2 or 3 African and 1 or 2 widely dispersed in warm countries. The genus is botanically nearer Lantana than Verbena, although the common forms of all three genera are very unlike horticulturally. Some species of Lippia have their spikes crowded into dense heads, like Lantana. The drupe in Lippia is dry, but in Lantana it is often juicy, and in Lantana the calyx is more or less truncate and the corolla not bilabiate.

The one well-known cultivated lippia is lemon verbena (*L. citriodora*), an old-fashioned favorite, with delightfully fragrant foliage, a sprig of which was often included in mixed bouquets. It is a low-growing tender shrub, with long narrow pointed entire leaves, which are usually borne in threes. In summer, it bears minute flowers in a pyramidal panicle, composed of many-flowered spikes, which appear in groups of three at decreasing intervals along the main axis. In southern California it attains a large size.—Culture by William Scott: A florist should always have a few lemon verbenas. Save a dozen plants in spring, shift them on as required, and in the summer plunge the pots outside. At the approach of frost bring them into the greenhouse, stand them under the lightest and coolest bench, and give them water enough merely to keep the wood from shriveling. In early February shake the plants out of the pots, shorten the unripened and weak wood, repot in fresh soil, using 4-inch pots, and start the plants into fresh growth in a temperature of 55°. In a few weeks they will be covered with new growths suitable for cuttings. Cuttings root readily in about three weeks. The sand of the cutting-bench should be a little warmer than the air. Water the sand twice a day, and keep it well soaked. Never allow the cuttings to wilt from sunshine or dryness. Transfer the cuttings when rooted to 2-inch pots, and in April shift to 3-inch pots, plunging them in a mild hotbed, where by the middle of May, with one pinching, they will have become fine, bushy plants. They need frequent syringing to prevent attacks of red-spider.

In California, Arizona, Mexico, Australia, the plant known as *L. repens* (properly *L. canescens*) is now an important ground-cover or lawn plant. The many thousands of acres thus covered are said all to have come from plants secured in a twelve-ounce box from the Botanic Garden in Rome by F. Franceschi, of Santa Barbara, in 1898.—Culture by Franceschi: It thrives in any soil, no matter how poor, rapidly covering the ground with a very dense matting. It will smother all weeds in short time, and the more trodden upon the better it grows. It requires much less water than other lawn plants, and saves the trouble of mowing. It will stand severe heat and many degrees of cold, and can easily be established on sloping grounds. It will never become a pest difficult to eradicate, having no underground runners. Have the ground well worked and pulverized, leveled and rolled, if possible. No manure is recommended. It seeds very sparingly or not at all. The best and quickest way to propagate it is by planting small sods (of 2 square inches) at a distance of 1, 2, or more feet apart, as one may prefer. The closer planted, the sooner the ground will be carpeted. Each small sod contains many joints, and from each joint runners and roots soon appear that will branch in every direction and will anchor it in the ground, rooting again as they run. Press and firm the sods in the ground, and give sufficient water to start them to grow. Occasional rolling will be of advantage. Frequent walking over it will have the same effect. If the tiny lilac flowers (much sought by the bees) are not desired, they can easily be removed with an ordinary lawn-mower. During the dry season, water must be given, with a lawn sprinkler or otherwise, at intervals as the local conditions suggest.

A. *Fls. in slender naked spikes.*

citriodòra, Kunth (*Aloýsia citriodòra*, Ort.). Lemon Verbena. Small shrub, glabrous, the branchlets striate and more or less scabrous: lvs. in whorls of 3 or 4, lanceolate, short-stalked, glabrous, densely covered beneath with glandular dots, entire or toothed at the middle, lemon-scented: spikes whorled and axillary or collected in terminal panicles, which may be 3 in. long and wide: fls. white, small, in summer and autumn. Uruguay, Argentina, Chile. B.M. 367 (as *Verbena triphylla*). Sometimes grown as standard and tree-like. G.C. II. 11:301.

ligústrina, Brit. (*L. lycioìdes,* Steud. *Verbèna ligustrìna,* Lag.). Tall shrub, often spiny, the branches more or less pubescent: lvs. small, coriaceous, opposite, elliptic-oblong or lance-oblong, attenuated to petiole, obtuse or acute, the margin somewhat revolute, entire or serrate at middle: racemes somewhat crowded, canescent, 2–3 in. long; fls. small, white, vanilla-scented; calyx campanulate, 5-costate, hirsute, with subulate teeth; corolla exceeding calyx, the throat villous. Mex. to Argentina.—Offered in S. Calif., where it is said to withstand drought exceedingly well.

chamædrifòlia, Linn. Shrubby, half climbing, branches 4-angled and pubescent: lvs. aromatic, opposite, very short-petioled, ovate, acute, coarsely serrate, margin revolute, shining above and more or less tomentose beneath: racemes 3–5 in. long, paniculate; fls. small, rosy lilac; calyx ovate, hirsute, the short teeth ovate-acuminate. Brazil, Argentina.—Offered in S. Calif.

urticoìdes, Steud. Tall shrub, with strict terete glabrous branches: lvs. dark green, rough, not aromatic, 3 in. long, opposite, ovate or oblong, attenuated into the petiole, acute, crenate-serrate: racemes paniculate; fls. white, vanilla-scented; calyx tubular, pilose below, partially 4-toothed, the teeth subulate-cuspidate. Peru, Brazil, etc.—Offered in S. Calif.

AA. *Fls. capitate or in short dense spikes, with broad bracts.*

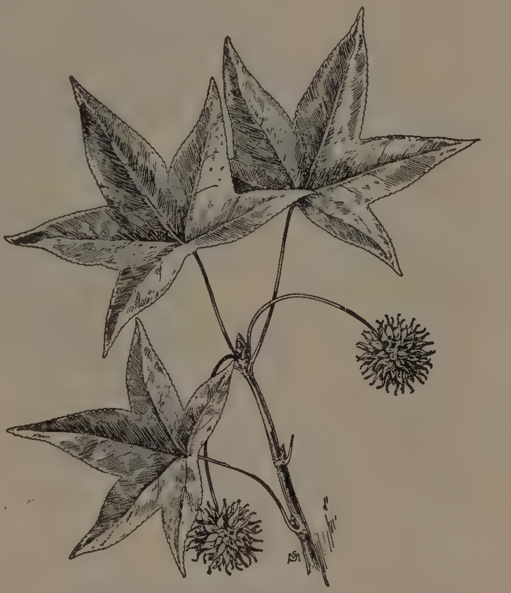
canéscens, Kunth (*L. rèpens,* Hort., not Spreng.). St. somewhat woody at the base and rooting, widely spreading, canescent: lvs. small, from spatulate to oblong and lanceolate, attenuate to petiole, acute, dentate toward apex: heads ovoid or subcylindrical; the bracts herbaceous, obovate-cuneate, acuminate, narrowly membranous-margined, imbricated; corolla conspicuously larger than in related species, rosy, with a yellow throat; calyx short 2-toothed, with villous keels; bracts of fl.-head shorter than the corolla-tube, with villous margins. S. Amer., in dry, grassy places.—This plant, under the name of *L. repens,* is exceedingly useful in Calif. as a ground-cover, especially to persons who do not care to go to the expense of keeping up a grass-lawn. The tops sometimes freeze in the region of San Francisco, but the plants come on well in spring. By keeping the area mown, the weeds are not very troublesome.

nodiflòra, Michx. (*Verbèna nodiflòra,* Linn. *Zapània nodiflòra,* Lam. *Phỳla nodiflòra,* Greene). Sometimes described as annual, but probably perennial, extensively creeping and rooting but with ascending branches, greenish or grayish: lvs. opposite, cuneate-spatulate to oblanceolate, nearly or quite sessile, tapering to a long entire base, serrate above the middle: heads ovoid and becoming nearly cylindrical, on filiform peduncles that exceed the lvs., the bracts obovate or irregularly cuneate, acuminate and sometimes mucronate; fls. rose-purple to nearly white, the corolla short; calyx thin in texture, equaling corolla, unevenly cleft on the two sides, the teeth lanceolate; bracts of fl.-head about as long as corolla-tube, with glabrous or nearly glabrous hyaline margins. Sandy soil, Ga., south (in the tropics widely distributed); in Calif. prominent on river banks, and, according to Jepson, esteemed for holding levees against erosion. L. H. B.

LIQUIDÁMBAR (from Latin *liquidus,* fluid, and the Arabic *ambar,* amber; in allusion to the fragrant juice which exudes from the tree). *Hamamelidàceæ.* Ornamental trees grown chiefly for their handsome foliage assuming crimson tints in autumn.

Deciduous: lvs. alternate, slender-petioled, palmately 3–7-lobed, serrate, with small stipules: fls. apetalous, usually monœcious, in globular heads; staminate fls. without perianth, intermixed with small scales, in heads forming a terminal raceme; pistillate fls. in slender-peduncled globular heads consisting of more or less cohering 2-celled and 2-beaked ovaries subtended by minute scales in place of calyx-lobes: fruiting head globose, spiny from the persistent styles, consisting of dehiscent caps., each with 1 or 2 winged seeds.—About 4 species in N. and Cent. Amer. and in W. and E. Asia. *L. orientalis* yields the liquid storax; the resin of *L. Styraciflua* is used in the preparation of chewing-gum.

Only *L. Styraciflua* is well known in cultivation; it is a beautiful pyramidal tree of very symmetrical habit with maple-like lustrous leaves assuming a deep crimson color in autumn; in winter it is conspicuous from its usually corky branches, the persistent pendulous fruit-heads and the deeply furrowed bark. It is hardy as far north as Massachusetts; it is of moderate growth and prefers moist situations. It is free from insects and diseases and is said to withstand salt air. It requires close pruning when transplanted. Propagation is by seeds which should be stratified as soon as ripe; many of them do not germinate until the second year.



2182. Liquidambar Styraciflua. (×⅓)

Styracíflua, Linn. Sweet Gum. Bilsted. Alligator Tree. Fig. 2182. Tree, 60–140 ft. high: lvs. 5–7-lobed, with acuminate, finely serrate lobes, lustrous and dark green above, paler below and glabrous except large tufts of pale rufous hairs in the axils of the principal veins, 3-7 in. across; petioles 5–6 in. long: fr. 1–1½ in. across. March–May. Conn. and S. N. Y to Fla., Ill., Mc and Mex. S.S. 5:199. G.F. 2:235. P.G. 3:111. G.C. II. 14:633. Mn. 4:117. Gn. 24, pp. 166, 167; 38, p. 208. F.S.R. 3, p. 85. F.E. 18, p. 90.

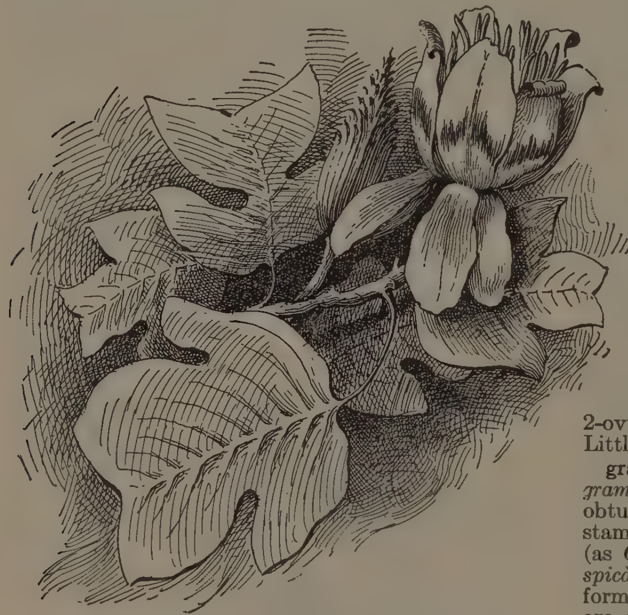
L. formosàna, Hance. Tree, to 120 ft.: lvs. usually 3-lobed, pubescent on young plants, glabrous on older trees and only slightly hairy in the axils; scales subtending the ovary subulate, becoming spiny in fr. S.E. to Cent. China. H.I. 11:1020. Var. *montícola,* Rehd. & Wilson. Lvs. always glabrous. Hardier than the type. Cent. China.—*L. orientàlis,* Mill. (L. imberbe, Ait.). Lvs. usually 5-lobed, the lobes usually with 2–4 small lobes, quite glabrous, smaller than in L. Styraciflua. W. Asia. H.I. 11:1019. F.S.R. 3, p. 87. Somewhat less hardy than L. Styraciflua.

Alfred Rehder.

LIQUORICE: *Glycyrrhiza.*

LIRIODÉNDRON (*lirion*, lily, and *dendron*, tree; referring to the shape of the flowers). *Magnoliàceæ.* Tulip Tree. Whitewood. Yellow Poplar. Ornamental trees grown for their handsome foliage and large tulip-like flowers.

Deciduous: lvs. alternate, long-petioled, 2–6-lobed, with conspicuous deciduous stipules cohering when young and inclosing the next lf.: fls. terminal, solitary, with 3 spreading sepals and 6 erect, broadly ovate petals; stamens numerous, with long and linear anthers; pistils numerous, forming a narrow column, developing into a light brown cone; at maturity the carpels, each consisting of a long, narrow wing with a 1–2-seeded nutlet at the base, separate from the slender spindle.—Two species in N. Amer. and China.



2183. Tulip tree.—Liriodendron Tulipifera. (×½)

Only the native species, one of the nobiest trees of the American forest, is well known in cultivation. It is a hardy beautiful tree of pyramidal habit, well adapted for park-planting and for avenues, with handsome, clean foliage of unusual shape and of rather light bluish green color, rarely attacked by insects or fungi, assuming in fall a brilliant yellow color; the tulip-like flowers, though of not very showy color are conspicuous by their size and shape. The tulip tree is also an important forest tree, and the soft, fine-grained, light yellow wood is much used in carpentry for furniture, boat-building and the manufacture of small articles; it does not split easily but is readily worked and bent to any required shape. The inner bark is said to have medical properties. The tulip tree grows best in deep, rich and somewhat moist soil. Transplanting is not easy; it is best done in spring, just before the tree starts into new growth. Propagate by seeds sown in fall or stratified and sown in spring; varieties are usually grafted or budded on seedling stock, rarely propagated by layers. The seeds are sometimes hollow, especially those grown along the eastern limit of the species.

Tulipífera, Linn. Fig. 2183. Tall tree, to 150, rarely to 190 ft., with a trunk to 10 ft. diam., often destitute of branches for a considerable height, glabrous: lvs. about as broad as long, with 2 lobes at the truncate and notched apex and 2–4 lobes at the base, bluish green above, pale or glaucous beneath, 5–6 in. long: fls. greenish yellow, marked orange within at the base. 1½–2 in. long; petals ovate or oval; fertile carpels acute. May, June. Mass. to Wis., south to Fla. and Miss. S.S. 1:13. Em. 2:605. B.M. 275. Gng. 7:259. A.G. 1892:485. Mn. 2, p. 4; 6, p. 145. Gn. 34, p. 42; 76, p. 646. F.S.R. 2, pp. 5, 7; 3, p. 203. G.C. III. 55:255. V. 20:86. Var. **pyramidàle,** Lav. (var. *fastigiàtum*, Hort.). With upright branches, forming a narrow pyramid. Var. **integrifòlium,** Kirchn. Lvs. rounded at the base without lobes. Var. **obtusílobum,** Pursh. Lvs. with only 1 rounded lobe on each side of the base. Var. **contórtum,** Goeschke. Lvs. with 2 lobes on each side, twisted so that the upper lobes often form a right angle to the lower ones. There are also several vars. with variegated lvs., of which var. **aùreo-marginàtum,** Hort. (var. *panaché*, Hort.), with lvs. edged yellow, is one of the best. F.S. 19:2025; 20:2081.—In the Middle West, liriodendron is universally known as whitewood. To lumbermen in the East it is known as poplar and tulip poplar.

L. chinénse, Sarg. (L. Tulipifera var. chinense, Hemsl.). Tree, to 50 ft.: lvs. with 4 acute or acuminate lobes, rounded or slightly cordate at the base, 5–6 in. long: fls. 1–1½ in. long: cone slenderer, the fertile carpels obtuse or obtusish at the apex. Cent. China. G.C. III. 34:370; 44:429. S.T.S. 1:52. H.I. 28:2785.—Seems somewhat tenderer than the native species.

Alfred Rehder.

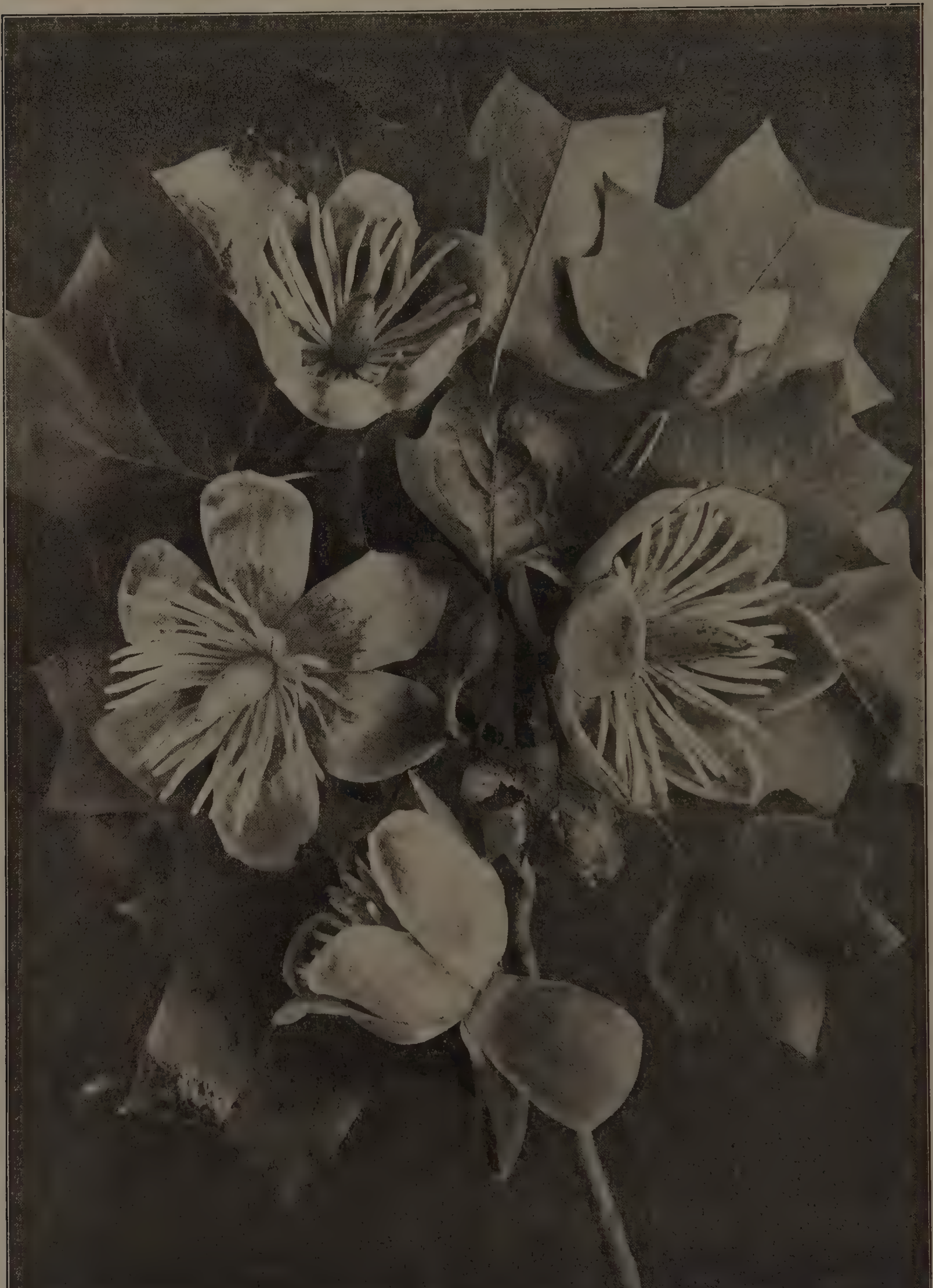
LÌRIOPE (named after the nymph Liriope). *Liliàceæ.* A tender violet-flowered cultivated plant from China and Japan.

Plants of somewhat doubtful affinity, having been referred to different families: rhizome short and thick, often stoloniferous: st. very short, the lvs. narrow and crowded, the fls. on simple scapes, small, violet or whitish; segms. distinct; stamens 6, hypogynous; ovary 3-celled, each cell 2-ovuled.—Species about 3, China, Japan, Philippines. Little cult.

graminifòlia, Baker (*L. spicàta*, Lour. *Dracæna graminifòlia*, Linn.). Lvs. all radical, linear-lanceolate, obtuse, 3-nerved, with a few brown scales at the base: stamens 6; style columnar; ovary 3-celled. B.R. 593, (as *Ophiopogon spicatus*). Var. **densiflòra,** Hort. (*L. spicàta* var. *densiflòra*, Wright) is presumably the best form. B.M. 5348 (as *Ophiopogon spicatus*). There are several forms of this species, as: Var. **mìnor** (*L. spicàtus* var. *mìnor*, Wright). L.B.C. 7:694 (as *Ophiopogon spicatus*); var. **koreàna** (Wright); var. **intermèdia** (Maxim.).—*L. graminifolia* should perhaps be grown in the greenhouse. It is 1 ft. or more high with grass-like foliage and 1 or 2 scapes overtopping the lvs., which bear from July to Sept. as many as 90 violet-colored fls. in a spike-like raceme 6–12 in. long and 1 in. wide. The fls. are less than ½in. across, 6-parted and arranged in groups of 3–5 along the raceme. They vary from dark purple through violet to whitish. The deepest color is the finest, and is set off by the yellow anthers.

Wilhelm Miller.
L. H. B.†

LISIÁNTHUS (Greek compound). *Gentianàceæ.* About 10 species in the W. Indies and Cent. Amer., herbs or shrubs with mostly rather large yellow-green, brown-black or rarely white fls. in cymose clusters, and opposite lvs. None of the species seems to be in the trade, although *L. Russelliànus*, Hook. (*L. erythropénsis*, Hort.), is recorded as a cult. plant in garden literature; this plant is **Eùstoma Russelliànum,** Griseb., growing on plains Neb. to La. and Mex. Glaucous: st. simple, or with a few opposite branches: lvs. opposite, connate, ovate or ovate-oblong, 3–5-nerved: fls. panicled, as large as a tulip; lobes obovate, spreading: stigma of 2 very large, green, velvety, spreading plates: pod oblong; seeds minute, pale brown. B.M. 3626. G.C. III. 4:240. R.H. 1863:51; 1881, p. 189. G.M. 49:479. Gn. 70, p. 77. G. 25:292. G.W. 11, p. 138. H.F. II. 4:240. It is a tender annual and grows 1½



LXVI. The tulip tree.—Liriodendron Tulipifera.

ft. high, producing its 5-lobed, purple, dark-eyed fls. in summer and fall. Under favorable conditions the fls. are 4 in. across, as many as 10 or 11 on a plant, and individual blossoms have been known to last three weeks. According to F. L. Harris, in the Old World it is usually treated as a cool greenhouse subject, being sown in early spring for summer and autumn bloom. The seed should be sown carefully, and at every stage of the plant's growth over-watering should be guarded against. The seedlings are very likely to damp-off. When they are ready for transplanting from the seed-beds, use small pots. When larger plants are needed, place them in a light, airy place and give generous bottom heat. For soil, use good loam, sand and well-rotted manure. Wilhelm Miller.

LISSOCHÌLUS (Greek, *smooth lip*). *Orchidàceæ.* Terrestrial herbs, some of which are very handsome, but they seem to be little cultivated in America, only a single species being advertised here.

The plants are distinguished from their near allies by the dissimilarity of the sepals and petals, the latter being much larger and wider and usually of a different color: lvs. plicate and prominently veined, long and narrow: sts. very short, leafy, finally thickened into pseudobulbs: raceme simple; scape long, stout, sheathed but leafless, growing beside the pseudobulb; labellum spurred or saccate, joined to the base of the column.—About 30 species dispersed in Trop. and S. Afr.

The plants may be grown in a compost of fibrous loam, leaf-mold and sand. During the growing season they require plenty of water, but during three months of winter they should be allowed to rest and be kept dry.

Krébsii, A. Rich. Lvs. in tufts on the young sts. elliptic-lanceolate, 8–12 in. long: scape 2–3 ft. high; raceme 12–18 in. long, with 20–30 fls.; sepals linear-oblong, bent back, green, with dull purple blotches; petals much larger, golden yellow; lip yellow, pendulous, saccate between the small, rounded lateral lobes; middle lobe orbicular, notched in front. Flowers from May to Oct., the fls. remaining a long time. Natal. B.M. 5861.

L. Ándersonii, Rolfe. Racemes loose, 4–8-fld.; sepals and petals pale greenish or sulfur-yellow; lip white. Trop. Afr.—*L. gigantèus*, Welw. & Reichb. f. A gigantic orchid whose lvs. are said to grow to a length of 8 ft., with fl.-spikes twice as high: sepals linear, curled backward; petals oblong-quadrate, 1½ in. across, pinkish rose; labellum 3 in. long, with a long spur; middle lobe trowel-shaped, purple, striped with darker lines. Congo. G.C. III. 3:617. S.H. 2:355. I.H. 35:53. J.H. III. 55:52.—*L. Grántii*, Reichb. f. Raceme about 6-fld.; sepals brownish green; petals bright yellow behind, paler in front; lip light yellow. E. Afr.—*L. Hórsfallii*, Batem. A robust plant, with plicate lvs. 2–3 ft. long and 5–6 in. broad, sharp-pointed: fl.-stalk twice the length of the lvs., with many large fls. 3 in. diam.; sepals reflexed, rich purple-brown on the upper side; petals much larger, almost square, white, suffused with rose. B.M. 5486. G.C. III. 39:200. G.M. 49:193. C.O. 1. Handsomer than the first.—*L. Mahònii*, Rolfe. Raceme stout, many fld.; fls. large; sepals reflexed, green, suffused and veined with brown; petals rose-lilac; lip 3-lobed, the lateral erect lobes green, crenulate, brown-nerved, the front lobe spreading, retuse crenulate, the front purple, darker nerved, green at base; keels denticulate, undulate, greenish. Uganda. B.M. 8047.—*L. purpuràtus*, Lindl. Sepals and petals rose-pink, narrowly oblong; middle lobe of lip purple, ovate-oblong. Trop. Afr. B.M. 7921.—*L. ròseus*, Lindl. Lvs. broad and stiff: st. 3–4 ft. high: sepals brown; petals and labellum fine rose-colored. B.R. 30:12. Also a showy plant.—*L. speciòsus*, R. Br. Pseudobulbs nearly underground: lvs. dark green, ensiform: scape 2–4 ft. high, with fragrant fls. 2 in. across; sepals small, green, reflexed; petals large, yellow; lip mostly yellow, apparently on the upper side, due to the inversion of the fls. June, July. Cape. B.R. 573 (erroneously numbered 578). P.M. 4:25.—*L. stylìtes*, Reichb. f. Fls. purple; sepals reflexed, pale green, tinged lilac at base; petals nearly erect, pale purple, nearly orbicular; lip pandurate, pale purple; base widely pouched, white outside, pale green inside and brown-dotted. Trop. Afr. B.M. 8397.—*L. ugándæ*, Rolfe. Fls. numerous, yellow, marked with purple-brown at apex of sepals and petals; lip with front lobe oblong-orbicular, reflexed. Uganda. B.M. 8044.

Heinrich Hasselbring.
George V. Nash.†

LISTÈRA (after Martin Lister, 1638(?)–1712). *Orchidàceæ.* Small orchids, sometimes transferred to cultivated areas.

Small, slender, erect herbs, with fibrous or sometimes fleshy roots, bearing a pair of opposite green lvs. near the middle, and 1 or 2 scales near the base of the st.: fls. small, spurless, in a terminal raceme; sepals and petals similar, spreading or reflexed; labellum rather longer, narrow, entire or 2-lobed.—About 10 species, natives of the North Temperate Zone.

convallarioìdes, Torr. St. 4–10 in. high, with smooth, round-oval, obtuse, cuspidate lvs.: raceme 2–3 in. long, bearing 3–12 greenish yellow fls. June–Aug. In woods, Nova Scotia to Alaska and Calif.; south to N. C. in the mountains. B.B. 1:473.

cordàta, R. Br. Very slender, 3–10 in. high: lvs. cordate-ovate, mucronate: raceme 1–2 in. long, with 4–20 minute purplish fls. June–Aug. In moist woods, Nova Scotia to Alaska and Ore., south to N. J.; Eu. B.B. 1:473. Heinrich Hasselbring.

LISTRÓSTACHYS (Greek, *shovel* or *hoe*, and *spike*). *Orchidàceæ.* Orchids with the habit of Angræcum.

Racemes many-fld.; sepals and petals alike, spreading; lip adnate to the foot of the column, with a long thin or reflexed spur; column bent back against the dorsal sepal; pollinia 2, upon divided stalks.—About 60 species, in Trop. Afr.

pertùsa, Reichb. f. (*Angræcum pertùsum*, Lindl. *A. Pescatoreànum*, Lindl.). Sts. up to 1 ft. tall: lvs. narrowly strap-shaped, obliquely 2-lobed: fls. covering peduncle nearly to the base, about ½in. across, white, on the upper side; sepals and petals ovate; lip obovate-spatulate; spur slender, greenish. Bourbon. B.M. 4782.

L. bìdens, Rolfe. Free-flowering epiphytal orchid from W. Trop. Afr.: sts. elongated, many-lvd.: lvs. thick, ovate-oblong, obliquely 2-lobed: fls. fragrant, many, in slender hanging racemes, white or pinkish, the spur as long as the lip. B.M. 8014.—*L. bracteòsa*, Rolfe. St. very short: racemes axillary, few-fld.; fls. pale yellowish green, fleshy. Mauritius.—*L. caudàta*, Reichb. f. (Angræcum caudatum, Lindl.). Racemes zigzag, 5- or more-fld.: fls. distant, about 3 in. across; sepals and petals linear-lanceolate, olive-green, flushed with pale brown; lip clawed, obcordate-cuneate; spur pale brown, 8–9 in. long. Sierra Leone. B.R. 1844. O.R. 20:297. B.M. 4370.—*L. Chailluàna*, Reichb. f. (Angræcum Chailluanum, Hook. f.). Lvs. up to 8 in. long, 1½ in. broad: racemes 6–10-fld.; fls. milk-white; spur slender, flexuous, greenish. W. Afr. B.M. 5589. J.H. III. 43:579. G.C. III. 31: suppl. March 22.—*L. dactylóceras*, Reichb. f. About 3 in. high: lvs. very fleshy, sword-shaped: fls. white. W. Trop. Afr.—*L. fimbriàta*, Rolfe. Fls. translucent white, with slight greenish tinge; spur long and slender. Uganda.—*L. forsipàta*, Kränzl. Plant small: fls. pellucid, white. Trop Afr.—*L. hamàta*, Rolfe. Remarkable for having all the long spurs hooked at the tip: fls. white, with green spur. W. Trop. Afr. B.M. 8074.—*L. imbricàta*, Rolfe. Plant very small: spike about 7-fld.; fls. white, small. Trop. Afr.—*L. Kindtiàna*, Wildem. Dwarf: racemes short, dense; fls. yellow, star-shaped. Congo.—*L. Mónteiræ*, Reichb. f. (Angræcum antennatum, Kränzl.). Robust epiphyte from W. Trop. Afr., sometimes met with in cult.: 1–2 ft., bearing roots toward the base: lvs. oblong or obovate oblong, obliquely bilobed: racemes erect, many-fld., 6–12 in. long; fls. yellowish white, the upper part of spur ochreous and the base light green. B.M. 8026.—*L. pellùcida*, Reichb. f. (Angræcum pellucidum, Lindl.). Racemes pendulous, many-fld.; fls. semi-transparent, spiral, yellowish white; lip cordate, truncate at apex, fimbriate; spur short. Sierra Leone. G.C. III. 49:18. C.O. 1. R.B. 32, p. 38.—*L. vandæfórmis*, Kränzl. Plant very large: racemes nodding, many-fld.; fls. yellow. W. Trop. Afr. G.W. 13, p. 54.—*L. Whỳtei*, Rolfe. Racemes several-fld.; fls. small, sweet-scented, white, wax-like, with pointed brown-tipped spurs. Uganda. George V. Nash.

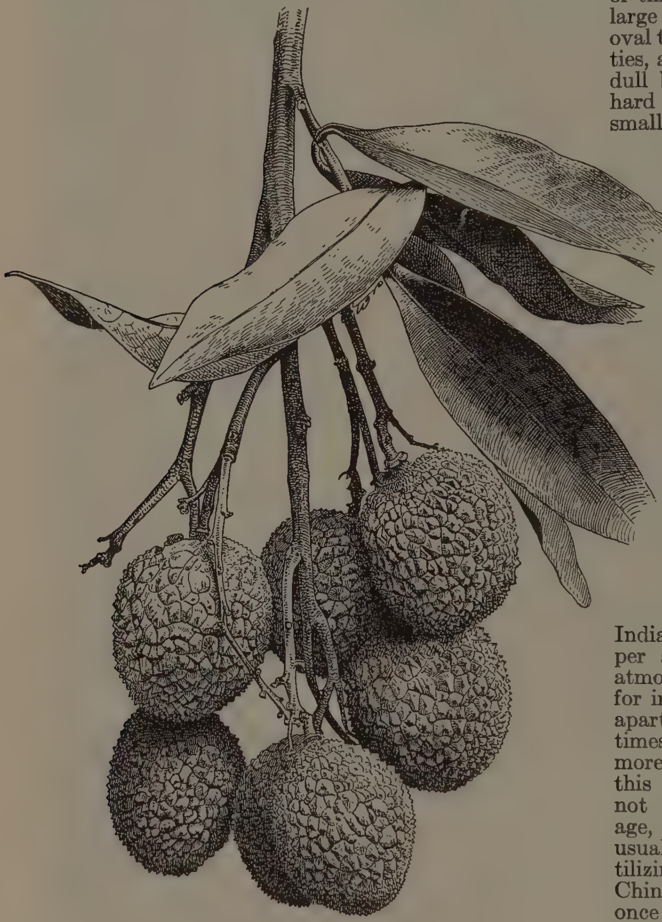
LÌTCHI (Chinese name). *Sapindàceæ.* One species in China, and cultivated elsewhere for its edible fruit.

By some botanists included in Nephelium, but the definition is probably clearer if Litchi and Euphoria are kept distinct, both of which differ from Nephelium in having the seed-covering or arillus free from the seed rather than grown to it.

chinénsis, Sonn. (*Scytàlia chinénsis*, Gaertn. *Dimocárpus Lìchi*, Lour. *Nephèlium Lìtchi*, Camb.). Litchi or Leechee. Fig. 2184. Lfts. 2–4 pairs, elliptic-oblong to lanceolate, glabrous, lustrous above, glaucescent beneath. China. A.G. 12:269.—Not to be confounded with the longyen (see *Euphoria*) or the rambutan (see *Nephelium*). L. H. B.

Culture of the litchi

Of the numerous fruits cultivated in south China. the litchi (*Litchi chinensis*) is one of the most highly esteemed, both by natives and Europeans. It is considered indigenous to the region, but has been in cultivation since a remote day, and lends itself to a wider variety of uses than many other tropical fruits. As a dried fruit it is well known, and is shipped to the United States and other occidental countries, while a considerable quantity is preserved in syrup and exported. Like most other fruits, however, it is considered most delicious when fresh.



2184. Litchi. (×⅔)

Its cultivation is not limited to south China and the adjoining regions. In parts of India it is very well known, especially in the section north of Calcutta, while it is also grown to a limited extent in northeastern Australia, Formosa, southern Japan, Hawaii, the West Indies, Brazil, and other regions. It is said to have been introduced to Florida in 1886, but, so far as known, has not yet fruited in that state, although in certain sections the climate and soil seem well adapted to its culture. It bloomed at Tampa in 1914 and 1915, but the trees were young and failed to carry any of their fruit to maturity. In California it has been grown successfully only in the most protected locations. The first fruits ripened in that state were produced at Santa Barbara in 1914. The litchi is quite susceptible to frost when young, but mature trees will withstand several degrees of freezing without permanent injury.

The litchi is a small to medium-sized tree, usually spreading in habit, with a dense head of bright green foliage. The leaves are compound, with two or three pairs of elliptical to lanceolate leaflets 2 to 3 inches in length. In India it is said to flower in February, in China during April, ripening its fruits about the first of May in the one case and during July in the other. The flowers are small and inconspicuous, but are produced in great abundance in terminal panicles.

The fruits, which are borne in loose clusters of two or three to twenty or even more, have been likened to large strawberries in appearance. In shape they are oval to ovate, in diameter 1½ inches in the better varieties, and in color deep rose when fully ripe, changing to dull brown as the fruit dries. The outer covering is hard and brittle, rough on the surface and divided into small scale-like areas, from which short conical protuberances usually arise. The seed is small and shrivelled in the grafted varieties, but in seedlings is as large as a good-sized castor bean; surrounding it, and separating from it readily, is the edible part, in reality the aril, which is translucent, whitish, juicy, and of firm texture. In flavor it is subacid, strongly suggestive of the Royal Ann cherry, especially when cooked. Firminger says it is "as delicious, perhaps, as that of any fruit in existence." The fruit is dried just as it comes from the tree, the aril shrinking away from the thin outer shell and remaining as a rather tough layer around the seed. In this form the litchi is occasionally seen on fruit-stands of American cities; the flavor bears little resemblance to that of the fresh fruit, having been likened to that of raisins.

In China the litchi is said to succeed best when planted on deep rich soil near the bank of an irrigating-canal. A soil rich in humus is by far the best, and there should be an abundance of water for irrigating purposes. From the fact that the tree does well in parts of northern India where the rainfall is not more than 40 inches per annum, it does not appear that a very humid atmosphere is necessary, provided there is ample water for irrigation. The trees should be set about 25 feet apart, and require very little pruning. It is sometimes necessary to thin the young fruits, leaving no more in a cluster than the tree can properly mature; this results in larger and finer fruit. Seedlings do not come into bearing until seven to nine years of age, but trees propagated by layering or grafting usually commence to bear at three to five years. Fertilizing is said to be extensively practised by the Chinese, an application of liquid manure being given once in every three or four months.

The gootee method of propagation, as it is known in the Orient, is the method most commonly employed by the Chinese, and is used in India as well. A healthy, well-matured branch is chosen, and a narrow ring of bark removed just below a leaf-bud or node. Around this is formed a ball of clay soil, with an outer covering of coconut fiber, tow, or moss, to hold it together. A little above the ball a good-sized flower-pot or earthen vessel is suspended, and a piece of soft rope is inserted through the small hole in the bottom. The rope should fit the hole snugly, and is knotted on the inside; it is then carried to the gootee, and wound around the ball several times. The water trickles from the pot, which should be filled every day or two, and after running slowly down the rope is distributed over the gootee, keeping it uniformly moist. The gootee is made in spring, from February to April, depending upon climatic conditions, and at least three or four months are required for roots to form. When the ball is filled with roots and they begin to show on the surface, the branch is severed from the tree and planted in its permanent location in the orchard.

In India, layering is often practised, the outer ends of branches being laid across flats of soil suspended upon a light framework of poles. After a notch is made in the under side of the branch, it is covered with soil for a distance of several inches, and kept moist by frequent waterings. Inarching is also practised, the method being the same as for the mango. Seedling litchis are generally used for stocks. The litchi can be grafted on its near relative the longan (*Euphoria Longana*), but it takes a longer time to effect a union, and it is believed that the tree grows more slowly than when on litchi stock.

The amount of variation among seedling litchis is considerable; hence the best varieties can be propagated only by some vegetative means, though seedlings are often grown. Grafting and layering have not only the advantage of reproducing a known variety, but trees so propagated come into bearing several years earlier than seedlings. Seeds should be sown as soon as possible after their removal from the fruit, as they do not long retain their vitality.

The Chinese cultivate several named varieties, and there are at least eight known in India, of which the best are said to be McLean's and Bedana ("seedless"), the latter having a very small stone which is usually sterile. Firminger mentions one variety in India which is green in color and of a distinct and very sweet flavor.

F. W. Popenoe.

LITHOSPÉRMUM (Greek, *stone seed;* the seeds like little stones). *Boragináceæ.* Gromwell. Puccoon. Low-growing hardy mostly herbaceous perennials of minor importance, some of them attractive as alpines and in rock-gardens.

Lithospermum has fifty species in extra-tropical regions around the globe, mostly in the northern hemisphere: herbs or subshrubs, rough, silky, or bristly: lvs. alternate, sessile and entire: fls. white, yellow, bluish or violet, in leafy often curved racemes or spikes, sometimes dimorphous as to stamens and style; calyx 5-parted; corolla funnel- or salver-shaped, 5-lobed, the tube cylindrical and straight, the throat naked or crested; stamens 5, fixed to the tube; ovary 4-lobed, with a slender style, stigma usually capitate or 2-lobed: plants mostly with red roots. The genus is closely allied to Moltkia, which see.

In cultivation, the best known is *L. fruticosum,* a rock-garden trailer, which bears numerous leafy spikes of blue flowers, each about ½ inch across, from early summer to autumn. *L. purpureo-cæruleum* is also an old garden plant. The common gromwell, *L. officinale,* is rarely cultivated as a medicinal herb. Others are procurable from dealers in native plants. Seeds of the gromwell and the western species are procurable, and plants of the other kinds from dealers in rock-garden plants. *L. fruticosum* is said to be propagated only by cuttings of the previous year's wood; *L. multiflorum* by cuttings of young shoots. The kinds with red roots yield a dye. *L. arvense* is an annual or biennial introduced weed; but most of the species (and those cultivated) are perennial. The best known garden kinds are European, but the American species are deserving of greater attention.

INDEX.

albicans, 7.
angustifolium, 6.
canescens, 4.
fruticosum, 8.
Gastonii, 10.
Gmelinii, 5.
hirtum, 5.
linearifolium, 6.
multiflorum, 3.
officinale, 1.
pilosum, 2.
prostratum, 8.
purpureo-cæruleum, 9.
Zollingeri, 11.

a. *Color of fls. dull white.*

1. **officinàle,** Linn. Gromwell. Much branched, 2–3 ft. high: lvs. lanceolate or ovate-lanceolate, 2 in. or less long: infl. sparse; throat of corolla crested with appendages; fls. dull white, small; tube about as long as the calyx. Along N. E. roadsides, naturalized from Eu.

aa. *Color of fls. yellow or orange.*

b. *Corolla-tube scarcely, if any, exceeding the calyx.*

2. **pilòsum,** Nutt. Mostly unbranched, 1 ft. high: lvs. linear and linear-lanceolate, 2–4 in. long: fls. dull greenish yellow, crowded in a leafy thyrse; throat of corolla nearly devoid of appendages. W. N. Amer.

bb. *Corolla-tube much longer than the calyx: roots red, long and deep: fls. large, showy.* (Puccoons.)

c. *Floral lvs. reduced to bracts no longer than the calyx.*

3. **multiflòrum,** Torr. Height 1–2 ft., often paniculate-branched at summit: lvs. linear to linear-lanceolate: fls. numerous, short-pedicelled and sometimes spicate, the corolla about ½in. long and with short rounded lobes, light yellow. Rocky Mts. to W. Texas.

cc. *Floral lvs. much longer than the calyx.*

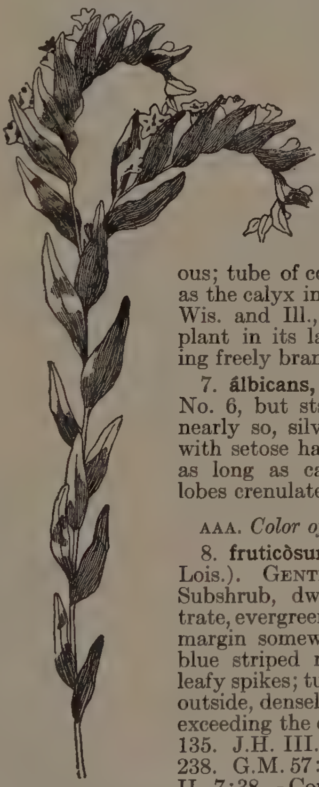
d. *Crests of throat little if at all projecting or arching.*

4. **canéscens,** Lehm. Puccoon, of the Indians. Red-Root. Indian Paint. Fig. 2185. Height 9–12 in. or more: lvs. oblong-linear or the upper ones broader, mostly silky pubescent and obtuse: fls. orange, the limb large and crests in throat prominent although not projecting: fls. nearly without pedicels. Plains and open woods, in sandy soil. Ont. to Ala., west to Ariz. B.M. 4389. G.M. 44:337.

5. **Gmélinii,** Hitchc. (*L. hírtum,* Lehm.). Height 1–2 ft.: lvs. lanceolate or the lower ones narrower: fls. bright orange, mostly pedicelled; glandular ring at base within bearing 10 very hirsute lobes or teeth. Pine barrens, Mich. to Fla. and Colo.

dd. *Crests of throat conspicuous and arching: fls. mostly very long and showy, often of two kinds.*

6. **angustifòlium,** Michx. (*L. linearifòlium,* Goldie). Height 9–12 in. or more: lvs. all linear: fls. of 2 sorts, the earlier and conspicuous kind bright yellow, with corolla-tube 1 in. or so long, later ones and those of the more diffusely branching plants with inconspicuous pale corolla, without crests in the throat and probably clistogenous; tube of corolla 2–4 times as long as the calyx in the large fls. Dry soil, Wis. and Ill., W. and S.—A showy plant in its large-fld. stage; becoming freely branched.



2185. Puccoon—Lithospermum canescens. (×½)

7. **álbicans,** Greene. Related to No. 6, but sts. fewer and simple or nearly so, silvery-hoary: lvs. linear, with setose hairs: corolla only twice as long as calyx, deep yellow, the lobes crenulate. S. Colo.

aaa. *Color of fls. blue or purplish.*

8. **fruticòsum,** Linn. (*L. prostràtum,* Lois.). Gentian-Blue Gromwell. Subshrub, dwarf, trailing or prostrate, evergreen: lvs. lanceolate-linear, margin somewhat revolute: fls. deep blue striped red-violet, in terminal leafy spikes; tube of corolla pubescent outside, densely villous at apex, much exceeding the calyx. S. Eu. Gn. 45, p. 135. J.H. III. 32:475. G.C. III. 30: 238. G.M. 57:455. G. 36:619. H.U. II. 7:38.—Correvon states that *L. prostratum,* which comes from the W. Pyrenees, is different from *L. frutico-*

sum; it is a low running species rather than erect-growing (as he defines *L. fruticosum* to be), covering the soil, and the lvs. are more lanceolate, shorter, broader, and reflexed at the edges: it is destroyed by limestone, which is not the case with *L. fruticosum.*

9. **purpùreo-cærùleum,** Linn. Sts. leafy and procumbent, reaching 2 ft. or more long, the fl.-sts. ascending or nearly erect and bearing leafy forked cymes: lvs. lanceolate, hairy: fls. rather large, rich blue, nearly sessile, usually surpassed by the lvs. Eu.

10. **Gástonii,** Benth. Beautiful plant, rare in the Pyrenees: a dwarf leafy perennial, adapted to alpine gardens, appressed-hairy, the erect branches 4–10 in. high: lvs. to 3 in. long, spreading and recurved, ovate-lanceolate, taper-pointed: fls. few, deep blue with star-like white eye, crowded near tips of branches; corolla-tube short, the lobes broadly ovate, the throat pubescent; calyx-lobes lanceolate, acute. B.M. 5926. G.C. III. 47:212.—Said to like lime.

11. **Zóllingeri,** A. DC. Perennial, with ascending sts., 4–6 in., silky-hairy: lvs. oval-oblong, usually mucronate, attenuate at base: fls. few, probably purple, the corolla nearly ½in. long; corolla-tube cylindrical-funnelform, twice longer than calyx; lobes of calyx linear, pilose. Java, but not since found there according to Koorders.—The plant in the trade under this name is said to make tufts of very rough glistening foliage, with sky-blue fls.: adapted to front-row of borders and large rockeries (in England).

The garden names of Lithospermum are confused and need to be re-studied. *L. cælestìnum,* Hort., is described as "a most desirable low-growing plant for the rockery," with pretty blue fls. in June. Probably Moltkia cærulea.—*L. Froèbellii,* Hort., is said to be "a dwarf compact plant with rosemary-like lvs. and deep blue fls. on erect sts. about 9 in. high."—*L. graminifòlium,* Viv.=Moltkia graminifolia.—*L. intermedifòlium,* Hort., is "a pretty dwarf shrubby plant with pale blue fls."—*L. intermèdium,* Hort., perhaps the same as the last, is "a pretty dwarf shrubby species, with fls. a lovely shade of blue." Somewhat shrubby, 8–10 in. high: lvs. narrow and slightly hoary: fls. tubular, drooping. G. 34:857. Probably these are Moltkias.—*L. petræum,* A. DC.=Moltkia.—*L. rosmarinifòlium,* Tenore. Evergreen, from Italy and Greece, 1–2 ft.: lvs. narrow, 1 in. or more long: fls. bright blue, striped white about ¾in. diam. Gn.W. 22:139.

L. H. B.†

LITHRÆA (*Llithi,* the Chilean name of *L. caustica*). *Anacardiàceæ.* Three species of evergreen S. American shrubs or small trees closely related to Schinus: lvs. alternate, simple or odd-pinnate: fls. small, greenish or whitish, in panicles; petals 5, valvate, stamens 10; disk annular in the staminate fls., cup-shaped and 10-lobed in the pistillate fls.; ovary superior, 1-celled with a basal, sessile ovule: fr. a dry subglobose drupe with a hard bony stone. The following species is occasionally cult. in S. Calif. **L. molleoìdes,** Engler (*L. Aroeírinha,* March.). Shrub, to 12 ft., glabrous: lvs. odd-pinnate; lfts. 5, rarely 3, lanceolate, acute, 1½–3 in. long; petiole 1–1½ in. long, like the rachis narrow-winged: panicles 2–3 in. long: fr. globose, ⅓in. across, whitish, lustrous. S. Brazil, Argentina. Flor. Brasil. 12, 2:83. **L. caùstica,** Miers, from Chile, has short-petioled simple, oval to ovate-oblong lvs. and pubescent panicles; it is said to be very poisonous. **L. Gillièsii,** Griseb. Tall shrub, 6–10 ft., the branches whitish gray, more or less dichotomous: lvs. 3-foliolate or 5-foliolate; lfts. lanceolate, the lower ones sessile, the upper narrowed below: fls. small, yellowish white, in few-fld. clusters: fr. a dry drupe. Brazil, Chile. R.H. 1914, p. 201.

Alfred Rehder.

LÍTSEA (Japanese name). *Lauràceæ.* Trees or shrubs of little horticultural importance, but may be planted S. Lvs. mostly alternate, coriaceous, usually evergreen: fls. diœcious, small, clustered in umbel-like cymes, mostly white or yellow; perianth-tube very short or sometimes ovoid or bell-shaped, the lobes usually 4–6; stamens mostly 6–12: fr. a dry or succulent drupe, on the enlarged perianth-tube. Species perhaps 150 in warm and tropical countries well around the globe, one of them (*L. geniculàta,* Benth. & Hook.) growing in shallow ponds, Ga. to La. Adanson's name, Malapoenna, is rejected by the Vienna or international rules.

LITTÆA: *Agave.*

LITTÒNIA (Dr. Samuel Litton, professor of botany in Dublin). *Liliàceæ.* One species is one of the so-called climbing lilies.

Tender, tuberous plants: fls. 6-parted, but in Littonia the segms. are not reflexed like a cyclamen, as in Gloriosa (which is another climbing lily), nodding, bell-shaped, orange or yellow, mostly 1 in. or more across; segms. oblong, acuminate; stamens 6, attached at base of perianth-segms.: caps. 3-celled; seeds scarlet or brown, about the size of a sweet pea, round, arranged in 2 series.—Species about 6, Arabia, S. Afr. and Trop. Afr.; most of them are erect not climbing herbs.

modésta, Hook. Slender and simple, either short and suberect or long and climbing or sarmentose: lvs. ovate to linear, produced into a tendril at the tip, the middle ones whorled and the upper ones opposite or alternate: fls. solitary in the upper axils, on slender pedicels; perianth-segms. provided with a small oblong nectary, partially closed by a ciliated scale on each side; style 3-cut. S. Afr. B.M. 4723. G.C. III. 36:183. Var. **Keìtii,** Hort., is an improved form, with larger and more abundant fls., the sts. longer, branched, and distinctly sarmentose. These plants require the cultural treatment of gloriosa.

Wilhelm Miller.
L. H. B.†

LITTORÉLLA (from Latin word for *shore,* from place of growth). Sometimes spelled *Litorella. Plantaginàceæ.* Small aquatic grass-like plants, one in Eu. and the northern part of N. Amer., offered abroad among hardy water-plants, and one little known in southern S. Amer. Perennial, somewhat succulent, with linear lvs. from the base: fls. monœcious, borne among the lvs., not showy, the staminate on scapes and pistillate sessile at base of lvs.; sepals 4; corolla 3–4-toothed; stamens 4, long-exserted; ovary single, with a long-exserted style. **L. uniflòra,** Aschers. (*L. lacústris,* Linn. *Plantàgo uniflòra,* Linn.). Growing in mats on borders of ponds and lakes, the lvs. 2–3 in. long, linear-subulate, bright green: stoloniferous. Newfoundland and Nova Scotia to Maine, Vt. and Minn.

L. H. B.

LIVE-FOREVER: *Sedum Telephium* and other *Sedums.*

LIVERLEAF: *Hepatica.*

LIVERWORT. A general name for a group of cryptogamia (flowerless plants), somewhat allied to mosses and known as Hepaticæ. Conocephalus and Marchantia have been offered by dealers in native plants as suitable for rockwork and bog-gardens. Lunularia is a common weed in greenhouses. See p. 6, Vol. I.

LIVING ROCK: *Ariocarpus.*

LIVISTÒNA (Patrick Murray, of Livistone or Livingstone). *Palmàceæ.* The most extensively grown genus of fan-leaved palms in commercial horticulture of the present day, its commonest representative being the "Chinese fan palm," *L. chinensis,* which is also known to the trade, and improperly, as *Latania borbonica.*

Trunks usually tall, stout, ringed below, clothed above with dead lf.-sheaths: lvs. spreading, orbicular, plicate, split to the middle or below; the segms. bifid, infolded, naked or fibrous along the margins; rachis short; ligule small, cordate, free; petiole long, stout, flat or rounded above, convex below, often spiny along the margins; sheaths margined with reticulate fibers: spadices long, at first ascending, pendent in fr., long-peduncled, loosely branched, the branches slender;

spathes many, long, tubular, compressed, sheathing the peduncle, thick, coriaceous, bifid or 2-lipped, 2-keeled or ancipital: no bracts or bractlets: fls. greenish: fr. smooth and shining, oblong-globose or ellipsoidal, black, blue, yellow or brown.—About 14 species from Trop. E. Asia, Malaya and Austral. From the seven allied genera mentioned under Licuala, Livistona is distinguished by the following characters: fls. hermaphrodite: carpels of the ovary globose, distinct or slightly cohering: styles short, distinct or cohering: albumen not twisted, broadly scooped out on the ventral side: branches of the spadices not bracted or the lower ones bracted. It is also remarkable in the group in having a thread in the lf.-segms., at least in many of the species.

In general, the members of this genus are by no means difficult to grow, though it is well to make some distinctions in culture between such strong-growing and comparatively hardy palms as *L. chinensis* and *L. australis*, and the more tender species from Java and northern Australia, among which *L. humilis*, *L. olivæformis* and *L. rotundifolia* are prominent. For those of the first section a strong loamy soil well enriched with thoroughly decayed stable-manure, good drainage, an abundance of water and a night temperature of 60° will provide satisfactory conditions for sturdy growth. The more tropical species, of which *L. rotundifolia* is a good example, make better progress in a somewhat lighter soil and a higher temperature, 65° to 70° being more congenial to them than the cool treatment accorded their stronger relatives. More shade is also required for the warmhouse species, in order to retain the rich green color that a healthy livistona should present.—Red-spider and white scale are two of the most troublesome insects to the grower of livistonas, the first being controlled to a great extent by thorough syringing, while the latter may be eradicated by the careful use of various insecticides, though avoiding the frequent application of extract of tobacco, the continued use of the latter substance often resulting in injury to the foliage of livistonas.—*L. australis* is a more stubby-growing plant than *L. chinensis*, the fan-like leaves are stiffer and less graceful, and the footstalks are more thoroughly armed with stout spines, while the leaves are also smaller in proportion to the plant than those of *L. chinensis*. *L. Hoogendorpii* and *L. olivæformis* are somewhat alike in young plants, but the first has many more and coarser spines on the footstalks, and the stalks of *L. Hoogendorpii* are generally longer, the leaves of both being much divided. *L. rotundifolia* and *L. altissima* are much alike in a small state, and the writer is inclined to think that the seeds of the latter are sometimes substituted for those of *L. rotundifolia*. The leaves of *L. rotundifolia* are flatter and more even in outline, those of *L. altissima* being somewhat undulated as though they were crowded on the stalk. In fact, small plants of *L. rotundifolia* are usually more symmetrical, and also have longer footstalks or petioles. (W. H. Taplin.)

2186. Livistona humilis.

INDEX.

altissima, 6.
australis, 7.
chinensis, 4.
decipiens, 10.
Hoogendorpii, 8.
humilis, 9.
Jenkinsiana, 1.
Mariæ, 7.
olivæformis, 3.
rotundifolia, 5.
subglobosa, 11.
Woodfordii, 2.

A. *Lvs. glaucous beneath.*

1. **Jenkinsiàna**, Griff. Trunk 20–30 ft., about 6 in. diam.: lvs. 5–6 ft. broad, reniform, flabellate, 70–80-fid, glaucous beneath, the divisions very narrow, straight, shortly and obtusely 2-toothed: spadix 2–3 ft., the branches forked; fls. in tiny bunches, small and green: fr. bluish. Assam. G.W. 12, p. 208.—Perhaps not specifically distinct from *L. chinensis*.

AA. *Lvs. not glaucous beneath.*

B. *Petioles without spines.*

2. **Woòdfordii**, Ridley. Petioles slender, without thorns, only ¼in. thick: lvs. orbicular, quite thin, 2 ft. long, 18 in. wide, split into very narrow acuminate lobes, the lower ones free almost to the base, the inner ones split only one-fourth of the way down: spadices very slender, the short slender branches protruding from the mouths of tubular brown sheaths: drupe globose, ⅜in. diam., bright red. Polynesia. First described in G. C. III. 23:177.—Nearly related to *L. australis*, but more graceful, with smaller fls. and fr.

BB. *Petioles spiny below the middle.*

C. *Length of spines ¼in. or less.*

3. **olivæfórmis**, Mart. (*Corýpha Gebánga*, Hort., in part). Sts. medium: lvs. glabrous; petiole somewhat 3-angled; spines retrorse, 1–3 lines long; segms. 12–15 in. long, deeply bilobed, the lobes very long, acuminate, linear, pendent, with or without very short filaments: fr. olive-shaped, solitary, or twin and connate to the middle. Brazil.

CC. *Length of spines 1 in. or more.*

D. *Shape of lvs. reniform.*

4. **chinénsis**, R. Br. (*Latània borbónica*, Hort., not Lam.). St. 6 ft. high, more than 1 ft. thick, gray, with approximate rings: lvs. many; petiole equaling the blade, covered to about the middle with retrorse brown spines, 1 in. or more long; blade reniform, 4–6 ft. diam.; segms. linear-lanceolate, long-pendulous, deeply forked, filiferous, the lower 1–2 ft. long, 1–2 in. wide, the middle 3 ft. long, the lobes acuminate, 4–8 in. long. China. G. 4:555. J.H. III. 48:185. Gn. M. 6:288. G.W. 10:202.

DD. *Shape of lvs. orbicular.*

5. **rotundifòlia**, Mart. (*Chamærops Bíroo*, Sieb. *C. Býrrho*, Hort.). Trunk 40–50 ft. high, 1–1½ ft. diam., erect or rather weak, brownish black, obscurely ringed; petiole 6 ft., with recurved spines 1½ in. long at the base; blade 3–5 ft. diam., suborbicular, appearing, though not truly peltate; segms. 60–90, connate for one-third their length, bifid to the middle, the lobes long-acuminate. Java. R.B. 21, p. 110.F. R. 1:301. S.H. 2:28.

BBB. *Petioles spiny from base to apex.*

C. *Segms. of lvs. free one-third of the way down.*

6. **altíssima**, Zoll. Mostly stemless, or rarely a few feet of trunk: lvs. bright

shining green, 1½–2 ft. long; segms. free one-third of the way down, bifid at the apex; petioles 2–6 ft., the base inclosed in a reddish brown network of woody fibers; spines stout, black, recurved. Java. A.F. 26:654.

cc. *Segms. free nearly to the base.*

d. *Position of segms. rigid, not drooping.*

7. **austràlis,** Mart. (*Córypha austràlis,* R. Br.). Sts. 40–80 ft. high, slender, and marked with circular scars: lvs. in a dense crown, orbicular, 3–4 ft. diam., divided to or below the middle into 40–50 narrow, plicate, acuminate segms., either entire or 2-cleft at the apex. Austral. B.M. 6274. Gn. 26, p. 337. V. 9:328. G.C. III. 30:287.—A form in which the young petioles and lvs. are blood-red color, said to be wild in S. Austral., has been grown under the name. *L. Màriæ,* Muell.

dd. *Position of segms. drooping.*

e. *Number of segms. 10–12.*

8. **Hoògendorpii,** Hort. St. tall, cylindrical, with triangular lf.-scars: petiole rounded on the back, 3–5 ft. long, red-brown at the base, olive-green above: spines stout, recurved, 1½–2½ in. apart, ¾–2½ in. long: lf. suborbicular, 4½–6 ft. diam.; segms. plicate, cuneate, pendulous at the apex and 5–7-lobed, the lobes acute. Java. I.H. 21:174. F.R. 1:427. Gn. 25, p. 392.

ee. *Number of segms. more than 12.*

9. **hùmilis,** R. Br. Fig. 2186 (redrawn from Martius). Sts. 4–16 ft. high: lvs. at length orbicular-cordate, 3 ft. diam., deeply divided; segms. narrow, plicate, acuminate, the filaments between the lobes altogether wanting or very minute or 1 in. long; petiole much flattened, with acute edges bordered with small prickles intermixed with larger ones, often ½in. long. N. Austral. G.W. 12, p. 208.

10. **decípiens,** Becc. A medium-sized palm with a trunk diam. of about 15 in.: lvs. with about 80 segms., the latter much pendent at the tips; petiole very spiny at the base, long and stiff; lf.-segms. very weak, hanging as though wilted: spadix long, but nodding when in fr. S. Austral.—Little known in cult. but interesting on account of its "weeping" lvs. It is perhaps the *Copernicia cerifera* of some dealers.

11. **subglobòsa,** Mart. A medium-sized palm: lvs. glabrous, the segms. 10–12 in. long, 2-parted nearly to the base, the lobes linear, very acuminate, pendulous: fr. subglobose, borne on a paniculate spadix about a foot long. Java.—Known in Java as "Sedangan."

L. Dournowiàna, Hort., is "a new palm with lvs. resembling those of Lantania borbornica," which is Livistona chinensis, Hab. (?).—*L. Muèlleri,* Bailey. A stout rugged palm about 20 ft.: lvs. densely crowded, the petiole about 3½ ft. long and covered with short curved prickles: fr. oval, nearly 6 in. long. Queensland, G.C. III. 32:431. Not in cult. in Amer.

N. Taylor.†

LLÀVEA (M. la Llave, who discovered the plant). *Polypodiàceæ.* One species, *L. cordifòlia,* Lag., related to Cryptogramma, native to the highlands of Mex., little cult. It grows 2 ft. high or more, with tripinnate lvs. that have fertile segms. on the upper part: sori under the reflexed edges of the segms. It requires warmhouse treatment.

LLÓYDIA (after Edward Lloyd, who found one of the plants in Wales). *Liliàceæ.* Small bulbous plants related to Erythronium, but with leafy stem.

Bulb narrow: st. slender, low, usually 1–2-fld.: radical lvs. few, linear or nearly filiform; st.-lvs. few: fls. small, white or yellowish, long-lasting; perianth 6-parted; segms. withering and persistent; stamens 6, hypogynous, shorter than the perianth: caps. obovoid or subglobose; seeds flattish.—Species 5 or 6, mountains in N. Amer., Eu., Asia.

serótina, Sweet (*L. alpìna,* Salisb. *Anthéricum serótinum,* Linn.). With an oblique, somewhat rhizomatous rootstock, and glands on the claws of the perianth-segms.: radical lvs. 2–4, linear: st. usually 1-fld., 3–6 in. long: lvs. 3–4, small, linear: fls. whitish, yellowish purple at its base, erect. Mountains of Colo. and north to arctic regions and in Eu.—Attractive spring fl.; grows in high mountains.

L. H. B.

LOÀSA (South American name). *Loasàceæ.* Comprises a few flower-garden annuals of minor value.

Annuals and perennials, herbs or subshrubs, of Trop. Amer., erect or twining: lvs. alternate or opposite, entire, lobed or decompound: caps. 3–5-valved from the apex, rarely twisted; ovary 1-celled; ovules numerous. The allied genus Blumenbachia differs in having caps. longitudinally 5–10-valved and most frequently spirally twisted.—Species 80–100. These plants are too much like nettles to deserve general cult., although their fls. are odd and interesting. The pain from their pricks may last several days. Each of the 5-hooded petals contains a bunch of stamens. They are treated as half-hardy annuals. *L. lateritia,* Hook. (*L. aurantiaca,* Hort.), a climbing vine, is *Blumenbachia lateritia* (*Cajophora lateritia,* Klotzsch), which see under Blumenbachia. It is a hispid stinging twiner, with opposite pinnate lvs.: fls. bright orange-red, or brick-red: little grown, but adapted to indoor work and to the open in summer: prop. readily by seeds or cuttings. It is in the American trade as an annual climbing plant: 6–20 ft.

a. *Petals white.*

vulcánica, André (*L. Wállisii,* Hort.). Erect, bushy annual, 2–3 ft. high: lvs. 3–6 in. broad, palmately 3–5-lobed, the lobes serrate, each with a long stalklet, the lateral ones often divided into 3 lfts.: sepals shorter than the petals; petals white; eye of fl. of 2 concentric red bands, with 5 yellow spots outside. Colombia. B.M. 6410. I.H. 25:302. R.H. 1894, p. 233.

aa. *Petals yellow.*

ùrens, Jacq. (*L. híspida,* Linn. f.). Annual, 1½ ft. high: lvs. alternate, 5 in. long, 3½ in. wide, pinnatifid; segms. lobed: fls. bright yellow, 1 in. across; sepals much shorter than the petals. June–Aug. Peru. B.M. 3057. G.C. III. 22:291. Gn. 25, p. 451.

trícolor, Lindl. Annual, 2 ft. high: lvs. opposite, bipinnatifid, very prickly: sepals as long as the petals; petals yellow; crown red; filaments white. Chile. B.R. 667.

L. H. B.

LOBÈLIA (Matthias de Lobel, or L'Obel, 1538–1616, a Flemish botanist and author; Latinized *Lobelius*). Including *Tùpa. Campanulàceæ.* Excellent flower-garden and border plants, annual and perennial.

Mostly herbs, some tropical species somewhat woody: lvs. alternate, sometimes the cauline ones reduced to bracts: fls. blue, red or yellowish, on 1-fld. pedicels, which are arranged in a terminal raceme; corolla gamopetalous and tubular, split down one side; lobes 5, the 3 on the lower side (as the fl. stands) somewhat united and forming a lip, the other 2 (1 on either side of the cleft or split) erect or turned back; calyx short-tubular

2187. Lobelia Erinus.

or globular, joined to the ovary, short-toothed; stamens 5, united into a tube around the single style, the tube often protruding from the cleft into the corolla: fr. a 2-valved caps.—Species 250 or more, in many parts of the world, well represented in E. U. S.

There are two horticultural groups of lobelias,—the annuals and the perennials. The annuals are low normally blue-flowered species suitable for bedding and edgings. They are of the easiest culture either from seeds or cuttings. See *L. Erinus* (No. 1). The perennials are again of two types,—the hardy and the half-hardy or tender. The hardy kinds are natives, of which *L. cardinalis* and *L. syphilitica* are the leading representatives. These inhabit bogs and low places, and the best results under cultivation are to be expected in moist and cool spots. The half-hardy sorts are chiefly derivatives of the Mexican *L. fulgens*, a plant deservedly popular in the Old World, but which has not attained great favor here. These species may be bedded out in the northern states. They are carried over winter in pots or in a cellar. They usually give good results the first year from seed, if started early; or seeds may be sown in the fall and the plants carried over in a frame. The hardiness of the hybrid perennial lobelias in this country is yet to be determined. It is probable that forms of *L. fulgens* will stand outdoors in the middle states if given winter protection. In the latitude of Washington they are hardy in winter but are scarcely able to withstand the summers.

INDEX.

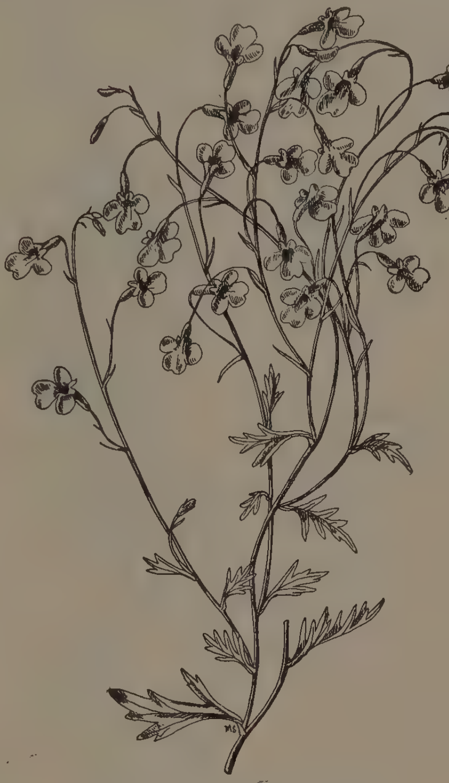
alba, 1c, 6.
angustifolia, 13.
atrosanguinea, 9.
aurea, 13.
bicolor, 1.
cardinalis, 7, 9.
Cavanillesii, 13.
compacta, 1a.
erecta, 1a.
Erinus, 1.
Feuillei, 14.
flore-pleno, 1c.
formosa, 9.
fulgens, 9.
Gerardii, 11.
glandulosa, 6.
Goldelse, 1b.
Golden Queen, 1b.
gracilis, 1, 1a, 2.
grandiflora, 1c.
hamburgia, 1c.
heterophylla, 1, 3, 4.
hybrida, 10.
Kalmii, 5.
kermesina, 1c.
laxiflora, 13.
Lindleyana, 1c.
lugdunensis, 11.
marmorata, 1c.
multiflora, 1c.
Nanseniana, 9.
Paxtoniana, 1c.
perennis, 10.
pumila, 1a.
Queen Victoria, 9.
ramosa, 4.
Richardsonii, 1c.
Rivoirei, 12.
speciosa, 1c.
splendens, 8.
syphilitica, 6.
tenuior, 4.
texensis, 8.
tricolor, 1c.
trigonocaulis, 2.
Tupa, 14.

A. *Plant annual (or so treated), low and diffuse-growing.*

B. *Beards or hairy tufts on only the 2 lower anthers.*

1. **Erinus,** Linn. (*L. heterophýlla*, Hort., sometimes, not Labill. *L. grácilis*, Hort., not Andr. *L. bicolor*, Sims). Figs. 2187, 2188. Diffuse and half-trailing annual or perennial, much used for edgings: glabrous or slightly hairy below, 6–12 in. high: lvs. variable, the lower ones obtuse and obovate or spatulate and crenate-toothed, the upper ones oblanceolate or oblong (becoming linear and acute near the top of the st.), and mostly sharp-angle-toothed: fls. ½–¾in. across, on slender pedicels, light blue or violet with a lighter center (throat white or yellowish); calyx-lobes awl-like, spreading, as long as the corolla-tube; 3 lower lobes of corolla large and spreading. S. Afr. "Stony places in flats and on mountains." B.M. 514; 901.—One of the commonest of all annual edging plants, particularly for early season effects. In our hot climate, it often ceases blooming in midsummer, but with good soil, plenty of water, and occasional cutting back, it will bloom till frost. Seeds sown in Jan. and Feb., will give blooming plants by April and May. For fls. alone, rather than for edgings, the seeds may be started later, or even sown in the open ground. For definite results in edgings, however, it is usually better to start from cuttings. In the fall, lift the best plants, and grow them in pots through the winter as stocks from which to secure cuttings. Cuttings taken in late Jan. or Feb., should give blooming plants by May. Seedlings vary, and one cannot rely on them for definite effects in design work, although they may be best for the amateur who desires only fls. Some strains of seeds, however, come very true. The species is also a good pot-plant for the winter conservatory.

2188. Lobelia Erinus. (Natural size)


2189. Lobelia tenuior. (× ¼-⅕)

Lobelia Erinus is exceedingly variable. The forms fall into three groups:

(*a*) *Variation in habit:* Var. **compácta** or **erécta,** dense-growing forms suitable for low, close edgings: subvarieties are blue, white and so on. The most popular bedding forms belong to this strain. The name *erecta* is often used for the taller strains. Var. **grácilis,** with slender growth and suitable for vases or baskets: blue. Var. **pùmila.** Very dwarf.

(*b*) *Variation in color of foliage:* Golden Queen and Goldelse, with yellowish foliage. Also forms with bronzy foliage, but not constant.

(*c*) *Variation in color and size of fls.:* Var. **álba.** White. Var. **flòre-plèno.** Double. R.H. 1875:71. Var. **grandiflòra.** Various large-fld. forms. Var. **kermesìna.** Crimson. Var. **Lindleyàna.** Rose-color, with white eye. Var. **marmoràta.** Fls. marbled. Var. **Paxtoniàna.** Light blue with white eye: growth straggling. Var. **Royal Purple.** Purple-blue. Var. **speciòsa.** Large-fld., light azure-blue, with white eye. Var. **trícolor.** Fls. blue or pink, with white eye and carmine spots. Var. **hambúrgia,** Hort., has fls. bright blue with white eye; growth very rapid, slender, making it a handsome pot or basket plant. Var. **Ríchardsonii,** Hort. (*L. Ríchardsonii*, Hort.), has long spreading or drooping sts.: lvs. cordate and crisped: fls. light blue, in a long terminal raceme. *L. multiflora* of lists presumably belongs in this species: soft rich pink.

BB. *Beards or hairs on all the anthers.* The three following species are probably not in the American trade, although they are known as cult. plants. The names sometimes occur, but the plants which they represent are probably forms of *L. Erinus.* The descriptions will enable the student to distinguish whether the species occur.

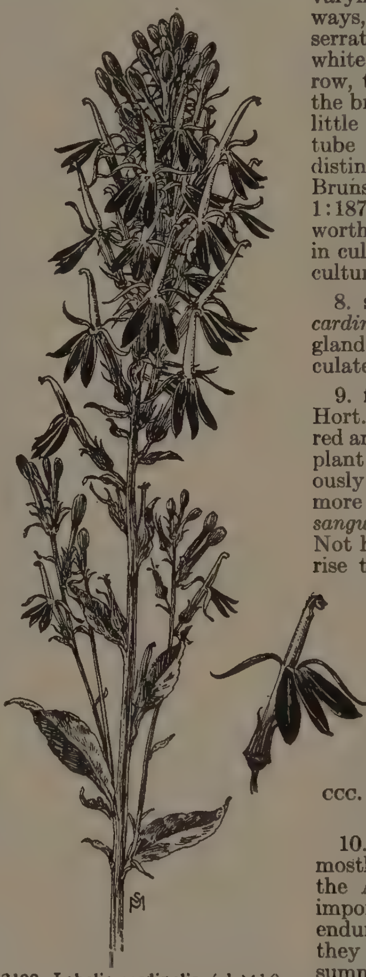
2. **grácilis,** Andr. (*L. trigonocaùlis,* Hook.). A foot or less high, slender, decumbent at the base, glabrous: lower lvs. ovate and deeply cut, the upper ones narrower and pinnatifid (becoming linear and entire at the top of the st.): fls. ½–¾in. across, blue with a whitish eye, the middle lower lobe strongly obovate, the 2 upper lobes small and curved and usually hairy; fl.-cluster long and open, more or less 1-sided: seed angled, not winged. New S. Wales. B.M. 741; 5088.

3. **heterophýlla,** Labill. Much like the last, but fls. larger (the middle lobe nearly 1 in. long), and the lower lvs. parted into linear lobes: seed winged. W. Austral. B.R. 2014. P.M. 9:101.

4. **ténuior,** R. Br. (*L. ramòsa,* Benth.). Fig. 2189. Erect or ascending, 12–18 in., pubescent: lower lvs. small, mostly ternately divided, the upper lvs. linear and mostly entire: fls. rather large, bright blue, borne far apart on very slender pedicels, the middle lobe much the largest and obovate: seed smooth and shining, compressed. W. Austral. B.M. 3784 (as *L. heterophylla*). B. 2:93. R.H. 1856:281; 1905:192. G.C. II. 15:105; III. 29:46. H.F. 7:27. G.W. 10, p. 2. G. 26:385.—It has received new attention in recent years.

AA. *Plant perennial (rarely biennial), usually tall or strict-growing.*

B. *Corolla very unequally bilabiate or 2-lipped, the lower lip 3-lobed and deflexed, the upper lip very small.*



2190. Lobelia cardinalis. (pl. × ⅕)

C. *Species: fls. blue (sometimes varying to white).*

5. **Kálmii,** Linn. A slender perennial (sometimes biennial ?), 6–18 in. high, glabrous, branched: lvs. narrow-spatulate to linear at the top of the st., remotely denticulate: fls. small (⅓in. long), very light blue, in a long, loose raceme, on filiform pedicels. On wet banks and slopes and margins of bogs, in northern states, Ont., Nova Scotia: prop. by offsets. B.M. 2238.—Sold by dealers in native plants. Useful for bog-planting.

6. **syphilítica,** Linn. Strong, weedy herb, 2–3 ft., glabrous or nearly so, mostly simple: lvs. thin, oblong-oval to lanceolate, attenuate to the apex but the point mostly blunt, small-dentate or crenate-denticulate, narrowed into a very short petiole: fls. about 1 in. long in a long, wand-like, racemose spike, blue or purplish, the tube about ½in. long; calyx hairy and enlarging in fr., the lance-acuminate lobes conspicuous, and bearing auricles in the sinuses. Moist places, eastern states (Maine to La.). B.R. 537; 32:6 (as *L. glandulosa*). Mn. 7:61. Gn.M. 5:344. Var. **álba,** Hort., has nearly white fls.—Interesting plant for bog-gardens and moist borders. In dry soils it will grow, but with less vigor.

CC. *Species: fls. in shades of red (or yellow or very rarely white).*

7. **cardinàlis,** Linn. Cardinal Flower. Indian Pink. Fig. 2190. Straight-growing, glabrous or very nearly so, 2–4 ft. tall, usually unbranched: lvs. narrow, varying from oblong-ovate to lanceolate, tapering both ways, the petiole very short or none, margin irregularly serrate: fls. bright intense cardinal (rarely varying to white), the tube 1 in. long, the 3 lower lobes very narrow, the fls. borne in a long racemose spike in which the bracts are mostly very narrow and the upper ones little exceeding the pedicels; calyx hemispherical, the tube much shorter than the long-linear lobes: seeds distinctly tuberculate. Wet places, as in swales. New Bruns. to Sask., and Fla. B.M. 320. G. 2:447. Gn.M. 1:187.—One of the most showy of all native fls., and worthy of cult. in any moist border. It has been long in cult., but has apparently given no important horticultural forms.

8. **spléndens,** Willd. (*L. texénsis,* Raf.). Like *L. cardinalis,* but more slender, the lvs. narrower and glandular-denticulate, mostly sessile: seeds little tuberculate. Wet places, Texas, west and south.

9. **fúlgens,** Willd. (*L. formòsa,* Hort. *L. cardinàlis,* Hort., in part). Very like the last, but fls. larger, deeper red and more showy, the 3 lobes of the lower lip broader: plant mostly pubescent (at least the foliage), and variously tinged or spotted with brown or bronze: bracts more leafy. Mex. B.M. 4002 (as *L. splendens* var. *atrosanguinea*).—Long in cult. and a most desirable plant. Not hardy without protection in the N. It has given rise to many horticultural forms, some of which (as "Queen Victoria") are commonly referred to *L. cardinalis.* The trade name *L. cardinalis atrosanguinea* probably belongs to this species. *L. cardinalis Nanseniana,* a purple-carmine sort, is probably *L. fulgens.* In Eu., *Lobelia fulgens* is one of the popular bedding plants, but it has never gained popularity in Amer. In this country it is usually grown in pots and treated as a conservatory subject.

CCC. *Species-hybrids or derivatives: fls. mostly in shades of red, pink or purple.*

10. **hýbrida,** Hort. The hybrid garden lobelias are mostly of French origin, and they are little known in the American trade, although they are occasionally imported by amateurs. It is doubtful whether they will endure the winters of the northern states, although they make excellent pot subjects for blooming in the summer border. They may also be planted in the open and lifted on the approach of winter: or new stock can be raised from divisions of the old plants, or from offsets, or from seeds. Many of these hybrids are most showy, and they should be better known in Amer. It is probable that they are derived chiefly from *L. fulgens,* although they are said to come largely from *L. cardinalis,* but *L. fulgens* and *L. cardinalis* are confused amongst gardeners. *L. syphilitica* has also, apparently, entered into some of these hybrid derivatives, particularly those with blue or purple colors, and *L. amœna* is supposed by some to be involved (see suppl. list). These hybrids are sometimes known collectively as *L. hybrida* and *L. perennis hybrida.* Two recent forms deserve separate mention (Nos. 11, 12):

11. **Gerárdii,** Hort. Habit of *L. fulgens* or *L. cardinalis:* lvs. lanceolate or lance-oblong, glabrous, denticulate: fls. in a heavy terminal spike or raceme, rich

violet, 1½ in. or more long. Obtained by Chabanne and Goujon of the Botanic Garden of Lyons, and intro. to the trade in 1895 by Rivoire Père et Fils, Lyons. The hispid calyx suggests *L. syphilitica.* R.B. 22, p. 112. I.H. 42, p. 268.—It varies into rose-color (var. **lugdunénsis**), and into coral-red, violet-purple, and the like. The pistillate parent was a form of *L. syphilitica* and the staminate parent was the "Queen Victoria" form of *L. fulgens.* The plant was named for M. Gérard, director of the botanical collection at Lyons.

2191. Lobelia Rivoirei. (×⅓)

12. **Rivòirei,** Hort., Fig. 2191, comprises still more recent types, with very large rose or pink fls. Gn. 56:182, which plate represents several derivative lobelias. G.C. III. 24:233. G.W. 4, p. 127.

BB. *Corolla somewhat equally 2-lipped, the lower lip only notched, the upper one 2-parted.*

13. **laxiflòra,** HBK. (*Syphocámpylus bícolor*, Don). Tall, branching herb or subshrub, with thinly hairy sts.: lvs. lanceolate or ovate-lanceolate, acuminate, sharp-denticulate: fls. nodding, on long, axillary pedicels, 1½ in. long, cylindrical, the stamens projecting from the side, red and yellow, pubescent. Mex.—An old plant requiring cool greenhouse cult., or thriving in the open in pots. It may also be planted out like *L. fulgens.* Var. **aùrea,** Hort., is a yellow-fld. variety. Var. **angustifòlia,** DC. (*L. Cavanillesii*, Hort.). Lvs. long and narrow, sometimes even linear: fls. scarlet with orange-yellow lip; corolla 1 in. long. Mex. B.M. 3600 G.C. III. 1:585; III. 57:263. A good tall subject for pots in a greenhouse and for planting-out in summer. Seeds sown in Feb. should give blooming plants in Aug.

BBB. *Corolla with all the lobes united by the tips into 1 lip.*

14. **Tùpa,** Linn. (*Tùpa montàna*, Hort. *T. Feuíllei*, Don. *Lobèlia Feuíllei*, Hort.). Very strong herb or subshrub (4–7 ft. tall), erect and mostly simple: lvs. oblong-oval, mostly acuminate, rugose, tomentose, denticulate: fls. in a long, terminal raceme, blood-red, 2 in. long, the hooded lip curving downwards and the column of stamens ascending; calyx-lobes short. Chile. B.M. 2550. G.C. III. 52:243. R.H. 1898, p. 189. G.W. 4, p. 139.—Cool greenhouse; hardy in southern states with protection.

L. amœna, Michx. Much like L. syphilitica, but the calyx plain and not hispid; corolla ½in. long, bright blue. N. C., south.—*L. ánceps*, Thunb. Perennial, blue-fld., with somewhat fleshy lvs. and 2-winged st. S. Afr. B.M. 2277 (as L. decumbens); 2519 (as L. rhizophyta).—*L. coronopifòlia*, Linn. Somewhat shrubby, with pinnatifid hairy lvs. and handsome blue fls. (sometimes 1 in. long), on long scapes. S. Afr. B.M. 644. G.C. II. 15:105.—*L. Dortmánna*, Linn. WATER LOBELIA. Aquatic perennial, 1 ft. or less, with lvs. radical and submerged, and small pale blue fls. on a scape. Useful amongst aquatic plants. Native.—*L. heterodónta*, Sprague. Erect, 3 ft. or more (perennial?): lvs. sessile, lanceolate, serrate: fls. pale green in a long raceme, the lobes about 1 in. long. Trop. Amer.—*L. horténsis*, DC., is a hybrid form of L. amœna, probably not in cult. now.—*L. inflàta*, Linn. INDIAN TOBACCO. Annual, of N. Amer., with ovate, pubescent, denticulate lvs., erect habit, and small blue or whitish fls.: herbage very acrid: plant formerly a domestic remedy.—*L. linnæoìdes*, Petrie. One of the New Zeal. lobelias: perennial, creeping: lvs. orbicular or ovate-orbicular, toothed: fls. white, purplish beneath, the corolla ⅓in. long.—*L. nicotianæfòlia*, Heyne. A striking perennial, 6 ft. and more: st. as thick as the arm at base: lvs. narrow-lanceolate, to 2 ft. long: fls. white (or pale lilac) in a branching infl. 2 ft. or more long. S. India. B.M. 5587. G.C. III. 35:195.—*L. sessilifòlia*, Lamb., from Kamtschatka: perennial, 1 ft. or so: fls. violet-blue, produced freely: lvs. broad, serrate: requires a wet place. G. 29:541.—*L. subnùda*, Benth. Annual from Mex., with radical lyrate lvs. and small pale blue fls. on long pedicels. G.C. III. 2:304.—*L. taliénsis*, Diels. Erect, to 4 ft. (perennial?): lvs. narrow-obovate or obovate-oblong: fls. blue, 1–1¼ in. long. W. China.

L. H. B.

LOBLOLLY BAY: *Gordonia Lasianthus.*

LOBOSTÈMON (Greek *lobe* and *stamen:* the stamens opposite the corolla-lobes). *Boraginàceæ.* Perennial herbs and shrubs, rough-pubescent or hispid, with alternate sessile often granular lvs., and white or blue fls. mostly in terminal cymes and heads. They are closely allied to Echium: species perhaps 50 in S. Afr. Apparently none is in the trade, although *L. formòsus*, Buek (*Èchium formòsum*, Pers. *E. grandiflòrum*, Andr.), is likely to be found in choice collections: shrubby and branched, 3 ft.: lvs. lanceolate to obovate-lanceolate: fls. reddish changing to blue, in spicate racemes. B.M. 1772. B.R. 36 (both as *E. fruticosum*).

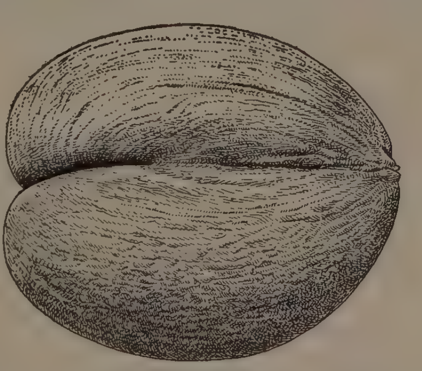
LOCHÈRIA (for Dr. Hans Locher of Zurich). *Gesneriàceæ.* Comprises a few species, which are now referred to Achimenes. In the trade are 2 species, *L. heterophýlla*, Œrst., or *L. ignéscens*, Klotzsch (see *Achimenes heterophylla*, p. 207), and *L. hirsùta*, Regel (see *Achimenes hirsuta*, DC., p. 208, suppl. list).

LOCO-WEED: *Astragalus; Oxytropis.*

LOCUST: Common locust is *Robinia Pseudacacia.* **Honey L.,** *Gleditsia triacanthos.* **Swamp** or **Water L.,** *G. aquatica.*

LODOÌCEA (said to be a modification of Laodice, daughter of Priam). *Palmàceæ.* DOUBLE COCONUT. COCO DE MER. MALDIVE-NUT, from the specimens found on the shores of the Maldive Islands in early days. One remarkable palm in the Seychelles (Indian Ocean), bearing an immense double nut which is one of the curiosities of the vegetable kingdom; the tree is sometimes seen in botanic gardens.

maldívica, Pers. (*Còcos maldívica*, Gmel. *Borássus Sonneràti*, Giseke. *Lodoícea callipỳge*, Comm. *L. sechellàrum*, Labill.). Fig. 2192. Tall diœcious palm, large in all its parts: lvs. palmately not deeply cut into many flabellate lobes or segms., the blade 6 ft. across, ovate-subrhomboid, cuneate at base, the segms. bifid, petiole 8–10 ft. long: fls. in axillary spadices which are subtended by several truncate spathes, the male fls in clusters in the hollows of the axis of the spadix and the female fewer and in cups or receptacles formed by a pair of bractlets; stamens in male fls. about 36, the pistil rudimentary; ovary in female fls. mostly 3-celled, the stamens being represented by staminodia: the great fr. usually 1-seeded, mostly 2-lobed: male spadix to 6 ft. long; female spadix of similar length, pendulous on a peduncle 1 ft. long; perianth ½in. long. B.M. 2734–8. G.C. II. 25:557; III. 4:732; 8:417. F.S. 5:523. Journ. N. Y. Bot. Gard. 7:8, 9 (1906).



2192. The double coconut.—Lodoicea maldivica.

The double coconut is one of the giants among palms, its straight and smooth trunk frequently reaching a height of 100 feet, and it is also a centenarian before its full growth is attained. The seeds of lodoicea are probably the largest known, the individual nuts being said to weigh sometimes fifty pounds, though the largest usually seen in collections do not likely exceed about fifteen pounds. The formation of such gigantic seeds requires a considerable period of time, and from the time of flowering to the full maturity of the seeds is said to cover a period of nearly ten years. The germination of such seeds is not an easy process, requiring much room and strong heat, the radicle being correspondingly large and running down for 3 feet or more before the top growth begins. Young plants require a strong and moist heat; and a considerable amount of root room, in combination with a light but rich compost, is best adapted to their needs. Seeds sometimes require three years to germinate. They are not advertised for sale at present, but have been sold as curiosities now and then in America. Their germination is a great event, but the plants are never grown to any considerable height, as they require too much care and room. The old nut remains attached at the surface of the ground until the tree is some years old. It is said that the heart of the crown of lvs. is eaten, as in the cabbage palm, and the lvs. are used in house-building. L. H. B.†

LŒSÈLIA (John Lœsel, an early Prussian botanist). *Polemoniàceæ*. Greenhouse plants, grown in the open far South, for their flowers.

Very close to Gilia, and often confused with it; and the genus is variously defined. As accepted by Peter in Engler & Prantl, it comprises 16 species in N.W. N. Amer., Mex., Cent. Amer. and northwestern Trop. S. Amer. The species occur very little north of Mex., however. As finally outlined by Gray (Suppl. Syn. Fl.), it has "fls. involucrate or involucellate; both bracts and calyx wholly or partly scarious; corolla funnelform, either regular or 1 or 2 sinuses deeper; seeds winged or margined, the surface becoming mucilaginous when wetted: suffruticose, rarely annual, with spinulose-toothed lvs."

L. coccínea, Don, is a handsome plant with brilliant rose-red tubular-trumpet-shaped fls. an inch long in terminal fascicles or compound bracted racemes, with stamens and 3-lobed stigma exserted: lvs. small and stiffish, oval or cuneate-oval, sharply and often spinulose dentate, grayish green: plant strict, pubescent, woody, perennial. Winter bloomer. It is offered in Calif. **L. tenuifòlia,** Gray, and **L. effùsa,** Gray, of S. Calif., are phlox-like plants offered some years ago. The former, Gray subsequently referred to *Gilia tenuifolia*, Gray, and the latter to *Gilia Dunnii*, Kellogg. L. H. B.

LOGANBERRY. Figs. 2193, 2194. The loganberry was originated by Judge J. H. Logan, of Santa Cruz, California. It is the result of a cross between the Aughinbaugh, a variety of *Rubus vitifolius*, the wild blackberry of California, and a red raspberry, probably the Red Antwerp. It was a chance hybrid developed from seed in 1881. Since that time the cultivation of the plant has increased extensively. It is cultivated all the way from southern California to British Columbia. However, while being a very vigorous plant, it is very tender and will not succeed where the temperature reaches zero unless protected and even under protection does not seem to fruit as heavily as it does where very mild winters are experienced.

A few years ago it was thought that the loganberry industry was overdone. This was due to the poor shipping character of the fruit and the fact that the berry was but little known; but at the present time not nearly enough fruit can be secured for canning and evaporating, and the berry promises to be one of the best horticultural assets of the Pacific coast. It is one of the very strongest-growing brambles and has a characteristic dark green foliage which it holds throughout the year.

The fruit when thoroughly ripe is of a purplish red and is very large, being one of the largest berries grown. In flavor and habits it shows the characteristics of both the blackberry and raspberry. Unless very ripe the fruit is exceedingly acid, but when thoroughly ripe has a pleasant acid flavor.

In western Oregon the fruit is coming to be of tremendous commercial importance. Salem is the principal center of the industry of the state, there being about 2,000 acres planted in that vicinity and the present outlook is that the acreage will be at least doubled. Extensive plantings are found all over western and southern Oregon. Many of the cultivators are taking hold of the loganberry industry in an extensive way, individual growers planting out as many as 200 acres in one season, while others are devoting from 100 to 200 acres purely for propagation purposes.

There are two other berries being grown in this same area which are very similar to the loganberry, one being the Primus, which is a blackberry-raspberry hybrid, introduced by Luther Burbank. It is an excellent home berry but cannot be picked easily until it is too soft to ship. It is also too shy a bearer to be commercially profitable. The Phenomenal is also a hybrid introduced by Luther Burbank and is supposed to be a cross between the California dewberry and the red raspberry. It is less acid than the loganberry. The fruit, if anything, tends to run a little larger, is a little brighter in color, the foliage is a lighter green and is a better shipper than the loganberry, but it does not yield nearly so well. It does not seem to be so long-lived and it is thought by the growers that it is not so good an evaporating berry as the loganberry. As far as the Pacific Northwest is concerned, the loganberry is driving the other hybrids from the market.

The loganberry tends to vary greatly in its seedlings and offers one of the best fields for plant-breeding to be found among small-fruits.

2193. Loganberry. (×⅜)

It will grow on any of the well-drained loams and is found to succeed well on the red hill soils and the silty loams along the rivers. It is thought by many of the growers that it prefers a clay subsoil rather than a gravelly or sandy subsoil. When planted on deep rich loams the plant seems to be longer-lived. There are commercial plantings in Oregon fourteen years old that are still very profitable. The principal requisite as regards soil and place is that the drainage must be very good, as the plant is an exceptionally heavy feeder.

The loganberry is propagated very easily by rooting the tips in the fall. In choosing plants to set out, one should choose either very vigorous-rooted tips, or else vigorous one-year-old plants. It is not advisable to plant the cutting or weak tips.

The fruit has not been grown commercially long enough as yet to demonstrate conclusively the best methods, especially as related to the distances of planting. Some growers put the rows as close together as 6 feet, some prefer 7 feet, but the larger number plant them 8 feet apart each way. The plants are set in the rows from 4 to 16 feet apart. When the plants are set as close together as 4 feet, the pruning is very different from that when planted at the greater distances. When planted close together the plants are kept headed back.

It is customary to train the plant as a trailer. It will be some time before it will be demonstrated thoroughly which method of pruning and training is superior, and naturally the distances at which the plants should be set will depend greatly on the soil in which they are grown.

The plants should be given very good care the first year. They do not tend to make a strong growth until the fall months, when the growth is very rapid. In the fall, good strong trellises should be provided. The most common method is to get good strong 7-foot cedar posts. These are set 30 feet apart. Two wires are generally strung on these posts, the first wire being 2 feet from the ground, the second one at or near the top of the post. Number 12 galvanized iron wire makes a very good wire for stringing. It is customary to run the rows north and south in order to obtain a good distribution of sunlight. There are many methods used in training the vines on the wires. Some growers practise the twining together of two or three fruiting canes, fastening them in a bundle to the wires. Others start out the canes in a fan shape. One of the best systems, and one that is meeting with considerable favor, is the weaving of the vines in and out among the wires. This weaving is performed whenever a shoot tends to come out in the row. This method seems to give a very good distribution of the fruiting canes along the wire. It is thought by many growers that it is well not to try to train the plants too high, since the finest berries are grown in the shade and one must take into consideration the convenience of the pickers.

So far, the pruning consists chiefly of cutting out the old canes and the general practice is to remove these canes as soon as the fruit is picked in July, thus minimizing any danger from disease.

The training of the new shoots for the succeeding year's growth may be done during the season or left until fall. A few of the growers wait until spring, thinking that if they have an unusually cold winter their plants are thus protected. In the growing season if the new plants interfere with the tillage or handling of the crop, they are generally kicked in under the fruiting canes. Sometimes small stakes are driven down to hold them in place.

The tillage given to the loganberry is very similar to that given other cane-fruits. If they suffer for lack of moisture or food, the berries become very small. Some growers practise plowing the ground up toward the plants in the fall and away in the spring. The most common practice is to leave the ground heaped up somewhat around the plants, as this usually means that the plants become deeper rooted and the moisture-supply is better held than when the ground is kept level.

The yield will vary tremendously, extremes probably being one to seven tons to the acre, with about four tons an acre as a very good average. A number of the growers the past year reported at least six tons, and one patch of 424 vines produced 425 crates. At the present prices and with the heavy yields the profits are very satisfactory. The wholesale price is 4 cents a pound, either for canning or evaporating. These figures mean a profit of $100 to $300 an acre. Some of the growers have contracted their crop up to 1920.

2194. The loganberry as grown in Oregon.

Thus far there are no troublesome insects and only one disease, namely, the cane anthracnose, which is very similar to the anthracnose that attacks other cane-fruits.

At the present time, the demand is many times greater than the supply for both canning and dried berries. The reason for this is that the loganberry has proved to be one of the best pie berries on the market. It makes a very excellent jelly, and its juice is a very refreshing beverage and is thought by many to be superior to grape-juice. Undoubtedly in the near future the juice manufacture will become a very extensive industry. At the present time such cities as Chicago, St. Paul, Omaha, and St. Louis, are unable to buy the quantities of dried and canned loganberries that they desire.

The berries are consumed fresh, but to be relished must be thoroughly ripe. Unless in a ripe condition the acid is so strong as to be unpleasant. Canned berries are generally put up in enameled tin cans, since the common tin cans are eaten by the acid.

In evaporating the berry, the common prune-drier is used. The berries are spread on trays of galvanized iron mesh wire. The trays are about 36 by 20 inches and the fruit is piled ½ to 1 inch deep on these trays. It takes from sixteen to twenty-four hours to evaporate the loganberry and probably twenty-four hours turns out a better product than when only sixteen hours is given. The tunnel drier is about as good a drier as can be used. The fruit is first placed in a temperature of 135° to 150° and this temperature is gradually increased until 165° is reached. The berries should be nicely dried in 16 hours; some seasons in less time. The product will be better than when the temperature is started low. The berries should be carefully selected and only ripe berries used, as the green berries do not dry well. It is almost impossible to dry them and even though they do dry they are too tart. If the fruit is uniformly ripe it dries very uniformly; but if it is over-ripe it tends to drip badly, caramels and burns easily. The wholesale price for the dried product is at the present time about 28 cents a pound. The berries dry down to about one-fifth, so that a twenty-five-pound crate will produce five pounds of dried fruit, although the percentage of the dried fruit to the fresh fruit will vary considerably. The first few pickings dry down more than those which come later, and should there be heavy rains the berries grow very large and luscious but contain relatively more water. It costs roughly about a cent a pound to dry the berries, although the commercial evaporators are charging about 3 cents for each dried pound. After drying, the berries are allowed to sweat and are handled about the same way as blackcap raspberries. They are then packed in boxes which hold either twenty-five or fifty pounds each.

Since the prune and the loganberry grow on similar soils successfully and both can be evaporated in the same drier, there are a number of growers who are combining these two crops. Thus a greater revenue is derived from the money invested in the evaporators. Loganberries come into bearing the second year and bear heavily the third, while the prune bears some the fifth year but not heavily until the seventh. The average evaporator will cost about $2,000 and such a building can handle the product of 40 acres.

As yet the loganberry is sold only in the United States. No attempt has been made to send it to foreign countries. This is due to the fact that the growers have not been able to satisfy the buyers who come to them. The future for this berry appears to be promising, the indications being that it will be many years before the demand can be satisfied.

C. I. Lewis.

LOGÀNIA (James Logan, Governor of Pennsylvania in Colonial times). *Loganiàceæ.* About 20 herbs and shrubs of Austral. and probably 1 in New Zeal., with mostly small white or flesh-colored more or less imperfect fls. Lvs. opposite: corolla campanulate or the tube cylindrical, the lobes 4 or 5; stamens 4 or 5, inserted in the tube; ovary 2-celled, becoming an ovoid or globular or oblong dehiscent caps. The loganias are seldom cult. They probably require the treatment of other coolhouse Australian things. *L. floribúnda*, R. Br., is an erect shrub with lanceolate or linear lvs. and white fls., of which the females are usually smaller than the males, in axillary short cymes or panicles. L.B.C. 12:1118. *L. latifòlia*, R. Br., is an erect shrub or undershrub, often glaucous, with broadly obovate to oblong-elliptic lvs. and white fls. in dense terminal cymes. Both species grow about 3 or 4 ft. high.

LOISELEÙRIA (after J. C. A. Loiseleur-Deslongchamps, physician and botanist in Paris, 1774–1849). Syn., *Chamælèdon, Chamæcistus. Ericàceæ.* A procumbent hardy evergreen shrub with very small, mostly opposite, closely set, entire lvs., and with small, usually rose-colored fls. in terminal, few-fld. umbels. A single species in the subarctic regions and high mountains of the northern hemisphere, allied to Kalmia and Leiophyllum, but calyx 5-parted, nearly as long as the bell-shaped corolla, stamens 5, with the anthers opening lengthwise and caps. 2–3-celled. Well adapted for rockeries, forming depressed tufts, but not easy to grow and rarely cult. It grows best in a sunny or partly shaded position in a porous, peaty and sandy soil, which is well drained and has a constant but moderate supply of moisture. Prop. by seeds treated like those of rhododendron or by cuttings of half-ripened wood under glass. **L. procúmbens,** Desv. (*Azàlea procúmbens*, Linn. *Chamæcístus procúmbens*, Kuntze). Only a few inches high, quite glabrous: lvs. petioled, oval to narrow-oblong, revolute at the margin, about ¼in. long: fls. 1–5, on rather short pedicels, pink or whitish, about ⅕in. across. July, Aug. L.B.C. 8:762. G.C. III. 53:343.

Alfred Rehder.

LÒLIUM (the ancient Latin name). *Gramineæ.* Darnel. Rye-Grass. Tufted grasses with flat blades and slender spikes.

Spikelets several-fld., sessile, placed edgewise on opposite sides of a zigzag axis.—Includes about 6 species of Old World grasses, 2 of which are intro. in the eastern states and are familiar fodder grasses of the same region. Perennial rye-grass was probably the first pasture grass to be cult. in Great Britain, and is grown there yet to a considerable extent, where it is said to occupy the same relative position of importance that timothy does here. A weedy species, *L. temulentum*, reputed to be poisonous to cattle, is supposed to be the "tares" of Scripture. It is the darnel, although that name is sometimes, but perhaps erroneously, applied to other species. Our 2 cult. species are short-lived perennials or the second scarcely more than an annual, not to be recommended for permanent pasture or lawn, but are frequently employed for hay or annual pasture. They are successful only in the moist regions of the eastern states. Seed sown in autumn or early spring, 25–30 lbs. to the acre. Rye-grass is often sown in lawn mixtures to give a quick covering to the soil, especially in large expanses such as parks and public grounds. It is replaced gradually by other constituents of the mixture that are more permanent. The loliums are agricultural grasses, scarcely grown for ornament or as garden plants.

perénne, Linn. Perennial Rye-Grass. One to 3 ft. high, with shining lvs. and slender spike, 4–10 in. long: spikelets 8–16-fld., awnless or only short-awned. Dept. Agric., Div. Agrost. 7:301.

multiflòrum, Lam. (*L. itálicum*, A. Br.). Italian Rye-Grass. Regarded by many as a variety of the preceding. Differs chiefly in having longer awns to the florets. Ibid 302.—This form of rye-grass is common on the Pacific Coast as a weed in open ground. It is there often called Australian rye-grass.

A. S. Hitchcock.

LOMÀRIA (Greek, *loma*, a forage). *Polypodiàceæ.* A generic name for a group of ferns, sometimes recognized as distinct from Blechnum, to which they are here referred. The species of ferns classed as Lomaria in Cyclopedia of American Horticulture have been referred to Blechnum in the present edition as follows: *L. ciliata* =*B. Moorei*, C. Chr.; *L. lanceolata*, Spreng.=*B. lanceolatum*, Sturm, *L. discolor*, Willd.=*B. discolor*, Keys; *L. gibba*, Labill.=*B. gibbum*, Mett.; *L. Boryana*, Willd.=*B. tabulare*, Kuhn; *L. spicant*, Desv.=*B. spicant*, Withers; *L. nipponica*, Kunze=*B. spicant* var.; *L. costaricensis*=Plagiogyria; *L. procera*, Spreng.=*Blechnum capense*, Schlecht., in Trop. Amer., Afr., New Zeal., etc.: rhizome short and stout, often woody, erect or prostrate: fronds many, 1–4 ft. or even to 10 ft. and more; pinnæ usually very numerous, 12 in. or less long, the margins minutely toothed. Variable. Var. *chilensis* (Kaulfuss) is sometimes mentioned in horticultural literature. G. 36:45.

A recent monograph on this group of ferns recognizes it as a distinct genus, but under the generic name Struthiopteris which is considered to take precedence of Lomaria.

R. C. Benedict.

LOMARIÓPSIS: *Stenochlæna.*

LOMÀTIA (from Greek word for *edge*, alluding to the winged seeds). *Proteàceæ.* About a dozen shrubs and trees in Australia and Tasmania, and in Chile, little known in cultivation, a very few of which are in the trade. They are coolhouse subjects, and suitable for the open in the warmer parts, grown primarily for the handsome dentate, pinnate or pinnatifid foliage. They require the general treatment of the Australian cool greenhouse things; propagated by well-ripened cuttings.

Leaves variable, alternate, from entire to toothed and bipinnatifid: fls. small, perfect, in pairs, borne in terminal or axillary racemes, white, pale yellow or reddish; perianth irregular, with an oblique tube open along lower side, the long lobes cohering in an ovoid-globular recurved limb; anthers sessile; ovary on a long stipe, with a long style and flat stigmatic disk: fr. a coriaceous follicle. **L. ferrugínea,** R. Br. (*L. pinnatifòlia,* Hort.), is the species most likely to be cult.: Chile: graceful in habit, handsome, with grevillea-like foliage: lvs. 2-pinnatifid, very dark green above and tomentose beneath, the segms. ovate and 3-toothed at the point: fls. about ½in. long, golden yellow and scarlet, rusty-hairy outside. B.M. 8112. G.C. III. 42:232, 233. *L. obliqua,* R. Br. Chile. Shrub or tree with densely leafy erect branches: lvs. ovate, crenate, leathery, smooth and bright green, 3–4 in. long: fls. white, with rusty hairs, about ⅓in. long, in short axillary racemes. *L. longifòlia,* R. Br. Austral. Erect, 8–10 ft., evergreen, glabrous or nearly so: lvs. linear-lanceolate to oblong-lanceolate, remotely serrate, 4–8 in. long: fls. greenish white, in terminal and axillary not elongated racemes, the perianth about ⅓in. long. B.M. 7698. B.R. 442.

L. heterophýlla is offered as an "elegant evergreen foliage plant."

L. H. B.

LOMÀTIUM (name refers to the *bordered* or winged fruit). *Umbellíferæ.* Under this name of Rafinesque's are now separated the American plants that have been referred to Peucedanum. More recently, however, the name Cogswellia has been substituted, although lacking priority, because Lomatium is held to be too much like the older Lomatia of Robert Brown. Lomatiums are mostly W. American plants, of about 60 species, growing in dry soil. They are mostly low or stemless perennial herbs from tuberous or fusiform roots, and compound (ternate, pinnate or dissected) lvs. From Peucedanum the genus differs, according to Coulter & Rose, as follows: "Peucedanum consists of tall and branching mesophytic plants of low fertile meadows of the Old World, with several umbels, conical stylopodium, and solitary oil-tubes; while Lomatium consists of low xerophytic plants of acaulescent habit belonging to the arid regions of W. N. A., with usually single umbels terminating simple elongated peduncles, no stylopodium, and often several oil-tubes." Horticulturally, the lomatiums are of small value, and they have not been cult. sufficiently to have given rise to cultural forms. A few of the species have been offered by dealers in native plants. They seem to thrive well in dry exposed places. They are interesting for the front row of hardy borders and for colonizing in wild open places, and for use in rockwork. Two of the species come as far East as Nebraska and Iowa.

A. *Peduncles usually slender, never swollen at the top.*

B. *Bractlets of involucel conspicuous, often broad or united at base.*

dasycárpum, Coult. & Rose (*Peucédanum dasycárpum,* Torr. & Gray). St. very short or wanting: peduncles several, stout, pubescent, 2 in. or less high: lvs. rather small, pinnately decompound, the numerous segms. short-linear: umbel 6–15-rayed, bearing white fls.: fr. nearly orbicular. S. Calif.

BB. *Bractlets small or wanting.*

C. *Lvs. narrow in outline, pinnate.*

Hállii, Coult. & Rose (*P. Hállii,* Wats.). Very short-stemmed, the peduncles 6–16 in. tall and glabrous: lvs. oblong in outline, the segms. ovate and deep-toothed or pinnatifid: umbel 3–6-rayed, bearing yellow fls.: fr. broadly elliptical, glabrous. Ore. and Wash., alpine.

CC. *Lvs. broad in outline, 1–3-ternate.*

platycárpum, Coult. & Rose (*P. símplex,* Nutt.). Often tall and stout, but sometimes nearly stemless: lvs. ternate or 2-ternate, the lfts. almost filiform to linear-lanceolate: umbel 3–15-rayed, bearing yellow fls.: fr. broadly oblong to nearly orbicular, sometimes emarginate at each end. Colo. and Utah to Mont. and Wash.

triternàtum, Coult. & Rose (*P. triternàtum,* Nutt.). Sometimes 2–2½ ft. high: lvs. 2–3-ternate, the lfts. narrow-linear to linear-lanceolate: fls. deep yellow: fr. narrowly oblong, glabrous. N. Calif. to Brit. Col.

AA. *Peduncle stout, swollen at the top.*

nudicaùle, Coult. & Rose (*P. leiocárpum,* Nutt. *Smýrnium nudicaùle,* Pursh). Stemless, glabrous: peduncle 12–16 in. tall, from a long, fleshy root: lvs. 1–2-ternate or 3-quinate, the lfts. thickish and ovate to narrow-lanceolate: umbel unequally 5–20-rayed, bearing yellow fls.: fr. narrowly oblong. Calif. to Brit. Col. and Idaho.

L. H. B.

LOMATOPHÝLLUM (Greek compound, referring to the *bordered leaves*). *Liliàceæ.* A few species in the Mascarene Isls., with the habit and perianth of Aloe, but differing in the red-margined or cartilaginous-margined lvs. and fr. a berry. They are fleshy subshrubs with hermaphrodite fls. and introrse anthers as in Sansevieria, but differ in having declined hypogynous stamens and several ovules in a cell, whereas Sansevieria has erect stamens inserted on the throat of the tube and solitary ovules. They are probably not in commercial cult. *L. borbónicum,* Willd. (*L. aloiflòrum,* Nichols.), the Bourbon aloe, is the one most likely to be found in amateur collections: st. 8 ft., thick at maturity: lvs. about 3 ft. long, horny-toothed, bordered red: fls. yellow, with brown-red outside, about ¾in. long. Mauritius. B.M. 1585 (as *Phylloma aloiflorum*).

LÒNAS (derivation in doubt; possibly a recombination of some of the letters of Santolina). *Compósitæ.* Species one, an unimportant hardy yellow-flowered "everlasting," known to the trade as the African daisy or *Athanasia annua.*

Leaves coarsely toothed or entire: heads small, in dense terminal corymbs, the fls. all alike; corolla yellow and regular: achene glabrous, angled and 5-ribbed; pappus cup-shaped, making a lacerated crown. The heads are about ⅜in. across, and composed entirely of disk-fls. There are 14 or more heads in the largest corymb, which may be 2 in. across. This plant was removed from Athanasia largely because it is an annual herb, while the athanasias are shrubs or subshrubs. A more fundamental reason for giving this plant a separate genus us that it has a cup-shaped pappus, while in Athanasia the pappus is absent or consists of small rather bristly chaff or else of hyaline hairs. The plant is of very easy cult.

inodòra, Gaertn. (*Athanàsia ánnua,* Linn.). AFRICAN DAISY. Annual, fleshy, branching, 1 ft. high: lvs. alternate, pinnatifid, the divisions linear, entire, remote: corymbs dense: seeds 5-ribbed, not hairy. Aug., Sept. Medit. region. B.M. 2276. J.H. III. 31:281.—Scarcely in cult. outside of botanic gardens, and of little horticultural importance.

N. TAYLOR.†

LONCHÌTIS (*lance,* from the shape of the fronds). *Polypodiàceæ.* A few species in Trop. Afr., allied to Pteris, differing in the sori: large ferns, the segms. broad and leafy, with interlocking veins: sori marginal, crescent-shaped, or kidney-shaped, on the ultimate sinuses, the pergamentaceous indusium formed of the reflexed membranous edge of the frond. They are warmhouse ferns little seen in cult. *L. pubéscens,* Willd., in several forms and under various names, is the species best known horticulturally. Stipes 1–2 ft. long, woolly pubescent, the fronds 2–4 ft. long, 3-pinnate, the lower pinnæ 1 ft. or more long, woolly or downy; pinnules lanceolate and deeply cut, to 1½ ft.

long; lfts. light green and soft, cut nearly or quite to the midrib into oblong-crenate segms. Trop. Afr., Cape, Mauritius and Seychelles.

LONCHOCÁRPUS (*lance-fruit*, from the shape of the pod). *Leguminòsæ*. Trees or climbing shrubs, in many species, in Trop. Amer. and Afr. and Austral., apparently not in the trade and little cult. Lvs. alternate, odd-pinnate, the lfts. opposite and sometimes stipellate: fls. papilionaceous, violet, purple or white, racemose or paniculate; standard very broad or rarely linear-oblong; wings oblique or falcate, lightly adhering to keel above the claw; keel arcuate or nearly straight; stamens 9 and 1: pod oblong or elongated, flat, indehiscent, the seeds few or only 1. An indigo is secured from the genus. *L. Bárteri*, Benth., is a glabrous climber from Guinea: lfts. 5–7, oblong, 5–6 in. long: fls. rose-colored, in clusters of 8 or 10. B.M. 6943. Said to be a good climber for the warmhouse. *L. ròseus*, DC., from S. Amer., has lfts. 13–15, lanceolate, acuminate: fls. large and showy, rose-colored. *L. latifòlius*, HBK., W. Indies, Cent. Amer. to S. Amer., a shrub or tree, has 2–4 pairs of elliptic or lance-oblong lfts., and pale purple fls.

On *L. speciòsus*, Bolus, about 10 years ago Harms founded the genus Bolusanthus (*B. speciòsus*, Harms). It is described by Bolus as a very distinct species with large and handsome bright blue fls.: tree, 15 ft. or more: lvs. stalked, the lfts. oblique-lanceolate and very acuminate: fls. 10–30 in terminal recurved or pendulous racemes. Delagoa and Transvaal.—Probably not cult. to any extent.

L. H. B.

LONGAN: *Euphoria*.

LONÍCERA (after Adam Lonicer or Lonitzer, a German physician and naturalist, 1528–1586). Including *Caprifòlium*, *Xylósteum*, *Nintòa* and *Chamæcérasus*. *Caprifoliàceæ*. HONEYSUCKLE. Ornamental shrubs grown for their handsome, usually profusely produced, often fragrant flowers and attractive berries.

Deciduous, rarely half-evergreen or evergreen, upright or climbing: lvs. opposite, usually short-petioled, entire or very rarely sinuately lobed, in a few species with distinct stipules: fls. in axillary peduncled pairs, each pair with 2 bracts and 4 bractlets, the latter often more or less connate into a cupula, sometimes wanting, or fls. in sessile whorls at the end of the branches; calyx 5-toothed; corolla with short or slender, often gibbous tube, 2-lipped or almost equally 5-lobed; stamens 5; ovary inferior, usually 2–3-, rarely 5-celled; the pairs sometimes partly or wholly connate: berry few- to many-seeded.—About 175 species throughout the northern hemisphere, in Amer. south to Mex., in Asia south to Java; about 90 species, besides numerous varieties and many hybrids, are in cult. For an account of the genus see Rehder, Synopsis of the genus Lonicera in Ann. Rep. Missouri Bot. Gard. 14:27–232, 20 pl. (1903).

The honeysuckles belong to our most popular ornamental shrubs. They are of easy cultivation and propagation, most of them are quite hardy and the flowers, though rather small, are profusely produced, mostly of pleasing and delicate colors varying from white or yellow to pink, purple or scarlet, and followed by attractive red, yellow, white, blue or black fruits; the shrubs are never coarse or weedy, do not produce dead wood to any extent, do not need much pruning, and are long-lived.

The upright or bush honeysuckles are very valuable for shrubberies, and the low procumbent species, like *L. spinosa* var. *Alberti*, *L. thibetica*, *L. pileata*, and *L. trichosantha*, are well suited for rockeries. Most of the cultivated species are hardy North, but *L. Standishii*, *L. fragrantissima*, *L. pileata*, *L. Ledebourii*, *L. quinquelocularis*, *L. Webbiana*, *L. rupicola*, and other Himalayan species are less hardy and need sheltered positions or protection North. Some of the handsomest in bloom are the well-known *L. tatarica*, *L. Korolkovii*, *L. spinosa* var. *Alberti*, *L. Maackii*, *L. Morrowii*, *L. Ledebourii*. For their sweet-scented early flowers, *L. Standishii* and *L. fragrantissima* are to be recommended. Honeysuckles with very decorative fruits are *L. Morrowii*, *L. tatarica*, *L. gracilipes*, *L. alpigena*, *L. trichosantha*, *L. Maackii* var. *podocarpa*, *L. chrysantha*. Nearly evergreen are *L. pileata* and *L. nitida*; half-evergreen, *L. fragrantissima* and *L. Standishii*. Loniceras thrive in almost any good garden soil, and prefer mostly sunny positions, but *L. canadensis*, *L. nigra*, *L. Ledebourii*, *L. hispida* and *L. Xylosteum* grow as well or better in partly shaded situations. Pruning may be done during winter except in the early-flowering species, like *L. Standishii*, *L. fragrantissima*, *L. gracilipes* and *L. hispida*. The climbing honeysuckles are well adapted for covering walls, arbors and other trelliswork; they have mostly handsome and often sweet-scented flowers, in the hardy *L. tragophylla* as long as 3 inches, in the tender *L. Hildebrandiana* as long as 7 inches, but are somewhat deficient in foliage, with the exception of *L. japonica*, and liable to become leafless and unsightly at the base, and therefore may be mixed with other climbers, like ampelopsis, akebia, clematis. They perhaps show their beauty to the best advantage when allowed to ramble over shrubs and small trees. Those of the Caprifolium group are mostly hardy North, with the exception of the species of southern Europe and *L. hispidula*, while of the Nintoa group *L. japonica* and *L. Henryi* are hardy North, at least in a sheltered position; these species make also a very handsome ground-cover, and, like *L. Periclymenum*, grow well in shade, but the others prefer sunny positions. Propagation is by seeds sown in fall or stratified and by cuttings of ripened wood; also by greenwood cuttings under glass in summer, but the species of the Periclymenum group grow less readily in this way. Most species hybridize very easily and only seeds collected from isolated plants should be used for propagation. *L. spinosa* var. *Alberti* is sometimes grafted high on stems of *L. tatarica*, thus forming a small weeping tree.

2195. Lonicera thibetica. (×½). No. 2.

INDEX.

alba, 20, 21, 48.
Alberti, 3.
albiflora, 5.
alpigena, 18.
altaica, 7.
altissima, 17.
americana, 49.
amœna, 21.
angustata, 20.
angustifolia, 20 and suppl. list.
Arnoldiana, 21.
atrosanguinea, 49.
aurea, 53.
aureo-reticulata, 35.
aurora, 22.
belgica, 53.
bella, 23.
brachypoda, 35.
Brownii, 40.
cærulea, 7.
californica, 41.
calvescens, 26.
canadensis, 4.
caprifolioides, 15.
Caprifolium, 48, 49.
caucasica, 19.
chætocarpa, 11.
chinensis, 35.
chrysantha, 31.
ciliata, 4.
ciliosa, 39.
dioica, 44.
Douglasii, 43.
edulis, 7.
erubescens, 32.
etrusca, 40, 49, 52.
flava, 38, 46.
flavescens, 12.
flexuosa, 35.
floribunda 22 and suppl. list.
Fortunei, 14.
fragrantissima, 14, 15.
Fraseri, 46.
fuchsioides, 40.
gibbiflora, 26, 31.
gigantea, 52.
glabra, 5, 52.
glabrescens, 22.
glandulosa, 5.
glauca, 44.
glaucescens, 43.
graciliflora, 7.
gracilipes, 5.
gracilis, 20.
grandiflora, 20.
Halliana, 35.
Heckrottii, 50.
Henryi, 34.
Hildebrandiana 37
hirsuta, 42.
hispida, 10, 11.
hispidula, 41.
hortense, 48.
humilis, 12

INDEX, CONTINUED.

iberica, 16.
implexa, 47.
intermedia, 13.
involucrata, 12.
italica, 49.
japonica, 35.
kamschatica, 19.
Karelinii, 7.
Kesselringii, 19.
Korolkovii, 22.
lancifolia, 14.
latifolia, 20.
Ledebourii, 13.
longiflora, 36.
longifolia, 19.
lutea, 20.
Maackii, 32.
Magnevillea, 38.
media, 44.
micrantha, 20 and suppl. list.
microphylla, 16 and suppl. list.
minor, 38.
minutiflora, 28.
Morrowii, 29.
muendeniensis, 25.
muscaviensis, 27.
nana, 20.
Niaguarilli, 15.
nitida, 9.
notha, 24.
oblongifolia, 17.
occidentalis, 39.
orientalis, 19.
ovalis, 33.
Pallasii, 7.
pallens, 20.
pallida, 48.
parviflora, 43, 44.
parvifolia, 20 and suppl. list.
pauciflora, 48.
perfoliatum, 48.
Periclymenum, 53.
Phylomelæ, 5.
pileata, 8.
plantierensis, 40.
podocarpa, 32.
præcox, 48.
prolifera, 45.
puberula, 20.
pubescens, 42, 52.
pulcherrima, 20.
punicea, 20, 40.
purpurea, 20.
quercifolia, 53.
quercina, 53.
Regeliana, 31.
reticulata aurea, 35.
rosea, 21.
rubella, 49.
rubra, 20, 48.
rubriflora, 20.
rupicola, 2 and suppl. list.
Ruprechtiana, 26.
savranica, 19.
semperflorens, 53.
sempervirens, 38, 40.
serotina, 12, 53.
sibirica, 20.
sinensis, 14.
Solonis, 7.
speciosa, 20, 38.
spinosa, 3.
splendens, 20.
Standishii, 14.
subcoriacea, 34.
sulphurea, 38.
Sullivantii, 45.
superba, 38, 52.
syringantha, 1.
tangutica, 6.
tatarica, 20.
thibetica, 2.
tragophylla, 51.
trichosantha, 33.
vacillans, 41.
villosa, 7.
Wolfii, 1.
xanthocarpa, 20, 26.
Xylosteum, 30.
Zabelii, 22.

KEY TO THE SPECIES.

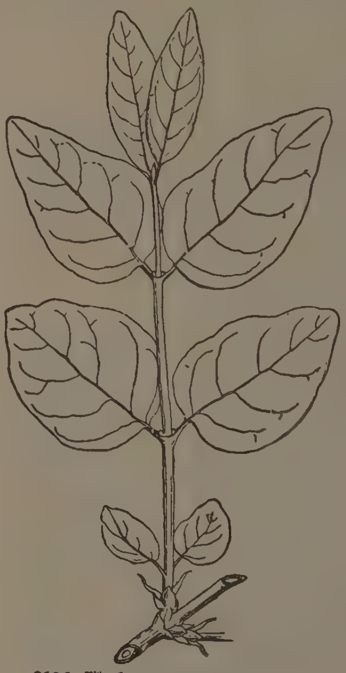
A. *Fls. in axillary pairs.*
B. *Habit upright, sometimes prostrate.*
C. *Branches with solid white pith.*
D. *Corolla with regular or nearly regular 5-lobed limb.*
E. *Tube of corolla equally tubular or campanulate: bractlets at least half as long as ovary: berries distinct: lvs. scarcely exceeding 1 in.*
F. *Stamens and style inclosed in the tube: fr. bright red.*
G. *Lvs. glabrous beneath* . . . . 1. **syringantha**
GG. *Lvs. tomentose beneath* . . . . 2. **thibetica**
FF. *Stamens and style exserted: fr. whitish or pale bluish purple, bloomy* . . . . 3. **spinosa**
EE. *Tube of corolla more or less ventricose or gibbous.*
F. *Bracts narrow, usually subulate.*
G. *Ovaries and frs. distinct: fr. red.*
H. *Style exceeding the limb: fls. whitish, in pairs* . . . . 4. **canadensis**
HH. *Style shorter than limb: fls. usually red, solitary* . . . . 5. **gracilipes**
GG. *Ovaries and frs. connate or partly connate or ovaries tightly inclosed by a cupule.*
H. *Frs. partly or wholly connate, red: bractlets wanting: corolla ventricose, pinkish* . . . . 6. **tangutica**
HH. *Frs. seemingly connate, blue, bloomy: corolla gibbous, yellowish white* . . . . 7. **cærulea**
HHH. *Frs. distinct, red: ovaries inclosed by a cupule: lvs. evergreen or half-evergreen.*
I. *Habit prostrate: lvs. ¼–1⅓ in. long, usually narrowed at base* . . . . 8. **pileata**
II. *Habit upright: lvs. ¼–½ in. long, usually rounded at base* . . . . 9. **nitida**
FF. *Bracts broad, enveloping the ovaries.*
G. *Bractlets wanting: fls. white: fr. scarlet.*
H. *Ovary glabrous or glandular: tube slender below the middle, gibbous at base* . . . . 10. **hispida**
HH. *Ovary setose and glandular-pilose: tube thick, saccate at base* . 11. **chætocarpa**
GG. *Bractlets large; fls. yellow or scarlet: fr. purplish black.*
H. *Stamens equaling the limb: lvs. glabrous or slightly pubescent* . . . . 12. **involucrata**
HH. *Stamens not exceeding the mouth: lvs. pubescent beneath: corolla orange and scarlet outside* . . . . 13. **Ledebourii**
DD. *Corolla 2-lipped.*
E. *Terminal bud wanting, replaced by 2 axillary buds; buds with 2 outer valvate scales: fr. red.*
F. *Lvs. acuminate* . . . . 14. **Standishii**
FF. *Lvs. acute or obtusish* . . . . 15. **fragrantissima**
EE. *Terminal bud present.*
F. *Fls. pale yellow: fr. red.*
G. *Bractlets connate into a cupule: buds with 2 valvate outer scales* . . . . 16. **iberica**
GG. *Bractlets minute: buds small, with imbricate scales* . . . . 17. **oblongifolia**
FF. *Fls. dull violet or brownish red; bractlets small in distinct pairs: frs. connate.*
G. *Berries red* . . . . 18. **alpigena**
GG. *Berries bluish black* . . . . 19. **orientalis**
CC. *Branches hollow, with brown pith: fls. 2-lipped; ovaries distinct.*
D. *Corolla light or deep pink, sometimes white, but not changing to yellowish.*
E. *Lvs. above 1 in. long, usually glabrous: upper lip of the corolla divided nearly or quite to the base.*
F. *Bractlets distinct; upper lip divided to the base* . . . . 20. **tatarica**
FF. *Bractlets connate into pairs; upper lip divided not quite to the base* . . . . 21. **amœna**
EE. *Lvs. 1 in. or less long, usually finely pubescent: upper lip divided to about the middle* . . . 22. **Korolkovii**
DD. *Corolla white or pink, changing to yellow: hybrids between No. 20 and Nos. 26 and 29.*
E. *Apex of lvs. obtusish or acute* . . 23. **bella**
EE. *Apex of lvs. acuminate.*
F. *Under side of lvs. nearly glabrous: bractlets glabrous or glandular-ciliate: fls. often pink* . . . . 24. **notha**
FF. *Under side of lvs. pubescent: bractlets ciliate: fls. white, sometimes pinkish* . . . . 25. **muendeniensis**
DDD. *Corolla white or pale yellow, changing to yellow or yellowish, rarely slightly pinkish.*
E. *Peduncles longer than petioles.*
F. *Winter-buds small, obtusish: ovary glabrous.*
G. *Bractlets small, glabrous or glandular* . . . . 26. **Ruprechtiana**
GG. *Bractlets as long or half as long as ovary.*
H. *Lvs. acuminate: bractlets half as long as ovary* . . . . 27. **muscaviensis**
HH. *Lvs. obtusish or acute, rarely short-acuminate: bractlets as long or nearly as long as ovary.*

I. *Under side of lvs. sparingly pubescent*............28. **minutiflora**
II. *Under side of lvs. densely pubescent* .29. **Morrowii**
FF. *Winter-buds rather large, pointed, with long-ciliate scales: ovary glandular.*
G. *Fls. whitish, often slightly pinkish: lvs. generally ovate to obovate, acute or abruptly acuminate, glabrous or soft-pubescent* ....30. **Xylosteum**
GG. *Fls. pale yellow changing to deeper yellow: lvs. rhombic-ovate to ovate-lanceolate, acuminate, pilose* ....31. **chrysantha**
EE. *Peduncles shorter than petioles.*
F. *Calyx with 5 acute teeth: lvs. acuminate*..............32. **Maackii**
FF. *Calyx truncate, splitting, scarious: lvs. obtuse or acutish*................33. **trichosantha**
BB. *Habit climbing: branches hollow.*
C. *Corolla less than 1 in. long, tube slightly ventricose; corolla dull red*.34. **Henryi**
CC. *Corolla over 1 in. long, with slender tube.*
D. *Bracts leafy, ovate; corolla 1¼–2 in. long, white or purplish: lvs. more or less pubescent, half-evergreen*...................35. **japonica**
DD. *Bracts subulate: lvs. quite glabrous, evergreen.*
E. *Length of corolla 3–4 in.: color changing from white to yellow*...................36. **longiflora**
EE. *Length of corolla 5–7 in.: color changing from yellow to orange-red*.............37. **Hildebrandiana**
AA. *Fls. in usually 6-fld. whorls at the end of the branchlets: lvs. below the infl. connate (except in No. 53).*
B. *Tube of corolla 3 or more times longer than limb; limb nearly equal or short 2-lipped. (See also No. 47.)*
C. *Limb regular: lvs. not ciliate* ......38. **sempervirens**
CC. *Limb short, 2-lipped.*
D. *Lvs. ciliate*...................39. **ciliosa**
DD. *Lvs. not or slightly ciliate*.......40. **Brownii**
BB. *Tube of corolla as long to twice as long as limb; limb deeply 2-lipped.*
C. *Corolla ½–1, rarely to 1½ in. long; tube of corolla ventricose, or slightly gibbous, pubescent inside (except in No. 46).*
D. *Bractlets at least half as long as ovary; corolla ½–¾ in. long, with gibbous tube*............41. **hispidula**
DD. *Bractlets one-third as long or shorter.*
E. *Disk of connate lvs. elliptic, pointed at both ends, usually concave.*
F. *Lvs. ciliate: branchlets pubescent: corolla glandular outside*.................42. **hirsuta**
FF. *Lvs. not ciliate: branchlets glabrous: corolla usually glabrous outside.*
G. *Under side of lvs. pubescent*.................43. **glaucescens**
GG. *Under side of lvs. glabrous*.44. **dioica**
EE. *Disk suborbicular or oval, rounded at the ends, nearly flat.*
F. *Style and tube inside pubescent: disk usually with dense whitish bloom above*.45. **prolifera**
FF. *Style and tube inside glabrous: disk bright green above or only slightly bloomy*.................46. **flava**
CC. *Corolla 1½–3 in. long; tube of corolla slender, not ventricose, glabrous inside (except in Nos. 47 and 51).*
D. *Whorls of fls., at least the lower ones in the axils of connate lvs.*
E. *Tube of corolla 3 or 4 times as long as limb, stamens much shorter than limb*..........47. **implexa**
EE. *Tube of corolla not more than 1½ times as long as limb; stamens about as long as limb.*
F. *Bractlets minute or wanting: whorls of fls. only 1 or 2*....48. **Caprifolium**
FF. *Bractlets about half as long as ovaries: whorls several*..49. **americana**
DD. *Whorls of fls. in peduncled heads or spikes.*
E. *Lvs. below the infl. connate.*
F. *Fls. in elongated spikes with remote whorls*...........50. **Heckrottii**
FF. *Fls. in dense heads.*
G. *Corolla about 3 in. long: head short-peduncled with 1 or 2 whorls*.....51. **tragophylla**
GG. *Corolla 1½–2 in. long: heads long-peduncled, often in 3's, with several whorls*...............52. **etrusca**
EE. *Lvs. all distinct: fls. in a dense head*......................53. **Periclymenum**

Subgenus CHAMÆCERASUS.

Section Isoxylosteum.

1. **syringántha**, Maxim. Upright slender-branched shrub, glabrous: lvs. elliptic to oblong, obtuse or acutish, dull bluish green, ½–1 in. long: peduncle ⅛in. long; cupule shorter than ovaries; calyx-teeth lanceolate; corolla tubular-funnelform, ½in. long, pale rosy lilac, fragrant; stamens and style included: fr. red. May, June: fr. in Aug. W. China. B.M. 7989. R.H. 1907, p. 281. Var. Wolfii, Rehd. Branches more spreading, often procumbent: lvs. narrower, usually acute: fls. lilac-carmine. W. China.—Very graceful shrub producing its fragrant fls profusely.



2196. Fly honeysuckle.—Lonicera canadensis. (×⅜) No. 4.

2. **thibética**, Bureau & Franch. (*L. rupicola* var. *thibética*, Zabel). Fig. 2195. Shrub, to 5 ft., with wide-spreading slender, often procumbent branches: lvs. oblong-lanceolate, acute, rarely obtusish, dark green and glossy above, white-tomentose beneath, ½–1¼ in. long: peduncle to ⅓in. long, cupule about half as long as ovaries; corolla tubular-funnelform, pale purple, about ½in. long, slightly tomentose outside, fragrant; stamens and style included: fr. red. May, June; fr. in Aug., Sept. W. China. S. T. S. 1:45. R. H. 1902, p. 449.—A dense much-branched shrub well suited for rocky slopes.

3. **spinòsa,** Jacquemont. Rigid spinescent shrub to 4 ft.: lvs. linear-oblong, about ½in. long: fls. ¾in. long with slender cylindric tube and spreading limb; stamens and style exserted: fr. pale bluish red or whitish, bloomy. Himalayas. Var. **Álberti,** Rehd. (*L. Álberti,* Regel). Shrub with slender arching or procumbent branches: lvs. linear or linear-lanceolate, sometimes with 2–4 teeth at the base, glaucous or bluish green, ½–1¼ in. long: fls. on slender, erect peduncles, rosy pink, fragrant. Turkestan. Gt. 30:1065. B.M. 7394.—Very graceful shrub.

2197. Lonicera gracilipes. (×½). No. 5.

Section ISIKA.

4. **canadénsis,** Marsh. (*L. ciliàta,* Muhl.). Fig. 2196. Shrub, to 5 ft.: lvs. ovate or oval, acute, rounded or cordate at the base, ciliate, pubescent beneath when young, 1½–3 in. long: fls. slender-peduncled, always in pairs, yellowish, sometimes slightly tinged red, ⅔in. long: fr. light red. April, May: fr. in June, July. Canada to Pa. and Mich. B.B. (ed. 2) 3:281.

5. **gracílipes,** Miq. (*L. Phylomèlæ,* Hort.). Fig. 2197. Shrub, to 6 ft., almost glabrous: lvs. roundish-ovate to oblong-ovate, ciliate, bright green, often with reddish margin, 1–2½ in. long: peduncles slender, nodding, usually 1-fld.; corolla pink, rarely white, ⅔in. long: fr. rather large, pendulous, bright red. April, May; fr. in June. Japan. G.F. 10:265 (adapted in Fig. 2197). S.I.F. 2:73. The form described here is var. *glàbra,* Miq.; the typical form has the lvs. ciliate and pubescent beneath, particularly on the midrib, and is not in cult. Var. **albiflòra,** Maxim. A form with white fls. Var. **glandulòsa,** Maxim. Lvs. and fls. pubescent: ovaries glandular.—A graceful species; one of the earliest to bloom, and very handsome in June with its pendulous scarlet frs.

6. **tangùtica,** Maxim. Low shrub with spreading branches: branchlet glabrous: lvs. obovate to obovate-oblong, acute or obtusish, cuneate at base, ciliate, usually sparingly hairy above, glabrous and glaucescent beneath, ½–1¼ in. long: fls. slender-stalked, pendulous; bracts subulate; calyx-teeth minute; corolla tubular-funnelform, slightly ventricose below the middle, limb upright, whitish, flushed pink, ½in. long; style exserted: fr. bright red. May, June; fr. in July. W. China. Gt. 40, p. 581.

7. **cærùlea,** Linn. Much-branched erect or spreading shrub, to 5 ft., with glabrous or pubescent branchlets: winter-buds often several, superposed: lvs. often stipulate, oval or obovate to oblong-lanceolate, pubescent or almost glabrous, pale or glaucous green, 1–2 in. long: fls. short-peduncled, yellowish or greenish white, ⅓–½ in. long: fr. blue, bloomy; berries connate only at the base, but wholly covered by the connate bractlets and hence seemingly connate. April, May. N. Eu., N. Asia and N. Amer. B.M. 1965.—A very variable species; the typical form is a spreading shrub with elliptic to oblong lvs. glabrescent like the branchlets and occurs in Eu. and N. Asia. Var. **altàica,** Sweet (*L. Pállasii,* Ledeb.). Branchlets and lvs. hirsute: fr. subglobose. N. Eu. to Japan. Var. **edùlis,** Regel. Lvs. oblong to lanceolate, pubescent like the branchlets: fr. oblong. E. Siberia, Tibet. Var. **graciliflòra,** Dipp. (*L. Karelìnii,* Hort., not Bunge). With upright rather slender, bright red branches, slightly pubescent: lvs. ovate to ovate-oblong, puberulous on both sides: fls. with slender tube. Var. **villòsa,** Torr. & Gray (*L. villòsa,* Muhl. *Xylósteum Solònis,* Eaton). Shrub, to 3 ft. with upright branches: winter-buds upright, always solitary: lvs. oval or obovate to oblong, usually pubescent: corolla campanulate, tube as long or shorter than limb. N. Amer. south to Tenn., Wis. and Calif. B.B. (ed. 2) 3:281.

8. **pileàta,** Oliver. Low, spreading shrub, sometimes prostrate: lvs. evergreen or half-evergreen, ovate to oblong-lanceolate, obtusish, dark green and glossy above, glabrous, ¼–1⅓in. long: fls. short-stalked, upright; bracts connate into a cupule inclosing the ovaries; calyx with a cap-like downward production at the base; corolla funnelform, whitish, gibbous at the base, ⅓in. long, fragrant; stamens exserted: fr. purple, surrounded at the base by the persistent cupula. April, May; fr. in July. Cent. and W. China. B.M. 8060. G.C. III. 35: 243; 47: 236. R.H. 1909, pp. 376, 377. H.I. 16:1585.—Though the fls. are insignificant, the handsome evergreen foliage and the purple frs. render it a desirable shrub; it resembles a small-lvd. privet.

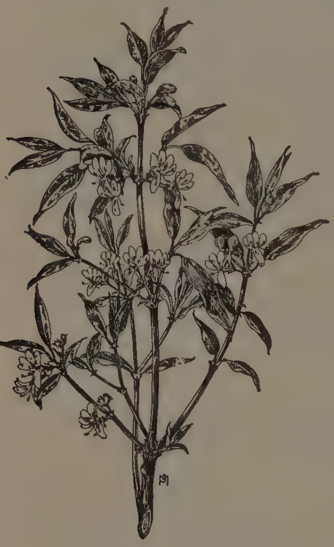
9. **nítida,** Wilson. Shrub, to 6 ft., with upright branches: lvs. broadly ovate to ovate-oblong, obtuse, subcordate to broadly cuneate at the base, glossy above, glabrous except short hairs on the midrib above and on the very short petioles, ¼–½in. long: corolla slightly larger: otherwise like the preceding species, of which it is possibly only a variety. W. China.—Apparently hardier than the preceding species.

10. **híspida,** Pall. Shrub, with spreading bristly-hispid or glabrescent branches: winter-buds large, 2-valved: lvs. obovate to oblong, ciliate and hirsute, at least when young, sometimes glaucous beneath, 1½–2½ in. long: fls. nodding, white, funnelform, strongly gibbous at the base, hairy outside, 1–1¼ in. long; bracts ovate, ciliate, whitish, ¾–1 in. long; bractlets none; ovaries glabrous or glandular: fr. oblong, bright red. April, May; fr. in June, July. Altai to Himalayas.

2198. Lonicera involucrata. (×⅓). No. 12.

—Distinct and handsome with its rather large white fls. and later with its red bracteate frs.

11. **chætocárpa,** Rehd. (*L. híspida* var. *chætocárpa*, Batalin). Shrub, to 6 ft.: branchlets hispid and glandular: lvs. ovate-oblong or elliptic-ovate, usually acute, sparingly pubescent above, more densely beneath and reticulate, 1⅓–3 in. long: bracts pubescent outside, about 1 in. long: corolla white, funnelform, with rather thick tube, saccate at the base, pubescent and glandular outside, about 1½ in. long; ovaries glandular and setose: fr. ovoid, bright red, setose. April, May; fr. in June, July. W. China.



2199. Lonicera Standishii. (×⅓)

12. **involucràta,** Banks (*Distègia involucràta*, Cockerell). Fig. 2198. Shrub, to 3 ft., with upright branches, glabrous or somewhat pubescent: lvs. elliptic-ovate to oblong-lanceolate, bright green, slightly pubescent beneath when young, 2–5 in. long: fls. erect, long-peduncled; corolla yellowish or slightly tinged red, viscid, pubescent, with short erect lobes, about ½in. long; stamens as long as limb: berries black, shining, almost inclosed by the enlarged purple bractlets. May–July. Ont. to Alaska, south to Mex. B.R. 1179. B.B. (ed. 2) 3:282. Var. **flavéscens,** Rehd. (*L. flavéscens*, Dipp.). Lvs. light green, thin, oblong- or ovate-lanceolate, 3–5 in. long: corolla less gibbous, yellowish. Brit. Col. to Wyo. and Utah. Gt. 37, p. 7. Var. **serótina,** Koehne. Lvs. oblong-ovate to oblong: corolla flushed bright scarlet. June–Aug. Colo. A very striking variety on account of its brightly colored fls. Var. **hùmilis,** Koehne. Dwarfer and with smaller lvs.

13. **Ledeboùrii,** Esch. (*L. intermèdia*, Kellogg). Similar to the preceding, but more vigorous: branches sometimes sarmentose, to 15 ft. long: lvs. of firmer texture, dark green above, pubescent beneath: fls. more salver-shaped, with rounded, spreading lobes, scarlet-red outside, ¾in. long; stamens shorter than lobes. May–July; fr. July–Sept. Calif. Gt. 2:64. R.H. 1843:373. H.U. 5:6. B.M. 8555.—Much handsomer than the preceding, but more tender.

14. **Stándishii,** Carr. (*L. sinénsis*, Hort. *L. Fórtunei*, Hort. *L. fragrantíssima* of some). Fig. 2199. Half-evergreen shrub, with spreading branches, to 6 ft.: branchlets with reflexed bristly hairs: lvs. coriaceous, oblong-ovate to ovate-lanceolate, acuminate, ciliate, bristly hairy on both sides or glabrous above, 3–4 in. long: fls. on rather short, curved peduncles, white or slightly blushed, very fragrant, ¼–½ in. long; bracts linear-lanceolate, exceeding the ovaries: frs. partly connate, scarlet. March, April; fr. in June. China. B.M. 5709. G.C. III. 5:245. R.H. 1873, p. 148. Var. **lancifòlia,** Rehd. Lvs. narrow-lanceolate. W. China.

15. **fragrantíssima,** Lindl. (*L. caprifolioìdes*, Koch. *L.* or *Caprifòlium Niaguarílli*, Hort.). Similar to *L. Standishii*, but with long and slender recurving and almost glabrous branches: lvs. broadly ovate or obovate, acute, almost glabrous, but bristly on the midrib beneath and ciliate, 1–2½ in. long: corolla glabrous outside. March–May. G.C. III. 5:245. R.H. 1873, p. 169. B.M. 8585.—Less hardy than *L. Standishii*. Both have handsome half-evergreen foliage and very early, sweet-scented, though not very showy fls.

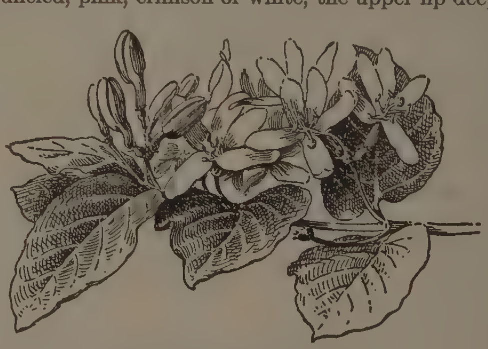
16. **ibérica,** Bieb. Much-branched upright shrub, to 6 ft.: branchlets pubescent: lvs. roundish-ovate or ovate, acute or obtusish, cordate or rounded at base, grayish green, ciliate, pubescent on both sides, ¾–1⅓ in. long: fls. short-stalked; bracts leafy, exceeding the ovary; corolla yellowish white, changing to yellow, finely pubescent, ½in. long: fr. bright red. June; fr. in Sept. Transcaucasia, Persia. Var. **microphýlla,** Dipp. Lower: lvs. ½–¾ in. long.

17. **oblongifòlia,** Hook. Shrub, to 5 ft.: lvs. almost sessile, oval-oblong, obtuse, pubescent beneath, 1–2½ in. long: fls. slender-peduncled; bracts and bractlets minute or indistinct; corolla hairy outside, yellowish white, sometimes tinged purplish: berries dark red, usually wholly connate. May, June; fr. in July. Que. to Manitoba, south to Pa. and Mich. B.B. (ed. 2) 3:281. Var. **altíssima,** Rehd. (*L. altíssima*, Jennings). Branchlets and lvs. glabrous. Pa.

18. **alpígena,** Linn. Shrub, to 8 ft., with stout branches: lvs. oblong-obovate or oblong, short-acuminate, glossy and dark green above, light green and often pubescent beneath, 2–4 in. long: fls. long-peduncled, with short usually yellowish green tube and brownish red limb: berries connate, bright scarlet, shining. April, May; fr. in Aug., Sept. Mountains of Cent. and S. Eu. H. W. 3, p. 129.—Very handsome in fruit.

19. **orientàlis,** Lam. Shrub, to 10 ft., almost glabrous: lvs. elliptic or ovate to oblong-ovate, rarely oblong-lanceolate, dark green above, pale or glaucescent beneath, 2–4 in. long: fls. short-peduncled, pale violet or pinkish: fr. black, wholly connate. May, June. W. Asia to Kamschatka. The typical form has ovate to ovate-lanceolate, acuminate lvs. pubescent beneath and is not in cult. Var. **caucásica,** Zabel (*L. caucásica*, Pall.). Lvs. oval to elliptic-oblong, glabrous and glaucescent beneath. Gt. 11:359. Var. **longifòlia,** Dipp. (*L. Kesselríngii*, Regel. *L. kamschática* and *L. savránica*, Hort.). Lvs. smaller, oblong to lanceolate, glabrous: corolla smaller, scarcely gibbous at base. Gt. 40, p. 124.—Fls. and frs. not very conspicuous.

20. **tatárica,** Linn. Fig. 2200. Shrub, to 10 ft., almost glabrous: lvs. cordate or rounded at the base, ovate to ovate-lanceolate, ciliate, sometimes slightly pubescent beneath when young, 1–2½ in. long: fls. slender-peduncled, pink, crimson or white, the upper lip deeply divided, spreading, with the outer lobes free to the base: bractlets distinct, small, glabrous: fr. red, rarely yellow. May, June; fr. in July, Aug. S. E. Russia to Siberia. B.R. 31. R.H. 1868:392. Gt. 18:627. B.B. (ed. 2) 3:282.—Variable in size and shade of fls. Var. **álba,** Loisel. Fls. white. Var. **grandiflòra,** Rehd. (var. *álba grandiflòra*, Dipp.). Fls. larger, white. Var. **sibírica,** Pers. (var. *rubriflòra*, DC. var. *rùbra*, Sweet. *L. punícea*, Sims. var. *purpùrea*, Hort.). Fls. bright red. B.M.



2200. Lonicera tatarica. (×⅔)

2469. Var. **latifòlia,** Loud. (var. *grandiflòra rùbra,* Pepin. var. *spléndens,* Regel). Lvs. large, to 4 in. long: fls. pink, the lobes bordered light pink. R.H. 1844: 109. Gt. 18:627, fig. 1. Var. **punícea,** Lindl. (var. *speciòsa,* Carr.; var. *pulchérrima,* Regel). Similar to the preceding form, but fls. deep pink. R.H. 1868: 392, fig. 1. Gt. 18:627, fig. 5. Var. **angustifòlia,** Kirchn. (*L. angustàta,* Wender.). Lvs. narrow-lanceolate: fls. bright pink. Var. **lùtea,** Loud. (var. *xanthocárpa,* Endl.). Frs. yellow. Var. **nàna,** Alphand. Low, dense shrub: lvs. ovate-lanceolate, narrowed at base: fls. small, pinkish. Var **parvifòlia,** Jaeger (var. *grácilis,* Carr. *L. parvifòlia,* Hayne, not Edgew.). Lvs. smaller, obtuse: fls. pure white, small, with broad and short lobes: fr. orange-red. Var. **micrántha,** Trautv. (var. *pubérula,* Regel & Trautv. *L. micrántha,* Regel). Branchlets, peduncles, bracts and corolla puberulous: lvs. pubescent beneath. Not in cult.: the plant cult. under this name is usually the preceding variety or *L. xylosteoides.* Var. **pállens,** Rehd. Lvs. smaller and narrower, bluish green: fls. small, finally almost white.

21. **amœ̀na,** Zabel (*L. Korolkòvii floribúnda* × *L. tatárica*). Branchlets nearly glabrous: lvs. ovate, rounded or subcordate at the base, glabrous, 1–2 in. long: fls. very numerous, slender-stalked; bractlets small, connate into pairs; corolla ¾in. long, pink (var. *ròsea,* Zabel) or white (var. *álba,* Zabel), outer lobes of the upper lip divided nearly to the base. May, June. Of garden origin. Var. **Arnoldiàna,** Rehd. (*L. Korolkovii* × *L. tatarica*). Lvs. narrow-elliptic to oblong-lanceolate, ¾–1½ in. long, nearly glabrous, grayish green: fls. white, flushed pink. Very floriferous and exceedingly graceful.

22. **Korolkòvii,** Stapf (*L. floribúnda* var. *Korolkòvii,* Zabel). Fig. 2201. Shrub, to 12 ft.: branchlets short-pubescent: lvs. ovate to narrow-elliptic, acute, rounded or narrowed at the base, slightly pubescent above, more densely beneath, bluish green, ½–1 in. long: fls. on slender peduncles ½–1 in. long; bractlets about one-third as long as ovary, connate into pairs; corolla light pink, rarely white, the upper lip divided about one-half or slightly more; tube slightly gibbous: fr. bright red. May, June; fr. in Aug. Turkestan. G.F. 7: 35. M.D. 1910, p. 117*a*. Var. **floribúnda,** Nichols. (*L. floribúnda,* Zabel, not Boiss. & Buhse). Lvs. broadly ovate to ovate, slightly cordate or rounded at the base (in the typical form generally elliptic and narrowed at the base). Gt. 42, p. 103, figs. 4–6. M.D. 1910, p. 117*d*. Var. **Zábelii,** Rehd. (*L. Zábelii,* Rehd. *L. floribúnda glabréscens,* Zabel). Lvs. glabrous, in shape like those of the preceding variety. Gt. 42, p. 103, figs. 1–3. M.D. 1910, p. 117*e*. Var. **auròra,** Koehne. Lvs. ovate to elliptic: corolla with slender tube, rosy pink; bractlets about half as long as ovaries.

2201. Lonicera Korolkovii. (×⅓)

23. **béllа,** Zabel (*L. Mórrowii* × *L. tatárica*). Upright shrub with spreading branches: branchlets usually slightly pubescent: lvs. ovate to ovate-oblong, obtusish or acute, usually truncate at the base, slightly pubescent beneath or nearly glabrous, 1–2 in. long: peduncles about ½ in. long; bractlets nearly orbicular to ovate, one-half to three-fourths as long as ovary; corolla about ½in. long, white to pink, with spreading lobes, the outer lobes of the upper lip free to the base: fr. red. May, June; fr. in July, Aug. Garden origin.

24. **nótha,** Zabel (*L. Ruprechtiàna* × *L. tatárica*). Upright, strong-growing shrub: branchlets glabrous or nearly glabrous; lvs. ovate to ovate-lanceolate, rarely elliptic, acuminate, rounded or truncate at base, slightly pubescent or nearly glabrous beneath, 1½–2½ in. long: bractlets ovate, about one-third as long as ovary, rarely longer, glabrous or glandular-ciliate: corolla ¾in. long, white, yellowish or pinkish, upper lip upright, divided to the middle or sometimes nearly to the base, tube gibbous, short: fr. red. May, June; fr. in July, Aug. Garden origin.

2202. Lonicera Xylosteum. (×⅔). No. 30.

25. **muendeniénsis,** Rehd. (*L. bélla* × *L. Ruprechtiàna*). Upright shrub: branchlets pubescent: lvs. ovate to ovate-lanceolate, acuminate, rounded or narrowed at the base, dark green above, pubescent beneath, 1⅓–3 in. long: bracts about as long as ovary; bractlets broadly ovate, one-third to one-half as long as ovary, ciliate: corolla white or yellowish white or sometimes slightly pinkish, upper lip upright, divided nearly to the base; filaments pubescent below the middle: fr. red. May, June; fr. in July, Aug. Garden origin. Gt. 42, p. 101 (figs. 4–6).

26. **Ruprechtiàna,** Regel. Shrub, to 12 ft.: lvs. ovate-lanceolate to lanceolate, acuminate, usually dark green above, grayish pubescent beneath, 2–4 in. long: fls. on rather long peduncles, pure white at first, glabrous outside; bractlets only glandular-ciliate, small, about one-third of the ovary: fr. red or sometimes yellow. May, June. Manchuria. Gt. 19:645. Var. **xanthocárpa,** Zabel (*L. gibbiflòra,* Dipp.) Fls. smaller, yellowish: fr. yellow. Var. **calvéscens,** Rehd. Lvs. almost glabrous except hairy nerves on under side.—This specics and *L. Morrowii* are likely to hybridize with *L. tatarica;* these hybrids are very common, and may be recognized by the glabrescent foliage and the tinge of pink in the fls. The true *L. Ruprechtiana* is much rarer in gardens than its hybrids.

27. **muscaviénsis,** Rehd. (*L. Mórrowii* × *L. Ruprechtiàna*). Upright shrub with spreading branches: branchlets pubescent: lvs. ovate to oblong-ovate, acuminate, dark green and sparingly pubescent above, densely beneath, 1⅓–2 in. long: bractlets ovate, ciliate, half as long as ovary: corolla white, upper lip upright, divided to somewhat below the middle; filaments glabrous: fr. bright red. Garden origin. Gt. 42, p. 101 (figs. 1–3).

28. **minutiflòra,** Zabel (*L. micranthoìdes* × *L. Mórrowii*). Upright shrub with spreading branches: branchlets puberulous: lvs. ovate-oblong to oblong, obtuse, acutish or short-acuminate, sparingly pubescent below, ¾–1½ in. long: bractlets ovate-oblong, nearly as long as ovary: corolla with spreading limb, upper lip divided below the middle, ½in. long, whitish;

stamens about half as long as limb: fr. red. May, June; fr. in July, Aug. Garden origin. A.F. 28:672.—On account of the narrow and rather small foliage, the frs. show to better advantage than in many allied honeysuckles.

29. **Mórrowii,** Gray. Shrub, to 6 ft., with wide-spreading branches: lvs. oval or oblong-ovate, obtusish or acute, dark green above, grayish tomentose beneath, 1–2 in. long: fls. peduncled, pure white at first, pubescent outside, upper lip divided nearly to the base, with spreading lobes; bractlets pubescent, about as long as ovary: fr. blood-red. May, June. Japan. A.F. 11:1267. Gng. 5:329. J.H.S. 35, p. 362. S.I.F. 2:73.—Very distinct in its habit; handsome in fl. and in fr. It hybridizes easily with *L. tatarica* and the hybrids are more common in gardens than the true species.

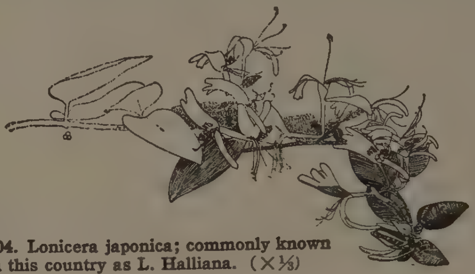
30. **Xylósteum,** Linn. Fig. 2202. Shrub, to 10 ft.: lvs. broadly oval to obovate, acute, dull green, sparingly pubescent above or glabrous, more densely pubescent beneath, rarely nearly glabrous, 1–2½ in. long: fls. peduncled, yellowish white, often slightly tinged red, hairy outside; bractlets pubescent, suborbicular, about half as high as ovary: berries dark red. May, June; fr. in Aug., Sept. Eu., W. and N. Asia, sometimes escaped from cult. B.B. (ed. 2) 3:282. H.W. 3, p. 127.—Not so ornamental as most allied species.

31. **chrysántha,** Turcz. (*L. gibbiflòra*, Rupr.). Upright shrub, to 12 ft. with upright sts.: branchlets pilose, rarely glabrous: lvs. rhombic-ovate, to rhombic-lanceolate, acuminate, dark or bright green above and nearly glabrous, pilose beneath, at least on the veins, 2–5 in. long: peduncles ½–1 in. long; bractlets distinct, ovate, one-third to one-half as long as ovary; corolla ¾in. long, yellowish white changing to yellow, upper lip divided about one-half, tube strongly gibbous, short: fr. coral-red. May, June; fr. in Aug., Sept. N.E. Asia to Cent. Japan. Gt. 12:404.—Particularly handsome in autumn with its bright red fr. Var. **Regeliàna,** Zabel (*L. Regeliàna*, Kirchn.). Fls. smaller, more yellowish.

32. **Maàckii,** Maxim. Fig. 2203. Upright shrub, to 15 ft.: branchlets short-pubescent: lvs. elliptic-ovate to ovate-lanceolate, acuminate, dark green above, paler beneath, usually only pubescent on the veins on both sides, 2–3⅓ in. long: peduncles shorter than petioles; bractlets half as long or as long as ovary; calyx distinctly 5-toothed, nearly as long as ovary; corolla ¾in. long, white, fading to yellowish, glabrous outside, fragrant, upper lip upright, divided to the middle or below, tube short, not gibbous; stamens usually only half as long as limb: fr. dark red. June; fr. in Sept.–Nov. N.E. Asia to Cent. Japan. Gt. 33:1162. G.C. III. 41:265. G. 29:411. G.W. 4, p. 235. Var. **podocárpa,** Franch. Lower and more spreading: lvs. broader, oval to elliptic, short-acuminate: ovaries raised above the bracts on a very short but usually distinct stalk: fls. slightly smaller. Cent. China. Var. **erubéscens,** Rehd. A form of the preceding variety, with larger fls. flushed pinkish.—A very desirable species, the latest of the bush honeysuckles to bloom; the type is showier in bloom, while the var. *podocarpa* is most beautiful in fr. which lasts, like the dark green foliage, into Nov.

2203. Lonicera Maackii. (×⅓)

33. **trichosántha,** Bureau & Franch. (*L. ovàlis*, Batalin). Spreading shrub with long and slender sometimes partly procumbent branches: lvs. ovate, obovate or oval, obtuse or acutish, usually rounded at the base, nearly glabrous, 1–2 in. long: peduncles shorter than petioles; bractlets broad, connate into pairs, truncate, about half as long as ovary; calyx rather large, nearly truncate, scarious, cleft: corolla slightly longer than ½in., changing from pale to bright yellow, tube strongly gibbous: fr. bright red. June; fr. in Aug., Sept. W. China.—Very handsome with its bright red fr.



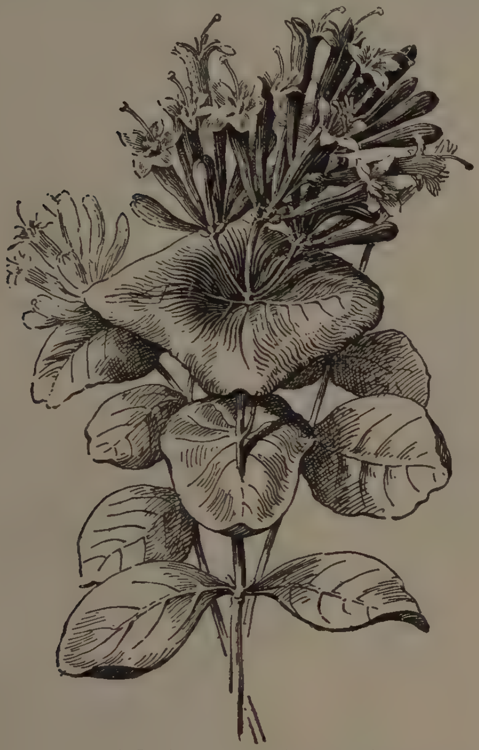
2204. Lonicera japonica; commonly known in this country as L. Halliana. (×⅓)

Section Nintooa.

34. **Hényri,** Hemsl. Climbing or prostrate, half-evergreen: branchlets densely strigose: lvs. ovate-lanceolate to lanceolate, ciliate and usually pubescent on the midrib beneath, 1½–3½ in. long: fls. in the axils at the end of the branchlets, often crowded, short-stalked; bracts subulate, short; bractlets roundish, one-third as long as ovary; corolla ¾in. long, dull purplish or yellowish red: fr. black. June–Aug.: fr. Sept., Oct. W. China. B.M. 8375. Var. **subcoriàcea,** Rehd. Lvs. subcoriaceous, ovate-oblong, 2–4 in. long, not ciliate: corolla slightly longer, tube longer than limb. W. China.

35. **japónica,** Thunb. Fig. 2204. Climbing, to 15 ft. high: branchlets usually pubescent when young: lvs. half-evergreen, roundish-ovate to oblong, pubescent beneath or almost glabrous, 1½–3 in. long: fls. short-pedicelled, white, changing to yellow, often purplish outside, very fragrant, glandular-pubescent outside, 1½–2 in. long; bracts leafy, ovate or oval; bractlets broad, half as long or as long as ovary: fr. black, separate. June–Aug. China, Japan; naturalized in some places from N. Y. to N. C. B.B. (ed. 2) 3:280. G.M. 45:613. M.D.G. 1901:609. Var. **aùreo-reticulàta,** Nichols. (*L. reticulàta aùrea*, Hort. *L. brachýpoda reticulàta*, Hort.). A form of var. *flexuosa*, with the smaller and shorter lvs. handsomely netted yellow. B.H. 21:59. G.Z. 9:48. Var. **flexuòsa,** Arb. Kew. (*L. flexuòsa*, Thunb. *L. brachýpoda*, DC.). Less high climbing: lvs. ovate or oblong, obtusish, pubescent on both sides while young or only on the veins beneath: peduncles usually as long as petioles or shorter; corolla 1–1½ in. long, usually purplish outside, with the upper limb divided into short lobes; bractlets broad, as long as ovary. Var. **chinénsis,** Baker (*L. chinénsis*, Wats.). Lvs. ovate, acute, ciliate and pubescent only at the veins beneath, often with purplish hue beneath: peduncles usually longer than petioles; corolla 1½–2 in. long, purple outside, the upper lip divided more than one-half; bractlets narrow, about half as long as ovary. B.R. 712. B.M. 3316. L.B.C. 11:1037. Var. **Halliàna,** Nichols. (*L. flexuòsa Halliàna*, Dipp. *Caprifòlium Halliànum*, Hort. *L. Halliàna*, Hort.) Of vigorous growth: lvs. usually pubescent on both sides when young, oblong-ovate, acute, to 2½ in. long: fls. short-peduncled, white, changing to yellow; tube as long as limb; bractlets broad, half as long as ovary. The type of the species seems to differ from this variety only in having the fls. purplish outside. A.G. 12:663. Gng. 3:293.

36. **longiflòra,** DC. Climbing shrub, glabrous, evergreen: lvs. oblong-lanceolate, shining above, pale beneath, 2–2½ in. long: fls. in short-peduncled pairs, sometimes crowded toward the end of branches; corolla white, changing to yellow, fragrant, 3-4 in. long, with very slender tube; bracts small, subulate: fr. white. S. China. B.R. 1232 (as *Caprifolium longiflorum*).—Tender. Intro. 1900, by Franceschi.



2205. Lonicera sempervirens. (×½)

37. **Hildebrandiàna,** Coll. & Hemsl. Climbing shrub, glabrous, evergreen: lvs. broadly ovate or elliptic-ovate, abruptly pointed, 4–6 in. long: fls. on stout peduncles; corolla 5–7 in. long, glabrous outside, yellow at first, changing to orange-red, with long and slender tube. Summer. Upper Burma. G.C. III. 24:219. B.M. 7677.—This has the largest fls. of any species, but is not hardy N.

Subgenus PERCLYMENUM (*Caprifòlium*).

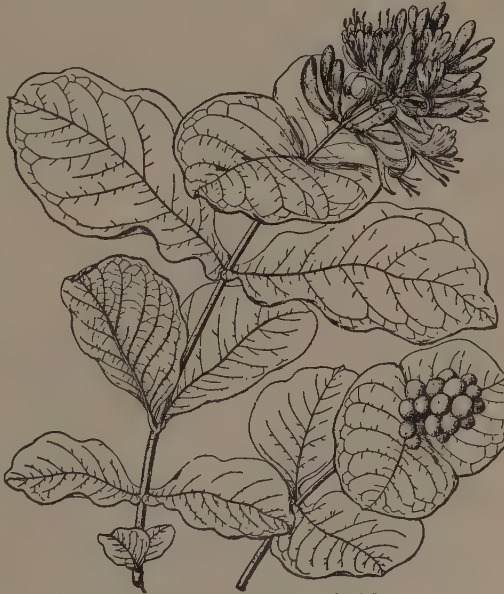
38. **sempérvirens,** Linn. (*Caprifòlium sempérvirens,* Michx.). Trumpet Honeysuckle. Fig. 2205. High-climbing, glabrous: evergreen southward: lvs. oval to oblong, glaucous beneath, the upper connate, 2–3 in. long: fls. in peduncled interrupted spikes; corolla with almost equal limb; tube slightly ventricose, glabrous, 1½–2 in. long, scarlet or orange-scarlet, rarely yellow. May–Sept. Conn. to Fla., west to Neb. and Texas; farther north sometimes escaped from cult. B.M. 781. R.H. 1856:361. Gn. 45, p. 307. G.M. 54:724. Var. **sulphùrea,** Jacques (var. *flàva,* Regel. *L. flàva nòva,* Hort.). Fls. yellow. Gt. 2:38. Var. **supérba,** Regel (var. *speciòsa,* Carr.). Fls. more brilliant scarlet. F.S. 11:1128. Sometimes cult. as *L. Magnevillea,* a name also applied to *L. dioica,* and to *L. Caprifolium* var. *pauciflora.* Var. **minor,** Ait. Lvs. oblong or narrow-oblong: fls. more slender, orange-red or orange-scarlet. Very free-flowering, but more tender. B.M. 1753. B.R. 556. Gn. 34:300.

39. **cilidsa,** Poir. Low sarmentose shrub: lvs. petioled, ovate or oval, glaucous beneath, glabrous but ciliate, the upper connate, 2–4 in. long: fls. in short-peduncled heads of 1 or few whorls; corolla slightly 2-lipped, with ventricose-gibbous tube, yellow to orange-scarlet, usually hirsute outside, 1¼–1¾ in. long. June, July. Brit. Col. to Calif. and Ariz. Var. **occidentàlis,** Nichols. (*L. occidentàlis,* Hook.). Fls. larger, glabrous outside, more brightly colored. B.R. 1457.

40. **Brównii,** Carr. (*L. sempérvirens Brównii,* André. *L. etrúsca* var. *Brównii,* Regel). Probably hybrid of *L. sempervirens* with *L. hirsuta.* Lvs. oval to oblong, glaucous beneath, the upper connate, glabrous: fls. in peduncled heads, orange-scarlet, scentless; tube gibbous at the base, longer than limb. Of garden origin. Gt. 2:38. F.S. 11:1133. Var. **plantierénsis,** Rehd. (*L. plantierénsis,* André). Fls. larger, more orange-colored and less deeply 2-lipped. I.H. 18:86. F.W. 1872:289. Var. **fuchsioìdes,** Rehd. (*L. fuchsioìdes,* Hort., not Hemsl.). Similar to *L. sempervirens,* but fls. 2-lipped, scarlet outside. G.F. 9:496. G.W. 5, p. 159. Var. **punícea,** Rehd. (*L. sempérvirens* var. *punícea,* Dipp.). Less vigorous: corolla orange-red.

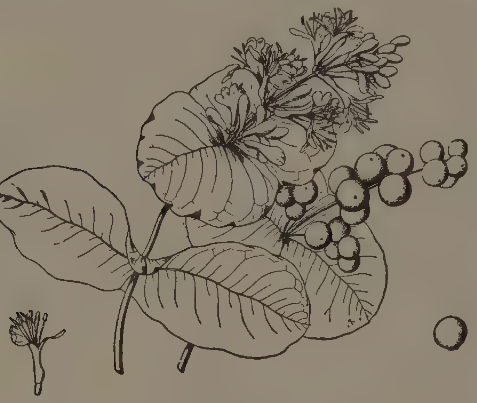
41. **hispídula,** Douglas. Bushy shrub with sarmentose branches, rarely twining, usually hirsute: lvs. oval to ovate, rounded or cordate at the base, often with foliaceous stipules, the upper connate or sometimes distinct, usually small, rarely to 2½ in. long, ciliate and pubescent, rarely glabrous: fls. in slender-peduncled and often panicled spikes, pink or yellowish, glabrous or hirsute, ⅓–½in. long, with short gibbous tube. June, July. Brit. Col. to Calif. B.R. 1761. Var. **vacíllans,** Gray (*L. califórnica,* Torr. & Gray. *L. hispídula* var. *califórnica,* Rehd.). Of more vigorous growth, with large lvs. to 3 in. long: corolla glandular-pubescent outside. Calif.

42. **hirsùta,** Eaton (*Caprifòlium pubéscens,* Goldie). Fig. 2206. High-climbing, with usually hirsute branchlets: lvs. petioled, broadly oval or ovate, obtuse, the upper connate and abruptly pointed, dark green above, pubescent on both sides when young, 2–4 in. long: fls. in short, mostly peduncled spikes, scentless, bright or orange-yellow, pubescent without, about 1 in. long, with the tube gibbous at the base; ovary and bractlets usually glandular. June, July. Vt. to Manitoba, south to Pa. and Ohio. B.M. 3103. Gn. 45, p. 307. B.B. (ed. 2) 3: 278. G.F. 9:344. (adapted in Fig. 2206).



2206. Lonicera hirsuta. (×½)

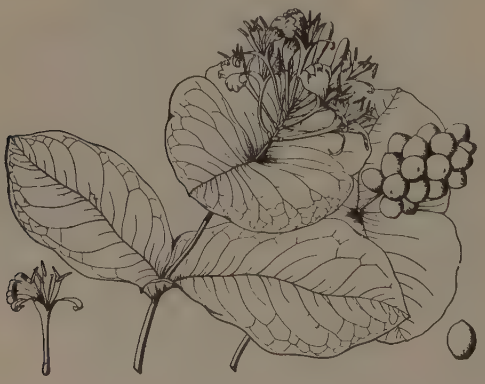
43. glaucéscens, Rydb. (*L. Doúglasii,* Koehne, not DC., nor Koch. *L. parviflòra* var. *Doúglasii,* Gray, partly). Climbing: branchlets glabrous: lvs. short-petioled or almost sessile, the upper connate, oval to obovate, glabrous above, pubescent beneath, 1½–3 in. long: fls. in short, almost sessile spikes; corolla yellow, mostly reddish outside and hairy, ¾–1 in. long; tube gibbous, longer than the limb; ovary and bractlets glabrous. May, June; fr. in Sept., Oct. Ont. to the Sask., south to Pa. and Neb. B.B. (ed. 2) 3:279.



2207. Lonicera prolifera. (×½)

44. dioìca, Linn. (*L. glaùca,* Hill. *L. mèdia,* Murr. *L. parviflòra,* Lam.). Usually shrubby, with slender, sarmentose branches, rarely climbing, glabrous: lvs. short-petioled or almost sessile, the upper connate, oval to oblong, obtuse, with usually undulate and transparent margin, very glaucous beneath, 1½–3 in. long: fls. in sessile or short-stalked spikes, greenish or whitish yellow, often tinged purplish, glabrous outside, ½–¾in. long, the tube gibbous, about as long as limb. May, June; fr. in Sept., Oct. Que. to Manitoba, south to Ohio and N. C. B.R. 138.

45. prolífera, Rehd. (*L. Sullivántii,* Gray. *Caprifòlium proliferum,* Kirchn.). Fig. 2207. Climbing about 4–5 ft., very glaucous: lvs. oval or obovate, the upper connate into a large disk, becoming thickish and very glaucous above, often finely pubescent beneath, 2–4 in. long: fls. in short-stalked or almost sessile spikes; corolla pale yellow, often marked purplish outside, about 1 in. long; tube gibbous, only little longer than limb. May, June; fr. in Sept., Oct. Ont. to Manitoba, south to Tenn. R.H. 1856:221 (as *L. flava*). G.F. 3:191 (adapted in Fig. 2207). Gn. 60, p. 285.—Very handsome in fall with the abundant scarlet berries.

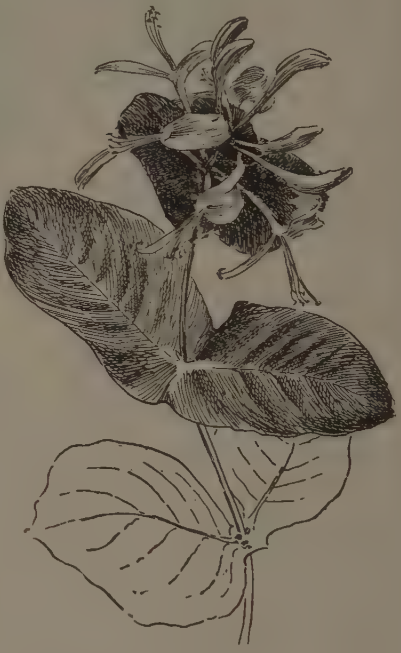


2208. Lonicera flava. (×½)

46. flàva, Sims (*Caprifòlium Fràseri,* Pursh). Fig. 2208. Climbing to 10 ft.: lvs. broadly oval to elliptic, the upper connate, bright green above, glaucous beneath, glabrous, 1½–3 in.: fls. in a peduncled head, bright or orange-yellow, fragrant, 1–1¼ in. long; tube slender, longer than limb. April, May. N. C. to Ky., Ga. and Ala. B.M. 1318. L.B.C. 4:338. G.F. 3:190 (adapted in Fig. 2208). Gn. 45, p. 307.—This species is rare in cult. and usually the preceding is cult. under this name.

47. impléxa, Ait. Much-branched, but less high-climbing, evergreen: lvs. oval to oblong-lanceolate, sessile, the upper connate into an elliptic, acute or mucronate disk, glaucous, glabrous 1–2 in. long: fls. in several whorls, each in the axils of connate lvs., scentless, yellowish white; tube slightly hairy within; limb rather short; stamens slightly exceeding the mouth. May, June. S. Eu., N. Afr. B.M. 640.

48. Caprifòlium, Linn. (*Caprifòlium horténse,* Lam. *C. perfoliàtum,* Roehl. *L. pállida,* Host). Fig. 2209. Climbing: lvs. oval to oblong, the upper connate into a roundish cup, almost glabrous, 2–4 in. long: whorls usually 2 or 3, each in the axils of connate lvs.: fls. yellowish white, often slightly purplish outside and slightly hairy, to 2 in. long, fragrant; bractlets very small or none. May, June. Cent. Eu. to W. Asia. B.B. (ed. 2) 3:278. H.W. 3, p. 129.—Sometimes escaped from cult. Var. **álba,** Ait. (*L. præcox,* Hort.). Fls. white. Var. **pauciflòra,** Carr. (*L. Caprifòlium rùbra,* Tausch, not Weston). Fls. purple outside.



2209. Lonicera Caprifolium. (×½)

49. americàna, Koch (*Periclýmenum americànum,* Mill. *L. itálica,* Schmidt. *L. etrúsca,* Hort. *L. Caprifòlium,* Auth.). Climbing: lvs. broadly oval to oblong-obovate, the upper connate, glabrous, 2–4 in. long; the upper whorls without connate lvs. at the base, somewhat crowded: fls. yellowish, usually purple outside and glabrous, fragrant, to 2 in. long; bractlets about half as long as ovary, smaller on the upper fls. June–Aug. Probably hybrid of *L. etrusca* and *L. Caprifolium,* much cult., mostly under the name of the latter, and sometimes escaped from cult. Gn. 45, p. 307 (as *L. etrusca* and *L. Caprifolium*); 54, p. 26. F.S. 11:1120 (as *L. Caprifolium major*). Var. **rubélla,** Rehd. (*L. Caprifòlium* var. *rubélla,* Tausch). Fls. purple outside. Var. **atrosanguínea,** Rehd. (*L. atrosanguínea,* Carr.). Fls. dark purple outside.

50. Heckróttii, Rehd. Only partially climbing: lvs. elliptic or oblong-elliptic, acute, almost sessile, the upper pairs connate, glaucous beneath, glabrous, about 2 in. long: fls. in peduncled spikes with few somewhat remote whorls, purple outside and sparingly glandular, 1½–2 in. long; bractlets about half as long as ovary. June–Sept.—Origin unknown, probably garden hybrid of *L. americana* and *L. sempervirens*. One of the most free-flowering of all climbing honeysuckles.

51. **tragophýlla**, Hemsl. High-climbing: lvs. short-petioled, oblong, rarely oval, obtuse or acute, bright green above, whitish beneath and pubescent at least along the midrib, 2–5 in. long: fls. in short-peduncled heads with usually only 1 or 2 whorls; bracts about one-third as long as ovary; corolla 3 in. long, yellow, glabrous, tube about 3 times as long as limb, sparingly pubescent inside. June. W. China. B.M. 8064. S.T.S. 1:46. G.C. III. 36:150. J.H.S. 28, p. 63. G. 28:289; 35:345. R.B. 32:261.—Has proved hardy as far north as Mass.

52. **etrúsca**, Santi. Climbing: lvs. broadly oval to obovate, usually obtuse, the upper ones connate into an oval obtuse disk, rarely distinct, 1–3 in. long, glabrous or pubescent: fl.-heads dense, long-peduncled, often in 3's; corolla yellowish white, usually tinged red, fragrant, 1½–2 in. long, with very slender tube. May–July. Distributed through the whole Medit. region in many different forms. Var. **pubéscens**, Dipp. (*L. gigantèa*, Zabel. *L. etrúsca gigantèa*, Zabel). Lvs. soft-pubescent on both sides, large. Var. **supérba**, Wright (*L. gigantèa*, Carr.). Lvs. large, about 2½ in. long, glabrous: fls. creamy yellow at first, finally almost orange. B M. 7977. Probably not different from var. *glabra*, Lowe.

53. **Periclýmenum**, Linn. (*Caprifòlium Periclýmenum*, Roem. & Schult.). WOODBINE. Fig. 2210. Climbing several feet high: lvs. all distinct, ovate to oblong-ovate, acute, 1½–3 in. long, dark green above, pale or glaucous beneath and sometimes sparingly pubescent: fls. in a peduncled dense head, very fragrant, yellowish white, usually carmine or purple outside and glandular pubescent, 1½–2 in. long. June–Sept. Eu., N. Afr., W. Asia. H.W. 3, p. 129. G.M. 45:615; 56:974. Var. **aùrea**, Lind. & André. Lvs. yellow or yellowish, particularly while young. I.H. 18:59. Var. **quércina**, Weston (var. *quercifòlia*, Ait.). Lvs. sinuately lobed and often with a narrow whitish margin. Var. **bélgica**, Ait. Glabrous: lvs. thickish, whitish beneath: fls. pale purple outside. Var. **serótina**, Ait. (*L. semperflòrens*, Hort.). Similar to the preceding: fls. dark purple outside, fading to pale purple, blooming late and profusely. Gn. 45:307.

2210. Lonicera Periclymenum. (×⅓)

L. affinis, Hook. & Arn. Allied to L. japonica. Lvs. ovate, pubescent or glabrous beneath, 2–3½ in.: fls. white at first, turning to deep yellow; bracts subulate; very free-flowering. China, Japan.—*L. alseuosmoìdes*, Graebn. Allied to L. Henryi. Branchlets glabrous: lvs. lanceolate or narrow-lanceolate, narrowed at base: fls. slightly over ½in. long, orange-red. W. China.—*L. Altmannii*, Regel & Schmalh. (L. tenuiflora, Regel & Winkl.). Allied to L. hispida. Shrub, to 6 ft.: branchlets pilose: lvs. broadly ovate to ovate-elliptic, pubescent below, ¾–2 in. long: bracts ovate-lanceolate; corolla 2-lipped, whitish, ½–¾in. long: fr. ovoid, scarlet. Turkestan. Var. *pilosiúscula*, Rehd. Lvs. only sparingly pilose on both sides. Hardy and handsome in fr.—*L. angustifòlia*, Wall. Allied to L. thibetica. Erect shrub, to 10 ft.: lvs. lanceolate, pubescent below when young, 1–2 in. long: fls. long-peduncled, white, fragrant, with regular 5-lobed limb. Himalayas. F.S. 4, pp. 407, 408 *b*. Tender.—*L arbòrea*, Boiss. Allied to L. Maackii. Erect shrub or small tree, to 30 ft.: lvs. roundish ovate, pubescent, ¾–1½ in. long.: fls. short-peduncled, 2-lipped, pinkish, small: fr. whitish. Spain. Var. *pérsica*, Rehd. (L. nummularia, Fisch. & Mey. L. nummulariifolia, Jaub & Spach). Lvs. smaller, less pubescent: corolla-tube not gibbous. W. Asia to Afghanistan.—*L. arizónica*, Rehd. Allied to L. ciliosa: lvs. slender-petioled, 1–1¾ in. long: limb of corolla nearly equal; tube slender; style glabrous. Ariz. S.T.S. 1:23.—*L. biflòra*, Desf. (L. canescens, Schousb.). Allied to L. japonica. Climbing, grayish tomentose: lvs. ovate, small: fls. in pairs, white, 2-lipped, with slender, long tube, fragrant; bracts subulate. Spain, N. Afr.—*L. cæruléscens*, Dipp.=L. xylosteoides.—*L. canéscens*, Schousb.=L. biflora.—*L. Chamíssoi*, Bunge. Allied to L. orientalis: lvs. very short-stalked, oval or ovate, glabrous, 1–2 in. long: peduncles ¼–½ in. long: fr. red. N. E. Asia.—*L. confùsa*, DC. Closely allied to L. biflora, but fls. and lvs. somewhat larger and ovary glabrous. Japan, China. B.R. 70 (as L. japonica). Gn. 45, p. 307. Has been often confounded with L. japonica, but is easily distinguished by the small subulate bracts.—*L. conjugiàlis*, Kellogg. Allied to L. orientalis. Erect shrub: lvs. oval or ovate, pubescent: fls. slender-peduncled, small, 2-lipped, dark purple: fr. red. Wash. to Calif.—*L. decípiens*, Hook. f. and Thoms.=L. lanceolata.—*L. deflexícalyx*, Batalin. Allied to L. trichosantha. Upright shrub, to 15 ft.: lvs. lanceolate, acuminate, pubescent on both sides, 1½–3 in. long: fls. slightly over ½in. long: fr. orange-red. W. China. B.M. 8536.—*L. Delavàyi*, Franch.=L. similis var. Delavayi.—*L. depréssa*, Royle=L. Myrtillus var. depressa.—*L. díscolor*, Lindl. (L. orientalis var. discolor, Clarke). Allied to L. orientalis. Lvs. ovate to ovate-oblong, glaucous and glabrous beneath: peduncles ½–1 in. long: fls. yellowish white, slightly pinkish. Himalayas. B.R. 33.44.—*L. diversifòlia*, Wall.=L. quinquelocularis.—*L. Ferdinandii*, Franch. Allied to L. iberica. Lvs. ovate to ovate-lanceolate, acuminate, sparingly hairy, 1–2¼ in. long, often with stipules: fls. short-peduncled, ¾in. long, yellow, appressed setose outside. N. W. and Cent. China. Var. *leycesterioìdes*, Zabel (var. Beissneriana, Zabel). Less hairy: lvs. larger, to 7 in. long: corolla less setose. Only the variety is in cult.—*L. floribúnda*, Boiss. & Buhse. Allied to Korolkovii. Lvs. broadly ovate to elliptic, obtuse: peduncles ½–⅕in., decreasing in length toward the end of the branchlets; bractlets nearly as long as ovaries. Persia. Not in cult.; the plant cult. under this name is L. Korolkovii.—*L. Giráldii*, Rehd. Allied to L. Henryi. Climbing: branchlets with fulvous spreading hairs: lvs. oblong-lanceolate, hairy on both sides, 1½–2¼ in. long: fls. crowded at the end of the branchlets, ¾in. long, densely covered with spreading yellowish hairs. W. China. B.M. 8236. R.H. 1907, p. 299.—*L. Gríffithii*, Hook. f. & Thoms. Allied to L. Periclymenum. Lvs. broadly ovate to ovate-oblong, the pair below the infl. nearly suborbicular: whorls of fls. 2–3, each subtended by a cupula. Afghanistan. S.T.S. 1:24.—*L. gynochlamýdea*, Hemsl. Allied to L. pileata. Upright shrub: lvs. deciduous, lanceolate, acuminate, nearly glabrous, 2–4 in. long: fls. short-peduncled, 2-lipped, ⅓–½in. long, whitish, flushed pink: fr. red. W. China.—*L. heterophýlla*, Decne. Allied to L. alpigena. Lvs. elliptic to oblong. lanceolate, sometimes irregularly lobed, acuminate, glabrous, 1¾–3½ in. long: corolla yellowish white, flushed red: fr. distinct. Afghanistan, Turkestan. Var. *Karelínii*, Rehd. (L. Karelini, Bunge). Lvs. not lobed, glandular along the midrib: corolla usually glandular outside. Cent. Asia. Only the variety is sometimes cult.; hardy.—*L. Karelíni*, Bunge=L. heterophylla var. Karelinii.—*L. Koehneàna*, Rehd. Allied to L. chrysantha. Lvs. ovate, rhombic-ovate to obovate, acuminate, soft-pubescent beneath, 1–4 in. long: peduncles ½–1 in. long; bractlets connate into pairs, half as long as the pubescent ovary: fr. dark red. W. China. S. T. S. 1:21.—*L. lanceolàta*, Wall. (L. decipiens, Hook. f. & Thoms.). Allied to L. orientalis. Lvs. ovate to ovate-lanceolate, acuminate, grayish green and pubescent beneath, particularly on the veins, 2–4 in. long: peduncle ½in. long; bractlets at least half as long as ovaries: fr. black, connate only at the base. Himalayas—*L. leycesterioìdes*, Graebn.=L. Ferdinandii var. leycesterioides.—*L. Maximòwiczii*, Maxim. Allied to L. orientalis. Shrub, to 6 ft.: lvs. oblong-elliptic: fls. peduncled, purplish violet, 2-lipped, rather small: frs. connate, red. N. E. Asia. Gt. 17:597.—*L. micrántha*, Dipp.=L. xylosteoides.—*L. micranthoìdes*, Zabel (L. nigra × L. tatarica). Similar to the latter: fls. small, reddish white; bractlets half as long or as long as ovary; stamens pubescent: fr. red. Garden origin.—*L. microphýlla*, Willd. Allied to L. tangutica. Erect shrub, to 4 ft.: lvs. oval, about ½in. long: fls. slender-peduncled, 2-lipped, yellowish white, small: berries connate, orange-red Altai to Himalayas.—*L. mucronàta*, Rehd. Allied to L. fragrantissima. Lvs. broadly oval to obovate, mucronate, ½–1 in. long: fls. short-stalked, white, fragrant: frs. connate, red. W. China. S.T.S. 2:122.—*L. mupinénsis*, Rehd. Allied to L. alpigena. Bud-scales upright, lanceolate, persistent: lvs. oblong, acuminate, sparingly pilose beneath: fls. dark purple: frs. distinct, red. W China.—*L. myrtilloìdes*, Purpus. Allied to L. syringantha. Lvs. elliptic to oblong-ovate, acute, ½–1⅓ in. long: peduncles ½in. long; fls. pinkish white, ⅓in. long, fragrant: frs. connate, red. Origin unknown.—*L. Myrtíllus*, Hook. & Thoms. (L. parvifolia var. Myrtillus, Clarke). Allied to L. syringantha. Lvs. oval, obovate or oblong, ¼–1 in. long: fls. short-stalked; bracts narrow-oblong; corolla tubular-campanulate, ⅓in. long, yellowish white: fr. red, connate. Himalayas. S.T.S. 1:44. Var. *depréssa*, Rehd. (L. depressa, Royle. L. parvifolia, Hook. f. & Thoms.). Fls. slender-stalked; bracts broader, usually oval.—*L. nepalénsis*, Kirchn.=L. xylosteoides.—*L. nervòsa*, Maxim. Allied to L. orientalis. Shrub, to 10 ft., with slender dark purple branchlets: lvs. ovate, with purple veins, 1–2 in. long: fls. small, pink, long-peduncled, 2-lipped: fr. black, connate only at base China. Hardy, graceful shrub.—*L. nìgra*, Linn. Allied to the preceding species. Shrub, to 5 ft.: lvs. elliptic to elliptic-lanceolate, 1½–

2½ in. long: fls. slender-peduncled, pink, small: fr. black. Mountains of Cent. Eu. H.W. 3, p. 128.—*L. nummulària*, Fisch. & Mey., and *L. nummulariifòlia*, Jaub. & Spach=L. arborea var. persica.—*L. obovàta*, Royle. Allied to L. tangutica. Lvs. very small, obovate: fls. small, yellowish white, gibbous, short-stalked: frs. connate, bluish black. Himalayas.—*L. Ólgæ*, Regel & Schmalh. Allied to L. hispida. Lvs. ovate to lanceolate, acute, ½–2⅓ in. long: fls. short-stalked, upright, 2-lipped, over ½in. long: fr. bright red, distinct. Turkestan.—*L. parvifòlia*, Hook. f. & Thoms.=L. Myrtillus var. depressa.—*L. pérsica*, Jaub. & Spach= L. arborea var. persica.—*L. propínqua*, Zabel (L. alpigena × L. Ledebourii). An interesting hybrid, in one form more like the first, in the other more like the second parent. Of garden origin.—*L. prostràta*, Rehd. Allied to L. trichosantha. Prostrate shrub: lvs. oval or ovate, acute, ½–1 in. long: fls. small: fr. bright red. W. China.—*L. purpuráscens*, Walp. Allied to L. tangutica. Branchlets pubescent: lvs. oval to oblong, pubescent, ¾–1¾ in. long: fls. tubular-funnelform, dull purple, hairy, over ½in. long, gibbous: fr. bluish black. Himalayas, Afghanistan.—*L. pyrenàica*, Linn. Allied to L. canadensis. Glabrous: lvs. cuneate-oblong: fls. slender-peduncled, tubular-campanulate, regularly 5-lobed, white, ¾in. long: frs. red, distinct. Pyrenees Mts. B.M. 7774.—*L. quinquelocularis*, Hardw. (L. diversifolia, Wall.). Allied to L. Maackii. Lvs. ovate or elliptic to oblong-ovate, narrowed or rounded at base, pubescent, 1¼–2¾ in. long: fls. short-stalked; corolla ¾in. long, with slender tube, pale yellow: fr. white. Himalayas, Afghanistan. H.I. 9:807. Var. *translùcens*, Zabel (L. translucens, Carr. L. diversifolia, Dipp.). Lvs. rounded or subcordate at base: tube gibbous, much shorter than limb. B.R. 30:33.—*L. ramosíssima*, Franch. & Sav. Allied to L. tangutica. Lvs. oval to ovate, pubescent, ½–1 in.: fls. long-peduncled, yellowish; bractlets connate, as long as ovaries: fr. scarlet. Japan. Very handsome in fr.—*L. retùsa*, Franch. Allied to L. orientalis. About 6 ft. high: lvs. obovate or broadly ovate, bluish white beneath: fls. in pairs, white, becoming yellowish: fr. shining black. W. China. S. T. S. 2:123.—*L. rupícola*, Hook. f. & Thoms. Allied to L. thibetica. Lvs. ovate to oblong, obtuse or acutish, dull bluish green above, glabrous or pubescent beneath, ½–1 in. long: fls. pubescent outside, pale purple. Himalayas.—*L. saccàta*, Rehd. Allied to L. tangutica. Lvs. elliptic-oblong to oblong, obtusish, pubescent beneath, ¾–2 in. long: fls. long-peduncled; bracts narrow-oblong, leafy; tube gibbous at base. Cent. and W. China. S.T.S. 1:20.—*L. segreziénsis*, Lav. Similar to L. Xylosteum: lvs. more pubescent, dark bluish green: fls. short-peduncled, yellowish: fr. dark red. Of garden origin. Supposed to be a hybrid of L. quinquelocularis and L. Xylosteum.—*L. símilis*, Hemsl. Allied to L. japonica. Plant pilose: lvs. ovate-oblong to lanceolate, ciliate, white-tomentose below, 1¾–3½ in. long: fls. slender-peduncled, 2 in. long, white; bracts subulate. Cent. and W. China. Var. *Delavàyi*, Rehd. (L. Delavayi, Franch.). Glabrous, but lvs. tomentose beneath and sometimes slightly ciliate. Only this variety is in cult.—*L. spléndida*, Boiss. Allied to L. implexa and L. etrusca: glabrous, glaucous: fls. in a many-fld., sessile head, yellowish white, tinged purple. Spain. F.S. 11:1130. Gt. 39, p. 65.—*L. strophióphora*, Franch. Allied to L. hispida. Winter-buds with several scales: lvs. short-stalked, ovate, sparingly hirsute, 2–3½ in. long: fls. funnelform, white, nearly ¾in. long, with the lvs.: fr. red, distinct. Japan.—*L. subæquàlis*, Rehd. Allied to L. ciliosa. Lvs. elliptic to obovate-oblong, glabrous, 2–5 in. long: fls. funnelform with nearly regular limb; usually only 1 sessile whorl. W. China.—*L. tenuiflòra*, Regel & Winkl.=L. Altmannii.—*L. tomentélla*, Hook. f. & Thoms. Allied to L. thibetica. Erect shrub, to 12 ft.: lvs. small, ovate to oblong, pubescent: fls. short-peduncled, nodding, small, regular, white: fr. connate, black. Himalayas. B.M. 6486. Tender.—*L. translùcens*, Hort.=L. quinquelocularis. —*L. Tschonóskii*, Maxim. Allied to L. orientalis. Lvs. elliptic-oblong, acute at both ends, quite glabrous 2–4 in. long: fls. long-stalked, pinkish; bractlets connate, about half as long as ovaries: fr. nearly distinct, red. Japan.—*L. utahénsis*, Wats. Closely related to L. canadensis. Lvs. broadly ovate to oblong, obtuse, not ciliate: corolla smaller, less gibbous. Brit. Col. to Ore., Utah, Wyo.—*L. Vidàlii*, Franch. & Sav. Allied to L. alpigena. Lvs. ovate or elliptic, abruptly acuminate, pubescent, 1½–3 in. long: fls. lilac, on glandular peduncles about ½in. long; bractlets connate, one-half or three-fourths as high as ovaries: fr. red, partly connate.—*L. Vilmòrinii*, Rehd. A garden hybrid between L. deflexicalyx and L. quinquelocularis—*L. Webbiàna*, Wall. Allied to L. alpigena. Lvs. larger, acuminate, pubescent: fls. paler; ovaries separate. Himalayas. S.T.S. 1:69.—*L. xylosteoìdes*, Tausch. (L. tatarica × L. xylosteum. L. micrantha, Dipp., not Regel. L. cærulescens, Dipp. L. nepalensis, Kirchn.). Lvs. usually rhombic-ovate, broadly cuneate at base, bluish green, slightly pubescent: corolla small, pinkish: fr. red. Garden origin.

ALFRED REHDER.

LOOSESTRIFE: *Lysimachia* and *Lythrum.*

LOPÈZIA (after the Spaniard Lopez, who wrote on the natural history of the New World). *Onagràceæ.* Greenhouse plants grown for the attractive flowers; may be planted in the open far South.

Erect, branching, glabrous or pubescent: lvs. alternate or the lower opposite, dentate: fls. usually small, in leafy racemes or subcorymbose at the ends of branches, slender-pedicelled; calyx-limb 4-parted, unequal, deciduous, linear-lobed; petals 4, short- or long-clawed, unequal, the posterior ones narrower, the claws glandular at the apex; stamens 2, attached to the pistil, one anther-bearing, the other petal-like; ovary 4-celled: caps. globose, leathery; seeds obovoid, with a leathery granulated coat.—Species a score or more, in Mex. and Cent. Amer. Little grown, but valuable for the gay forms and colors.

albiflòra, Schlecht. Fig. 2211. Suffruticose perennial, diffuse, 2 ft. high: young branches somewhat villous: lvs. cuneate at the base, ovate-lanceolate to ovate, irregularly serrate or remotely dentate, largest 1½ in. long: pedicels horizontally spreading, slender; petals white, often tinged slightly pinkish at base, larger ones obliquely spatulate, obtuse and mostly notched, smaller ones linear, obtuse, equaling or exceeding the sepals. Mex.

lineàta, Zucc. Shrubby, the st. and petiole usually hairy, 3 ft.: lvs. ovate, acute, crenate-serrate: fls. red, described as "insect-like," in terminal short racemes or clusters; posterior petals bearing a single gland. Mex. B.R. 26:40. G. C. III. 43:294.

2211. Lopezia albiflora. (×½)

miniàta, DC. Slender shrubby perennial, with terete sts. which are glabrous or with lines of hairs: lvs. small, ovate-oblong, serrate: fls. many, small, the petals red in lower part, and rose-color with violet margins in upper part; posterior petals with 2 glands; sepals spreading. Mex., Guatemala. —Probably confused with the last.

macrophýlla, Benth. Semi-shrubby perennial, with green and succulent branches: lvs. long-stalked, ovate-acuminate, serrate: fls. solitary on axillary peduncles, large, bright red. Mex., Guatemala. B.M. 4724. H.F. 1:48.

coronàta, Andr. Annual: lvs. scattered or in whorls, glossy, glabrous: 2 upper petals linear, bright lilac; 2 side ones larger; lamina roundish obovate, light lilac, with dark red mark at base. Mex. R.H. 1905, pp. 216, 217.—Cult. in S. Calif.

L. H. B.

LOPHÁNTHUS (Greek, *crested flower;* application not apparent). *Labiàtæ.* As defined by Briquet in Engler and Prantl's "Natürlichen Pflanzenfamilien," this genus comprises 2 Asian species. They are erect herbs with dentate lvs. and axillary clusters of blue or bluish fls. *L. chinénsis*, Benth. (*Hyssópus Lophánthus*, Linn.), from N. China and Siberia is sometimes planted, although apparently not in the trade. It is a nepeta-like plant, 1–1½ ft. high, with aromatic foliage, ovate lvs., and blue fls. in 3–5-fld. cyme-clusters: blooms midsummer to autumn, and useful in the alpine garden.

The few N. American species formerly held under this name are now included under Agastache. Two of them have been offered by dealers in native plants, but they are scarcely horticultural subjects, although useful for the wild garden. These are: **Agástache Fœniculum,** Kuntze (*L. anisàtus*, Benth.). GIANT HYSSOP. Height 2–5 ft.: lvs. ovate, anise-scented when crushed, white beneath: fls. blue; calyx-teeth tinged purple or violet. July, Aug. Prairies, Wis., to Rockies. **A. scrophulariæfòlia,** Kuntze (*L. scrophulariæfòlius*, Benth.). Height 4–6 ft.: lvs. not anise-scented, not white beneath: fls. dull purplish; calyx-teeth whitish. Borders of thickets, N. Y. to Wis. and N. C.

L. H. B.

LOPHOCÁRPUS: *Lonchocarpus.*

LOPHOCÈREUS (*crest* and *Cereus*). *Cactàceæ.* Stout plants growing in clusters, with few ribs. Areoles on lower part of st. very different from the upper ones; flowering areoles bearing long, bristle-like hairs standing at right angles to the st.: fls. several from each areole, small: fr. small, red.—Three species have been described.

Schóttii, Brit. & Rose (*Pilocèreus Schóttii,* Lem.). Branching from the base, 10–15 ft. high, glaucous: ribs 4–10, commonly 5; spines 4–7, very short, thickened at base; areoles of the fruiting area bearing very copious and long (1–3 in.) stiffish twisted bristles: fls. small, pinkish, about 1 in. long: fr. soft, edible, the size and somewhat the color of an olive. N. W. Mex. and Low. Calif.

L. Sargentiànus, Brit. & Rose, (G.F. 4:437), and *L. austràlis,* Brit. & Rose, are occasionally seen in cult.

J. N. Rose.

LOPHÓPHORA (Greek, *crest-bearing*). *Cactàceæ.* Depressed globose, often proliferous and cespitose, unarmed except in seedling forms; tubercles conical, bearing at summit the flowering areole filled with white hairs: fls. from the center of the plant, small, pinkish: fr. clavate, naked, pinkish; seeds black. A very distinct genus, sometimes referred to Anhalonium and at other times to Echinocactus. Under the latter genus it was described in Cyclo. Amer. Hort.

Wílliamsii, Coult. (*Echinocáctus Wílliamsii,* Lem. *Anhalònium Wílliamsii,* Lem. *E. Lewínii,* Schum. *Anhalònium Lewínii,* Hennings. *L. Lewínii,* Thomp.). Hemispherical, from a very thick root, often densely proliferous, transversely lined below by the remains of withered tubercles: ribs usually 8 (in young specimens often 6), very broad, gradually merging above into the distinct nascent tubercles, which are crowned with somewhat delicate penicillate tufts, which become rather inconspicuous pulvilli on the ribs: fls. small, whitish to rose. Texas and Mex.—The well-known "mescal button," used by the Indians in religious rites. Other Indian vernacular names are: peyotl, peyote, pellote, xicori, hicori, hiculi, huatari, camaba, señi (Kiowa Indians), ho (Apaches), wokowi (Comanches), mescal-buttons, mezcal-buttons (Oklahoma, Texas), teonanacatl (Ancient Aztecs).—This plant is highly esteemed and even held in superstitious reverence by several tribes of Indians in the mountains of Mex. and in the U. S., on account of its narcotic properties. It is said that it produces beautiful highly colored visions. Its taste is bitter and disagreeable, and it sometimes causes vomiting. The use of the drug is accompanied by the loss of a sense of time. Its effects have been compared to those of hasheesh (*Cannabis indica*), but that narcotic produces delusions of merriment while lophophora causes a condition of ideal content followed by wakefulness. Several alkaloids have been separated from it, among them lophorine, anhalonine, and mezcaline. (See Dixon, W. E., Journ. Physiol., Sept., 1899, p. 71.) This plant was first received by wholesale druggists from Mrs. Anna B. Nickels, of Laredo, Texas, who called attention to the fact that the Indians of N. Mex. and S. W. U. S. "use the plant in manufacturing an intoxicating drink, also for breaking fevers" and that the tops cut off and dried are called mescal-buttons. These dried tops, which are often strung and sold in the markets of Mex., look very much like mushrooms and were mistaken for such by the early Spaniards. The Aztecs, who applied the name nanacatl to mushrooms in general, called this plant teonanacatl, which signifies "sacred mushroom," but they had very imperfect notions of botanical distinctions, and their name may be compared to "pine-apple," which is certainly far removed from an apple. Hubert Howe Bancroft mentions this narcotic as a mushroom, and for centuries investigators have sought in vain for a Mexican fungus causing the effects attributed to the teonanacatl. Its indentity, however, was for the first time established by W. E. Safford at a meeting of the Botanical Society of Washington, May 4, 1915. For an account of the history and ceremonial use of this plant, see Journal of Heredity, July, 1915.

J. N. Rose.
W. E. Safford.

LOPHOSPÉRMUM: *Maurandia.*

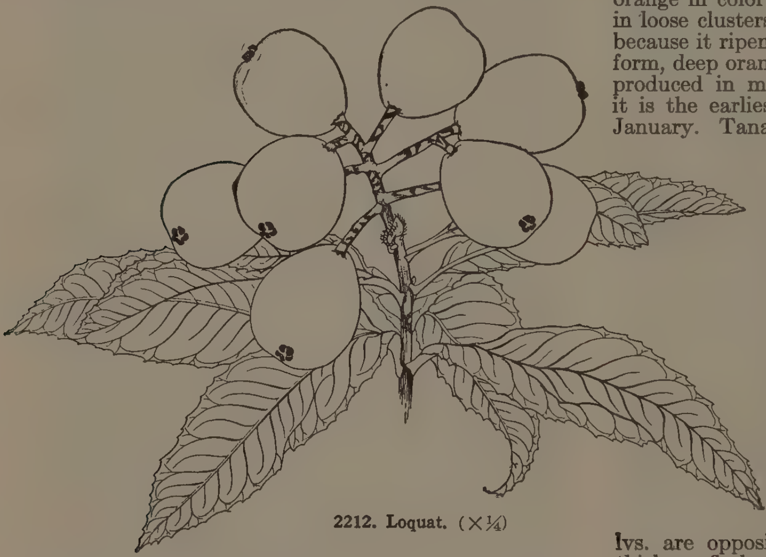
LOQUAT. Fig. 2212. The loquat, or biwa of the Japanese (*Eriobotrya japonica,* Lindl.), is a small evergreen fruit tree with handsome foliage, considered to be a native of China and Japan. It has long been cultivated in those countries as well as in northern India; within recent years it has become fairly common in the Mediterranean basin, especially in Algeria and Sicily, and in the milder sections of the United States. In Florida and the Gulf States it is seen in dooryards and gardens, but is rarely planted in orchard form; in California its cultivation is conducted commercially. It is also grown in some tropical regions, but does not succeed so well as in the subtropics. In Japan the annual production is said to be over 20,000,000 pounds.

The tree, which attains an ultimate height of about 25 feet, is more or less densely clothed with elliptical to oblong-obovate, nearly sessile, remotely toothed deep green leaves, varying from 6 to 10 inches or more in length. The small, white, very fragrant flowers, which are produced in fall, are borne in crowded woolly panicles 4 to 7 inches long. The fruit, which ripens in spring, varies in shape from spherical to pyriform, in color from pale yellow to deep orange, and in the best varieties is sometimes 3 inches in length. The skin is thin and smooth, but tougher than that of an apple. The flesh is firm and meaty in some varieties, more melting in others, almost white to salmon-orange in color, juicy, and of a sprightly flavor suggestive of a cherry. The seeds, which are about ¾inch long and dark brown in color, vary from one to eight or nine in number, four or five being common. They occupy a large amount of space in the center of the fruit, the reduction of the proportion of seed to flesh being one of the points most sought in breeding. The loquat is eaten while fresh, or is made into pies, jams, jellies, preserves and the like.

The tree is successful on a wide variety of soils, but has done best on clay loam. Ikeda, a Japanese authority, considers that the fruit reaches its highest degree of perfection when grown near the seacoast. For orchard-planting a piece of well-drained land should be chosen, and the trees set 20 to 24 feet apart. Their culture presents few difficulties; in fact the loquat will thrive and produce good crops with less care than many other fruit trees. It does not require a great amount of fertilizer on reasonably good soils, but leguminous cover-crops have been found highly beneficial. Occasional pruning is required to admit light to the center of the tree, and to keep the branches somewhat thinned out. To obtain fruit of good size and best commercial value, it may be desirable to thin the crop as soon as the young fruits have set, leaving no more in a cluster than the tree can properly mature. Picking for market should be done when the fruit has lost its acidity and is fully ripe; if picked too soon the loquat is quite sour. For jelly only acid fruit is used. When packed in boxes holding about thirty pounds, the fruit can be shipped successfully to nearby markets, but for distant markets smaller packages and great care in packing are necessary.

Pear blight (*Bacillus amylovorus*) and loquat scab (*Fusicladium eriobotryæ*) are at times troublesome in the California orchards, and a borer is reported from Japan which occasionally attacks the tree.

While in many countries the loquat is usually propagated from seed, there is as much variation among the seedlings as with other tree-fruits, and good varieties can be perpetuated only by some vegetative means of propagation. Both budding and grafting are practised, budding being the method preferred in the United States, and usually employed when trees are desired for commercial planting. Seedlings are often planted in dooryards, where they not only serve as admirable ornamental trees, but produce an abundance of reasonably good fruit. In budding and grafting, seedling loquats are generally used as stocks. When budded on quince, the tree is considerably dwarfed; this stock is sometimes used, however, because its fibrous root-system readily permits of transplanting. Seeds should be planted as soon as removed from the fruit, either singly in pots, or in flats from which they can be potted off later on. A light loam should be used, covering the seeds to a depth of about 1 inch. When the young plants have attained a height of 6 or 7 inches, they may be planted in nursery rows in the open ground, where they can be grown until the stems are about ½ inch in diameter at the base, when they are ready for budding. This is best done during October or November, depending upon climatic conditions. The buds are allowed to lie dormant until early spring, when they must be forced into growth. Budwood should be of young and smooth wood, preferably that which has turned brown and lost its pubescence, and from which the leaves have dropped. Shield-budding, essentially the same as practised with the citrous fruits, is the method commonly used. The buds should be cut somewhat larger than for the orange, preferably not less than 1½ inches in length. After inserting them in T-incisions made in the stocks at a convenient point not far above the ground, they should be tied with raffia, soft cotton string, or waxed tape, and left about three weeks, when they should have formed a union. At this time they may be unwrapped, and if necessary, rewrapped loosely, so as to allow the buds to start into growth. When not rewrapped, the bark sometimes opens up around the bud and exposes it to the air, causing its death. The stock must be cut back to a point about 3 inches above the bud, and all adventitious buds rubbed off as fast as they make their appearance. Difficulty is sometimes experienced in forcing the bud into growth.



2212. Loquat. (×¼)

In grafting, a simple cleft graft is used, with a cion of about the diameter of a lead pencil, and of well-matured wood.

Most of the named varieties of the loquat have originated in Japan, Algeria and California. Ikeda mentions forty-six varieties of Japanese origin, of which eight are recommended as the best for cultivation. Trabut of Algiers describes twelve varieties of Algerian origin, though none of them is considered so desirable, from a commercial standpoint, as Tanaka, with the possible exception of Taza, which resulted from a cross between Tanaka and one of the local forms. Tanaka is of Japanese origin, but has been grown in Algeria for several years, and also to a very limited extent in California, where it has not, however, become as popular as several varieties of local origin. Most of the varieties originated in the United States have been produced by C. P. Taft, of Orange, California, who has done more to improve the loquat than any other man. Among the best may be mentioned Advance, a bright yellow, pyriform fruit, sometimes 3 inches in length, produced in very large, compact clusters and ripening from March to June; Champagne, oval to pyriform, 2 to 3 inches in length, white-fleshed, produced in clusters as large as those of Advance but less compact, considered the best of all in flavor; Premier, oval, not quite so large as Advance, salmon-orange in color; Victor, a very large and showy fruit, in loose clusters, not considered valuable in California because it ripens late in the season; Early Red, a pyriform, deep orange-colored fruit, 1 to 2 inches in length, produced in medium-sized clusters, valuable because it is the earliest of all, commencing to ripen in late January. Tanaka is an attractive fruit of large size and deep orange-color, with unusually good shipping qualities, but it ripens too late to be of commercial value in California. The earliest fruits are the ones which yield the greatest returns, because they come into market at a time when fresh fruits are scarce.

F. W. Popenoe.

LORÁNTHUS (*strap-flower*, from the form of the petals). *Loranthàceæ*. Several hundred parasitic evergreen shrubs, mostly of tropics in many countries; one of the extensive mistletoe family. They are not horticultural subjects, but attempts are sometimes made to grow them, it is said with success, by sowing them on the exposed roots or branches of their hosts. The lvs. are opposite or alternate, entire, usually either thick or fleshy: fls. usually perfect, often showy, the 4–6 petals free or more or less joined to form a tubular corolla; calyx entire or 4–6-toothed; stamens as many as petals and attached on them: fr. a berry or drupe, with mucilaginous viscid contents. They are parasitic on upper parts of trees or shrubs or sometimes on the ground.

LOROPÉTALUM (Greek *loros*, strap, and *petalum*, alluding to the strap-shaped petals). *Hamamelidàceæ*. Ornamental shrubs grown chiefly for their white flowers, appearing in winter or early spring.

Evergreen, stellate-pubescent: lvs. alternate, short-petioled, entire, without stipules: fls. fascicled at the end of short branchlets, sessile; calyx short, 4-lobed; petals 4, linear; stamens 4, with very short filaments; ovary inferior, 2-celled: caps. woody, dehiscent, 2-seeded.—Two species in China.

Only *L. chinense* is in cultivation, a handsome much-branched shrub with rather small dull persistent foliage and clustered white or sometimes yellowish or greenish white feathery flowers in early spring. It will probably be hardy as far north as Washington, D. C. It is a desirable plant for the cool greenhouse and if grown in pots a peaty and sandy soil will suit it best. Even where the plant is hardy out-of-doors, the flowers are liable to be injured by frost. Propagation is by seeds, and probably by grafting on Hamamelis.

chinénse, Oliver (*Hamamèlis chinénsis*, R. Br.). Shrub, to 12 ft.: branchlets densely ferrugineous-pubescent: lvs. ovate to ovate-lanceolate, acuminate, rounded and oblique at the base, glaucescent below and hairy on the veins, ciliate, 1–2 in. long: fls. in clusters of 4–5; petals strap-shaped, ¾–1 in. long, white, yellowish or greenish white. March, April. Cent. and S. E. China. B.M. 7979. G. C. II. 19:152; III. 15:343. Gn. 65, p. 255. J.H. III. 18:235. R.H. 1904, p. 571. I.T. 2:58. G. 26:69.

Alfred Rehder.

LÒTUS (an old Greek name). *Leguminòsæ.* Herbs and subshrubs, grown for the yellow, purple, rose-colored or white flowers.

Plants glabrous, silky or hirsute: lvs. with 3–5 lfts. crowded at the apex of the petiole and commonly 2 joined to the st. and resembling stipules: fls. mostly pea-shaped, often in axillary few-fld. umbels, rarely solitary; standard broad, contracted at base; wings obovate; keel incurved or inflexed, beaked; calyx-lobes longer than the tube; stamens 9 and 1, connate but free from the petals: pod oblong or linear.—Species 80–100, largely in the Medit. region, but also in S. Afr., Temp. Asia and Austral. By some botanists, the genus Hosackia (which see) has been united with Lotus, but it differs in having usually more lfts., short calyx-teeth, obtùse keel. One lotus (*L. corniculatus*) has become established in N. Amer. *Lotus nigricans* of cult. is *Kennedya nigricans.*

Lotus meant several things to the ancients: (1) the Greek lotus, a leguminous plant on which horses fed. This was probably what we call to-day *Lotus corniculatus,* the common bird's-foot trefoil of temperate regions. (2) The Cyrenean lotus, an African shrub, the fruit of which was eaten by certain North African tribes who were called lotus-eaters. The fruit was said to be honey-sweet, the size of an olive and in taste like a date. This was probably *Zizyphus Lotus,* a prickly shrub whose fruit is, however, considered inferior to that of the common jujube, *Zizyphus sativa.* Other conjectures have been: *Celtis australis,* a tree which has a small, sweet berry; *Nitraria tridentata,* a thorny desert shrub whose succulent fruit has a stimulating quality, and *Rhamnus Lotus,* another North African plant. European lotus is a name for *Diospyros Lotus,* a kind of date plum which is cultivated in southern Europe, but the fruit is hardly edible. (3) The Egyptian lotus or sacred lily of the Nile. This is *Nymphæa Lotus,* which, like the Hindu lotus, has rose-colored as well as white flowers. American cultivators at the present time almost universally consider that the true Egyptian lotus is *Nelumbium speciosum,* now called *Nelumbo,* but *Nelumbium speciosum* is not a native of Egypt. (4) The Hindu and Chinese lotus, also called the sacred or Pythagorean bean. This is *Nelumbo indica,* better known as *Nelumbium speciosum.* The name lotus was doubtless used for other water-lilies, particularly the blue-flowered *Nymphæa cærulea.*

A. *Lvs. thread-like: fls. odd, scarcely pea-shaped.*

Bertholètii, Masf. (*L. peliorhýncus,* Hook. *L. pelyorénsis,* Hort.). Coral Gem. Small, much-branched, slender bush, with a silvery hue: lfts. whorled, 8–9 lines long: fls. 1½ in. long, in loose clusters of about 20 toward the end of the branches, short-pedicelled, scarlet or crimson fading to orange; standard recurved like a horn; keel acuminate, longer than the wings. Cape Verde, Canaries. B.M. 6733. R.H. 1895:308; 1914, p. 185. G. 25:255. G.L. 27:169.—Peliorhyncus means "bruised or discolored nose." This name, however, is apparently more recent than *L. Bertholetii.* Grown chiefly in hanging-baskets; in S. Calif. it is much used for sunny rockeries. Prop. by division or cuttings. The odd long-pointed fls. make this an interesting and showy species. Var. **atrococcíneus,** Hort., is an easily grown greenhouse plant for baskets, differing from the species in its darker-colored glossy deep scarlet black-spotted fls.

mascaénsis, Burch. A recent species from Teneriffe: similar to *L. Bertholetii* in foliage, but more compact and bushy, with shorter branches: fls. pure shining canary-yellow, produced freely. M.D.G. 1912:253.

AA. *Lvs. not thread-like: fls. pea-shaped.*

B. *Fls. yellow.*

corniculàtus, Linn. Bird's-foot Trefoil. Babies' Slippers. Perennial, prostrate or ascending, a few in. to 2 ft. high, glabrous or hairy: lfts. obovate or ovate, ½in. long, the 2 stipular ones broader and very oblique: fls. yellow, often tinged bright red, 5–10 in an umbel; calyx-lobes about as long as the tube. Temperate regions and Austral.; run wild at certain places in U. S. and Canada. Var. **flòre-plèno** has showy double fls.—A hardy trailer for covering dry banks and rockwork, blooming all summer and autumn. Also grown for forage.

BB. *Fls. pink or white.*

austràlis, Andr. Perennial, diffuse, sometimes subshrubby, glabrous or pubescent: lfts. narrower than in *L. corniculatus,* and the stipular ones less dissimilar, but varying from obovate and under ½in. long, to linear and 1–1½ in. long: fls. usually pink, but varying from white to purple-red. Austral. B.M. 1365. L.B.C. 11:1063 and B. 5:211 (as *L. albidus*).

BBB. *Fls. normally dark purple or dark red.*

C. *Lfts. linear-lanceolate.*

Jacobæus, Linn. Perennial, subshrubby: lfts. few, narrow and long-acuminate: fls. about 3 in a flat-topped cluster, dark purple, almost black. Cape Verde. B.M. 79.—Treated as a tender annual bedding plant: blooms for a long season. A yellow-fld. form is mentioned.

CC. *Lfts. obovate to elliptic.*

Tetragonólobus, Linn. (*Tetragonólobus edùlis,* Link. *T. purpùreus,* Moench). Winged Pea. Annual trailer: lfts. 3, broad-ovate: fls. solitary or twin, purplish cardinal-red: pods 4-sided, 2–3 in. long, somewhat fleshy at first; seeds yellowish, nearly globular or somewhat flattened. Medit. region. B.M. 151.—Tetragonolobus was once considered a separate genus, largely because of the 4 leafy wings of the pod. Grown chiefly for food, the pods being eaten when young and the seeds, when roasted, substituted for coffee. Seeds are sown in drills in April. The plants require no special care except water during drought.

Wilhelm Miller.
L. H. B.†

LOÙRYA (Jules Louis Charles Boys de Loury). *Liliàceæ;* by some referred to *Hæmodoràceæ.* An aspidistra-like plant of recent intro.: perennial herb with creeping rhizome: lvs. basal, lengthened and stalked: fls. in dense heads or spikes at the surface of the ground; parts of perianth ovate, becoming spreading; at the throat a corona; anthers 6, sessile. One species: **L. campanulàta,** Baill. Rootstock stout, subterranean: lvs. 1–2 ft. long, oblong-lanceolate, tapering at both ends: fls. basal, larger and more showy than those of Aspidistra and in longer spike, pale yellow (white?) with purple center, broadly campanulate, the 6 lobes broad: fr. blue, 1 in. long. Cochin-China: a very worthy plant. B.M. 7482. G.C. III. 33:107. R.H. 1889, p. 129. It looks like Curculigo, but differs botanically in having basal ovules and in the characters of stamens, the filaments being united in a dark purple membrane which nearly closes the tube, the anthers small and erect.

L. H. B.

LOUSEWORT: *Pedicularis.*

LOVAGE: *Levisticum.*

LOVE-IN-A-MIST: *Nigella.* **Love-lies-bleeding:** *Amarantus caudatus.*

LOWBERRY. A kind of bramble berry lately originated by Stuart Low & Co., Bush Hill Park, Enfield, England. In 1908, the Royal Horticultural Society gave it an award of merit as "a reputed cross between the blackberry and the loganberry, with the color of the former and the size of the latter. The fruits had been ripened under glass." It is hardy in England, making an annual growth of 12 to 18 feet; it is recommended as an ornamental plant for arbors as well as for fruit. Apparently it has not been thoroughly tested in North America.

The fruit is described as very large and long, jet-black when ripe. The flavor resembles that of the blackberry and is sweeter than the loganberry. The berries make excellent jam, with fewer seeds and less cores than that made from blackberries. The cultural treatment should be that given the loganberry.

LOWIÀRA. A generic name for a garden hybrid (Stuart Low & Co., England) between *Sophronitis grandiflora* and *Brassolælia* "Helen." The name follows the form of Linneara and Adamara (which see). The hybrid is *Lowiàra insígnis*, Rolfe. "The fls. show much of the Sophronitis character, but the sepals are not widely spreading; the sepals and petals are 2½ in. long, the latter nearly 1¼ in. broad, and the color dark rosy salmon; the lip is 2 in. long and entire, with an undulate crenulate margin, and the color rose-purple with a yellowish white throat; the column is broad, whitish and over ½in. long." O.R. Dec., 1912.

LOXOSCÀPHE (Greek, *an oblique boat*). *Polypodiàceæ.* A small group of low southern hemisphere ferns of doubtful relationship; by some botanists referred to Asplenium, by others to Davallia. Indusium forming a compressed, suborbicular or cup-shaped sac, open only at the top: lvs. with linear segms. For cult., consult *Davallia.*

thecíferum, Moore (*Davállia concínna,* Schrad.). Lf.-stalks 3–4 in. long; lf.-blades 6–9 in. long, bipinnate; segms. 2–3 lines long, ½ line wide. S. Amer. and Afr.

fœniculàceum, Moore (*Davállia fœniculàcea,* Hook.). Lf.-stalks 6–8 in. long; lf.-blades 9–18 in. long, quadripinnate; segms. less than ½ line wide. Fiji Isls.

L. M. Underwood.
R. C. Benedict.†

LUCÙLIA (probably adapted from a native name). *Rubiàceæ.* Glasshouse plants grown for the flowers.

Two species of tender shrubs from the Himalaya and Khasia Mts., bearing in winter terminal corymbs sometimes a foot across, composed of 20–40 pink or white, fragrant, salver-shaped fls. with 5 rounded lobes, each fl. being 1½–2 in. across. A plant of *L. gratissima* is on record which attained 6½ ft., bearing 24 bunches of fls. each 2 ft. in circumference, beside 30 smaller bunches. Calyx-tube top-shaped; lobes unequal, deciduous; stamens 5, inserted on the tube of the corolla; filaments very short; disk annular; ovary 2-celled; style 2-branched: caps. almost woody, 2-valved, many-seeded.

For house decoration, *L. gratissima* is one of the most beautiful winter-flowering shrubs, and deserves to become more popular with florists for Christmas sales. The wood ripened after flowering furnishes the best cuttings. Newly rooted plants require a night temperature of 60° at first, but the temperature should be gradually reduced and the plants hardened off before they are planted outdoors for the summer. Young plants should never be allowed to get dry from the time of first potting until they are taken outdoors. For potting, a light soil is desirable. When the pots are well filled with roots, apply liquid manure two or three times a week until the buds appear. During the summer the plants should be syringed daily, as they are subject to red-spider. The plants should be lifted, potted and brought indoors the last week of August. If left out later they do not set flower-buds so well. As soon as the buds appear the plants should be moved to a warmer house, with a night temperature of 55°. After flowering, the plants should be trimmed somewhat, given less water, kept in a night temperature of 45° and syringed daily. They start slowly, but make hardy growths for planting out. (George McWilliam.)

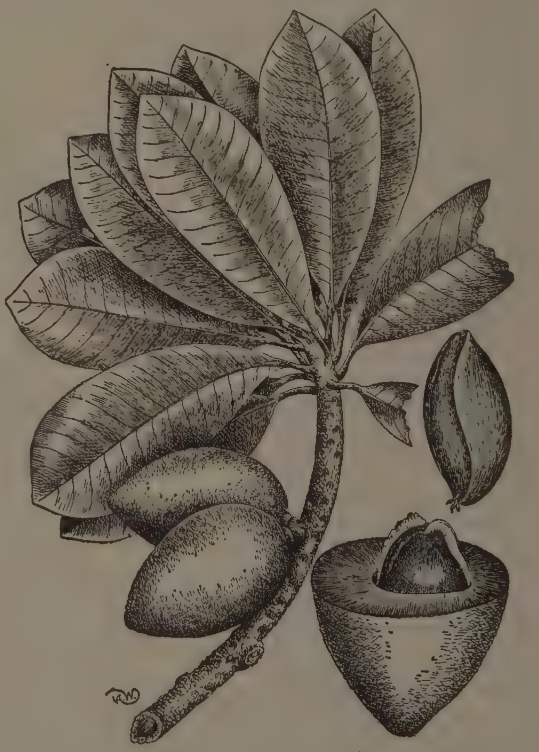
gratíssima, Sweet. In the wild a tree or spreading shrub 10–16 ft.: lvs. opposite, ovate-oblong, acuminate, acute at the base, 4–6 in. long: panicle decussately branched; fls. pink or rose, forming a gorgeous rounded mass; corolla-lobes 1½ in. across, imbricated in the bud; stamens inserted in the tube, slightly exserted. Temperate Himalaya, 4,000–6,000 ft. altitude. B.M. 3946. G.C. III. 21:81; 43:12. R.H. 1843:385; 1890:180. Gn. 35, p. 58; 41, p. 469; 55, pp. 42, 107; 59, p. 49; 78, p. 623. J.H. III. 48:457; 54:459. G. 1:581; 29:671 H.F. 4:120. H.U. 4, p. 353. A.F. 7:443; 10:679.—*L. speciòsa,* Hort., is apparently a form of this species with large and deep-colored fls., and strong growth.

L. Pinceàna, Hook. Bush, 4–6 ft.: lvs. smaller than in above, elliptic-lanceolate and acuminate: fls. in a compound cyme, the lobes pure white above, changing to a cream, with a rosy tinge, outside rosy and the tube red. Distinguished by the presence of 5 pairs of tubercles at the base of each sinus. Khasia Mts., etc., 3,000–5,000 ft. B. M. 4132. Gn. 35, p. 59, and 41, p. 469.

Wilhelm Miller.

LUCÙMA (Peruvian name of one species). *Sapotàceæ.* A group of tropical trees and shrubs, several of which are cultivated, principally in America, for their edible fruits. Other well-known trees which belong to the same family are the sapodilla (*Achras Sapota*) and the star-apple (*Chrysophyllum Cainito*), both of which resemble the lucumas in having fruits with soft, melting flesh of very sweet flavor.

The genus is characterized by lvs. more or less elongate, usually broadened upward; by the imbricate calyx, with lobes in 1 or 2 series; and by the tubular corolla, with stamens opposite the lobes, alternating



2213. The mamey sapote.—Lucuma mammosa. (Spray × ⅙) with the staminodes. The fr. is a berry, 2–10-celled, the seeds exalbuminous.—Species perhaps 60, mostly in Amer. but extending to New Guinea and Austral.

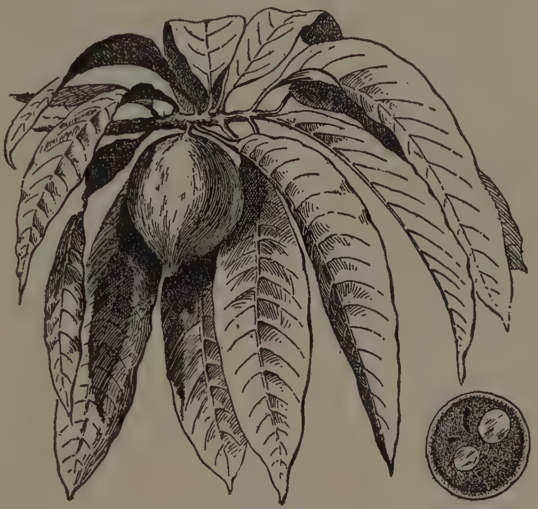
mammòsa, Gaertn. Marmalade Fruit. Mamey Sapote. Mamey Colorado. Sapote. Fig. 2213. A large erect tree, 30 to nearly 100 feet high, cult. in Mex., Cent. Amer., the W. Indies, and N. S. Amer. Lvs. obovate to oblanceolate, cuneate at base, rounded to acute at apex, 4–10 in. long, 1½–4 in. broad, glabrous, light green above, paler or brownish beneath: fls. pedicellate or subsessile, in glomerules of 2–5; calyx-lobes 8–10; corolla white, 5-lobed, ciliate; stamens 5, inserted slightly lower than the staminodes, anthers elliptic-ovate; style conical-elongate, obtuse at tip; ovary 5-celled: fr. globose to elliptical, 3–7 in. long, rusty brown, usually 1-seeded by abortion. Considered a native of Cent. Amer. Pittier has referred this species to *Calocarpum mammosum*, Pierre, while Cook makes it *Achradelpha mammosa.*

nervòsa, A. DC. (*L. Rivicòa* var. *angustifòlia*, Miq.). Ti-es. Egg-Fruit. Canistel. Fig. 2214. A small tree, 10–25 ft. high, with spreading branches: lvs. oblong-obovate to oblanceolate, 4–8 in. long, glabrous, bright green, acute: calyx-lobes 5, the inner ones rounded at the apex; corolla whitish, lobes ovate; style columnar, stigma slightly dilated; ovary 5-celled: fr. globose to ovoid, orange-yellow, 2–4 in. long, usually 2- or 3-seeded. A native of N. S. Amer., but cult. in other parts of Trop. Amer., naturalized on some of the Florida keys.

Caimìto, Roem. (*Poutèria Caimìto*, Radlk.). Abiu. A small tree, about the size of *L. nervosa*, and very similar in appearance: lvs. obovate to lanceolate, 4–8 in. long, acute, bright green, glabrous: fr. ovate-elliptical, bright yellow, 2–4 in. long, usually 2- or 3-seeded. A native of Peru, but cult. in other parts of S. Amer., especially on the coast of Brazil.

In addition to the above may be mentioned the jacana, or hakana, of Porto Rico (*L. multiflòra*, DC.), with oblong or globose frs. 1½–2 in. diam., and sweet, mealy, yellow, edible pulp resembling in appearance the yolk of an egg, inclosing 1–3 seeds. Another noteworthy species is *L. obováta*, HBK., the "lucuma" of Peru and N. Chile, with fr. about the size and shape of a small orange, containing yellow pulp of excellent quality surrounding 1 to several seeds and inclosed in a thin, bright, dark green skin. According to W. E. Safford, specimens of this fr., usually divided into halves, and of the glossy subglobose seeds, are frequently found in prehistoric graves of the coast tribes of Peru, and facsimiles of the fr. in the form of terra-cotta vases are also dug up with Peruvian mummies. *L. Pálmeri*, Fern., is listed in S. Calif.: shrub, to 10 ft., with reddish brown bark on young branches: lvs. dark green, oblanceolate or narrow-obovate: fls. in 2's or 3's or solitary, the corolla twice as long as calyx; stamens and staminodia inserted at top of corolla-tube: fr. over 1 in. long, yellow. Mex. *L. salicifòlia*, HBK., has proved hardy at Santa Barbara: lvs. 5–7 in. long and 1 in. wide, lanceolate, somewhat acuminate, entire and shining: fls. yellowish green, in 2's or 3's, axillary; ovary hirsute, ovate; style about equaling the corolla. Mex. *L. Sellòwii*, A. DC. Lvs. linear or linear-lanceolate, acute, entire or somewhat repand, shining, the young ones tomentose: fls. on solitary or twin axillary pedicels, the corolla tubular, the calyx-lobes and corolla-lobes 4: drupe oblong, size of a pigeon's egg, beaked. Brazil. R.H. 1900, pp. 33, 34.

The most important member of the genus is without doubt *L. mammosa*, the mamey sapote, a common fruit in Cuba, and not infrequently seen on the Central American mainland. It can be grown in extreme south Florida, though it does not seem to thrive on shallow calcareous soils. California has so far proved too cool for it, and no trees of any size are known in the state. It is said to prefer a deep, rich soil and a rainfall of about 70 inches per annum. The fruit is commonly elliptical, and about 6 inches in length. Within the thick woody skin, somewhat rough and rusty brown on the surface, is the soft melting flesh, of a beautiful reddish salmon color, and of about the same consistency as a ripe canteloupe. The large elliptical seed can be lifted out of the fruit as easily as that of an avocado; it is hard, brown and shining, except on the ventral surface, which is whitish and somewhat rough. To one unaccustomed to tropical fruits, the flavor of the mamey sapote is at first somewhat cloying because of its utter lack of acidity; when made into a sherbet, however, as is done in Havana, it is delicious and sure to be relished at first trial. Although natives of tropical countries commonly eat the fruit while fresh, it is also made into marmalade, or used as a "filler" in making guava cheese. The Cubans prepare from it a thick jam, known as *crêma de mamey colorado*, which is delicious. The fruits are picked when mature, and laid away in a cool place to ripen, which takes about a week. If shipped as soon as picked from the tree they can be sent to northern markets without difficulty, and are occasionally exported from Cuba and Mexico to the United States. The season of ripening is during the summer; in Costa Rica the tree is said to lose its foliage in the dry season, flowering at the same time. The seed contains a large oily kernel, which has a strong smell and a bitter taste. According to Pittier, it is used in Costa Rica, after being finely ground, to prepare an exquisite confection; the same authority states that it is sometimes used by the Indians, after being boiled, roasted and ground, to mix with cacao, imparting a bitter taste to the beverage. The foliage of the mamey sapote resembles that of the loquat (*Eriobotrya japonica*), except in its lighter color and entire margins. Propagation is by seed, young trees coming into bearing at the age of five to seven years. Before planting it is well to remove the hard outer husk from the seed; it is then easily germinated by planting in light, sandy loam, barely covering it with soil.



2214. The Ti-es.—Lucuma nervosa. (×¼)

The ti-es (*L. nervosa*) is esteemed in Cuba, where it is called canistel, and is also popular among many of the residents of southern Florida. It is too tender to be grown in California, unless in the most sheltered locations. Unlike the mamey sapote, the tree succeeds on thin poor soils, and seems to be at home on the Florida keys. Its season, in Florida, is from December to March. The fruits when ripe are broadly oval to round, orange-yellow in color, commonly about 3 inches in length, and produced upon short stems toward the ends of the branches. The flesh is dry and sometimes mealy in texture, bright orange-yellow, often likened to the yolk of a hard-boiled egg, which it greatly resembles in appearance but not in taste. The flavor is sweet and rather cloying, to the novice at least, while the aroma is peculiar and somewhat musky. The seeds are one to three in number, oval, about an inch in length, hard, dark brown and shining, except on the ventral surface, which is dull, pale brown. The fruits usually require several days to soften after being picked from the tree, and as the skin is soft and delicate they do not ship so well as those of the mamey sapote. This species is not put to many different uses, the fruit usually being eaten while fresh. The tree is ornamental in appearance, with bright green, glossy foliage, and rarely grows to a height of more than 20 feet. It is usually propagated by seeds, young plants requiring three to five years to come into bearing. The hard outer husk should be removed from the seed before planting.

The abíu of tropical Brazil (*L. Caimito*), greatly resembles the ti-es in growth and foliage, but is easily distinguished by its light yellow fruit, with translucent, whitish, rather juicy flesh, of less cloying flavor than that of the ti-es. The abíu is very popular among the Brazilians, and is commonly cultivated at Rio de Janeiro, Bahia, and other points along the coast. The fruits vary from 2 to 4 inches in length, are usually ovate in form, and have a thick, closely adhering skin, within which lies the soft and melting flesh and two or three large oval seeds. It must be fully ripe to be appreciated; if cut while still firm, a milky latex exudes which is sticky and objectionable in the mouth, while the fruit has a strong taste of tannin. The same is true of other species. The tree, called *abiero* in Portuguese, thrives on a rich clay loam, with an abundance of moisture, and is propagated by seed.

Little has been done to improve any of the lucumas. There is much variation among seedlings, not only in size and quality of fruit, but in productiveness and other characters as well. The best ones should be selected and propagated by some vegetative means, such as budding.

F. W. Popenoe.

LUDDEMÁNIA: *Lueddemannia.*

LUDWÍGIA (C. G. Ludwig, botanist and botanical author at Leipzig, 1709–1773). Sometimes spelled *Ludvigia. Onagràceæ.* Herbs, listed among aquatics.

Annual or perennial aquatic or semi-aquatic small herbs: fls. small and inconspicuous in the axils of the lvs., the parts usually in 4's: fr. a terete ribbed or winged caps.: lvs. mostly small and entire or very nearly so, usually not distinctly petioled, alternate or opposite, the opposite-lvd. species by some referred to Isnardia.—Species about 25, widely spread in warm and temperate regions. The sts. are often creeping, sometimes floating. The ludwigias have little standing as horticultural subjects. They are sometimes useful in bog-gardens, and one is advertised for aquaria. Three names are in the American trade.

A. *Lvs. alternate.*

alternifòlia, Linn. Seed-box, or Rattle-box. An erect shrub, 2–3 ft. or more tall, in appearance not unlike an epilobium, the root sometimes tuberous: lvs. lanceolate or oblong-lanceolate, narrowed below, entire or sometimes with mere suggestions of teeth: fls. large for the genus (½in. across), with yellow caducous petals: caps. large, square in cross-section. Bogs and wet woods in eastern half of U. S.—Interesting, but not showy.

AA. *Lvs. opposite.*

palústris, Ell. (*Isnárdia palústris*, Linn.). Water Purslane. Trailing in muddy places or floating on shallow water, rooting at the joints: lvs. oval or oval-oblong, narrowed into a short petiole: fls. very small, usually reddish.—Nova Scotia to Calif. and Mex.; Eu., Asia; offered as a bog-plant.

Mùlerttii, Mulertt. Lvs. oval to lance-oblong, narrowed into short petioles, entire: fls. yellow: fr. oblong, truncate on top, ⅜in. long.—Intro. from S. Amer. by Hugo Mulertt, then of Cincinnati, and described in "Isis" (published in Germany) in 1880 or 1881, and also in the "Aquarium," Vol. III, pp. 43, 64. It is now widely distributed amongst growers of aquarium plants. It seems not to have been studied by systematic botanists. It is prized for its graceful habit and because it is evergreen. Grows well from cuttings and from seeds. Mulertt, now residing in Germany, gives the following additional information: From the soil coming with rhizomes of nymphea from the Amazon Valley in 1878 this ludwigia made its appearance. At first the plants were not considered to be unusual, but it soon became a favorite with customers, and it has now been widely distributed among aquarists. In Germany, where it is now frequently prop. from seed, several varieties have appeared, but although they retain the evergreen character they do not develop the graceful shape and brilliant crimson coloring of the foliage of the type. "The plant wants a shady location with a high temperature in a water-depth of about 15–18 in. to display its full character below the water-surface. In a sunny location, during summer, it grows above water, the foliage then displaying glossy dark brownish green on top and crimson-purple (or violet-crimson) below. Yellow flowers soon appear in the axils of the lvs. and develop into little caps. that bear the seeds. If left in the caps., these retain life for 6 or 8 years."

L. H. B.

LUEDDEMÁNNIA (Herr Lueddemann). *Orchidàceæ.* A small group of S. American orchids, allied to Cycnoches, but resembling Acineta in habit and requiring treatment similar to the acinetas: sepals oblong and acute, arched; petals cuneate-oblong and acute; ovary pubescent or velvety; fls. handsome, very many on a pendulous peduncle.

L. Lèhmannii, Reichb. f. (Cycnoches Lehmannii, Reichb. f.). Lvs. long and petioled, acute: pseudobulbs furrowed, pyriform, 6 or 7 in. long: fls. 20–30, wax-like, orange-yellow; sepals copper-colored on exterior. Colombia.—*L. Pescatòrei*, Reichb. f. (Cycnoches Pescatorei, Lindl. & Paxt.). Lvs. lanceolate, glaucous, leathery: fls. 30–50, about 1¾ in. diam., sepals orange-brown; petals and lip deep yellow, the disk hairy: peduncle 3 ft. Colombia. B.M. 7123.—*L. Sanderiàna*, Kränzl.=Lacæna bicolor.—*L. tríloba*, Rolfe. Pseudobulbs and lvs. smaller than in two preceding, the lvs. about 1 ft. long and the ovoid pseudobulb about 2½ in. long: fls. deep orange-yellow, the peduncle short (about 6 in.); lip marked with chocolate-red; sepals with a crimson flush. Andes.—*L. Vyvereàna*, Schlecht. Allied to L. Pescatorei, but lip with a longer claw and different shape, with a smaller basal callus, and a less prominent thickening in middle of the blade. Peru.

L. H. B.

LUÈHEA (F. Karl van der Lühe, Austrian botanist interested in the Cape of Good Hope). *Tiliàceæ.* About 16 species of trees and tall shrubs from the warmer parts of Amer., with usually toothed lvs. and handsome white or rosy fls. borne in a terminal panicle, or sometimes in the axils: sepals and petals 5; stamens numerous, the outer ones often without anthers; ovary 5-celled: caps. rather woody, loculicidally semi-5-valved. A species was intro. into Santa Barbara, some years ago, from Paraguay. It is probably *L. divaricàta*, Mart., with lvs. oblong or elliptic to oblong-lanceolate, irregularly serrate, grayish beneath. Luehea is also spelled Luhea, and the genus of this name of the Verbenaceæ is a S. African group referred to Stilbe.

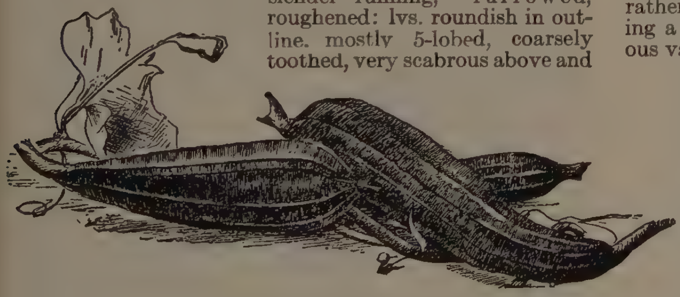
LUÈTKEA (after Fr. Luetke, Russian sea captain, in charge of the fourth Russian voyage around the world). Syn. *Eriogýnia. Rosàceæ.* A prostrate and trailing undershrub, forming dense carpets, with ascending flowering shoots 2–6 in. high, small alternate trifid lvs. and small white fls. in upright racemes. It is closely related to Spiræa, but differs in its habit, the 3-cleft lvs., in the carpels being dehiscent on both sutures and in the stamens being connate at the base. It is best adapted for rockeries and to be treated like other alpine plants; it is rarely seen in cult. Prop. is by greenwood cuttings and division. The only species is **L. pectinàta,** Kuntze (*Spiræa pectinàta,* Torr. & Gray. *Eriogýnia pectinàta,* Hook.). Lvs. 3-cleft, with linear lobes trifid at the apex, bright green, with the petiole ½–¾in. long: racemes 1–2 in. long; fls. white, ⅓in. across. Alaska to Calif., in the high mountains. Bot. Gaz. 15:241, pl. 14. Hooker, Fl. Bor. Am. 88.

Alfred Rehder.

LÚFFA (*luff* is the Arabic name). *Cucurbitàceæ.* Rag Gourd. Dish-cloth Gourd. Vegetable Sponge. About 8 species of annual tendril-climbing herbs, inhabiting the tropics of the Old and New Worlds, mostly in the former. Lvs. 5–7-lobed: tendrils simple or multifid: fls. monœcious or diœcious, the staminate ones in a long-stalked raceme or cluster, the pistillate solitary and shorter-peduncled; calyx bell-shape or top-shape, strongly 5-lobed; corolla of 5 soft yellow or whitish petals, sometimes ragged-edged; stamens usually 3, borne in the calyx-tube: fr. a long, gourd-like, 3-celled pepo, becoming dry when ripe and the fibrous interior sponge-like. In the South it has been called "California okra."

The luffas have come into more or less prominence in American gardens, being an importation from the tropics, and China and Japan. In other countries, the fruit is eaten when young, being cooked like squash or served in soups and stews. The young fruit is sometimes sliced and dried. (See Georgeson, A. G., Sept., 1892, and Bailey, Bull. 67, Cornell Exp. Sta.) In this country, luffas are grown mostly for curiosity and ornament. The fibrous interior of the dried fruit, when bleached and prepared, is used as a sponge for the bath and for scrubbing (whence "vegetable sponge"). The culture is the same as for cucumbers and melons. They are tender plants, running 10 to 15 feet. The luffas are widely dispersed in the tropics as cultivated plants. The genus divides itself into two groups,—those species (*L. cylindrica* and *L. acutangula*) with fruits not spiny or tuberculate, and those with spiny fruits.

cylíndrica, Roem. (*Momórdica cylíndrica,* Linn. *L. ægyptìaca,* Mill. *L. Petòla,* Ser. *L. Veìtchii,* Naudin. *L. fœtida,* Hort. [at least in part], not Cav. *L. Fabiàna, L. japónica, L. mexicàna* [?] and *L. noctiflòra álba,* Hort.). Naga itouri of Japanese. Sua-kwa of Chinese. The commonest dishcloth gourd: sts. slender-running, furrowed, roughened: lvs. roundish in outline, mostly 5-lobed, coarsely toothed, very scabrous above and beneath: staminate fls. 2–3 in. across, wilting in the sun; ovary cylindrical or clavate, pubescent, destitute of distinct ridges, ripening into a slender cylindrical curved fr. 1–2 ft. long; seeds black or rarely whitish, narrow-winged. A var. *macrocárpa* is listed. Probably native to the Old World, but widely distributed in the tropics. A.G. 13:526.



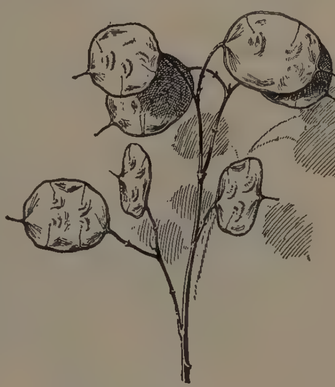
2215. Luffa acutangula. (×⅑)

acutángula, Roxbg. (*L. fœtida,* Cav.). Sing-kwa of Chinese. Fig. 2215. Lvs. rounded, scarcely lobed, very coarsely toothed: ovary 10-ribbed, ripening into a strongly ribbed fr.; seeds black and wingless. Tropics, probably indigenous in Asia. B.M. 1638. Gt. 48, p. 136.

L. H. B.

LUÍSIA (after Don Luis de Torres, Spanish botanist). *Orchidàceæ.* Curious epiphytic orchids, grown indoors.

Stems with simple or branched erect sts. bearing alternate, elongated, fleshy-terete lvs.: fls. sessile, on short lateral spikes; sepals and petals sub-similar, connivent or half-spreading; labellum adnate to the column, somewhat concave, with small lateral lobes and a large, spreading, entire or bifid middle lobe; column short; pollinia 2, on a broad, short pedicel.—About 20 species in Trop. Asia, the Malay Archipelago, and Japan. These plants are rarely cult. They grow well in any warm or intermediate house, requiring the treatment given to aërides. A few of the species are listed by orchid specialists, but are not in the general popular trade.



2216. Lunaria annua. (×¼)

L. Amesiàna, Rolfe. Habit of Vanda teres: fls. rather large, in clusters at sides of st.; sepals and petals pale yellow, brown outside; lip white, shaded yellow and spotted purple. India. G.C. III. 14:32.—*L. burmánica,* Lindl.=L. teretifolia.—*L. platyglóssa,* Reichb. f.=L. teretifolia.—*L. Psỳche,* Reichb. f. Sts. erect: lvs. about 6 in. long, quill-like: fls. axillary, in 2's; sepals and petals green; lip marked with deep purple. Burma. B.M. 5558.—*L. teretifòlia,* Blume (L. burmanica, Lindl. L. platyglossa, Reichb. f. L. zeylanica, Lindl.). Stout, often producing very many downy roots: fls. small, chocolate-brown, in few-fld. clusters; petals and sepals sometimes whitish; lip convex, oblong. Burma. B.M. 3648 (as Cymbidium triste).

L. H. B.†

LUNÀRIA (*luna,* Latin for moon; name referring to the silvery white partition of the large pods). *Cruciferæ.* Satin Flower. Moonwort. Honesty. Herbaceous perennials and annuals, natives of Europe and western Asia, of two species, both of which are cultivated in old gardens.

Leaves rather large, simple, broad or more or less cordate: fls. purple, in terminal racemes or panicles, rather large and showy: fr. stalked in the calyx, becoming a very large flat disk-shaped silicle, with deciduous valves and a thin persistent septum; seeds winged, 2–4 in each compartment.—The plants are of easy cult. under any ordinary garden conditions. They are interesting for their showy fls., but are grown mostly for their great flat pods, which are used in winter bouquets. They are called "honesty" because the seeds can be seen through the pods. Prop. by seeds; or the second species rarely by division. The species sometimes escape from gardens for the seed readily self-sows.

ánnua, Linn. (*L. biénnis,* Moench). Fig. 2216. Loose-hairy plant, 1½–2½ ft. tall, branching as it matures: lvs. somewhat cordate or halberd-cordate, coarsely and irregularly toothed, stalked: fls. numerous, pink-purple, fragrant, in May and June: pods about 2 in. long and somewhat narrower, very flat, rounded at the ends, tipped with the persistent style, interesting. Eu. R.H. 1857, p. 30.—Frequent in old-fashioned gardens; especially useful in sandy damp places, even in shady spots. There is a recent form with handsomely variegated lvs. Var. **corcyrénsis,** Hort., has blue fls. Corfu. There is a white variety which is much admired, since the fls. do not possess the bright color of the type species which is objectionable to many persons.

redivìva, Linn. Differs from the last in being perennial, the fls. usually larger and lighter colored (often grayish purple), May and June, and the pod elliptic or lance-elliptic, and tapering to either end: 1½–7½ ft. tall. Eu.—Less common and less valuable than *L. annua*. Thrives best in partial shade.

L. H. B.
A. C. Hottes.†

LUPÌNUS (from the Latin *lupus*, a wolf, because a crop of lupines was supposed to destroy fertility). *Leguminòsæ*. Lupine. Usually herbs adapted to borders in masses, and to all places in which low-growing showy herbs would be found; some make good bedding-plants, others cut-flowers.

Mostly annuals or herbaceous perennials, 2 species in cult. being shrubby: lvs. usually digitate, with 5–15 entire lfts.: fls. with calyx deeply bilabiate, 5-toothed, unequal; corolla with simple erect broadly ovate standard, having strongly reflexed sides; wings united at the apex and inclosing the keel; stamens united into a closed tube: pod 2-valved, flattened, inclosing several large seeds.—A group of about 300 species mostly confined to W. N. Amer., a few growing in E. N. Amer., Peru, Brazil, Mex., Guatemala, Afr., and in the Medit. region. A very variable genus in the garden. There are numerous garden hybrids of unknown parentage. Some of these names will be found in the supplementary list. Voss groups these under the name of *L. hybridus*, Hort., and its vars. *atrococcineus* and *roseus*, or florists' lupines. They have variegated fls.

In addition to those described below the following native species have been advertised, mostly by Gillett, in 1881, for western collections. Probably they are not in cultivation. They are mostly described in Bot. Calif.: *L. albicaulis*, *L. Chamissonis*, *L. lepidus*, *L. leucophyllus*, *L. ornatus* and *L. villosus*.

The lupines are showy plants with conspicuous flowers in terminal racemes, those of the species in cultivation being mostly verticillate. The flowers are blue, white or yellow, or a union of these, papilionaceous and free-blooming. All are of easy cultivation in any garden soil, except that they are said not to succeed in soil containing lime. They are propagated by seed, the perennials also by division. They do not bear transplanting when once established, hence it is recommended to sow seed where the plants are finally desired. A few species are of value economically for soiling or plowing under.

INDEX.

affinis, 15.
albiflorus, 8.
albo-coccineus, 23.
albus, 8, 16, 18, 20, 23.
arboreus, 1.
argenteus, 6.
bicolor, 8.
Cruckshanksii, 21.
cytisoides, 7.
densiflorus, 2.
diffusus, 3.
foliis roseis, 16.
Foxei, 8.
grandiflorus, 8.
Hartwegii, 20.
hirsutissimus, 17.
hirsutus, 16.
luteus, 1, 12.
Menziesii, 2.
micranthus, 14.
Moerheimii, 8.
mutabilis, 21.
nanus, 23.
nootkatensis, 9.
parviflorus, 5.
perennis, 4.
pilosus, 13.
plattensis, 10.
polyphyllus, 8.
pusillus, 19.
rivularis, 7.
roseus, 6.
ruber, 16.
subcarnosus, 22.
sulphureus, 11.

KEY TO THE SPECIES.

A. *Perennials.*
B. *Plants shrubby.*
C. *Shrub tall, 4–10 ft.*............... 1. **arboreus**
CC. *Shrub dwarf, 1½ ft.*............... 2. **densiflorus**
BB. *Plants herbaceous.*
C. *Lvs. with 1 lft.*................... 3. **diffusus**
CC. *Lvs. with several lfts., digitate.*
D. *Foliage not conspicuously hairy above.*
E. *Number of lfts. 5–9.*
F. *Lfts. shorter than petioles.*
G. *Pod ½ in. long*........ 4. **perennis**
GG. *Pod ¾ in. long*......... 5. **parviflorus**
FF. *Lfts. as long as petioles*.... 6. **argenteus**
EE. *Number of lfts. 7–9*........ 7. **rivularis**
EEE. *Number of lfts. 10–16*...... 8. **polyphyllus**
DD. *Foliage conspicuously hairy or silky above.*
E. *Fls. parti-colored, striped*.... 9. **nootkatensis**
EE. *Fls. light blue, with a dark spot on the standard*.......10. **plattensis**
AA. *Annuals.*
B. *Fls. yellow.*
C. *Number of lfts. 13–15*...........11. **sulphureus**
CC. *Number of lfts. 7–10*............12. **luteus**
BB. *Fls. blue, white or red, but self-colored.*
C. *Arrangement of fls. in whorls.*
D. *Number of lfts. 9–11*.........13. **pilosus**
DD. *Number of lfts. 5–7.*
E. *Plant villous*..............14. **micranthus**
EE. *Plant merely puberulent*.....15. **affinis**
CC. *Arrangement of fls. scattered.*
D. *Lfts. hairy on both sides*.......16. **hirsutus**
DD. *Lfts. with viscid stinging hairs*..17. **hirsutissimus**
DDD. *Lfts. not hairy above.*
E. *Color of fls. white*..........18. **albus**
EE. *Color of fls. blue*...........19. **pusillus**
BBB. *Fls. of 2 or more colors.*
C. *Foliage hairy on both sides*.......20. **Hartwegii**
CC. *Foliage not conspicuously hairy above.*
D. *Height about 5 ft.*.............21. **mutabilis**
DD. *Height 1 ft. or less.*
E. *Arrangement of fls. alternate*...................22. **subcarnosus**
EE. *Arrangement of fls. whorled*..23. **nanus**

1. **arbòreus,** Sims. Tree Lupine. Lfts. 7–11, lanceolate-linear, acute, silvery downy below, entire: fls. somewhat verticillate, in tall, loose racemes, sulfur-yellow, fragrant: pods pubescent, 1½–3 in. long. July–Sept. Common in Calif. B.M. 682. Gn. 30, p. 289; 47:398. —Shrub, 4–10 ft. high, somewhat pubescent, not hardy at the north. Var. Snow Queen or Queen of the Snow is pure white. Var. **lùteus** has been advertised.

2. **densiflòrus,** Benth. (*L. Menzièsii*, Agardh). A dwarf shrub, 18 in. tall with long hairy lf.-stalks and handsome compound lvs.: fls. in a long dense raceme, deep yellow, large. Calif. B.M. 5019.—A very attractive plant.

2217. Lupinus parviflorus.

3. **diffùsus,** Nutt. Deer Cabbage. St. decumbent and many-branched, 1–2 ft., somewhat woody at the base, densely silky: lvs. large, oval or oblong-ovate, obtuse, mucronate, on long, soft-silky petioles: fls. more or less alternate, on a very long (6–12 in.) spike, light blue, the standard with a greenish yellow center: pods oblong, flattish, very woolly. April. Sandy barrens, N. C. to Fla.—Hardiness N. not determined.

4. **perénnis,** Linn. Sun-Dial. Common Wild Lupine. St. erect, 1–2 ft. high, rather stout, minutely pubescent: lvs. long-petioled, soft-downy; lfts. 7–9, obovate-oblong to lanceolate, obtuse, glabrous above, soft-downy below: fls. in large, loose terminal spikes or racemes, alternate, blue, varying to white. June, July. Canada to Fla. B.M. 202. Mn. 6:101. B.B. 2:269.—

Desirable species, growing in the poorest soil, preferring sandy land. Grows from subterranean rootstocks.

5. **parviflòrus,** Nutt. Fig. 2217. Fls. light blue, smaller than in *L. perennis:* lfts. 5–11, broad-linear to oblanceolate. N. Mex. to Wash.

6. **argénteus,** Pursh. Fls. blue or cream-colored: lfts. 5–8, linear-lanceolate. W. N. Amer. B.B. 2:269. Var. **ròseus,** Hort. Fls. rosy-pink, lower half slightly paler. Suitable for herbaceous border.

7. **rivulàris,** Douglas (*L. cytisoìdes,* Agardh). Perennial, 4–6 ft. high: sts. stout: lvs. large and handsome; lfts. 7–9, oblanceolate: fls. deep pink or rose-purple, in long racemes. W. N. Amer.

8. **polyphýllus,** Lindl. (*L. grandiflòrus,* Lindl.). Stout, erect species, forming tufts 2–5 ft. high: lvs. distant, mostly radical, long-petioled; lfts. lanceolate, glabrate above, silky hairy below, 2–6 in. long: fls. on long stalks, alternate, pedicelled, deep blue: pod 1–1½ in. long, narrow. June–Sept. Wash. to Calif. Gn. 45, p. 459; 55, p. 215.—A common garden species of merit, succeeding in any good soil. Var. **Mòerheimii,** Hort. A very beautiful new intro. from the firm of B. Ruys at Dedemsvaart in 1906–7. Two to 3 ft. tall, much more compact and erect than the true polyphyllus forms: fls. long-lived, bright pink, rose to white. Without doubt it is the best variety which exists. R.B. 37:225; 38:217. G.M. 51:613. Var. **albiflòrus,** Hort. (var. *álbus*), is white, bold and showy. Var. **bícolor,** Hort., is variegated blue and white. Var. **Fóxei** is uncertain.

9. **nootkaténsis,** Donn. St. hairy, decumbent, with long, spreading hairs, 2–3 ft. high: lfts. 5–9, narrowly obovate-oblong, smooth above, hairy below, mucronate; stipules lanceolate, nearly as long as the lfts.: fls. in dense racemes, blue, variegated with red and yellow, with large veins, variable. May–July. Nootka Sound. B.M. 1311; 2136.—Coarse stocky species, said to be unsuitable for small gardens, but of merit.

10. **platténsis,** Wats. One to 1½ ft. high: lfts. 7–10, oblanceolate, spatulate or narrowly oval: raceme loosely fld., terminal; corolla blue, standard with a conspicuous dark spot. June, July. Neb., Wyo., Dak. B.B. (ed. 2) 2:348.

11. **sulphùreus,** Douglas. St. very erect, white silky: lfts. narrowly lanceolate, densely hairy on both sides, shorter than the petiole: fls. in tall, dense racemes, sulfur-yellow: pods woolly, 1 in. long. July, Aug. Mountains of Ore. R.H. 1890:252.—Strong species branching above, bare below.

12. **lùteus,** Linn. Yellow Lupine. Fig. 2218. St. erect, nearly simple, hairy, 2 ft. high: lfts. lanceolate, acute, hairy: fls. on pubescent stalks longer than the lvs., verticillate, yellow, fragrant: pod oblong, flat. June, July. S. Eu. B.M. 140.—Succeeds in the poorest soil. Useful for cut-fls., for the border, for fodder or for plowing under to improve sandy soils. As a fodder, it may be fed green or as hay.

13. **pilòsus,** Linn. St. hairy, 2–4 ft. high: lfts. oblong-lanceolate, hairy: fls. verticillate, pedicelled, rose, the middle of the standard red. S. Eu.

14. **micránthus,** Douglas. St. slender, 3–12 in. high, hairy: lfts. linear, ¼–1 in. long: fls. in short, dense racemes, somewhat verticillate, very small, violet, standard and wings narrow: pod linear. Gravelly places, Ore. to Calif.—A slender plant of branching habit.

15. **affínis,** Agardh. St. rather stout, 8–10 in., pubescence very short: lfts. broadly wedge-obovate, obtuse, long, more or less smooth above; stipules one-half the length of lvs.; petioles twice longer than the lfts.: fls. on a long stalk, deep blue: pod linear. Early spring. Calif.—A free, hardy species, often growing very rank.

16. **hirsùtus,** Linn. Blue Lupine. St. hairy, 2–3 ft. high, branching toward the top: lfts. 7–9, oblong or oblong-oval, hairy, long-petioled: fls. somewhat verticillate or scattered, large, mostly purple, sometimes variegated with blue or violet: pod large, very hairy. July, Aug. S. Eu.—Used ornamentally and as an economic plant for the same purposes as *L. luteus.* It is valuable for fodder and for plowing under. Var. **álbus,** Hort., has white fls. Var. **rùber,** Hort., and var. **fòliis ròseis** are advertised.

2218. Lupinus luteus.

17. **hirsutíssimus,** Benth. Annual, 1½–2½ ft. high: sts. rather stout, covered with stiff hairs: lfts. 5–7, cuneate-obovate: fls. large, deep reddish purple, very showy. Calif.

18. **álbus,** Linn. White Lupine. Erect st., 1½ ft. high: lfts. obovate-oblong, 5–7, hairy below, 1½–2 in. long: fls. alternate stalked, on erect sts., quite large, white: pods large. Summer. Asia and S. Eu.—A good fodder plant said to be of greater thrift than *L. luteus,* and remaining green longer. Succeeds well on the poorest soil and is valuable for plowing under. Seeds are sown April–July, and the plants are plowed under when in flower.

19. **pusíllus,** Pursh. Lfts. about 7, mainly oblong, acute: fls. blue or purple. Prairies. B.B. 2:270.

20. **Hártwegii,** Lindl. St. erect, 2–3 ft. high, somewhat branching: lfts. 7–9, oblong, obtuse, very hairy: fls. in many-fld. elongated racemes, blue; standard whitish, then reddish. June–Sept. Mex. B.R. 25:31. Var. **álbus** is also sold. Possibly a perennial but cult. as an annual.

21. **mutábilis,** Sweet. St. erect, branched, somewhat woody, 5 ft. tall: lfts. 7–9, lanceolate, obtuse, hairy below and somewhat glaucous: fls. large, somewhat verticillate, fragrant; standard white mixed with blue, becoming blue with a large yellow mark in the center; wings and keel white. June–Aug. Mountains of S. Amer. B.M. 2682.—Attractive species, erect and branching but half-hardy.

Var. **Crúckshanksii,** Hook. (*L. Crúckshanksii,* Gray). Fls. large, fragrant, white, the standard yellow-rose, becoming violet. B.M. 3056.

22. **subcarnòsus,** Hook. St. 3–10 in. high, ascending, silky pubescent: lfts. 5–7, obovate-lanceolate, obtuse, somewhat fleshy, smooth above, silky below and on margins: fls. in pyramidal racemes, alternate; standard orbicular, deep blue with a white spot in the center divided by a longitudinal fold: pod linear-oblong, silky. Spring. Texas. B.M. 3467.—Spreading species of merit.

23. **nànus,** Douglas. St. slender, ½–1 ft., often branching from the base, hairy: lfts. 5–7, linear to oblanceolate, pointed, pubescent both sides, stalks 1–3 times longer: fls. in elongated, loose racemes, verticillate on slender stalks, large, white, pointed with clear blue, edged with deeper blue; wings bluish, hiding white-

brownish keel: pod hairy. June, July. Calif. B.R. 1705.—This species and its varieties are very floriferous, giving a fine effect in masses and in the border. Var. **álbus** Hort., white tinged with lilac. Var. **álbo-coccíneus,** Hort. A very compact variety, the lower half of the spike rosy red, the upper white; forms compact tufts and is called a superior variety.

L. angustifòlius, Linn., with blue fls., is much grown in Eu. as a fodder plant and for plowing under: annual. Native to the Medit. region.—*L. pubéscens*, Benth. Perennial or subshrubby, the pubescence short, spreading, hardly silky in the new parts: lfts. 7–9, oblong-lanceolate, acute, shorter than the petiole, pubescent on both sides: fls. loosely arranged almost in whorls: pedicels shorter than the calyx: pod hirsute, 4–6-seeded. The above is from the original description. Bentham neglects to state the color of the fls., but an allied species has blue fls. Mottet must be in error in calling this an annual. Mex., Cent. Amer., Colombia.—*L. villòsus*, Willd., is mentioned occasionally in garden literature.

The following are garden hybrids of unknown origin. They mostly have variegated fls. and are common in cult.: *L. atroviolàceus*. Perennial, 2 ft. high: fls. dark violet, striped with white and yellow.—*L. cœléstinus*. Annual, 2 ft. high: fls. light blue.—*L. Dúnnettii*. Fls. lilac-purple, gold and white. According to Voss, this is the same as the kinds known to the trade as L. superbus, L. insignis (Vilmorin, not Dippe), L. tricolor elegans and L. superbus Dunnettii. There is also a double form.—*L. hýbridus*. Probably mixed kinds.—*L. trícolor*. See L. Dunnettii.

A. Phelps Wyman.
John W. Harshberger.†

LÙZULA (Latin *lux*, light, in diminutive derivation, from some fanciful attribute or interest). *Juncàceæ*. Wood Rush. About forty species of grass-like or rush-like, often cespitose, perennial herbs of wide distribution in temperate and frigid regions, some of them adapted to borders and for colonizing. Several species are native in the United States and Canada, but none of them seems to be listed in the trade; two European species are offered abroad. By some, the name Juncoides is used in place of Luzula.

These are plants of mostly inconspicuous green or scarious fls. (sometimes white) in umbel-like, paniculate, corymbose or congested infl., the fls. always bracteolate; perianth parts distinct, glumaceous; stamens usually 6; ovary 1-celled: fr. a dry 3-seeded caps.: lvs. soft, usually hairy or webby: dry ground. Juncus, to which the genus is closely related, differs in its mostly 3-celled and many-seeded caps.

sylvática, Gaud. (*L. máxima*, DC. *L. sylvéstris*, Hort. *Juncoìdes sylváticum*, Kuntze). Rhizome woody: st. 12–18 in. or more high: lvs. linear-lanceolate, hairy-edged, shining, striate: panicle double-compound, much exceeding the lf.-like bracts; perianth-segms. bristle-pointed; filaments very short. Eu.—There is a form with variegated (striped?) foliage.

nívea, DC. (*Juncoìdes níveum*, Kuntze). Fls. pure white, large, in thick panicles that are shorter than the lf.-bracts; filaments about equaling the anthers: plant 12–18 in.: lvs. linear, hairy on margin. Eu., Alps.—Useful in dry bouquets.

L. H. B.

LYCÁSTE (fanciful name). *Orchidàceæ*. Epiphytic and terrestrial orchids; very popular as greenhouse subjects.

Pseudobulbs ovate or oblong-ovate, bearing 1 to several plicate lvs. at the summit, and sheathing lvs. from the base: sepals subsimilar, spreading, the lateral pair united with the base of the column and forming a spur-like chin or mentum; petals smaller, projecting forward, with the tips often recurved; labellum 3-lobed, the lateral lobes erect, middle lobe ascending or recurved, with a fleshy, tongue-like callus on the disk; pollinia 4.—About 30 species, all natives of S. Amer., Mex., and the W. Indies. The fls. are freely produced and remain in good condition on the plant for several weeks. They are normally borne singly on erect or sub-erect bracted scapes, but sometimes twin-fld. stalks occur. In Lycaste the scape arises from the very young leafy axis, which does not develop until several months later. The scape, therefore, appears from the base of the bulb. Among the species, *L. Skinneri* is a favorite orchid with growers. The species of Lycaste are very distinct from each other and do not fall readily into natural groups. The arrangement in the key is purely artificial, and does not indicate close relationship among the species grouped together.

The genus Lycaste is closely allied to Maxillaria and has a similar geographical range, being found from Mexico and the West Indies to Peru and southeastern Brazil. Notwithstanding this wide distribution, however, they readily subject themselves to one general mode of treatment, and may be grown in a bright cool portion of the cattleya or warm end of the odontoglossum department, where they should receive plenty of indirect solar light, moisture and sufficient ventilation to ensure an active atmosphere. During winter, the night temperature should range from 50° to 55° Fahr. and that of the day from 60° to 65°, or a few degrees higher, with sun heat and ventilation. In summer, the air should be as cool as possible, and contain plenty of moisture. When lycastes are growing they need a good supply of water at the roots, and should never be allowed to remain dry for a long time, even when at rest. Light syringing overhead is beneficial at all times in bright weather when air can be admitted. The deciduous species, however, must be carefully watered when at rest, for it must be remembered that in casting their foliage they lose most of their active radiating surface, thus reducing evaporation to a minimum.—For special treatment, they may be divided into three groups, *L. aromatica*, *L. costata* and *L. tetragona* forming good types. The *L. aromatica* section embraces, besides the type, *L. candida*, *L. cruenta*, *L. Deppei*, *L. lasioglossa*, *L. macrobulbon* and kindred sorts, all more or less deciduous. These grow best in pots in a mixture of equal parts chopped peat fiber and sphagnum moss, with a small quantity of leaf-mold added. About one-third of the pot space should be devoted to drainage of broken charcoal or potsherds, and the compost must be carefully and rather firmly pressed in about the roots, leaving the base of the pseudobulbs on a level with or a little below the rim of the pot. The best time for transplanting is just after the plants start into new growth, at which time give a more abundant supply of water.—The *L. costata* group includes, besides the type, such species as *L. lanipes*, *L. locusta* and *L. Skinneri*, which, excepting the last, are but semi-deciduous, large-growing species. They succeed best under pot culture, and should be grown in a compost of about equal parts chopped sod, from which some of the fine soil has been removed, and decomposed leaves, adding a little chopped live sphagnum to keep the soil porous and to retain moisture. The compost should become nearly dry occasionally to prevent it from becoming sour.—The *L. tetragona* section is small; all are sempervirent and grow best under basket culture in porous material consisting of chopped peat fiber and live sphagnum, well mixed and interspersed with nodules of charcoal. The compost should be pressed in moderately firm about the roots to keep the plant steady, and newly imported pieces should be held in place by copper or brass wire crossed between the pseudobulbs.—Lycaste stock is usually supplied by new importations, but plants may be increased by cutting through the rhizome between the pseudobulbs, two at least being left to each piece. (Robert M. Grey.)

INDEX.

alba, 12.
albo-sanguinea, 12.
armeniaca, 12.
aromatica, 13.
brevispatha, 4.
candida, 4, 12.
costata, 2.
cruenta, 10.
delicatissima, 12.
Denholmiana, 12.
Deppei, 14.
gigantea, 7.
grandiflora, 12.
hellemense, 12.
lanipes, 3.
lasioglossa, 1.
Lawrenceana, 4.
locusta, 8.
macrobulbon, 11.
magnifica, 6.
Measuresiana, 5.
plana, 5.
punctatissima, 14.
purpurata, 12.
rosea, 12.
rubra, 4.
Schilleriana, 6.
Skinneri, 12.
superba, 12.
tetragona, 2.

L. cristàta=Paphinia cristata.—*L. Harrisóniæ*=Bifrenaria.—*L. inodòra*, Lindl.=Bifrenaria.—*L. jugòsa*, Benth.=Colax.

KEY TO THE SPECIES.

A. *Middle lobe of lip semi-oblong or rounded, usually obtuse or truncate.*
B. *Lip pilose with long hairs* .... 1. **lasioglossa**
BB. *Lip glabrous or short-pubescent.*
C. *Fls. white, sometimes green-tinged (some white forms of L. Skinneri might be sought here).*
D. *Sepals ivory-white; disk-plate grooved and emarginate* ...... 2. **costata**
DD. *Sepals greenish white; disk-plate with 3–5 parallel raised lines* .... 3 **lanipes**
CC. *Fls. not entirely white.*
D. *Petal white.*
E. *Sepals oblong, but little longer than petals.*
F. *Front lobe of lip entire; sepals pale green* .... 4. **candida**
FF. *Front lobe of lip denticulate; sepals olive* .... 5. **plana**
EE. *Sepals lanceolate, much longer than petals* .... 6. **Schilleriana**
DD. *Petals not white.*
E. *The lip toothed or fringed.*
F. *Sepals and petals olive, much longer than the maroon orange-bordered lip* .... 7. **gigantea**
FF. *Sepals and petals dull green, about as long as the green white-bordered lip* ...... 8. **locusta**
EE. *The lip entire.*
F. *Size of fls. 3 in. across or less; sepals yellowish green.*
G. *Sepals and petals streaked with red-brown; lip white* ..... 9. **tetragona**
GG. *Sepals and petals not marked; lip yellow.*
H. *Base of lip blood-red; front lobe quadrate*. 10. **cruenta**
HH. *Base of lip yellow; front lobe oblong-ovate* .... 11. **macrobulbon**
FF. *Size of fls. 5–6 in. across; sepals rose (white in some forms)* .... 12 **Skinneri**
AA. *Middle lobe of lip spatulate* .... 13. **aromatica**
AAA. *Middle lobe of lip ovate-acuminate*.... 14. **Deppei**

1. **lasioglóssa**, Reichb. f. Pseudobulbs 3 in. long, ovoid, compressed: lvs. 8–12 in. long, elliptic-lanceolate: scape 1-fld.; fls. 5 in. across; sepals spreading, narrowly oblong, dull brown or greenish brown; petals one-third as long, erect, concave, obtuse, golden yellow; labellum as long as the petals, also golden yellow; lateral lobes short, obtuse; middle lobe oblong, covered with long, soft hairs; callus ovate, notched. Autumn and winter. Guatemala. B.M. 6251. G.M. 44:179.—Very odd but not showy.

2. **costàta**, Pseudobulbs oblong, compressed, 3–5 in. long: lvs. 2–3 at the apex, 6–10 in. long, broadly oblong-lanceolate, acuminate: scape erect, as long as the pseudobulb; fls. large, nearly white or creamy yellow; dorsal sepals oblong-lanceolate, the lateral sepal similar but falcate, united with the column to form a blunt spur; petals smaller, somewhat undulate; lateral lobes of the labellum small, erect; middle lobe ovate-rotund, toothed. Peru. B.M. 5706 (as *L. Barringtoniæ* var. *grandiflora*). J.H. III. 42:5. C.O. 10.

3. **lánipes**, Lindl. Pseudobulbs large: lvs. lanceolate, 12–18 in. long: fls. solitary, as many as 15 on a plant, creamy white; sepals and petals oblong-lanceolate; labellum smooth; lateral lobes ovate-obtuse; middle lobe oblong, obtuse, serrate, with a concave, ribbed callus. Oct. Ecuador.—Lindley says the fls. are pale green, 2½ in. long before they expand, without a trace of any other color.

4. **cándida**, Lindl. (*L. brevispatha*, Klotzsch). Pseudobulbs ovoid, much compressed: lvs. oblong-acuminate: fls. about 2 in. across; sepals spreading, reflexed and acute at the apices, oblong, slightly woolly at base, yellowish green, sometimes dotted with light rose; petals whitish, revolute, obtuse; labellum white, with a few rose-colored spots; disk-plate obtuse, emarginate at the apex; column hairy on the inner surface. Costa Rica. C.O. 6. Var. **Lawrenceàna**, Hort. Sepals and petals tinted with rose, otherwise the fls. are like those of the type. Var. **rùbra** has been offered.

5. **plàna**, Lindl. A robust plant, with large ribbed pseudobulbs and ample-pointed oval lvs.: fls. 3–4 in. across; sepals oblong, plane, rich madder-red inside; petals smaller, with recurved tips, white, tipped with crimson; labellum smaller, white spotted with crimson; side lobes crenulate; middle lobe rounded, obtuse, serrate, crested. Winter. Bolivia. B.R. 29:35. Var. **Measuresiàna**, Williams. Sepals reddish brown, tipped with green; petals and labellum white spotted with bright rose, except on the margins of the petals. Autumn.

6. **Schilleriàna**, Reichb. f. Plant resembling *L. Skinneri* in habit: pseudobulbs 2-lvd.: lvs. elongate-lanceolate, up to 2 ft. long: scape 1-fld., suberect, 8 in. long; sepals large, spreading, oblong-lanceolate, 4 in. long, brown; petals erect, with recurved tips, small, 1½ in. long, white, speckled with brown on the back; labellum as long as the petals, white, speckled and tinged with rose; side lobes small; middle lobe ovate-quadrate, crenulate; callus tongue-shaped, concave. Often the parts of the fl. are more or less spotted and hairy in places. July, Aug. Colombia. Gt. 39:1321. Var. **magnífica,** Hort. Sepals long, olive-tinted; petals and lip white.

7. **gigantèa**, Lindl. Pseudobulbs often 6 in. high, bearing 2–3 oblong-lanceolate lvs. 1½–2 ft. long: scape 1-fld., somewhat shorter than the lvs.; sepals ovate to lanceolate, 3 in. long, rather olive-green; petals somewhat smaller, lanceolate, spreading, of the same color; labellum oblong-lanceolate; side lobes acute; middle lobe ovate, acuminate, serrate, rich maroon bordered with a narrow orange margin; crest fleshy, emarginate. The fl.-sts. are said to attain a height of 2 ft., with a single large fl. In most of the specimens in cult. the lip is abruptly rounded off. June–Aug.; Nov., Dec. Widely dispersed in Cent. Amer. B.M. 5616. B.R. 31:34. C.O. 7.

8. **locústa**, Reichb. f. Pseudobulbs pyriform: lvs. oblong-ligulate, acute: fls. smaller than those of *L. Deppei*, all green except the white column; the odd sepal oblong, obtuse; the lateral ones linear-oblong, acute; petals bent down inside of the lateral sepal; labellum with acute side lobes and a semi-oblong, fleshy, convex middle lobe, all green; on the disk are 2 narrow keels, confluent behind into a fleshy emarginate callus. Peru. B.M. 8020. G.C. III. 49:260.

9. **tetragòna**, Lindl. Pseudobulbs ovate, tetragonal: lvs. solitary, ovate-lanceolate: scape 1–4 fld.; fls. greenish streaked with crimson; sepals and petals oblong-ovate, rather obtuse, half-spreading, the 2 lower forming a blunt, projecting angle at base; labellum smaller, white and purple or green and purple, with a shovel-shaped appendage on the disk. Fls. not beautiful, but very fragrant, remaining fresh for two months. June. Brazil. B.M. 3146 and B.R. 1428 (both as *Maxillaria tetragona*).

10. **cruénta**, Lindl. Pseudobulbs compressed: lvs. many, oblong, membranaceous: scape bearing 1 yellow fl. (rarely 2), much larger than those of *L. aromatica;* sepals ovate, obtuse; petals similar, erect and smaller; labellum half as long as the sepals; lateral lobes rounded; middle lobe rounded-truncate, crisp on the margin, pubescent; crest small, fleshy. Like *L. aromatica*, but the lvs. much broader, fls. larger, and the labellum of different shape and somewhat spotted with purple.

March, April. Guatemala. B.R. 28:13 (as *Maxillaria cruenta*). Gn. 44:394 (as *L. aromatica*). C.O. 9.

11. **macrobúlbon,** Lindl. Pseudobulbs very large, ovate, compressed, with several large, oblong, acute lvs.: scapes usually 2 from each pseudobulb, much shorter than the lvs.: fls. large, yellow; sepals ovate-oblong, spreading; petals shorter, somewhat concave, with recurved tips; labellum oblong, as long as the petals, spotted on the disk with brown. Colombia. B.M. 4228 (as *Maxillaria macrobulbon*).

12. **Skínneri,** Lindl. Pseudobulbs oblong-ovate, 3–5 in. high, 1–2-lvd.: lvs. oblong-lanceolate, 9–12 in. long: scapes 5–6 in. long, each bearing a single waxy fl. 5–6 in. diam.; sepals ovate-oblong, white tinged with rose; petals half as long, broadly ovate, pointing forward with acute, reflexed tips, striated and tinged with dark rose; lateral lobes of the labellum erect truncate; middle lobe oblong-ovate, recurved with a fleshy tongue-shaped callus on the disk, dark crimson-purple. Guatemala. B.M. 4445. P.M. 11:1. Gn. 25:410; 30, p. 374; 37:397. F. 1861:65 (var.). A.F. 4:519. J.H. III. 34:367; 60:321. A.G. 14:433. C.L.A. 6:166. G.M. 53:894. C.O. I. O.R. 19:276.—The most useful of the genus. Spring. The following varieties are advertised:

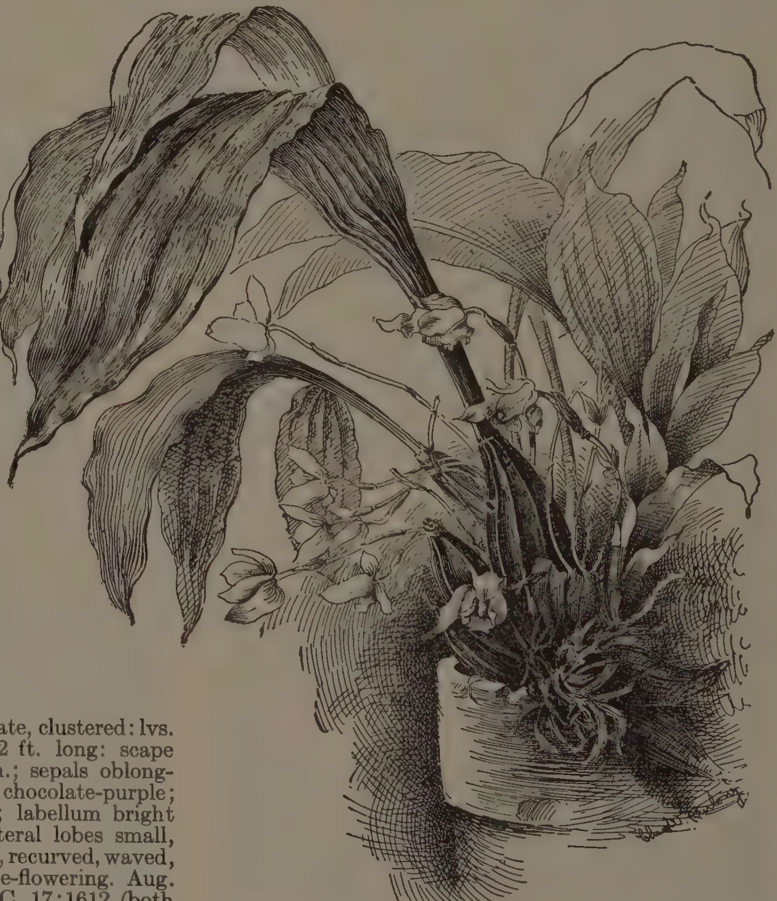
Var. **álba,** Hort. A large-fld. white variety with a tinge of yellow at the base of the labellum and a yellow, tongue-shaped appendage in its throat. I.H. 27:405. Gn. 25:410. F.M. 1872:35. G.C. III. 7:424. A.F. 6:631. J.H. III. 50:253; 62:541. C.O. 1*a*. O.R. 19:177. Var. **álbo-sanguínea.** No description. Var. **armeníaca,** Hort. Sepals white; petals and lips suffused with apricot-yellow. G.M. 53:72. J.H. III. 60:51. C.O. 1*d*. Var. **cándida,** Hort. White. Var. **delicatíssima,** Hort. Fls. large, rose-white; labellum white, blotched with rose. Feb. C.O. 1*b*. Var. **Denholmiàna,** Hort. Upper lobes of fl. rich crimson; lip almost white. Var. **grandiflòra.** No description. Var. **hellemènse,** Cogn. Fls. bright rose-purple. C.O. 1*e*. R.B. 35:53. Var. **purpuràta,** Hort. Sepals and petals rose-white; labellum crimson-purple. Var. **ròsea,** Hort. A beautiful variety with deep rose fls. and a white labellum spotted with crimson. Var. **supérba.** Sepals and petals white; labellum crimson.

13. **aromática,** Lindl. Fig. 2219. Pseudobulbs ovate, compressed: lvs. many, sheathing, oblong-lanceolate: scape erect, 1-fld., shorter than the lvs.; fls. yellow, 2½ in. across; sepals and petals ovate-oblong, acute; the latter smaller and pointing forward; lateral lobes of the labellum with narrow, projecting blades; middle lobe spatulate, dentate, recurved, and having a large truncate plate as a crest. Winter and spring. Mex. B.R. 1871.—Floriferous.

14. **Déppei,** Lindl. Pseudobulbs ovate, clustered: lvs. 3–4, broadly elliptic-lanceolate, 1½–2 ft. long: scape erect, bearing 1 or 2 fls. 4 in. diam.; sepals oblong-lanceolate, dingy green, spotted with chocolate-purple; petals smaller and cucullate, white; labellum bright yellow, with a few purple spots; lateral lobes small, rounded; middle lobe ovate-acuminate, recurved, waved, with a yellow callus. Vigorous and free-flowering. Aug. to May and June. B.M. 3395. L.B.C. 17:1612 (both as *Maxillaria Deppii*). P.M. 2:268 (as *Maxillaria Deppei*). C.O. 11.—Named after Deppe, but originally spelled Deppii. Var. **punctatíssima,** Hort. Fls. much spotted with dark purple. Guatemala.

L. Bàlliæ=L. Skinneri × L. plana var. Measuresiana. Sepals terra-cotta with a rosy flush; petals rose, fading, to white at tips; lip white, irregularly carmine-spotted. O.R. 11:80. G.M. 46:356; 55:219.—*L. Bárringtoniæ*, Lindl. Fls. green to tawny yellow; sepals and petals ovate-lanceolate; lip 3-lobed, the front lobe ovate; fimbriate. W. Indies.—*L. Cáppei*=L. Skinneri × L. plana.—*L. Chárlesworthii*=(?).—*L. Dyeriàna*, Sander. Fls. pale green; lip obscurely 3-lobed, the front lobe elliptic, denticulate, reflexed, obtuse. Peru. B.M. 8103.—*L. eisgrubénsis*=L. Skinneri × L. lasioglossa.—*L. formòsa*=(?). Fls. large, cream-white, with red spots at the base of the petals.—*L. fulvéscens*, Hook. Sepals and petals lanceolate, acuminate, red-brown, paler at base; lip orange-brown, oblong, obtuse. Colombia. B.M. 4193.—*L. Gròganii*=L. aromatica × L. Deppei.—*L. Henniseàna*, Kränzl. Allied to L. lasioglossa. Fls. large; petals nearly white; lip quite glabrous, white or cream-colored; column pure white, hairy above the middle. Colombia.—*L. hýbrida*=L. Skinneri × L. Deppei. Fls. in size between the two parents, cream-color, minutely dark-spotted.—*L. Imschootiàna*, Lind. & Cogn.=L. Skinneri × Maxillaria nigrescens. Sepals pale yellow, red-spotted; petals pale yellow, smaller, less spotted; lip yellow, dark purple at base. Lind. 410. J.H. III. 62:425.—*L. làta*, Rolfe. Allied to L. Barringtoniæ. Fls. white, except sepals and apex of petals which are green. Peru.—*L. Lucianiàna*=L. Skinneri × L. lasioglossa.—*L. macrophýlla*, Lindl.=L. plana.—*L. Micheliàna*, Cogn. In general aspect much resembling L. aromatica, but with the floral segms. broader. Mex.—*L. peruviàna*, Rolfe. Sepals and petals light brown, becoming paler at base, lip nearly white. Peru.—*L. Pourbaixiàna*=L. Skinneri var. superba × L. Deppei.—*L. Rógersonii*=L. Skinneri × L. plana.—*L. trícolor*, Reichb. f., var. *álbens*. Sepals pale green; petals white with greenish tinge at ends. —*L. Túnstillii*=(?). Sepals rose-colored; petals white with rose-pink spots; lip ruby-red, with white markings. G.C. III. 54:415.—*L. xytrióphora*, Reichb. Sepals light greenish brown, with a horny point on the under side; petals yellowish green at base, white above; lip small, white, sometimes stained rose-pink. Peru (?).

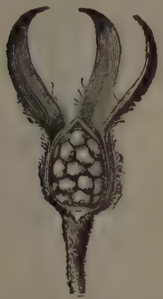
HEINRICH HASSELBRING.
GEORGE V. NASH.



2219. Lycaste aromatica.

LÝCHNIS (from the Greek word for *lamp*, in allusion to the flame-colored fls. of some species). Including *Agrostémma* and *Viscària*. *Caryophyllàceæ.* Interesting flower-garden herbs.

The technical generic characters are so variable as to allow the genus to be thrown into Silene or to be broken up into 7 or 8 distinct genera (for the latter, see Williams, Journ. Bot. 31:167; Journ. Linn. Soc. 32:11), according to the point of view of the particular author. They are mostly erect-growing, and the lvs. are opposite and entire. The caps. usually has but one locule or compartment, and the seeds are borne on a central or axile placenta (Fig. 2220). The styles are usually 5 or rarely 4, in this differing from Silene (in which the styles are 3), and the calyx-teeth are commonly 5. In some species, the styles are 3 and the caps. is more than 1-loculed at base, but in these cases the habit of the plant and minor technical characters enable one to refer them to Lychnis rather than to Silene. The stamens are 10; and the petals 5 and usually with a 2-cleft scale or a pair of teeth at the base of the blade.—As defined above, the genus contains 40–50 species, annuals, biennials, and perennials, of the temperate parts of the northern hemisphere. Agrostemma and Viscaria might be separated, although the distinctions are not very marked. Agrostemma has the 5 stamens opposite the petals and the petals are not appendaged; Lychnis would then be distinguished as having the stamens alternate with the petals, and the latter are often or usually appendaged so as to form a crown in the corolla. If Lychnis is restricted to those species in which the caps. is 1-celled to the base, then Viscaria may be distinguished for certain species that are several-celled at the base (see *Viscaria*). For horticultural purposes these distinctions are not important. Petrocoptis is here kept distinct. In the following synopsis of the garden kinds, little attempt is made to follow technical botanical divisions.



2220. Capsule and seeds of Lychnis Githago. (×¾)

2221. Flower of Lychnis Githago.

Some of the species of Lychnis are amongst the best known of old-fashioned flowers, as the mullein pink, Maltese cross and ragged robin. These are essentially flower-garden subjects, and of simple cultural requirements. Others, as *L. alpina*, are better known as border or rockwork plants (see also *Petrocoptis*). All species are easily grown from seeds, the biennials and perennials blooming the second year. The perennials are often propagated by division. All of them apparently thrive in the sun.

INDEX.

alba, 9, 10.
alpina, 4.
chalcedonica, 2.
Cœli-rosa, 7.
Coronaria, 5.
coronata, 14.
dioica, 8.
diurna, 8.
elegans, 10.
fimbriata, 7.
Flos-cuculi, 13.
Flos-Jovis, 6.
fulgens, 3, 12.
Githago, 1.
grandiflora, 14, 16.
Haageana, 16.
japonica 14.
lapponica, 4.
Miqueliana, 15.
oculata, 7.
plenissima, 13.
Preslii, 11.
semperflorens, 13.
Senno, 17.
Sieboldii, 14.
Silene, 7.
speciosa, 14.
splendens, 10.
vespertina, 9.
Viscaria, 10.
yunnanensis, 12.

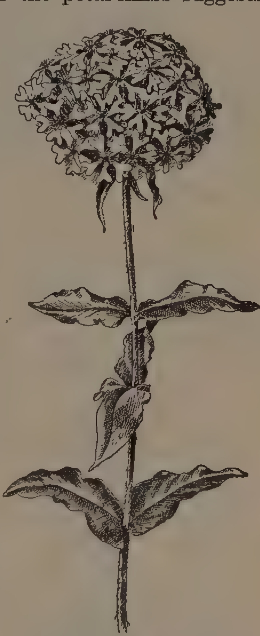
A. *Calyx-lobes long and leafy; petals not crowned.*

1. **Githàgo,** Scop. (*Agrostémma Githàgo,* Linn.). CORN-COCKLE. Figs. 2220, 2221; also 1515. An annual weed in wheat-fields, and difficult to eradicate because the seeds are not readily screened from the wheat in the thresher or fanning-mill: plant strict, 2–3 ft. tall, white-hairy: lvs. nearly linear: fls. long-peduncled, red-purple and showy, the obovate entire petal-limbs exceeded by the narrow calyx-lobes—these lobes falling when the fr. is ripe. Eu.—Rarely cult. in old gardens.

AA. *Calyx-lobes not prolonged and leafy; petals usually crowned.*

B. *Fls. 1 in. or less across, in dense terminal cymes or umbellate heads. (Forms of No. 14 may be sought here.)*

2. **chalcedónica,** Linn. MALTESE CROSS. JERUSALEM CROSS. SCARLET LIGHTNING. Fig. 2222. Perennial, 2–3 ft. tall, usually loose-hairy, the sts. simple or nearly so: lvs. oblong or cordate-lanceolate, clasping (upper ones often narrow and tapering), short-pointed, hairy: fls. 1 in. long, with narrow upward-enlarging ribbed calyx and spreading obcordate-notched limb. June. B.M. 257. Gn.M. 5:17.—Probably Japanese, but long in cult., and one of the best of all old-fashioned fls. The fls. are usually brick-red to scarlet, but there are varieties with rose-colored, flesh-colored and white blossoms; also with double fls. G. 4:391. The arrangement of the petal-limbs suggests the Maltese cross, hence one of the common names. Rarely persists for a time as a weed.



2222. Lychnis chalcedonica. (×⅛)

3. **fúlgens,** Fisch. (not Hort.). An erect-stemmed perennial, hairy: lvs. ovate to ovate-oblong, roughish, tapering below but scarcely petioled: fls. few, in a rather dense terminal cluster, bright scarlet, each petal divided into 2 broad lobes, on the outer side of which are 2 other and very narrow lobes, the ends of the main lobes slightly toothed; calyx oblong or ovate, 10-ribbed, with erect teeth. Siberia, China, Japan. B.M. 2104. B.R. 478.—Perhaps not in cult. in this country. The plant that passes under this name is probably a form of *L. coronata*. From *L. chalcedonica* it is distinguished by lower stature, much larger fls., and the well-marked side teeth or lobes on the petals.

4. **alpìna,** Linn. (*Viscària alpìna,* Don). Glabrous, tufted, a foot or less tall: lvs. mostly at the base, thickish, linear or oblong: fls. pink, with 2-lobed petals (segms. linear), and short broad calyx with red teeth. N. Asia, Eu., and Amer.; arctic and subarctic. B.M. 394. L.B.C. 9:881 (as *L. suecica*). *L. lappónica,* Hort., is apparently a form of this species; said to be perhaps somewhat dwarfer and deeper in color. G.M. 50:209.—An attractive alpine.

BB. *Fls. mostly larger, borne singly or in loose clusters, or at least the clusters not all terminal.*

C. *Plant white-woolly throughout.*

5. **Coronària,** Desr. (*Agrostémma Coronària,* Linn. *Coronària tomentòsa,* A. Br.). MULLEIN PINK.

Dusty Miller. Rose Campion. Fig. 2223. Biennial or perennial, 1–2½ ft. tall, forking toward the top: lvs. oblong, oblong-oval or oblong-spatulate, the lower ones obtuse or nearly so, tapering to a more or less clasping base: fls. large (1½ in. across), circular in outline, crimson or rose-crimson, borne singly on the ends of the branches; petals with appendages at the throat; calyx with filiform teeth. Eu. and Asia. B.M. 24. J. H. III. 57:571. Gn. W. 26:43. G. 30:401.—A common plant of old gardens, and sometimes escaped. The glowing fls. and white foliage make it a conspicuous plant. A hybrid of this and *L. Flos-Jovis* is figured in G. C. III. 2:101.

2223. Lychnis Coronaria.

6. **Flós-Jòvis,** Desr. (*Agrostémma Flós-Jòvis,* Linn. *Coronària Flós-Jòvis,* A. Br.). Flower of Jove. Fig. 2224. Perennial, 12–18 in., making a clump: lvs. in a rosette, also cauline, oval-lanceolate, more or less clasping: fls. small (½in. or less across), bright red or rose, in a rather dense, umbel-like cluster. Eu. B.M. 398.—Hardy perennial, rarely seen in old gardens.

cc. *Plant not white-woolly, green.*

d. *Petals 2-notched or 2-cleft.* (*Forms of No. 14 may be sought here.*)

e. *Annuals.*

7. **Cœli-ròsa,** Desr. (*Agrostémma Cœli-ròsa,* Linn. *Silène Cœli-ròsa,* Rohrb. *Coronària Cœli-ròsa,* Fries). Rose of Heaven. Fig. 2225. A very floriferous annual, 12–18 in., glabrous: lvs. linear, long-acuminate and very sharp-pointed: fls. on slender sts., about an inch across, the petals only slightly notched, rose-red, with a linear bifid scale at the throat; calyx club-shaped. Medit. region. B.M. 295.—A popular garden annual, loving the sun. There is a white-fld. form; also var. **fimbriàta,** Hort., with toothed petals; and other forms. For an account of the leading garden forms, see Rehder, M.D.G. 1897, p. 346.

2224. Lychnis Flos-Jovis.

Var. **oculàta,** Hort. (*L. oculàta,* Backh. *Viscària oculàta,* Lindl.), is a handsome form with purple-eyed fls. B. R. 29:53. B. M. 4075.

ee. *Biennials and perennials.*

8. **diòica,** Linn. (*L. diúrna,* Sibth.). Red or Morning Campion. Fig. 2226. Coarse, hairy and usually somewhat viscid, 1–2 ft. tall, forking above: lvs. ovate-lanceolate or oblong, the cauline ones broad-based or clasping: fls. normally red (varying to pink and white), in loose, elongating or forking clusters (or at first single on the ends of the branches), opening in the morning, not fragrant, more or less diœcious; calyx oblong, reddish, not exceeding ½in. length: fr. or caps. large and globose, wide-mouthed, the teeth recurved. Eu. and Asia.—Frequent in old gardens, and also run wild in waste grounds in the eastern states. There are double-fld. forms. G.C. III. 48:105 (double).

9. **álba,** Mill. (*L. vespertìna,* Sibth.). White or Evening Campion. Fig. 2227. Very like the last, and perhaps not specifically distinct, but more viscid: lvs. longer: fls. usually white and fragrant and opening at evening; calyx longer and green: caps. ovate to conical, with teeth erect or spreading, not recurved. May, June. Eu.—In old gardens and also escaped. There is a double-fld. form. G. 4:319; 8:511; 30:400. This and the last are easily grown biennials or perennials.

10. **Viscària,** Linn. German Catchfly. Interesting hardy perennial, 6–20 in. high, glabrous but with viscid patches beneath the fl.-clusters: lvs. long-linear, the lower ones tapering toward the base: fls. not large, red, in opposite short-stalked clusters, which form an interrupted glomerate panicle; calyx ¾in. long, reddish, usually somewhat swollen above the middle, with short teeth. Eu., N. Asia. G. C. III. 20:122.—Sometimes seen in old gardens, and a useful plant with a tufted habit; a most profuse bloomer in sunny places. Var. **álba,** Hort. Fls. white. G. M. 56:455. G. 30:401. Var. **spléndens,** Hort., has rose-pink fls. Var. **élegans,** Hort., has scarlet and white-striped fls. There are double-fld. forms. G. 25:347.

11. **Préslii,** Sekera. Perennial (?), 1–1½ ft., with many root-lvs. which are oval-lanceolate or obovate, acuminate: st.-lvs. oval and obtuse, dark green: fls. about 1 in. diam., purple, in forked panicled clusters; petals 2-notched (?); crown fringed, rose; calyx reddish and much inflated. Bolivia.—Apparently little known horticulturally.

2225. Lychnis Cœli-rosa. (Natural size)

12. **yunnanénsis,** Baker. Allied to *L. Flos-cuculi,* but with much the habit of *L. sibirica* (see suppl. list, next page): perennial, many-stemmed, 6 or 7 in. high, the sts. slender and pubescent: lvs. lanceolate or linear-lanceolate, sessile, glaucous-green and pubescent, acute: fls. white, the petals much longer than calyx and usually 2-lobed; filaments longer than calyx, the latter 10-nerved, tubular-campanulate, reddish at margin and the segms. ovate and somewhat glandular. China.—Recently offered.

DD. *Petals 4-lobed or parted.*

13. **Flós-cùculi,** Linn. (*Agrostémma Flós-cùculi,* Don. *Coronària Flós-cùculi,* A. Br.). Ragged Robin. Cuckoo Flower (note the Latin name). Fig. 2228. Perennial, slender, 1–2 ft. tall, slightly roughened, and glandular above: root-lvs. oblanceolate; st.-lvs. lance-linear to linear and rather small: fls. in a loose, cymose-paniculate cluster, red or pink, the petals cut into 4 linear segms.; calyx short-oblong, 10-ribbed. Eu., N. Asia. G. 26:401 (var. *rosea*).—Common in old gardens and also naturalized in parts of the eastern country. The double form (red or white) is prized for its close-packed fimbriate fls. An old-time and deserving favorite, blooming profusely and for most of the season. Hardy.

2226. Lychnis dioica. (×⅕)

Var. **plenissima,** Hort. (*L. plenissima semperflòrens,* Hort.), is an excellent very double form, blooming from spring till autumn, and also forcing well.

DDD. *Petals several-toothed or fimbriate or nearly entire, not simply 2-lobed (perhaps exceptions in some of the forms).*

2227. Lychnis alba. (×⅕)

14. **coronàta,** Thunb. (*L. grandiflòra,* Jacq.). Perennial, or often biennial under cult., erect, glabrous, 1–1½ ft.: lvs. oval-elliptic and acute, the cauline ones sessile or nearly so: fls. very large (2 in. or more across), the wide-spreading petals sharply several-toothed or somewhat laciniate, brick-red, salmon, or cinnabar, scattered or in an open panicle. China, Japan. B.M. 223. L.B.C. 15:1433. G.C. III. 28:205 and 42:189 (the same cut). R.H. 1911:12. G.M. 51:141. F.S. 10:979.—Half-hardy or tender perennial, growing 1–1½ ft. high, mostly a spring and summer bloomer. Of this handsome plant there are various forms, and to at least some of them the name *L. fulgens* is frequently applied.

Var. **speciòsa,** Bailey (*L. speciòsa,* Carr. *L. grandiflòra* var. *speciòsa,* Voss. *L. japónica speciòsa,* Hort.). Usually not so tall, very bushy: lvs. narrower and sharper: fls. very large and redder (usually scarlet), the petals less toothed and indistinctly 2-notched. R.H. 1870–1:530.

Var. **Sièboldii,** Bailey (*L. Sièboldii,* Van Houtte. *L. grandiflòra* var. *Sièboldii,* Voss). Fls. large and pure white, with lacerate and obscurely 2-notched petals.

15. **Miquelìana,** Rohrb. Much like *L. coronata* but well distinguished by petals not eroded, bracts and bractlets short and strict, the infl. spreading, peduncles often about as long as calyx: described as a pretty species forming a spreading bush of olive-green foliage and freely producing salmon-red large fls. in Aug. and Sept. Japan.

16. **Haageàna,** Lem. (*L. fúlgens* forma *Haageàna,* Voss. *L. grandiflòra* var. *Haageàna,* Hort.). Hybrid of *L. fulgens* and *L. coronata* var. *Sieboldii,* and a good intermediate, the fls. being large, with 2-notched petals and 2 short side teeth or lobes and dentate ends to the large lobes. It is a hardy or half-hardy, more or less hairy perennial, 12 in. or less high, in summer producing large clusters of orange-red, scarlet or crimson fls., which are nearly 2 in. across. Very desirable. I.H. 6:195. G.C. III. 42:243. G. 34:675. F.S. 22:2322.

17. **Sénno,** Sieb. & Zucc. Erect-growing villous perennial, with sessile, ovate or lance-ovate lvs. and 1–3 large fls. at the ends of the branches, deep carmine (or in some forms with striped fls.), the petals deeply cut (half their length) into several divisions which are again toothed at the ends; possibly a form of *L. coronata.* Japan.—Little known in this country.

L. Árkwrightii, Hort. Garden hybrid between L. chalcedonica and L. Haageana. Shades of scarlet.—*L. Lagáscæ,* Hook. f.=Petrocoptis.—*L. pyrenàica,* Berger = Petrocoptis. —*L. Sártori,* Hort. Said somewhat to resemble L. dioica but has narrower and more lanceolate lvs. and the inflated calyx is more elongated, the fls. being similar color of purple and ½in. across: about 9–12 in. high. China (?).—*L. sibírica,* Linn. Perennial, from Siberia, apparently not in commerce: cespitose: lvs. linear, somewhat hairy: fls. long-peduncled; calyx campanulate-globose, the lobes very short and obtuse; petals 2-lobed.—*L. striàta,* Hort., offered abroad, "deep scarlet with distinct white stripes," is probably not L. striata, Rydb., of W. U. S.; the latter is a perennial with exserted white or purplish 2-cleft petals and strongly 10-nerved calyx, growing at an altitude of 6,000–10,000 ft. in Colo., Wyo., Utah.

L. H. B.

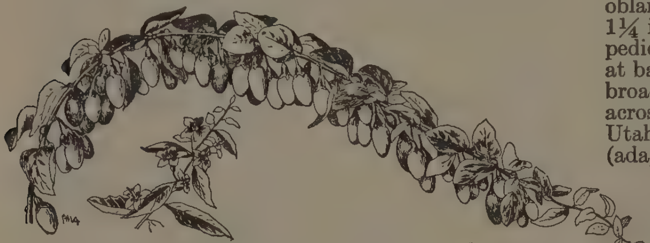
2228. Lychnis Flos-cuculi. (×⅕)

LÝCIUM (Greek, *Lykion,* a name given to a Rhamnus from Lycia, transferred by Linnæus to this genus). *Solanàceae.* Matrimony-Vine. Box-Thorn. Ornamental shrubs grown for their flowers and for the attractive fruits, scarlet in most species.

Deciduous or evergreen, thorny or unarmed: lvs.

alternate, often fascicled, short-petioled, entire, without stipules: fls. axillary, solitary or clustered; calyx campanulate, 3–5-toothed; corolla funnelform, with usually 5-lobed limb; stamens mostly 5: fr. a berry, with few to many seeds.—About 100 species, distributed through the temperate and subtropical regions of both hemispheres.

The matrimony-vines are shrubs with usually spiny branches, rigid in some species, slender and arching or procumbent in others, with rather small and narrow usually grayish green leaves and dull-colored, whitish, purplish or violet flowers, followed by scarlet, rarely yellow or black berries. Most of the species are tender, but *L. halimifolium*, *L. chinense*, and also *L. turcomanicum* and *L. ruthenicum* are hardy North. *L. pallidum* has proved hardy at the Arnold Arboretum. The two first named are especially attractive in fall, when the long and slender branches are loaded with scarlet or bright red fruits, which contrast well with the green foliage. The leaves remain fresh and unchanged in color until they drop, after severe frost. The species are well adapted for covering walls, fences, arbors and other trellis work, but are, perhaps, most beautiful when the branches are pendent from rocks or from the top of walls. They are also used sometimes for hedges, and for warmer regions, especially, *L. horridum* and *L. afrum* may be recommended. The latter is much used in South Africa for this purpose under the name of "caffir thorn." The box-thorns grow in almost any soil that is not too moist. They should not be planted near flower-beds or similar places, where the suckers are apt to become troublesome. Propagation is accomplished readily by hardwood cuttings or suckers; also by layers and seeds.



2229. Lycium chinense. (×⅓)

A. *Lvs. 1 in. long or longer: fls. 5-lobed.*

B. *Corolla-lobes as long or nearly as long as the tube: fls. purplish.*

halimifòlium, Mill. (*L. vulgàre*, Dun. *L. fláccidum*, Koch). Shrub, with long and slender, spiny or unarmed branches, recurving or sarmentose, glabrous: lvs. cuneate, narrow, oblong-lanceolate, acute or obtuse, grayish green, 1½–2 in. long: fls. 1–4, long-pedicelled; corolla ½in. across, limb about as long as tube; filaments hirsute at the base: fr. oval, orange-red or sometimes yellow, to ½in. long. May–Sept. China to S. E. Eu. Gn. 31, p. 334; 34, p. 63. B.B. (ed. 2) 3:168. G.W. 15, p. 346. Var. **lanceolàtum,** Schneid. (*L. lanceolàtum*, Poir.). Lvs. lanceolate: frs. oval. Var. **subglobòsum,** Schneid. (*L. subglobòsum*, Dunal). Dwarfer: lvs. lanceolate: frs. subglobose.—This species and also the following are often confounded with *L. europæum* and *L. barbarum*, which are chiefly distinguished by the filaments being glabrous at the base, by the longer tube and by the narrower and smaller lvs. They are not hardy N. and are rare in cult. while *L. halimifolium* and the following are hardy.

chinénse, Mill. Fig. 2229. Similar to the former, of more vigorous growth: branches to 12 ft. long: lvs. rhombic-ovate to lanceolate, bright green, 1½–3 in.: fls. somewhat larger: fr. scarlet or bright orange-red, ovate to oblong, sometimes almost 1 in. long. June–Sept. China. G.F. 4:102. F.E. 28:641.—The larger-fruited form is sometimes distinguished as var. **ovàtum,** Schneid. (*L. rhombifòlium*, Dipp. *L. ovàtum*, Poir. *L. chinénse* var. *macrocárpum*, Hort.). Lvs. rhombic-ovate, to 4 in. long: fr. very obtuse at the apex, large. Var. **inérme,** Schelle, is a spineless form.

BB. *Corolla-lobes much shorter than the tube: fls. pale greenish white.*

pállidum, Miers. Fig. 2230. Much-branched upright shrub, to 4 ft., with spreading, spiny branches: lvs. oblanceolate, obtuse, glaucous, somewhat fleshy, 1–1¼ in. long: fls. solitary or in pairs, nodding, on short pedicels; corolla pale greenish yellow or whitish, pinkish at base, ¾in. long; tube about 3 times longer than the broadly ovate obtuse lobes: berries globose, ¼–⅓in. across, scarlet. May, June; fr. in July–Aug. Ariz. and Utah to Mex. B.M. 8440. G.C. III. 46:232. G.F. 1:341 (adapted in Fig. 2230). M.D.G. 1908:209.—Very floriferous and attractive from the peculiar color of its fls., which are rather large for the genus; the very ornamental frs. do not seem to be produced regularly in cult. Does not produce suckers and does not grow readily from cuttings.

AA. *Lvs. small, ¾in. long or shorter.*

B. *Foliage glabrous or puberulous.*

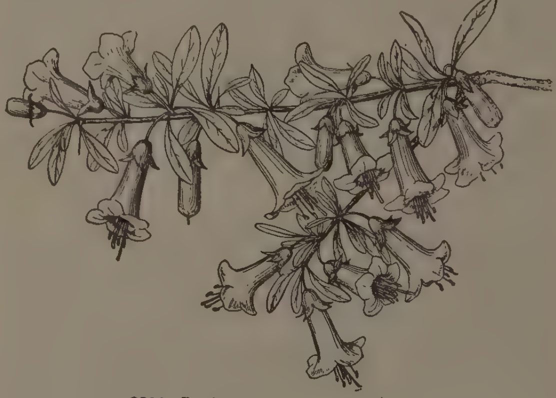
Ríchii, Gray. Shrub, with slender spiny branches: lvs. short-petioled, cuneate, obovate, obtuse, glabrous or minutely puberulous when young, about ½in. long: fls. usually 2–3; calyx as long as pedicels, with elongated teeth; corolla ½in. long, tube longer than 4-lobed limb: fr. globular, bright red, ¼in. across. May–Sept. S. Calif.

hórridum, Thunb. Erect, spiny, much-branched shrub, to 3 ft., glabrous: lvs. sessile, spatulate, glabrous, about ¼in. long: fls. short-pedicelled, small, whitish, with rather slender tube and 3–4-lobed limb. S. Afr.—It is not certain whether the plant in the trade is the true *L. horridum* of Thunberg described above, or *L. afrum*, which is much used in S. Afr. for hedges; the latter is easily distinguished by its large purple fls.

BB. *Foliage glandular-pubescent.*

chilénse, Bert. Shrub, with slender, often procumbent and mostly spineless branches: lvs. cuneate at base, oblong, glandular-pubescent on both sides, grayish green, ⅓–¾in. long: fls. usually solitary; pedicels longer than the 5-lobed, whitish pubescent calyx; corolla about ⅓in. long, pubescent and yellowish outside, limb 5-lobed, purplish within, about as long as tube: fr. orange-red. July–Oct. Chile.—The grayish color and glandular pubescence gives the foliage a frosted appearance. Intro. 1900 by Franceschi, Santa Barbara, Calif.

L. áfrum, Linn. Upright, rigid, spiny: lvs. linear-spatulate, small: fls. solitary, tubular, with short limb, purple, 1 in. long. N. and S. Afr. B.R. 354.—*L. bárbarum*, Linn. Spiny or rarely unarmed shrub, similar to L. halimifolium: fls. 3–6; tube inside and filaments at base glabrous, limb half as long as tube. N. Afr.—*L.*



2230. Lycium pallidum. (×⅔)

califórnicum, Nutt. Spiny shrub, to 2 ft.: lvs. thickish, spatulate, very small: fls. whitish, small: fr. red, small, subglobose. Calif.—*L. europæum*, Linn. (L. mediterraneum, Dun.). Spiny shrub, with spreading branches: lvs. spatulate, thickish: fls. short-pedicelled, with the slender tube much longer than limb. Medit. region.—*L. fuchsioides*, HBK.=Iochroma fuchsioides.—*L. ruthénicum*, Murr. Upright, spiny: lvs. linear, small, thick: fls. small, with rather long tube: fr. globular, black. S. Russia, W. Asia.—*L. turcománicum*, Turcz. Slender, spiny, allied to L. halimifolium: lvs. and fls. smaller, tube more slender and longer: fr. globular. Turkestan, N. China.

Alfred Rehder.

LYCOPÉRSICUM (*wolf peach;* probably an allusion to its inferiority as compared with the peach or possibly to its supposed poisonous qualities). Sometimes written *Lycopersicon. Solanàceæ.* Tomato. Familiar garden fruit or vegetable.

Perhaps nearly a dozen herbs of the western side of S. Amer., two of which are in common cult. for their frs. (which in common speech are classed with vegetables). Fls. small, yellow, nearly rotate when in full bloom, in short superaxillary racemes; stamens 5, connate about the single style; ovary 2-loculed in the non-ameliorated forms, becoming a fleshy many-seeded berry: foliage irregularly or interruptedly pinnate, rank-smelling: plant pubescent, straggling.—Botanically the genus is very close to Solanum, from which it is distinguished by the characteristic pinnately compound lvs., and the longitudinally dehiscing anthers which are prolonged into an empty beak. It is united with Solanum by Wettstein in Engler & Prantl's "Natürlichen Pflanzenfamilien." In native conditions, tomatoes are probably perennial, but in domestication they are treated as if annual. Tender to frost. See *Tomato.*

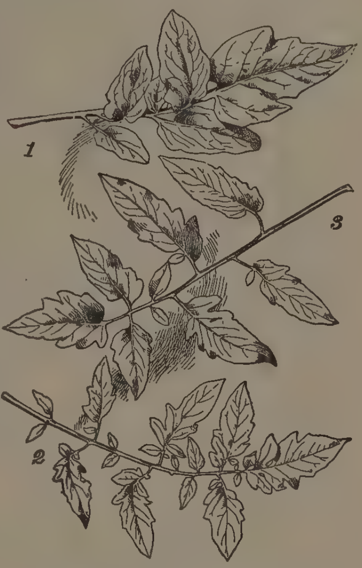
2231. Old-time garden tomato, Lycopersicum esculentum.

esculéntum, Mill. (*Solànum Lycopérsicum,* Linn.). Common Tomato. Figs. 2231, 2235. Plant spreading, with grayish green, mostly conduplicate ("curled") lvs. and slender, ascending shoots: lvs. pinnate, with small, nearly entire lfts. interposed, the main lfts. notched or even lobed toward the base: fls. in a short raceme of 4–6: fr. medium to small, flattened endwise and furrowed on the sides.—In cult. for more than 300 years. Two hundred years ago red and yellow varieties were known. The great evolution of the tomato did not take place until last century, giving rise to the garden race. The plant sometimes escapes from cult. and runs wild for a time.

Var. **vulgàre,** Bailey. Fig. 2232, No. 2. This is the common garden tomato of N. Amer., distinguished by very heavy growth, greener foliage, much larger and plane lvs., the comparative absence of stiffish ascending shoots (in the mature plant), few fls., and larger, "smoother" (i. e., not furrowed) fr., which has numerous locules or cells.—There is every reason for believing that the original tomato had a 2-loculed (2-celled) fr., but the course of amelioration has multiplied the locules; it has also modified the foliage and the stature of the plant.

Var. **cerasifórme,** Hort. (*L. cerasifórme,* Dunal). Cherry Tomato. Still grown for its little globular frs. (in red and yellow), which are often 2-loculed: plant less large and dense-foliaged, the lvs. smaller, grayer: growth more erect.—Probably a very close approach to the wild plant. Frs. used for pickles and conserves.

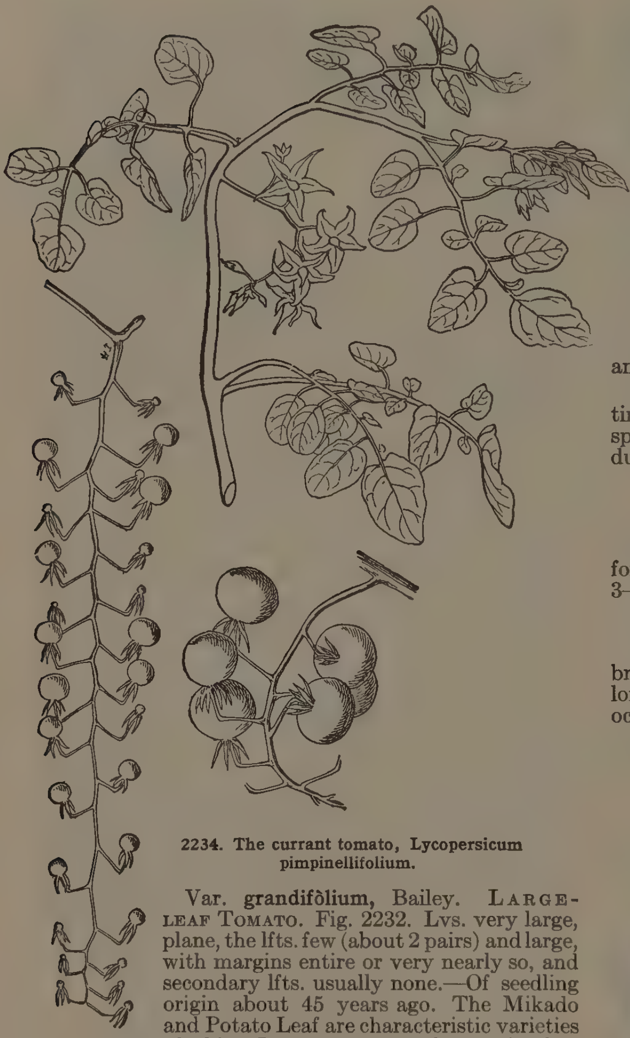
Var. **pyrifórme,** Hort. (*L. pyrifórme,* Dunal). Pear and Plum Tomato. Differs from the last only in having pear-shaped or oblong frs.—Probably occurs wild in very nearly the form seen in old gardens.



2232. Leaves of tomatoes: *1,* Lycopersicum esculentum var. grandifolium; *2,* var. vulgare; *3,* cross of the two.

Var. **válidum,** Bailey. Upright Tomato. Fig. 2233. A remarkable cultural form, of low stiff erect growth, and small, condensed, curled lvs.—Originated as a chance seedling in France about 65 years ago. Looks like a potato plant.

2233. Tree tomato, Lycopersicum esculentum var. validum.



2234. The currant tomato, Lycopersicum pimpinellifolium.

Var. **grandifòlium**, Bailey. Large-leaf Tomato. Fig. 2232. Lvs. very large, plane, the lfts. few (about 2 pairs) and large, with margins entire or very nearly so, and secondary lfts. usually none.—Of seedling origin about 45 years ago. The Mikado and Potato Leaf are characteristic varieties of this. In very young plants, the lvs. are usually entire. This race has produced crosses of commercial value with var. *vulgare*. In Fig. 2232, No. 2 is a lf. of var. *vulgare*, No. 1 is var. *grandifolium*, and No. 3 is a lf. of a hand-made cross between the two.

pimpinellifòlium, Dunal (*L. racemígerum* and *L. racemifórme*, Lange. *Solànum racemiflòrum*, Vilm., not Dunal). Currant Tomato. Fig. 2234. Plant weaker, very diffuse and twiggy, scarcely pubescent: lvs. with small ovate nearly entire lfts., and very small secondary lfts.: racemes elongating, distichous, bearing 10–40 small currant-like red berries. S. Amer.—Grown as a curiosity and for ornament. The plant makes an excellent summer cover for brush or rubbish piles. The frs. are edible, but are too small for domestic use. However, it has been intro. as a garden vegetable under the name of German Raisin tomato. It hybridizes with *L. esculentum* (see Fig. 2235). L. H. B.

LYCOPÒDIUM (Greek, *wolf-foot*). *Lycopodiàceæ*. Club-moss. Ground-pine. Running-pine. A group of pteridophytes, with erect or trailing stems, commonly used for holiday decorations.

Leaves narrow, needle- or scale-like, arranged in 4 to many ranks, and bearing spores in sporangia, located either in the axils of ordinary lvs. or in the axils of modified lvs. clustered in spikes.—About 100 species are known. The spores of some species form the officinal lycopodium powder. The plants which florists grow as lycopodiums are selaginellas. Horticulturally, the species of Lycopodium are valuable mainly as oddities. The hardy species are not always easy to get started, and the tender species need special cult. for good results. See *Selaginella*.

A. *Lvs. many-ranked.*

B. *Sporangia in the axils of unaltered lvs.*

Selàgo, Linn. Sts. erect, 3–9 in. long, dichotomously branched: lvs. ascending, hollow at base, glossy green, not reflexed. Northern hemisphere, usually in high altitudes.

lucídulum, Michx. (Fig. 2236), much like preceding, but usually larger, is more common in lowlands and has lvs. wide in the middle and erose.

squarròsum, Forst. Sts. pendulous, 1–2 ft. long, 2–3 times dichotomously branched: lvs. firm, dark green, spreading, ½–¾in. long: sporangia in the axils of reduced lvs., forming a spike. E. Indies.

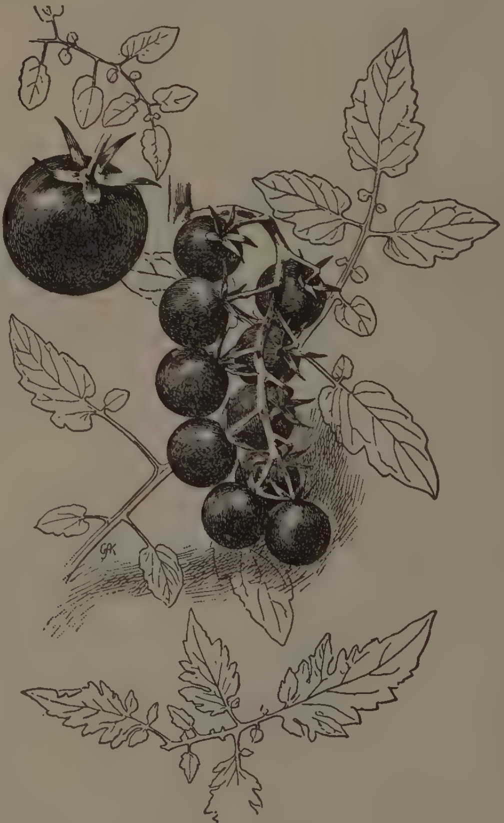
BB. *Sporangia aggregated in terminal spikes.*

C. *Sts. pendulous: lvs. acute.*

Phlegmària, Linn. Sts. ½–2 ft. long, dichotomously forked: lvs. ½–¾ in. long, ovate: spikes copious, lax, 3–6 in. or more long. Tropics of Old World.

CC. *Sts. erect, tree form.*

cérnuum, Linn. Sts. erect, reaching 3–4 ft., copiously branched: lvs. crowded, linear: spikes sessile, ¼–¾in. long, curved downward. Tropics of both hemispheres, occasionally in our Gulf states.



2235. Lycopersicum esculentum beneath; L. pimpinellifolium at top; hybrid between.

obscùrum, Linn. (*L. dendroídeum,* Michx. *L. japónicum,* Thunb.). Fig. 2236. Sts. 6–12 in. high, much-branched, forming a somewhat tree-like growth: lvs. loose, erect: spikes erect, ½–1½ in. long. Temp. N. Amer. to Japan. G.W. 9, p. 520.—The common ground-pine.

CCC. *Sts. (main ones) wide-trailing, with erect branches.*

annótinum, Linn. Sts. trailing, often several feet long, with numerous ascending branches 6–8 in. high, which bear sessile, solitary spikes. Arctic and North Temperate Zones of both hemispheres.

clavàtum, Linn. Fig. 2236. Main st. trailing to the length of several feet, usually much branched: spikes 1–4 on an elongated peduncle. Arctic and North Temperate regions of both hemispheres.—The common club-moss.

AA. *Lvs. 4-ranked, on fan-like branches.*

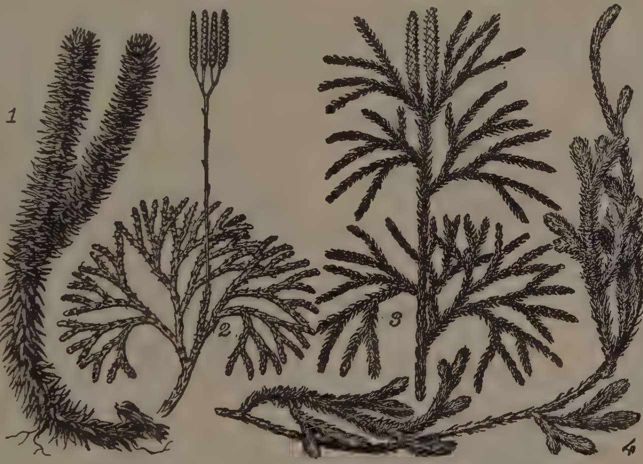
complanàtum, Linn. Fig. 2236. Sts. trailing on the surface of the ground: branches spreading out in a horizontal plane: lvs. of the under side of sts. reduced to slender, spreading, cuspidate apices: first and second forks of peduncles approximate. Northern hemisphere.—*L. Chamæcyparíssus,* R. Br., is an allied species, with sts. growing underground.

L. M. UNDERWOOD.

LYCÒRIS (named probably after a nereid in Greek mythology). *Amaryllidàceæ.* Attractive amaryllis-like bulbous plants from China and Japan.

From Amaryllis, the genus is separated by technical characters of the fl., which has few rather than many ovules in a cell, and by black rather than green seeds. Perianth funnel-shaped, somewhat irregular, with a short cylindrical tube enlarged at the top, sometimes with scales in the throat; segms. oblanceolate, clawed; stamens inserted near the throat, the filaments long and declinate; ovary 3-celled, the style filiform, the stigma minute and capitate: bulb tunicated, short-necked: peduncle solid: lvs. linear or strap-shaped: umbel many-fld., bearing red or yellow blooms.—Species about a half-dozen. At least two species are hardy in New England. Two bloom in summer and two in early autumn. Two have red fls., one has lilac or purple fls., one yellow or orange. Three have the perianth-segms. more or less recurved and fluted or crisped at the margin. In all cases the fls. appear without foliage, being borne on a scape 1–3 ft. long, in umbels of 4–12 fls., each 3–4 in. across. The white filaments and yellow anthers are conspicuous features. The lvs. make their growth, die down, and after a long rest the bulbs send up fl.-stalks alone. These plants are highly esteemed in China and Japan, and bulbs are constantly sent to the western world, but with us they seem to be wayward and uncertain, particularly as to the time of blooming. *L. aurea* reverses the custom of nature. It rests in the wet season and flowers in the dry season. How the bulbs can remain dormant during the early Chinese summer, with the thermometer at 85° in the shade and a yearly rainfall of 100 in., is a mystery. Botanically this genus is placed next to Hippeastrum, an American genus, in which the seeds are numerous in a locule, and usually flat, while in Lycoris they are few in a locule and turgid. Horticulturally Lycoris is most nearly comparable to Nerine, but the seeds of the former are black and of the latter green; in Nerine the tube is nearly or quite wanting, stamens inserted at base of segms., filaments thickened at base and 3 shorter, style obscurely tricuspidate, fls., red.

For many years, *L. aurea* has been cultivated in American gardens, although it is not a common plant. More recently, with large importations of *L. radiata,* the interest in the genus has widened. These species have the handsomer flowers, and are preferably cultivated under glass, although the bulbs are probably hardy in warm protected borders; at least they have more than once been frozen in pots at Elizabeth, New Jersey, without apparent harm. In its habitat in China, *L. aurea* rests in the wet season, and the most success in culture has been found in growing it in a warmhouse, taking care to cultivate the foliage and rest the bulbs in warmth and moist earth. The same general directions may be followed for *L. radiata.* As with all bulbs, a vigorous growth of foliage is essential to the future appearance of flowers. *L. squamigera* amd *L. sanguinea* are perfectly hardy; their leaves appear in March, mature and disappear. The flowers come in the nature of a surprise in August. The former species has a columnar scape 2 to 3 feet tall and a cluster of large, amaryllis-like flowers, of a bright rosy purple, rather attractive in the back row of a garden, but not of first rank. *L. sanguinea* has a scape 1½ to 2 feet, with small orange-red flowers, dull and curious rather than striking. The two former species have the beauty of the nerines, but the two latter have none of this resemblance. (J. N. Gerard.)



2236. Species of Lycopodium: *1*, L. lucidulum; *2*, L. complanatum; *3*, L. obscurum; *4*, L. clavatum. (After Knobel)

A. *Blooming in July and Aug.*

B. *Fls. red.*

sanguínea, Maxim: Bulb ovoid, 1 in. diam.; neck 1–2 in. long: lvs. linear. fls. red, 4–6 in an umbel on a peduncle 12–18 in. high; tube ½in. long; stamens shorter than the perianth-segms. Japan.—The only species with segms. neither wavy or reflexed. Statements that the blooming period is May and June are probably erroneous. A var. **álba** is advertised. It is said that the lvs. of this and the next appear in March; also that the fls. of *L. sanguinea* are dull brownish red.

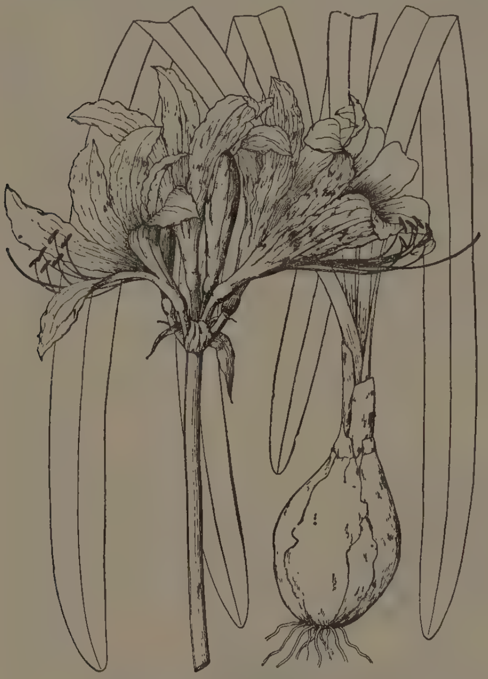
BB. *Fls. rosy lilac.*

squamígera, Maxim. (*Amarýllis Hállii,* Hort.). Fig. 2237. Bulb globose: lvs. produced in spring, 9–12 lines wide: fls. rosy lilac, banded yellow; segms. curving, much narrowed below and forming a tube nearly an inch long with truncate scales in the throat (whence the name). Japan. B.M. 7547. G.C. III. 21:137. A.G. 25:119. G.F. 3:177 (reduced in Fig. 2237).—The only fragrant kind. Var. **purpùrea,** Hort., intro. about 1898. This species is hardy in New England. It was intro. into this country by Geo. R. Hall, Bristol, R. I. (see p. 1578 for account of Dr. Hall). Apparently the most popular species.

AA. *Blooming from Sept. to Nov.*

B. *Fls. orange-colored.*

aûrea, Herb. (*Amarýllis aùrea,* L'Her. *Nerìne aùrea,* Bury). GOLDEN SPIDER LILY. Bulb 2 in. diam.: lvs. sword-shaped, 6–9 lines wide, glaucous, produced in May. China. B.M. 409. B.R. 611. G.C. III. 17:263; 18:545; 47:12, 13. Gn. 47:42.—Baker says it blooms in Aug. and has bright yellow fls., but the colored plates show orange-colored fls.



2237. Lycoris squamigera. (×⅛)

stramínea, Lindl., allied to *L. aurea,* and probably not in commerce: segms. pale straw-color with pink keel and a few scattered red dots: tube very short. China.

BB. *Fls. bright red (a white form).*

radiàta, Herb. (*Amarýllis radiàta,* L'Her. *Nerìne japónica,* Miq.). Bulb globose, 1½ in. diam.; neck short: lvs. 5–6, produced in winter, linear: stamens much longer than the perianth-segms. China and Japan. B.R. 596. A.G. 13:211.—The perianth-segms. are more recurved than in other species. The tube is very short, while in all the other kinds here described it is ½in. or more long. Var. **pùmila,** Hort., is much dwarfer than the usual forms. Var. **álba,** Hort. Pure white shaded cream. S. Japan.

Recent names in horticultural literature are: *L. incarnàta* (Sprenger, Naples). Scape 1–1¾ ft., bearing 6–12 fls., which are large and widely expanded, pale flesh-colored or bright rose and fragrant; segms. scarcely undulate, not much reflexed. Cent. China. G.W. 10:489.—*L. Sprèngeri,* Comes. Fls. rose-pink or purplish rose, on long pedicels, without perianth-tube; spathe-valves short, ovate. Probably Japan. G.C. III. 32:suppl. Dec. 27. G.W. 10:489. Allied to L. squamigera, but with shorter less pointed spathe-valves; perianth-tube ½in. long.

WILHELM MILLER.
L. H. B.†

LYGÈUM (Greek, *lugoein,* to bend). *Gramíneæ.* Spikelets 1-fld., 1½–2 in. long, with a hard, curved beak, 2–3 together at the summit of the culms, partially inclosed in a foliaceous sheath: sts. slender, wiry, 2–3 ft., from a hard scaly running rootstock: blades involute, flexuous.—Species 1, **L. Spártum,** Linn., of arid parts of the Medit. region. This species, together with *Stipa tenacissima* (which see), forms the "Esparto" of commerce, which comes mostly from Spain and Algeria.

A. S. HITCHCOCK.

LYGÒDIUM (Greek, *twining*). *Schizæàceæ.* CLIMBING FERNS. A group of ferns with twining vine-like lvs., with the sporangia borne singly under overlapping scales on the under surface of reduced portions of the lf.—Some 30 species are known from all parts of the world. They make an especially attractive growth, and do well when allowed to twine on wires or strings in a large conservatory. For cult. see *Ferns,* p. 1215.

A. *Sterile pinnules palmate. (Native hardy species.)*

palmàtum, Swartz. HARTFORD FERN. Lvs. 2 ft. or more high, twining, bearing pairs of cordate-palmate pinnules 1½–2 in. long, on short petioles; fertile pinnules 3–4-pinnatifid, with the ultimate divisions linear. Mass. to Fla. and Tenn.—Requires light moist soil and partial shade.

AA. *Sterile pinnules pinnate. (Exotic glasshouse species.)*

scándens, Swartz. Lvs. many feet long; pinnules 4–8 in. long, 2–4 in. broad, with a terminal segm. and 4 or 5 on each side, which are simple and usually ovate. India and China.—Most of the American material cult. under this name belongs to the next species.

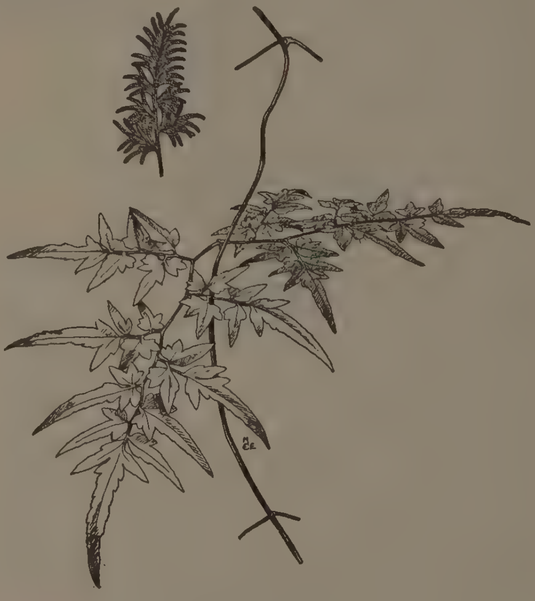
japónicum, Swartz. Fig. 2238. Lvs. many feet long; pinnules 4–8 in. long, nearly as wide, deltoid, with a pinnatifid terminal segm. and 2 or 3 lateral ones on each side, all unequal and the lowest long-stalked and pinnate in the lower part. Japan and the E. Indies. —The common species in cult.

AAA. *Sterile pinnules forked.*

circinàtum, Swartz (*L. dichótomum,* Swartz). Pinnules practically sessile, once forked, the divisions deeply 5–6-lobed, or sometimes forked twice; the sterile segms. 4–12 in. long, ½–¾in. broad, the fertile segms. very much contracted. Malaysia.

L. M. UNDERWOOD.

LYÒNIA (after John Lyon, who introduced many American plants into England; died before 1818, in Asheville, N. C.). Syn., *Xolísma.* *Ericàceæ.* Ornamental shrubs, sometimes grown for their white flowers and dense foliage.



2238. Lygodium japonicum. (×⅛)

Deciduous or evergreen: lvs. alternate, short-petioled, entire or serrulate: fls. fascicled or panicled, white; calyx-lobes 4–5, valvate; corolla globular or urceolate, pubescent; stamens 8–10; anthers oblong, truncate at the apex; disk 8–10-lobed: caps. 4–5-valved, with ribs at the sutures and intruded at the apex; seeds numerous, with a loose reticulate testa.—About 10 species in E. N. Amer., W. Indies and Mex. Allied to Pieris and often included under Andromeda.

The lyonias are much-branched shrubs with dull green medium-sized foliage and small white flowers in clusters or panicles. Only the deciduous *L. ligustrina* is hardy North, but is less desirable than other hardy species of allied genera. It prefers moist peaty soil, while the evergreen tender *L. ferruginea* thrives best in a sandy, well-drained soil. Cultivated and propagated like leucothoë and pieris.

ligústrina, Muhl. (*Xolísma ligústrina,* Brit. *Andrómeda paniculàta,* Ait. *A. ligústrina,* Muhl. *A. parabólica,* Duham. *L. paniculàta,* Nutt.). Deciduous, much-branched shrub, to 10 ft.: lvs. obovate to oblong-lanceolate, entire or obscurely serrate, pubescent beneath, 1–2 in. long: fls. in leafless racemes, forming terminal panicles; corolla globose, whitish, ⅙in. long. May–July. Canada to Fla., west to Tenn. and Ark. B.B. (ed. 2) 2:691. Var. **foliosiflòra,** Fern. Racemes less crowded, often elongated, conspicuously leafy-bracted. Var. **pubéscens,** Rehd. (*Andrómeda ligústrina* var. *pubéscens,* Gray. *A. tomentòsa,* Hort., not Dum.-Cours.). A form with soft dense pubescence.

ferrugínea, Nutt. (*Xolísma ferrugínea,* Heller. *Andrómeda ferrugínea,* Walt.). Evergreen shrub or small tree: lvs. cuneate, obovate to oblong, with revolute margin, scurfy when unfolding, especially below, 1–2 in. long: fls. nodding, globular, white, in clusters in the axils of the upper lvs. Feb., March. S. C. to Fla. S.S. 5:234. L.B.C. 5:430.—Handsome evergreen shrub, but rarely cult., hardy only S. Var. **arboréscens,** Rehd. (*Andrómeda rígida,* Pursh). Of vigorous growth, more rigid and with crowded lvs., growing into a small tree. Var. **fruticòsa,** Rehd. (*Xolísma fruticòsa,* Nash. *A. rhomboidàlis,* Nouv. Duh.). Shrubby: lvs. sparser, conspicuously reticulated. ALFRED REHDER.

LYONOTHÁMNUS (*Lyon's shrub;* named for W. S Lyon, who sent specimens to Asa Gray from Santa Catalina Island, California). *Rosàceæ.* Ornamental woody plant grown for its handsome foliage and the large clusters of white flowers.

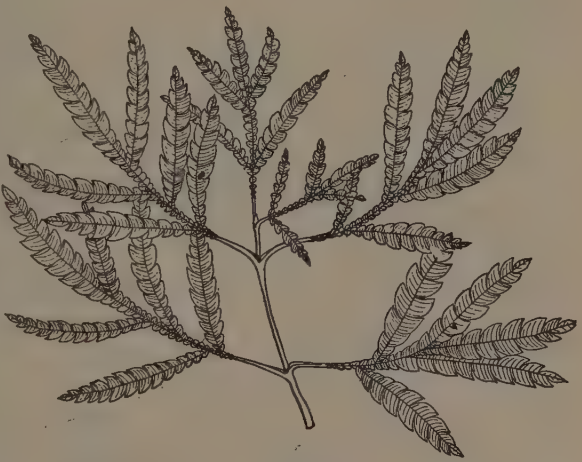
Evergreen shrub or small tree: lvs. opposite, petioled, lanceolate and nearly entire or pinnate: fls. perfect, in terminal flat corymbs; calyx with 2–3 bractlets at the base; tube hemispherical; lobes 5; petals 5, orbicular; stamens 10, inserted at the margin of the 10-lobed, lanate disk: carpels 2, developing into woody dehiscent caps., each with 4 ovate-oblong seeds.—One species on the islands off the coast of S. Calif. The pinnate-lvd. variety is grown to some extent in N. and S. Calif. and is locally known as "ironwood" or "palo fierro." It is difficult to prop.; seeds are rarely obtainable and only a small percentage germinate; cuttings are usually not successful, but it is said that basal sprouts root more readily

floribúndus, Gray. Usually shrubby: lvs. of the typical form lanceolate, crenulate or subentire, dark green and lustrous above, yellowish green and glabrous or pubescent below, 4–8 in. long and ½–¾ in. wide: fls. white, ⅙–¼in. across in large corymbs 4–8 in. wide. June, July. Various transitional forms between the foliage of the type and that of the following variety are shown in Zoe. 1:5. Var. **asplenifòlius,** Brandegee (*L. aspleniifòlius,* Greene). Fig. 2239 (after Hall). Sometimes tree-like, to 75 ft.: lvs. pinnately divided into 3–8 incisely lobulate segms. S.S. 4:297.—This variety is quite plentiful on the island of Santa Cruz and also on Santa Rosa and is cult. for its handsome fern-like foliage; the type, which is found only on the island of Santa Catalina, is less handsome and was never brought under cult. ALFRED REHDER.

LYSICHÌTUM (Greek, a *loose* or *free cloak;* probably referring to the spathe). Also written *Lysichiton. Aràceæ.* A genus of one species; a hardy plant resembling the skunk cabbage, which has been offered by dealers in native plants.

Nearly stemless swamp herb with large lvs. from a thick horizontal rootstock: spathe peduncled, sheathing at base, with a broad colored lamina or none, at first enveloping the cylindrical spadix, which becomes long-exserted upon a stout peduncle; fls. perfect, crowding and covering the spadix; perianth 4-lobed; stamens 4; ovary 2-celled, 2-ovuled; ovules horizontal, orthotropous: fr. a 2-seeded berry, immersed in the spadix.

camtschatcénse, Schott. Lvs. 1–4 ft. long, 3–15 in. wide, oblong-lanceolate: peduncle shorter than the lvs. May, June. E. Siberia, Japan, Alaska, Ore., Calif. B.M. 7937. G.C. III. 27:219; 57:301. G.M. 48:330. L. H. B.



2239. Lyonothamnus floribundus var. asplenifolius.

LYSILÒMA (Greek, probably meaning *free border*). *Leguminòsæ.* About a dozen unarmed trees and shrubs of the American tropics, scarcely cult. They bear bipinnate lvs., and fls. in heads or in cylindrical spikes; petals united into a 5-lobed corolla: pods straight and flat, the valves opening away from the persistent sutures. Some of these plants are often called acacias. *L. acapulcénsis,* Benth. (*Acàcia acapulcénsis,* Kunth). Tree-like: pinnæ 8–9 pairs, the lfts. very many, oblong-linear and pubescent, glands 2 or 3 between some of the pinnæ; fls. white in cylindrical axillary spikes; stamens many, monadelphous. Mex. Reported in Santa Barbara.—*L. bahaménsis,* Benth. (*L. latisíliqua,* Gray, not Benth.). WILD TAMARIND. Tree, to 50 ft., wide-spreading: pinnæ 3–5 pairs; lfts. 20–50; blades of the latter oblong or oblong-lanceolate, acute, glabrous or nearly so: fl.-heads white, less than ½in. diam.: pod oblong, flat and undulate. S. Fla., Bahamas, Cuba.—*L. Schiedeàna,* Benth. Pinnæ 6–9 pairs: lfts. 40 pairs, linear, obtuse, glabrous or minutely puberulent; stipules semi-ovate to falcate: fls. white, in 1–3 axillary pedunculate heads. Mex.—*L. divaricàta* (*Mimòsa divaricàta,* Jacq.) is a doubtful species with synonymy apparently yet to be cleared up. L. H. B.

LYSIMÀCHIA (probably after King Lysimachus). *Primulàceæ.* LOOSESTRIFE. Erect or creeping leafy herbs grown in damp wild gardens and borders.

Leaves opposite or whorled, entire, usually black-punctate: fls. spicate, racemose or solitary, with a rotate or campanulate, 5-parted corolla with an equal number of slightly monadelphous stamens opposite the lobes: caps. 1-loculed, with many seeds on a central placenta. —Over 100 species found in temperate and subtropical regions of all parts of the world. Only a few in cult., and these all perennials. They differ from related genera in the absence of staminodia between the stamens, which are usually slightly united. Revision, Knuth in Das Pflanzenreich, hft. 22, p. 256 (1905).

The loosestrifes are of easy culture, thriving best in moist situations. Propagation is by division in late autumn or early spring.

INDEX.

aurea, 2.
barystachys, 10.
brachystachys, 10.
clethroides, 12.
Ephemerum, 9.
Fortunei, 11.
Hillebrandii, 1.
Leschenaultii, 13.
Nummularia, 2.
nutans, 14.
paridiformis, 4.
punctata, 8.
quadrifolia, 6.
stricta, 5.
terrestris, 5.
thyrsiflora, 3.
verticillata, 8.
vulgaris, 7.

KEY TO THE SPECIES.

A. *Plant shrubby*...................... 1. **Hillebrandii**
AA. *Plant herbaceous.*
B. *Color of fls. yellow.*
C. *St. creeping: lvs. round-ovate, obtuse*...................... 2. **Nummularia**
CC. *St. erect: lvs. ovate-lanceolate or linear, mostly acute.*
D. *Fls. in dense axillary pedunculate clusters*.................. 3. **thyrsiflora**
DD. *Fls. in dense terminal clusters surrounded by large lvs.: cauline lvs. very small*....... 4. **paridiformis**
DDD. *Fls. racemose or axillary.*
E. *Whole plant glabrous or nearly so: fls. 3–6 lines broad.*
F. *The fls. in terminal racemes*................ 5. **terrestris**
FF. *The fls. axillary*......... 6. **quadrifolia**
EE. *Whole plant densely pubescent: fls. 9–12 lines broad.*
F. *Calyx 2 lines long, dark-margined: fls. in leafy panicles*.............. 7. **vulgaris**
FF. *Calyx 3½–5 lines long, not dark-margined: fls. axillary*.................. 8. **punctata**
BB. *Color of fls. white: pedicels short.*
C. *Lvs. opposite, somewhat connate*.. 9. **Ephemerum**
CC. *Lvs. alternate, attenuate at base.*
D. *Blades glaucous beneath, oblong-linear* ....10. **barystachys**
DD. *Blades green, lanceolate or ovate-lanceolate.*
E. *Plant glabrous: lvs. oblong*..11. **Fortunei**
EE. *Plant puberulent: lvs. ovate*..12. **clethroides**
BBB. *Color of fls. red, blue or purple.*
C. *Calyx-lobes acuminate, slightly shorter than the entire-lobed corolla*.....................13. **Leschenaultii**
CC. *Calyx-lobes obtuse, much shorter than the usually erose-lobed corolla*....................14. **nutans**

1. **Hillebrándii,** Hook. Shrub 1½–8 ft. high, densely branched, often red-tomentose: lvs. alternate, subopposite or subverticillate, lanceolate, ovate or linear, acuminate at each end, coriaceous, short-petioled: calyx-lobes acuminate; corolla reddish purple, campanulate; lobes obovate, obtuse; stamens included. Hawaiian Isls.

2. **Nummulària,** Linn. Moneywort. Creeping Charlie. Creeping Jenny. Glabrous, forming large patches: lvs. opposite, rarely cordate, petiolate, ½–1 in. long: fls. 8–12 lines broad; sepals cordate or lanceolate, acute, half as long as the 5 oval, sparingly dark-dotted corolla-lobes; filaments glandular. June–Aug. Eu.; also naturalized extensively in the E. U. S. R.H. 1891, p. 303; 1899, p. 21. B.B. 2:589.—Very useful for rustic vases and baskets, also for carpeting ground in shady places. Sometimes a low weed in lawns. Var. **aùrea,** Hort. Lvs. all or in part bright yellow.

3. **thyrsiflòra,** Linn. (*Naumbùrgia guttàta*, Moench). Glabrous: st. simple, 1–3 ft. high: lvs. opposite, lanceolate: fls. small, 2–3 lines long, yellow, in short pedunculate axillary heads; calyx-lobes narrow; corolla-lobes linear, dotted. Swamps, N. E. N. Amer. and Eu. B.M. 2012.—Prefers shallow water.

4. **paridifórmis,** Franch. Glabrous: st. verticillately branched above: upper lvs. large, 3–5 in. long, whorled, sessile, elliptic or obovate-lanceolate, acuminate, glaucous beneath; lower very small, opposite: fls. large, yellow, condensed into a dense cluster surrounded by large lvs., sometimes also axillary clusters; sepals lance-subulate; corolla campanulate; lobes lanceolate, acute; stamens included. China. B.M. 7226.

5. **terréstris,** BSP. (*L. stricta*, Soland.). Simple or branched, glabrous, 8 in. to 2 ft. high: lvs. opposite, lance-linear, acute at both ends, glaucous beneath, scarcely veiny, 1–3 in. long: fls. 3–5 lines broad, very numerous, in a distinct, elongated, terminal raceme; pedicels 3–9 lines long, slender; corolla yellow, the lobes elliptical, streaked with dark lines; filaments glandular. Common on moist ground in the E. U. S. B.M. 104 (as *L. bulbifera*). B.B. 2:588. Blanchan Nat. Gard., p. 324.—Often bears bulblets in the lf.-axils after flowering.

6. **quadrifòlia,** Linn. Usually simple, sometimes slightly pubescent, 1–3 ft. high: lvs. verticillate, in 3's–4's, rarely some opposite, lanceolate, oblong or ovate, acute, 1–4 in. long, green beneath, veiny: fls. axillary, 3–6 lines broad, on very slender pedicels, which are ½–1½ in. long; calyx and corolla as in *L. terrestris*. Dry soil. E.U.S. B.B. 2:588.

7. **vulgàris,** Linn. Common Yellow Loosestrife. Tall and erect, 2–3 ft. high, and stout; branched above, downy, especially on the st.: lvs. verticillate, in 3's–4's, ovate-lanceolate or lance-oval, acute at both ends, nearly sessile: fls. in the upper axils, or densely paniculate at the summit; calyx often dark-margined; corolla large, the lobes broad, glabrous. Eu., Asia. R.H. 1891, p. 303.; 1899, p. 21.—Very showy when grown in clumps.

8. **punctàta,** Linn. (*L. verticillàta*, Bieb.). Tall and stout: lvs. verticillate, in 4's, lanceolate, ovate or cordate-ovate, acute, subsessile: corolla-lobes oval, denticulate, glandular-ciliate, acute; stamens united. Very similar to *L. vulgaris*, but differs in the larger calyx-lobes not dark-margined: fls. in axillary, equidistant whorls, not paniculate, and corolla glandular. Eu., W. Asia. B.M. 2295 (as *L. verticillaris*). G.M. 57:111.

9. **Ephémerum,** Linn. Smooth: lvs. opposite, glaucous, elongate-lanceolate, obtuse, connate and somewhat decurrent: raceme long, terminal: bracts equaling the short (2–4 lines long) pedicels; fls. white, often tinged with purple; calyx-lobes ovate, obtuse; corolla-lobes ovate, obtuse, twice as long as the calyx; stamens slightly exserted. S. Eu. B.M. 2346. R.H. 1891, p. 303.

10. **barýstachys,** Bunge (*L. brachýstachys*, Hort.). St. strict, simple, hispid and leafy above: lvs. few, alternate, linear-oblong, abruptly acute, attenuate at base, appressed puberulent, glaucous beneath: raceme at first nodding, dense, terminal, spike-like: bracts exceeding the short pedicels: fls. white; calyx shorter than the corolla; the lobes ovate, obtuse, ciliolate, membranous-margined; corolla-lobes oblong-linear, obtuse, longer than the stamens. China. R.H. 1881:90.

11. **Fórtunei,** Maxim. Glabrous: lvs. alternate, oblong-lanceolate, acuminate or mucronate; base acuminate, cartilaginous-margined: raceme dense: bracts equaling the short (1–2 lines long) pedicels: fls. white; calyx broadly campanulate; the lobes obtuse, mem-

branous-margined; corolla longer; the lobes ovate, obtuse. China, Japan.

12. **clethroìdes,** Duby. Tall and stout, 3 ft. high or less, sparingly pubescent, rarely glabrous: lvs. opposite, large, 3–6 in. long, and sessile, broadly lanceolate, attenuate at each end, radical spatulate: fls. ½in. diam., in a very long, slender, terminal spike; pedicels short, bracts subulate; fls. white; calyx blackish, shorter than corolla; lobes lanceolate, acute, membranous-margined; corolla-lobes ovate-lanceolate, obtuse; stamens included. China, Japan. Mn. 8, p. 141.—Fine for cut-flowers, also for border.

13. **Leschenaùltii,** Duby. Somewhat branched: lvs. opposite or verticillate in 3's, lanceolate, acuminate, glabrous, short-petioled: raceme dense, terminal: bracts shorter than the pedicels: fls. blue or purple; calyx much shorter than corolla; lobes narrow, acuminate; corolla campanulate; lobes obovate, obtuse, entire; stamens unequal, exserted. Mountains of India. R.H. 1891, p. 303.

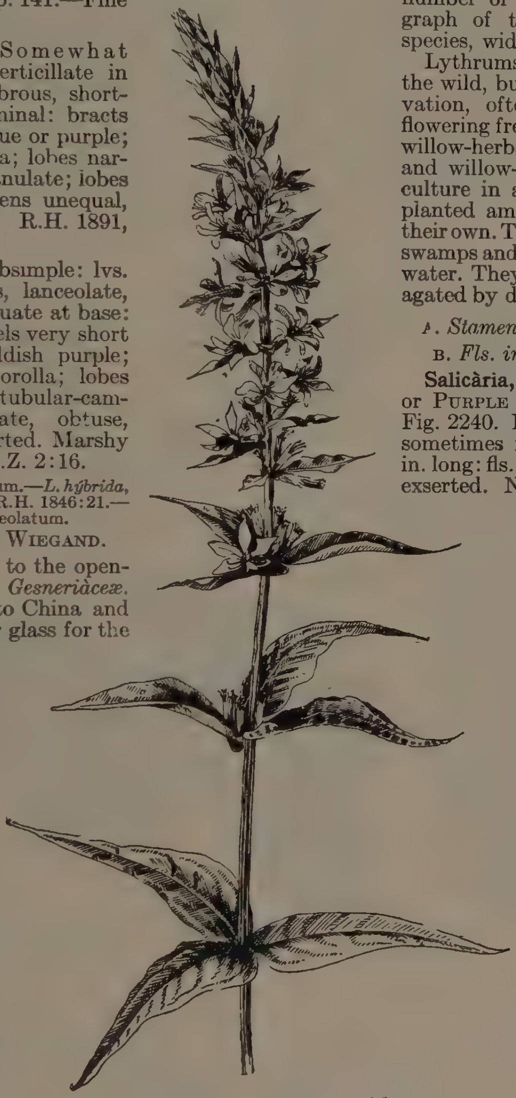
14. **nùtans,** Nees. St. subsimple: lvs. opposite or verticillate in 3's, lanceolate, acuminate, very smooth, attenuate at base: racemes dense, terminal; pedicels very short at first; fls. deep bright reddish purple; calyx one-third as long as corolla; lobes lance-linear, obtuse; corolla tubular-campanulate; lobes lance-spatulate, obtuse, erose-denticulate; stamens exserted. Marshy regions, S. Afr. B.M. 4941. G.Z. 2:16.

L. ciliàta, Linn.=Steironema ciliatum.—*L. hýbrida,* Michx.=Steironema lanceolatum. R.H. 1846:21.—*L. lanceolàta,* Walt.=Steironema lanceolatum.

K. M. Wiegand.

LYSIONÒTUS (name refers to the opening of the caps. at the back). *Gesneriàceæ.* Six to 10 small shrubs, India to China and Japan, grown sometimes under glass for the blue or white fls., but apparently not in the trade. Some or all are epiphytic; glabrous: lvs. opposite or in 3's: fls. in few- to many-fld. inconspicuously bracted cymes; sepals narrow; corolla tubular and straight, inflated at middle, 2-lipped; stamens 2 perfect and 2 or 3 staminodia; the filaments flattened; disk ring-like: caps. very narrow, 2-valved. *L. serràta,* Don (*L. ternifòlia,* Wall.), is about 1 ft. high: lvs. elliptic or lanceolate, serrate or sinuate: fls. pale lavender or white and purple-veined, an inch or two long, about 10 or less in peduncled clusters. Subtrop. Himalayan region, 2,000–7,000 ft. B.M. 6538. *L. carnòsa,* Hemsl. Dwarf shrub with straight rigid branches: lvs. in 3's, short-stalked, thick and fleshy, ovate, few-toothed: fls. 1½ in. long, white tinged lilac, in pairs in the upper axils. China. *L. warleyénsis,* Hort. Little shrub, 9 in. high: lvs. opposite or in 3's, oblong to lanceolate, few-toothed, fleshy, white beneath, the petiole crimson: fls. white with 3 purple lines, 2 in. long. China.—A beautiful plant, of very recent intro. *L. carnòsa,* Hemsl., is a dwarf shrub from China, glabrous, with straight and rigid green branches: lvs. in 3's, short-stalked, fleshy, ovate, to 2 in. long, dentate: fls. 1¼ in. long, white tinged lilac, in pairs in the upper axils.

L. H. B.



2240. Lythrum Salicaria. (×⅕)

LÝTHRUM (Greek, *blood;* possibly from the styptic properties of some species, or the color of the flowers). *Lythràceæ.* Herbs or subshrubs, of which three are cultivated in hardy borders.

Branches 4-angled: lvs. opposite, or alternate, rarely whorled, linear-oblong or lanceolate, entire: fls. rosy purple or white, in the upper axils usually solitary, lower down more or less whorled; calyx-tube cylindrical, 8–12-ribbed; petals 4–6, obovate; stamens as many or twice as many: caps. 2-celled, with an indefinite number of seeds.—Koehne in his monograph of the Lythraceæ recognizes 24 species, widely scattered.

Lythrums grow about 2 to 3 feet high in the wild, but improve markedly in cultivation, often attaining 4 to 5 feet and flowering freely. Some of them are called willow-herbs from their strong, erect habit and willow-like leaves. They are of easy culture in any moist soil, and are usually planted amid shrubbery, where they hold their own. They are denizens of low grounds, swamps and meadows, often growing in the water. They flower in summer and are propagated by division. (F. W. Barclay.)

A. *Stamens twice as many as the petals.*

B. *Fls. in an interrupted, leafy spike.*

Salicària, Linn. (*L. ánceps,* Hort). Spiked or Purple Loosestrife. Black Blood. Fig. 2240. Height 2–3 ft.: lvs. opposite or sometimes in whorls of 3, lanceolate, 2–3 in. long: fls. purple; stamens barely if at all exserted. North temperate regions. Austral. B.B. 2:473. G. 3:622.—Best of the genus. Koehne has made 29 botanical varieties and subvarieties of this one species. Var. **supérbum** and var **ròseum,** Hort., have rose-colored fls. Var. **ròseum supérbum,** Hort., may be the same as the preceding varieties. It is large-fld., rose-colored, more robust (4–6 ft.); somewhat later in blooming. July–Sept.; a clearer, finer colored form than the species. It is generally sold as *L. roseum superbum* (not as a variety of *L. Salicaria*). G. 29:167. Var. **atropurpùreum,** Hort., is a fine variety producing large spikes of very dark rose-purple fls. Var. **tomentòsum,** DC. Lvs. tomentose. Var. **ròseum,** Perry's Variety, has cherry-red fls., larger and upon longer spikes. Excellent for the bog-garden.

BB. *Fls. solitary in the upper axils, racemose.*

virgàtum, Linn. (*L. austriacum,* Jacq.). Lower lvs. opposite, rounded at the base: calyx not bracted: fls. smaller than *L. Salicaria* and rose-purple. Eu., N. Asia.—Of good landscape value and compact growth: the brightest colored kind of lythrum. Var. "Rose Queen" is much catalogued.

AA. *Stamens not more numerous than the petals.*

alàtum, Pursh. Two ft. tall: half shrubby, with twiggy 4-angled branches: lvs. mostly alternate, obtuse: stamens exserted: fls. crimson-purple. June to Sept. N. Amer.

Wilhelm Miller.
A. C. Hottes.†

M

MAÀCKIA (after Richard Maack, Russian naturalist who explored northeastern Asia; 1825–1886). *Leguminòsæ.* Trees grown out-of-doors for their handsome foliage and the panicles of white flowers.

Deciduous: winter-buds free, scaly: lvs. alternate, odd-pinnate, with entire, opposite or nearly opposite short-stalked lfts.: fls. white, papilionaceous, in dense upright racemes, usually several in terminal panicles; calyx campanulate, 5-toothed; stamens 10, more or less connate: pod linear-oblong, compressed, with 1–5 seeds.—Two or three species in E. Asia; usually united with Cladrastis, but easily distinguished even without fls. by the free scaly winter-buds and the opposite lfts.; in Cladrastis the winter-buds are naked and inclosed in the base of the petiole and the lfts. are alternate.

The maackias are small or medium-sized trees or rarely shrubs with rather large pinnate foliage and upright dense panicles of small white flowers appearing in summer. They are hardy North and not particular as to the soil, but prefer a warm and sunny position to bloom well. Propagation is by seeds sown in spring or by root-cuttings like cladrastis.

amurénsis, Rupr. (*Cladrástis amurénsis,* Koch). Tree, to 40 feet.: lfts. 7–11, elliptic- or oblong-ovate, rounded at the base, glabrous, 2–3 in. long: racemes erect, dense-fld., usually panicled, 4–8 in. long: fls. whitish, about ⅓in. long: pod 1½–2 in. long. July, Aug. Manchuria. B.M. 6551. Gn. 24, p. 265; 33, p. 444; 44, p. 60. F.S.R. 3, p. 23. G. 6:379. H.F.II. 13:298. Var. **Buèrgeri,** Schneid. (*Cladrástis amurénsis* var. *floribúnda,* Shirasawa), from Japan, has the lvs. pubescent beneath. S.I.F. 1:50.

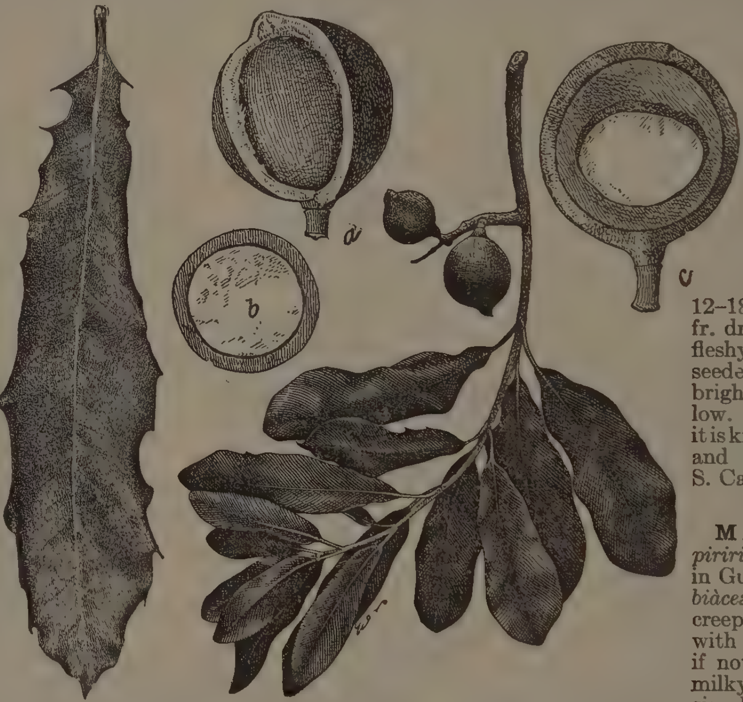
M. Tashiròi, Makino (Cladrastis Tashiroi, Yatabe). Shrub: lfts. 9–15, nearly glabrous, ½–1½ in. long: fls. smaller; standard not emarginate. Japan. Tokyo Bot. Mag. 6:10.

Alfred Rehder.

MÀBA (native name). *Ebenàceæ.* Some 60–70 species of trees and shrubs in the warmer regions of the world, mostly with hard ebony-like wood. Closely allied to Diospyros, the floral parts mostly in 3's instead of 4's or 5's, stamens usually 9 but varying from 3 to many, ovary 3- or 6-celled: lvs. usually smaller than in Diospyros. Lvs. alternate, simple and entire: fls. axillary, solitary or in short cymes, usually diœcious; corolla bell-shaped or tubular; styles 3, or 1 and 3-parted: fr. a berry, ovate or globose, 1–6-seeded. Two species have been intro. S. as ornamental subjects.

natalénsis, Harv. Much-branched evergreen shrub, with flexuous branches: lvs. wide, ovate, oblong or elliptical, obtuse, dark green above, paler beneath, glabrous, netted-veined beneath: female fls. solitary; calyx cup-shaped, glabrous, entire; abortive stamens 6–7; ovary glabrous: berries in large bunches, black. Natal; offered in S. Fla.

sandwicénsis, A. DC. Attractive tree, 20–40 ft.: lvs. thick and leathery, dull green, elliptic or ovate-oblong, distichous: fls. single or the males rarely clustered, small, the corolla 3-toothed and densely hairy on upper half; male fls. with 12–18 free stamens: fr. dry or somewhat fleshy, usually 1-seeded at maturity, bright reddish yellow. Hawaii (where it is known as "lama") and Fiji; offered in S. Calif. L. H. B.



2241. Macadamia ternifolia; a, nut showing dehiscence of husk; b, cross-section; c, longitudinal section. (Spray ×⅓, separate leaf ×¼, nuts ×1)

MABÈA (from *piriri-mabe,* the name in Guiana). *Euphorbiàceæ.* Climbing or creeping shrubs, some with economic uses, if not in cult. Juice milky: lvs. alternate, simple, pinnately veined, short-petioled, pubescent: fls. monœcious, apetalous; staminate calyx 3–5-lobed, lobes imbricate; stamens 10–70; styles connate into a long, slender column, free above; ovary 3-celled, 1 ovule in each cell; seeds carunculate.—Thirty species in Trop. S. Amer. Related to Sapium and Stillingia. *M. fistulòsa,* Mart., is used in Brazil for pipe-stems and in medicine. This species and *M. occidentàlis,* Benth. (*M. Pirìri,* Benth.), yield some rubber. J. B. S. Norton.

MACADÀMIA (after John Macadam, M.D., secretary Philosophical Institute, Victoria, Australia). *Proteàceæ.* A small group of Australian trees or tall shrubs, of which *M. ternifolia* is cultivated for its edible fruit, and is the best known.

Leaves verticillate, entire or serrate: fls. hermaphrodite, pedicellate in pairs or scattered, in terminal or axillary racemes or panicles; perianth regular or nearly so; stamens inserted a little below the blades, filaments short; ovary sessile, with a long straight style, ovoid or clavate at end, stigma small; ovules 2: fr. globular; seeds either solitary and globular or 2 and hemispherical; testa membranous.

ternifòlia, F. Muell. QUEENSLAND NUT. Fig. 2241. In its typical form this is a tall tree, with dense foliage, the young branches and infl. minutely pubescent: lvs. sessile or nearly so, glabrous and shining, in whorls of 3 or 4, oblong or lanceolate, acute or obtuse, serrate or entire, from a few inches to 1 ft. long: racemes almost as long as the lvs.; perianth minutely pubescent or glabrous; ovary villous, style end clavate: fr. with a 2-valved leathery exocarp, endocarp smooth and shining, thick and very hard; seeds 1 and globular or 2 and hemispherical. Queensland and New S. Wales. G.C. 1870: 1181.—Other species are *M. Whèlanii*, Bailey, Queensland, a medium-sized tree; *M. preálta*, Bailey, Queensland, sometimes lofty, wood of reddish color, useful for cabinet-work, as is that of nearly all species; *M. Lòwii*, Bailey, Queensland, the Maroochie nut, tree 15–20 ft. high, forming 6–20 woody sts. from a hard, spreading rhizome, and with a pointed, ribbed fr. about 1 in. diam., edible; *M. mìnor*, Bailey, Queensland, the small-fruited Queensland nut, small tree or large shrub, sending up numerous sts. from base, lvs. up to 2 in. long, fr. up to 1 in. diam., velvety outside, sometimes inversely conical in form, edible.—The Queensland nut is cult. to a small extent in S. Calif. and S. Fla., and has recently fruited in Cuba, where it appears to thrive. It is slow in growth, rarely coming into bearing before 6–8 years of age, and delights in a deep rich loamy soil, containing plenty of moisture. It has succeeded in Calif., however, with very little water, though its growth under such conditions is naturally slower. Several distinct forms of the tree are thought to exist, but the typical one is upright, sometimes 50 ft. in height, with a clean trunk and a deep green umbrageous head of foliage. The nuts are about 1 in. diam., with a hard shell about ⅛in. thick, which is rather difficult to crack. The kernel is ½in. or more in diam., white, crisp, and of a flavor resembling that of the Brazil nut (*Bertholletia excelsa*) but milder and more delicate. The tree is evergreen, and even while young withstands slight frosts (perhaps 26° F.) uninjured. For its ornamental appearance alone it is worthy of a place in parks and gardens. Its close-grained reddish timber is considered of value for cabinet-making. Prop. is usually by seeds, which may be stratified in sand or planted singly in pots of light, porous, sandy soil. If planted during the summer or if artificial heat is provided they will usually germinate within a month or 6 weeks; otherwise they may take a long time. When the seedlings make their appearance water should be given sparingly, as they are likely to damp-off if kept too wet. Plants may be set out in the open ground when about 18 in. high, and should be staked to keep them shapely. Practically no pruning is required. A promising tree for intro. into the American tropics and the warmest parts of the U. S. F. W. POPENOE.

MACARÁNGA (the Madagascar name). *Euphorbiàceæ.* Trees or shrubs, rarely cult. in greenhouses or in tropical lands. Lvs. alternate, simple, entire, palmately nerved, peltate: fls. diœcious or monœcious, inconspicuous, apetalous; calyx valvate; anthers 3–4-celled; styles free, short, undivided; ovary 1–3-celled, 1 ovule in each cell. Species more than 100 in the Old World tropics. Related to Mallotus and Mercurialis. Prop. and cult. similar to codieum. *M. Porteàna*, André (*Máppa Porteàna*, Hort.), of Philippine Isls. A very striking plant, with orbicular-ovate, strongly ribbed lvs. nearly 3 ft. wide, and small fls. in red panicles, is in cult. in Eu. R.H. 1888, p. 176. G.C. III. 16:284. B.M. 7407. *M. kilimandschárica*, Pax, resembles *M. Porteana* in habit, but is smaller, with peltate lvs., bronze-colored when young. German E. Afr. The other species appear not to be in cult. J. B. S. NORTON.

MACFADYÈNA (Dr. J. Macfadyen, author of a flora of Jamaica). *Bignoniàceæ.* As defined by Bentham & Hooker, 21 species of tall-climbing shrubs in Trop. Amer. and extra-Trop. S. Amer., including Dolichandra; as defined by Schumann in Engler & Prantl, 3 species in S. Amer., excluding Dolichandra and others. The plant in the trade (offered in S. Calif.) is **M. cynanchoìdes,** Morong (or **Dolichándra cynanchoìdes,** Cham.). It is a glabrous liana of S. Brazil and Argentina: branches slender and terete: lvs. opposite, of 2 oblong, ovate or ovate-lanceolate acute entire lfts. and usually a 3-parted tendril at end: fls. single or few on the peduncle, red; calyx cut to the middle, spathaceous; corolla long, tubular (2¼ in. long); stamens 5, one being a rudiment, exserted: stigma exserted: fr. a caps. 3 in. long and ¾in. wide.

M. dentàta, Schum. (Bignonia Fraseri, Hort. B. Tweediana, Griseb., not Lindl. M. Tweediana, Griseb.). A strong climber, self-clinging, with 3-forked tendrils: lfts. 2, ovate to ovate-oblong, short-acuminate, dentate, lepidote on both sides, glossy above, 1½–2½ in. long: fls. axillary, solitary; calyx split; corolla tubular funnelform, yellow, 2½ in. long, outside lepidote; ovary lepidote: caps. linear, 7–12 in. long. Brazil to Argentina. Intro. in S. Calif.

L. H. B

MACHÆRIUM TIPU: *Tipuana speciosa.*

MACHINERY AND IMPLEMENTS. The American farmer is known by his tools and machinery. Labor costs much and land relatively little. The American is inventive. The result is that there is a tool to expedite and lighten almost every labor. The effort of each man is multiplied. Not only are the American tools numerous and adapted to almost every agricultural labor, but they are trim, light and comely in design.

A tool is properly a hand implement, used to facilitate mere manual labor. A machine is a contrivance, usually more elaborate, that multiplies and transmits power or motion. Yet tools and machines merge so completely that it is impossible to make a definite category of one or the other. The word implement is more generic, and applies to any intermediary device by means of which a man accomplishes a given work. The phrase "agricultural implements," as used by tradesmen, usually refers to both tools and machines. In general discussions the word tool is used somewhat indefinitely, as in this sketch; but even then it does not include complicated machinery.

The machines and tools used by horticulturists may be thrown into five general categories:

1. To till the land, as plows, harrows, rollers, cultivators, weeders, hoes, rakes. See *Tillage.*
2. To facilitate various handwork, as seed-sowers, transplanters, markers, pruning implements, and most greenhouse devices.
3. To facilitate the destruction of insects and fungi, as fumigators, syringes, spraying devices. See *Diseases and Insects*, Vol. II.
4. To transport, as carts, barrows.
5. To aid in packing and sorting. See article on *Packing.*

In the multiplicity of tools, one is often at a loss what to purchase. The buyer should have a definite idea of the kind of labor that he needs to have performed and he should then consider how well adapted the tool may be to perform it. Once purchased, the tools should be cared for. A tool-shed or -room is the greatest convenience and often good economy. Labor is expedited and annoyance saved if each tool has its place. Every farm or garden should be provided with a room that can be warmed in cold weather, in which repairs can be made on machinery and implements. No farm establishment is complete without such a room. The care of tools not only contributes to the longevity and usefulness of the implements themselves, but it sets distinct ideals before the farmer and thereby is a means of educating him. The greater the variety and the better the quality of the tools the more alert the user of them is likely to be. One should look up the new ideas in tools each year as one does in markets or crops. The advertising pages of rural journals are suggestive in this direction.

Hoeing the ground.

Plow drawn by men.

Plow drawn by oxen.

2242. Tools in the sculptures on a Theban tomb.

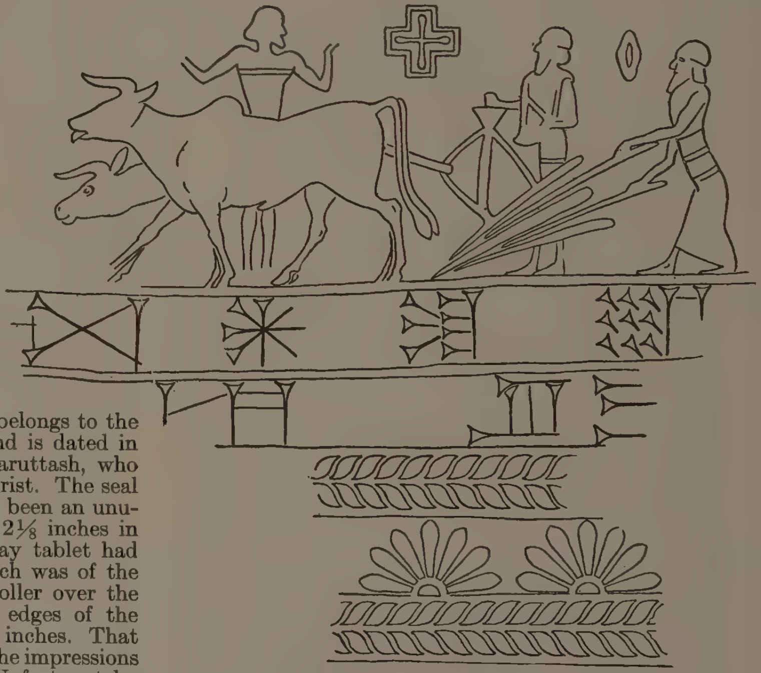
The very early tool for opening or tilling the ground appears to have been a forked or crotched stick, one prong of which was used as a handle and the other as a cleaving instrument. From this the hoe and the plow appear to have developed. (Fig. 2242.) This set of illustrations shows sculptures from a Theban tomb "of the eighteenth or the beginning of the nineteenth dynasty;" it is reproduced from Daubeny's "Lectures on Roman Husbandry," in which it is said that "The plough itself is nothing more than a modification of the hoe, which was first dragged along the ground by manual labor, before the force of oxen was substituted."

In "The Museum Journal," published by The University Museum of Philadelphia, June, 1910, Babylonian Section, is an interesting account by A. T. C., of "an ancient plow," together with an illustration (Fig. 2243). "An exceedingly interesting seal impression depicting a plow, drawn by two oxen, is found on a clay tablet with a cuneiform inscription in the University Museum. This tablet belongs to the Cassite period of Babylonian history, and is dated in the fourth year of the reign of Nazi-Maruttash, who lived in the fourteenth century before Christ. The seal used to make the impression must have been an unusually large one, for it measured about 2⅛ inches in length. After the surface of the soft clay tablet had been covered with writing this seal, which was of the usual cylindrical form, was run like a roller over the inscription on both sides and the four edges of the tablet, which measure about 2¾ by 4½ inches. That is, the entire document was covered with the impressions of different parts of this large seal. Unfortunately, there is no complete impression of the seal on the tablet. Some of the parts were repeated a number of times, but other parts seem to be entirely wanting. Moreover, the surface of a portion of the tablet has suffered considerably, due probably to the moisture in the earth, or exposure to the atmosphere after the tablet had been excavated. The accompanying drawing of the seal impression (Fig. 2243) was made after a careful study of the different traces found on the various parts of the tablet by Herman Faber, Miss Baker and the writer.

"The plow gang consists of three men. The one depicted larger in size than the others is doubtless the chief. He appears to be driving the animals, as is indicated by his raised arm, perhaps holding a whip. Another, having a bag over his shoulder, is in the act of feeding the tube or grain-drill, through which the seed was dropped into the furrow made by the plow, which is being guided by the third man. The animals drawing the plow, known as *alpu*, 'ox,' in the inscription, are in use in Babylonia at the present time. It is the Zebu or humped bull (*Bos indicus*).

"The individual for whom the seal was cut regarded himself as a devotee of Nin-Sar, the god of vegetation, as the first line of the inscription shows (Arad-NIN-SAR). Unfortunately the name of the owner in the second line is so imperfectly preserved that it cannot be read.

"For some time other representations of the plow in antiquity have been known, but in no instance is it so accurately represented as in this seal impression. A boundary stone of Meli-Shipak, of the Cassite period, recently found at Susa, contains the picture of a plow, which has hitherto been regarded as the earliest. It does not seem to have a tube. There is another picture of a plow found on an undated fragment belonging to the same period. Later representations of plows with tubes are found on monuments of Sennacherib and Esarhaddon. Plows similar to the one found in this seal impression are in use in Syria at the present time. The plow on the Museum tablet, here discussed, is the earliest known, being about a century earlier than the one on the boundary stone belonging to the reign of Meli-Shipak.



2243. Men plowing and sowing. From a Babylonian seal impression, 14th century B. C.

"It is also interesting to note that one of the latest inventions of our Western civilization whereby the grain is sown by machinery was already anticipated by ancient Babylonians at least thirty-three centuries ago. In fact the simple Babylonian device accomplished what no single piece of modern machinery does, in that it combined the processes of plowing and sowing."

A set of ancient plows is shown in Fig. 2244, reproduced from Bradley's "Survey of the Ancient Husbandry and Gardening," 1725. Bradley's explanation is as follows:

> "No. 1. Figure of an ancient Plough, supposed to be used about the Time of the *Romans*.
>
> "No. 2. Figure of a *Spanish* Plough, which some suppose, preserves somewhat of the Manner of the *Roman* Plough, only alter'd to be drawn by one Horse, instead of a Yoke of Oxen. 'Tis said, that the Husbandmen in *Spain*, will plough two or three Acres of light Land in a Day with this Plough.
>
> "No. 3. The common Shoulder Plough or best Plough, used in several Parts of *England*, for cutting or breaking the Surface of Grass Grounds, or Heath Lands; 'tis push'd along by one Man; sometimes cutting the Turf half an Inch thick, sometimes an Inch or two. At A is an Iron turn'd up with a sharp Edge, to cut the Turff from the rest of the green Sward.
>
> "No. 4. Is a Figure of the common Dray Plough, which is good to be used for miery Clays in Winter; but is not so proper to be used in Clays when they are hard.
>
> "No. 5. The Figure of a single Wheel'd Plough, used in *Sussex*.
>
> "No. 6. The Figure of the *Hertfordshire* Wheel Plough, which is of the easiest Draught; proper for any Grounds, except miery Clays, which are apt to clogg the Wheels. The several Parts of this Plough, being understood, will explain to us the Use of the other Ploughs. A is the plough Beam, B the Handle, Tail, Stilts, or Staves, C the Neck, or Share Beam, D the Earth Board, Mould Board, Furrow Board, Shield Board, E the Sheath, F the Share Iron, G the Coulter, H the Plough Pin and Collar Links, I the Plough Pillow, K the Wheels."

With these various forms may be compared those represented in Figs. 2245–2247; and also all the modern implements shown and described in the succeeding pages.

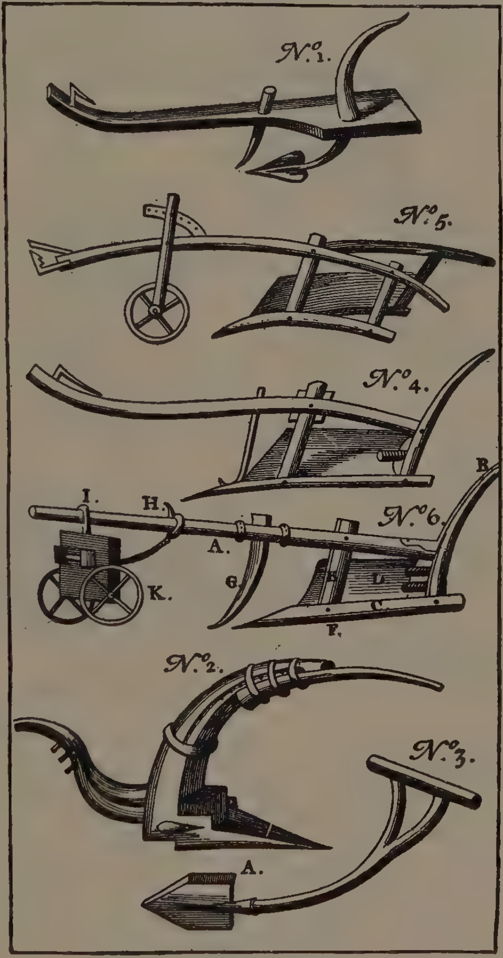
The hoe and the plow, and their many modifications, are still the fundamental or primary tillage tools, one being for hand-work essentially what the other is for power-work. As the necessity of tillage has come to be better understood, these tools have been greatly improved. It is surprising to know that the plow was not perfected until within a century. It is doubtful whether the invention of any of the most important machines of modern times has really meant so much for the welfare of the race as the development of this humble implement. To many persons is ascribed the credit of the invention of the modern moldboard plow, for the implement seems to have originated independently in different countries, and even in America there are various contestants for the honor. Thomas Jefferson, Charles Newbold, David Peacock, and others have been accorded the honor. There is reason for ascribing the modern type of plow to Jethro Wood, of Scipio in Cayuga County, New York. The years 1814 and 1819 are the dates of his most important patents, although the latter is usually regarded as the natal day of the implement. Wood was born in Massachusetts in 1774 and died in 1845 or 1846. (See "Jethro Wood, Inventor of the Modern Plow," by Frank Gilbert, Chicago, 1882.) The study of plows is a curious and profitable undertaking, and one that still needs to be prosecuted.

The large-area farming of North America and the apprehension of the principles that underlie tillage have resulted in the invention of a great number of surface-working tillage tools. These inventions are particularly important in orcharding, as they enable the grower to maintain the necessary surface mulch with small expenditure of labor and without training the trees too high. There are now many cultivators and harrows that cover a wide space and that are adapted to the light stirring of the surface soil without the turning of furrows and the ridging of the land. One who contemplates a serious study of tillage tools should familiarize himself with the inventions of Jethro Tull, before the middle of the eighteenth century. Tull devised implements to facilitate the tillage of plants when they were growing in the field. See Cyclopedia of American Agriculture, Vol. I, page 374.

In hand-tillage tools, the recent development of the wheel-hoe is significant for horticultural operations. This light and simple tool, usually with adjustable blades, performs the labor of many sets of fingers and does the work more effectively so far as tillage is concerned. It also enforces better initial preparation of the land in order that it may do its work more perfectly; and this remark will also apply to the modern seed-sowers.

There has been surprisingly little authoritative early writing on machinery and implements. Practically, our only sustained effort in that direction for many years was Thomas' "Farm Implements and Machinery," 1859 and 1869. Very recently, the subject has been taken up in the colleges of agriculture and elsewhere, and important reports and books are now available.

L. H. B.



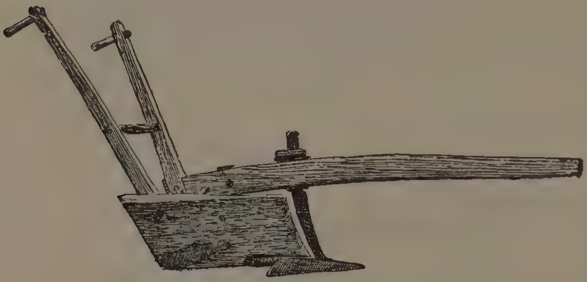
2244. Ancient plows.

The present symposium on machinery and implements in their horticultural relations comprises the following discussions:

- Tillage machinery (Trullinger), page 1942.
- Tools for the orchardist (Alderman), page 1949.
- Machines and implements in vegetable-gardening (Corbett), page 1953.
- Brief lists of implements for greenhouse and grounds (Thilow), page 1955.
- Spraying machinery and tools (Anthony), page 1956.

Tillage machinery.

Soil-tillage may be briefly defined as the art of preparing the land for the seeding and growth of a crop and of maintaining the necessary conditions until the crop has matured. The entire process of tillage for a certain crop consists of several more or less related but nevertheless distinct operations. The agricultural tools and machines which are especially adapted for the different tillage operations, and used in them are known as tillage machinery.

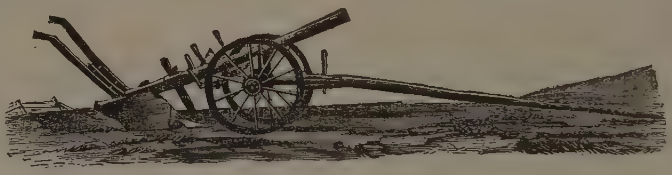


2245. An early Yankee plow, made of wood and the moldboard protected by iron nailed on. (After Roberts)

Purpose of tillage.

The different tillage operations form a chain, each link of which is necessary because it accomplishes one or more of the objects of tillage. The chief of these as stated in other works may be enumerated as follows:

1. To produce a deep, thorough, and uniform granulation, giving a well-marked crumb structure.
2. To regulate soil-ventilation, moisture-content, and temperature.
3. To destroy and prevent the growth of weeds and other undesirable vegetation.



2246. A former European type of plow, still used in improved forms.

4. To effect the deep and thorough incorporation of organic matter.
5. To make available the maximum amount of plant-food required by the particular crop.

In short, the object of tillage is to make the soil physically and chemically fit for crop-growth. Tillage is in itself a mechanical operation, producing at first only physical effects on the soil as shown above by the first four objects. The proper combination of these objects, however, results in the chemical transformation of certain soil compounds and the setting free of a certain amount of plant-food elements for direct assimilation by the crop. Proper tillage is, therefore, of the utmost importance in crop-growing, as it has to do with both the housing and nourishing of the crop.

Different tillage operations.

Tillage operations may be divided into two types or classes according to depth, as (1) plowing or breaking and (2) surface or comparatively shallow cultivation.

The first type of tillage may be applied to the breaking of virgin sod, the plowing under of stubble, or merely the plowing of land often plowed before. Plowing, however, may be considered as the basic operation of tillage. It is the first and most extensive step in the preparation of the soil for the crop and on its depth depends largely the extent of the physical and chemical perfection of the soil with reference to the crop. Furthermore, the success of the second type of tillage operations depends largely on the first type and, in fact, from the standpoint of economical and efficient soil management, the second type of operations is of relatively little use without being preceded by the first type. Although the second type of operations may be repeated a number of times until the proper depth of effective tillage is reached, it has been demonstrated in this country, and in Europe particularly, that such a method of procedure is usually impracticable.

Max Ringelmann, of the Institute Nationale Agronomique, Paris, distinguishes between the two types of tillage operations by calling the first type real-tillage and the second type pseudo-tillage. According to this classification, real-tillage consists in cutting, inverting and partially pulverizing the soil by plowing. The tough sod of the virgin prairie is turned over in a more or less compact slice and much of the dense poorly aërated texture remains. This necessitates the intensifying of the pseudo-tillage operations until the virgin soil is reduced to the well-aërated, loose, crumbly, and productive structure of the well-cultivated soil.

Stubble land is not only cut and inverted by real-tillage, but is usually pulverized to the desired texture much more extensively than is virgin land. Theoretically the pseudo-tillage need not, therefore, be quite so intense to produce the proper tilth, although in practice it can hardly be overdone. On land often plowed before, real-tillage, theoretically, should produce even greater pulverization than on the other two kinds of land. But, as a matter of fact, many such soils have been so repeatedly cultivated that they require progressively deeper plowing and intensive pseudo-cultivation in order to maintain the standard of good tilth.

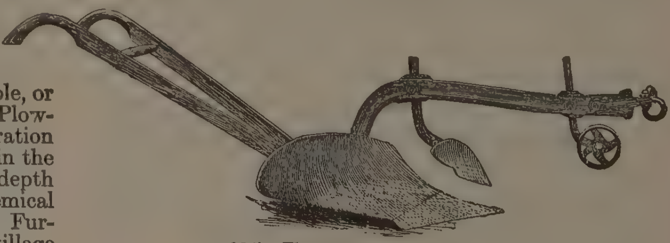
Pseudo-tillage consists mainly of the operations of harrowing, rolling, packing, clod-smashing, weeding, and stirring and pulverizing the surface soil generally. The pulverizing function is the main one in pseudo-tillage as it tends to improve ventilation and moisture-conservation. The rolling and packing function is perhaps next in importance and it is especially important in the drier localities from the standpoint of moisture-conservation.

In accordance with the above, then, the plow is the basic tillage tool and is the sole implement used in the first type of tillage, while the several forms of surface cultivators, including harrows, weeders, rollers, packers, cultivators, scarifiers, and pulverizers, constitute the list of machines used in pseudo-tillage.

The moldboard plow (Figs. 2245–2251).

The plow, without question, stands first among tillage implements. Historically it is probably one of the oldest of farm implements and from the standpoint of evolution its advance has been slow and its changes profound.

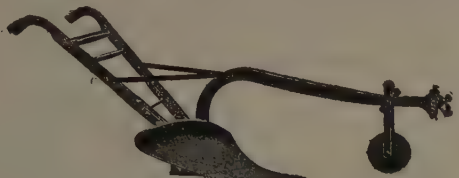
The evolution of the plow is here quoted from Davidson and Chase "Farm Machinery and Farm Motors," New York and Lon-



2247. The perfected American plow.

don, 1908: "The first plow was simply a form of hoe made from a crude stick of the proper shape to penetrate and loosen the soil as it was drawn along, ... The records of the ancient Egyptians illustrate such a plow.

"At an early time the point of the plow was shod with iron. Virgil describes a Roman plow as being made of two pieces of wood meeting at an acute angle and plated with iron. During the middle ages there was but little improvement over the crude Roman plow as described by Virgil. The first people to improve the Roman plow were the Dutch, who found that a more perfect plow was needed to do satisfactory work in their soil. The early Dutch plow seems to have most of the fundamental ideas of the modern plow in that it was made with a curved moldboard and was provided with a beam and two handles. The Dutch plow was imported into Yorkshire, England, as early as 1730 and served as a model for the early English plows.



2248. Moldboard view of a steel moldboard walking-plow showing beam wheel.

"Howard was one whose name may be mentioned among those instrumental in the development of the early English plow. . . . James Small, of Scotland, was another who did much toward the improvement of the plow. Small's plow was designed to turn the furrow smoothly and to operate with little draft. Robert Ransome, of Ipswich, England, in 1785 constructed a plow with the share of cast-iron. In 1803, Ransome succeeded in chilling his plows, making them very hard and durable. The plows of Howard and Ransome were provided with a bridle or clevis for regulating the width and depth of the furrow.

"Before the Revolutionary War, the plows used in America were much like the English and Scottish plows of that period. The plow used during the later Colonial period was made by the village carpenter and ironed by the village smith with strips of iron. The beam, standard, handles, and moldboard were made of wood and only the cutting edge and strips for the moldboard were made of iron. Among those in America who first gave thought to the improvement of the plow was Thomas Jefferson. Daniel Webster is another prominent American who, history relates, was interested in the development of the plow. He designed a very large and cumbersome plow for use upon his farm. It was over 12 feet long, turned a furrow 18 inches wide and 12 inches or more deep, and required several men and yokes of oxen to operate it. Charles Newbold, of Burlington, New Jersey, secured the first letters patent on a plow in 1797. Newbold's plow differed from others in that it was made almost entirely of iron. Jethro Wood gave the American plow its proper shape. The moldboard was given such a curvature as to turn the furrow evenly and to distribute the wear well.

2249. Bottom view of steel moldboard plow.

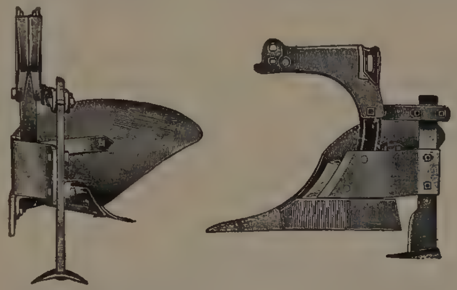
"As farming moved farther west the early settlers found a new problem in the tough sods of the prairie states. A special plow with a very long sloping moldboard was found to be necessary in order to reduce friction and to turn the sod over smoothly. Owing to the firmness of the sod it was found that curved rods might be substituted for the moldboard. Later, when the sod became reduced, it was found that the wooden and cast-iron plows used in the eastern portion of the country did not scour well. This difficulty led to the use of steel in the making of plows. Steel, having the property of taking an excellent polish, permitted the sticky soils to pass over a moldboard made of it where the other materials failed.

"In about 1833 John Lane made a plow from steel cut from an old saw. Three strips of steel were used for the moldboard and one for the share, all of which were fastened to a shin or frame of iron. John Lane secured in 1863 a patent on soft-center steel, which is used almost universally at the present time in the making of tillage tools. It was found that plates made of steel were brittle and warped badly during tempering. Welding a plate of soft iron to a plate of steel was tried and although the iron supported the steel well when hardened it warped very badly. The soft-center steel, which was formed by welding a heavy bar of iron between two bars of steel and rolling all down into plates, permitted the steel to be hardened without warping. It is very strong on account of the iron center which will not become brittle.

"In 1837 John Deere built a steel plow from an old saw which was much similar to Lane's first plow."

The modern steel moldboard plow is a three-sided wedge which is pulled through the soil by means of a beam and held steady by two handles behind. (Figs. 2248–2250.) The main parts of the plow may be enumerated as follows: (1) The share, or cutting edge, of which the point is the part first penetrating the soil. and the heel is the outside corner; (2) the moldboard, forming a twisted face which turns the furrow; (3) the landside, which receives the side pressure produced when the furrow is turned and aids in preventing the furrow from becoming crooked, particularly when irregularities in the texture of the soil are encountered; and (4) the frog, or metal shape to which the moldboard, landside and share are attached.

The functions of the plow with reference to the soil are a cutting function, an inverting function, and a pulverizing function. The cutting of the soil is effected in two planes, one vertical and the other horizontal. The inversion of the furrow-slice requires first a lifting and then a rolling of the slice to one side, bottom up. The pulverizing of the slice of soil is effected by bending the slice upon itself more or less abruptly and then dropping it suddenly upon the ground, the intensity of which effect is governed largely by the shape of the moldboard.

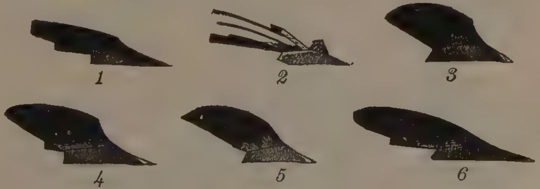


2250. Landside and back view of steel moldboard plow, showing subsoiling attachment.

In general, there are two extreme types of moldboard plow, namely, the breaker and stirring plow. Between these extremes occur several intermediate forms to meet all soil conditions. The average, or medium, of these is the so-called general-purpose plow.

The breaker (Fig. 2251) has a long low moldboard with no abrupt curvature which turns the slice of tough virgin sod gradually with minimum friction and effects little or no pulverization. This type of plow has been adopted for breaking tough prairie land owing to the advantage as regards draft over the other types. In some of the breaker plows the moldboard is replaced by rods bent to the shape of the moldboard, thus further reducing friction and consequently the draft.

The stirring or stubble plow has a short, high, and rather wide moldboard with an abrupt curvature, which turns the furrow-slice of old soil over suddenly and produces the maximum pulverization for a plow in that particular soil.



2251. Types of moldboard plows adapted to different kinds of plowing: *1*, prairie breaker bottom; *2*, rod breaker bottom; *3*, stubble bottom; *4*, general-purpose bottom; *5*, black land bottom; *9*, tame sod breaker bottom.

The general-purpose plow strikes an average between these two as regards shape and operation, and may be used either in stubble or light sod.

Deep plowing is objectionable in some soils, particularly in those having a sand or gravel subsoil, owing to the fact that it is inadvisable to bring this subsoil material too near the surface. Such soils may, however, be plowed deeply if the proper plow is used. Fig. 2252 illustrates a deep-tilling plow, which, it is asserted, is adapted for the deep pulverization of a soil, the subsurface soil of which should not be brought to the surface. It has a broad share and the moldboard is very narrow at the point where it joins the share but widens gradually at the upper end. The share loosens and pulverizes the bottom part of the furrow-slice which then falls through the space between the outer edge of the moldboard and the wing of the share, thus preventing its being brought to the surface. The broad part of the moldboard turns the upper part of the furrow-slice in the usual way.

2252. Deep-tilling plow equipped with jointer and coulter.

The material of the plow-beam may be either of wood or iron. While the iron beam is perhaps lighter and more wieldy than the wooden beam, it is likely to bend out of shape when the plow strikes a root or stump. The wooden beam will probably break under the same circumstances and can be replaced. The steel beam is curved over the moldboard and down to the landside. The wooden beam is fastened to the plow by a beam standard. The plow-handles are usually of wood and are fastened to the beam.

2253. Knife coulter fastened to plow beam.

A beam-wheel (Fig. 2248) is usually fastened to the plow beam, the function of which is to aid in regulating and maintaining the depth of plowing. Its proper adjustment is secured when it simply rolls on even ground without carrying weight.

The more common types of coulter (Figs. 2253, 2254) are the knife and rolling types. The coulter is used chiefly in sod-plowing but may be used in any soil. When the coulter is thick, dull, and improperly located on the beam it is likely to increase the draft. If, however, it is so located just behind the plow point as to cut directly above where the point and share are cutting and lifting the soil, the two parts of the plow should assist each other materially. When the ground is covered with wet corn-stalks, the rolling coulter should usually be set high and slightly back of the point. In very trashy ground it is often advantageous to set the rolling coulter well forward, but not on very hard ground. For stubble ground the rolling coulter had best be set about ⅝ inch outside of the landside and run one-third to one-half the depth of the furrow. For shallow plowing in sod, it may be set closer to the landside and should run the entire depth of the furrow.

2254. Rolling coulter.

The jointer (Fig. 2252) should be used when there is trash or organic matter on the surface which is not thoroughly covered. This implement is attached to the plow-beam in front of the plow and can be gaged to any required depth. As the trash is turned, it strikes the previous furrow a little below the top and is completely covered by the furrow-slice as it turns from the moldboard. In this way trash, and the like, is completely covered but not too deeply. Sod especially can be deep plowed when the jointer is used.

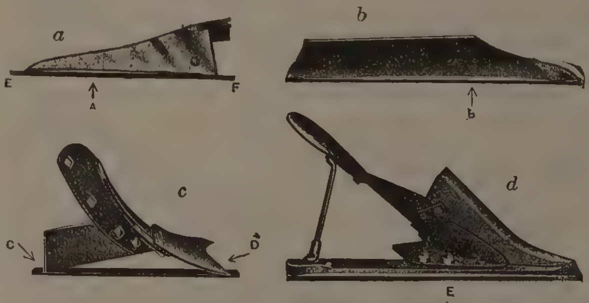
2255. Subsoil plow.

It is often necessary to use a subsoil plow when the soil conditions are such that deep plowing is out of the question. The modern subsoil plow (Fig. 2255) is built more or less on the principle of a coulter. It cuts a narrow gash in the soil, the depth of which is regulated by a beam-wheel, and the small point forms a sort of reservoir for water. The subsoil is thus aërated and the capillarity is generally improved.

In regard to the operation of walking-plows, it may be stated that a walking-plow is very sensitive to soil conditions, depth of plowing, the nature of the hitch, the set of the coulter or of the beam-wheel, and the set of the share. A walking-plow should usually be balanced about the point and run level. The proper set of the share point to secure penetration is shown in Fig. 2256*a*. There should be $\frac{3}{16}$ to ¼ inch of suction at point A. Hard plowing requires slightly more suction. Fig. 2256*b* shows the clearance in the throat of the share, which should be about ⅛ inch at point B.

Walking-plowshares have what is called a wing bearing. That is, a straight edge as shown in Fig. 2256*c* when placed at the rear of the landside point C and extending to the wing of the share point D should touch the share bottom from ¾ inch to 1¾ inches back of the edge, according to the size of the plow. The point of the share is also turned outward to the land to cause the plow to follow directly behind the team. As shown in Fig. 2256*d*, the clearance at E should be about ⅛ inch.

The plow must scour in order to operate satisfactorily; that is, the share and moldboard must be of hard material taking a smooth polish so that the furrow-slice

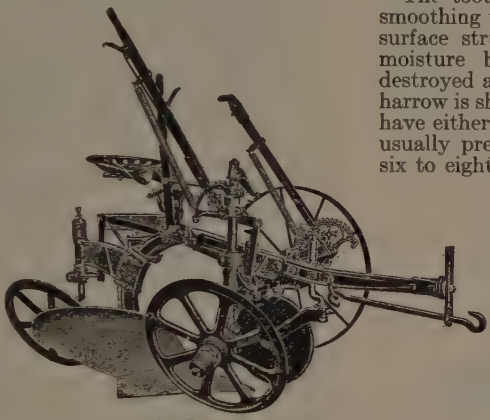


2256. Plow adjustments.

slips smoothly off without sticking. The plow must, therefore, be carefully polished and not allowed to rust. If the face is of good hard metal, hard soil-grains cannot scratch it. The plow must also be properly adjusted and the share and moldboard joined perfectly in order to insure perfect scouring.

2257. Frame riding-plow.

The riding-plow is more convenient than the walking-plow and generally does better work, particularly in dry soils. Two general types, the frame and frameless, are made. The frame plow (Fig. 2257) has its wheels attached to a frame which is connected to the plow-beam by "bails." This arrangement permits the lifting of the plow within the frame and the beam may be "floated" so that if the plow strikes a rock or other obstruction the plow only is raised and not the frame and the operator. The frameless plow (Fig. 2258) has no special framework and the wheels are attached directly to the beam by means of wheel brackets.


2258. Frameless riding-plow.

In the riding-plow, the side and downward pressure due to turning the furrow-slice is carried by the wheels and not as sliding friction, as in the walking-plow. It will be noted that the furrow-wheels are set at an angle better to carry the landside pressure. The rear furrow-wheel is usually turned a little from the unplowed land and in order to reduce the pressure on the landside is set toward the unplowed land 1 to 1½ inches beyond the landside. The front furrow-wheel is turned toward or from the unplowed land, according to the number and arrangement of the horses, and serves as a sort of side-draft equalizer. The plow is given the same suction as a walking-plow and the landside heel is raised about ½ inch from the furrow-bottom. The point is set the same as for a walking-plow.

2259. Riding gang-plow.

A sulky gang-plow is one having two or more plow-bottoms, so that two or more furrows may be plowed at one operation. Fig. 2259 illustrates a sulky gang-plow. A subsoiling attachment (Fig. 2250) is sometimes attached to one of the bottoms of a double gang-plow so that alternate furrows may be subsoiled.

The disc-plow (Fig. 2260) is the result of an attempt to reduce plowing draft due to sliding friction. In ordinary soils it has been found to have no material advantage over the moldboard-plow and the draft is in some cases greater. In sticky or very hard dry soils, however, it usually has the advantage over the moldboard-plow and operates with less draft.

The harrow.

The harrow is perhaps second in importance to the plow as a tillage implement. While the plow breaks the soil and pulverizes it in a general way, the harrow does finer work by breaking up clods and pulverizing the soil in detail. The original harrow was a tree limb with most of the branches extending on one side. Other early types were a forked limb with spikes driven in each arm and a rectangular-shaped frame having cross-bars each containing several teeth.

The main purposes of the harrow as a tillage tool may be enumerated as follows: (1) To effect pulverization and to secure a uniform soil-texture; (2) to destroy young weeds; (3) to improve soil-aëration; (4) to smooth the soil-surface; (5) to check evaporation; (6) to prepare a shallow seed-bed; (7) to cover seed; and (8) to mix manure with the surface soil.

Harrows may be grouped under perhaps three distinct types, according to the work they accomplish, as toothed- or smoothing harrows, disc-harrows, and curved-knife, clod-crusher, or pulverizer-harrows.

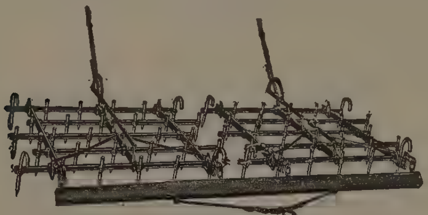
The toothed-harrow is effective in pulverizing and smoothing the surface soil of plowed ground. The fine surface structure produced tends to prevent loss of moisture by evaporation. Young weeds are also destroyed at a tender age. A common type of toothed-harrow is shown in Fig. 2261. The toothed-harrow may have either wood or steel tooth-bars, but the latter are usually preferable. The number of teeth varies from six to eight to a foot of width and these vary slightly in size for light and heavy soils. The lever enables the operator to incline the teeth forward for penetration and pulverization and backward for smoothing.

A steel harrow riding-cart is now used which may be attached so as to follow the harrow. Its wheels are made to caster to facilitate operations in turning. The harrow cart is a desirable adjunct to the harrow as it saves the hard labor of walking over plowed ground, and if properly constructed with wide-tired wheels does not cause an excessive increase in draft.

The disc-harrow is an implement of varied utility. It is especially adapted for rather deep surface-cultivation. One of its main uses is for preparing a seed-bed in plowed ground. It is likewise useful for preparing stubble or sod for plowing and for reducing sod after plowing. It is also useful as a general soil-pulverizer, for covering broadcasted seed in stubble, and for destroying weeds. In fact, many of our foremost agriculturists state that on an up-to-date farm the disc-harrow is indispensable.

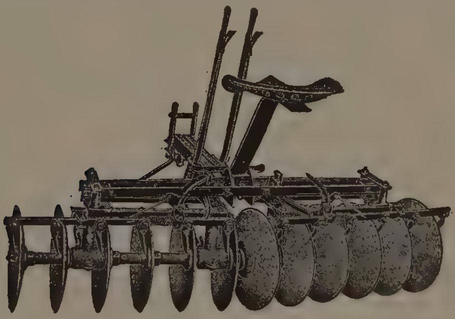
2260. Single disc-plow.

In Fig. 2262 is illustrated a common type of disc-harrow called the full-bladed type. The diameter of the discs usually varies from 12 to 20 inches and the harrow width usually covers from 4 to 10 feet. The depth of penetration of the discs is governed chiefly by the curvature and sharpness of the discs, the angle of the gangs, and the weight of the harrow.



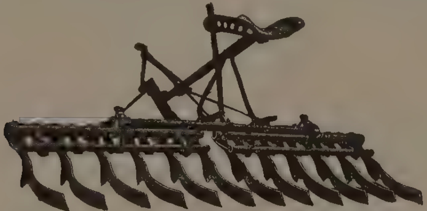
2261. Common type of toothed harrow with metal tooth bars.

The disc-harrow bearings are usually of wood, oil-soaked maple being preferred. The friction between wood and iron is less than between two pieces of iron, hence the value of wooden bearings. The end thrust of each gang is usually taken care of mainly by the bumpers between the gangs. The couplings between the main frame and the bearing-box casting are usually so arranged that the bumpers will come together with the angling levers in any position. The individual discs are usually set about 6 inches apart. The scraper for cleaning the discs may be made stationary or to be operated by the driver. A special type of disc-harrow for use in orchards has the disc-gangs widely separated so as to disc under trees without injuring the branches.



2262. Common type of disc-harrow, showing bearings and scraper.

The cutaway disc-harrow differs from the full-bladed type in that notches are cut out of the discs to permit deeper penetration. It has been found, however, that the pulverization is not so complete with this type as with the full-bladed disc-harrow. It has a further disadvantage in that the discs are difficult to sharpen since each disc must be removed and ground. Its principal use seems to be for renovating hay land and old pastures.



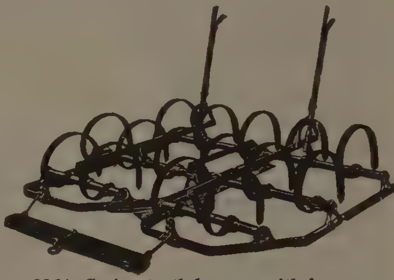
2263. Curved-knife harrow or clod-crusher.

A type of curved-knife harrow or pulverizer is illustrated in Fig. 2263. This is often called the Acme harrow. The slanting curved knives are effective in crushing clods, leveling the surface, destroying small weeds, and in producing the uniform soil structure so desirable for a seed-bed. Some of these implements have a set of rake-teeth following the knives, the purpose of which is to complete the pulverizing and smoothing process.

The so-called spring-toothed harrow illustrated in Figs. 2264, 2265, while in one sense a harrow, is really a cultivator. It is an implement which has been in more general use in Europe than in this country. The long spring teeth when striking a stone or root are easily released, thus making this implement effective in bad ground. It effects considerable pulverization but is said to have a rather excessive draft.

The weeder.

Weeds in a seed-bed or between crop-rows have been found to use up considerable moisture and plant-food. The plow and harrow serve to destroy many weeds, particularly the latter.



2264. Spring-tooth harrow, with frame.

Special weeder implements are, however, in use. These usually combine surface-cultivation with the destroying of weeds. One type used on seed-beds has a large number of rather long teeth with flattened and curved points which tear out and destroy weeds and pulverize or scarify the surface soil.

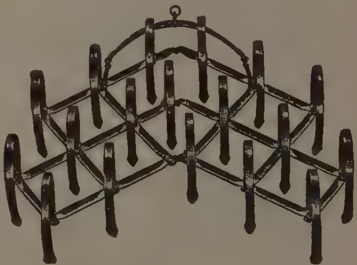
A second type, used between the rows of truck and root crops, is in reality a combination horse-drawn hoe, weeder, and cultivator. The hoes are broad and flat and by passing almost horizontally just beneath the surface of the soil, cut off and destroy weeds and at the same time form more or less of a surface mulch.

The roller, or packer and planker.

The roller as originally used was a tree-log. This, however, did not operate satisfactorily. Wrought- and cast-iron rollers succeeded the wood and they are now also made of concrete in some cases. Like the disc-harrow, rollers and packers usually have wooden bearings to reduce the friction.

While fairly deep general pulverization of the soil is desirable, the loose mellow seed-bed should be rather shallow and the plowed soil below be well packed to conserve moisture.

The iron roller (Fig. 2266) not only compacts the soil but effects considerable pulverization in the way of smashing clods. The smooth surface left by the roller, however, while desirable from the standpoint of mowers, binders, and so on, permits excessive surface evaporation and consequent loss of soil-moisture. This condition is remedied somewhat by following the roller immediately with a harrow, thus producing a surface mulch and breaking up evaporation.

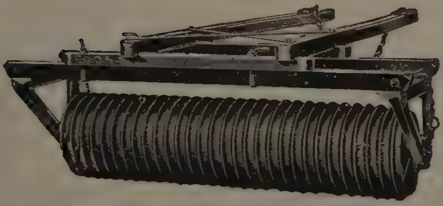


2265. Another form of spring-tooth harrow.

The roller pulverizer or pulverizer-packer (Fig. 2267) may perhaps be used to better advantage than the smooth roller. This type of roller compacts the subsurface soil and pulverizes the surface soil, leaving more or less of a mulch to prevent evaporation. Similar claims are made for corrugated and tubular rollers.

A so-called subsurface packer, consisting of a series of wheels with wedge-shaped tread, is on the market, for which many claims are made.

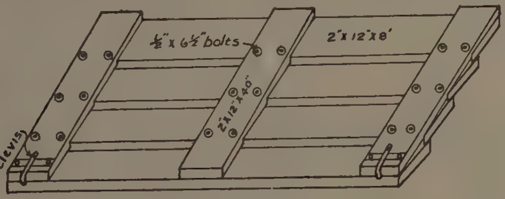
2266. Iron roller.



2267. One form of roller pulverizer or packer.

The Montana Experiment Station has been instructing the farmers of the state how to make their roller pulverizers of concrete. A circular has been issued describing and illustrating this method in detail. It is stated in this circular that the roller should weigh not less than 225 to 250 pounds to a foot of width. This is provided the roller is not used on moist soil. The concrete roller described is about 19 inches in diameter.

The planker (Fig. 2268) or clod-smasher is a home-made wooden implement which is very useful for crushing clods and for surface-smoothing. In fact, on some Hawaiian soils the wooden planker has been successful in pulverizing the top soil when both the disc- and Acme harrows have failed. The planker is effective in listed corn after the first plowing when the soil tends to be cloddy. The weight of the planker may be gaged according to the type of soil. The planker is more generally successful when the surface soil is rather dry. When the soil is wet and sticky, it may cause more harm than good by causing excessive packing of the soil. This also applies more or less to the roller.



2268. The planker.

Cultivators.

The term cultivator is applied to a number of tillage tools. These are surface tillage tools but are usually equipped with shovels or discs instead of teeth and some of them till the soil to a slightly greater depth than the harrow.

Cultivators are more generally used between the rows of growing crops, corn in particular. Corn-stubble is, however, frequently cultivated in the spring with a corn-cultivator previous to listing the corn. The main purpose of cultivators is to destroy weeds, pulverize and ventilate the soil, and thereby conserve moisture and plant-food.

The cultivator has developed from the single-shovel and double-shovel cultivator, which cultivated only one side of a row, to the single straddle-row and double straddle-row types. The single- and double-shovel types have also developed into cultivators having from five to fourteen shovels which are used for cultivating between two rows. These are used almost exclusively now for garden and truck crops. Fig. 2269 illustrates a common type of garden cultivator. These are made for both horse- and hand-power.

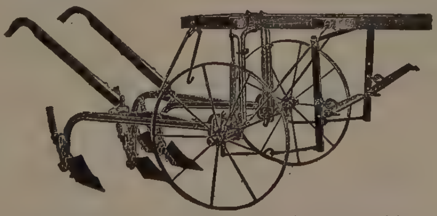
Corn-cultivators are of several types. There are single-row walking-cultivators with and without tongues, and single-row and double-row cultivators. The tongueless or "speechless" walking-cultivator is a rather old type and its use in the corn-belt now is rather limited. When standing still it was likely to fall in a heap if not held steady.

2269. Garden or truck cultivator.

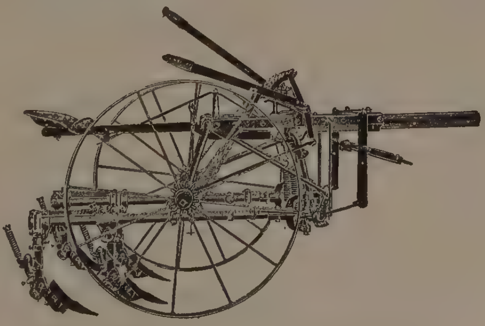
The single-row four-shovel walking-cultivator with a tongue (Fig. 2270) is a very effective corn-cultivator, particularly for second plowing. However, a strong man is required to operate a walking-cultivator, especially during second plowing when considerable care is required not to injure the corn and at the same time to effect thorough cultivation and destroy weeds.

Riding-cultivators are in very general use now for corn-cultivation. Fig. 2271 illustrates a common type of four-shovel single-row riding-cultivator. The shovel gangs are hung on springs and the shovels themselves are also sometimes fitted with springs better to withstand shock. The operator regulates the depth of the shovels by hand levers, maintains the required depth, and guides the gangs with his feet, the guiding being frequently aided by a hand lever.

Corn-cultivators now have four, six, eight, and sometimes ten shovels. While the four-shovel types do very good work, the six-shovel types effect a rather more

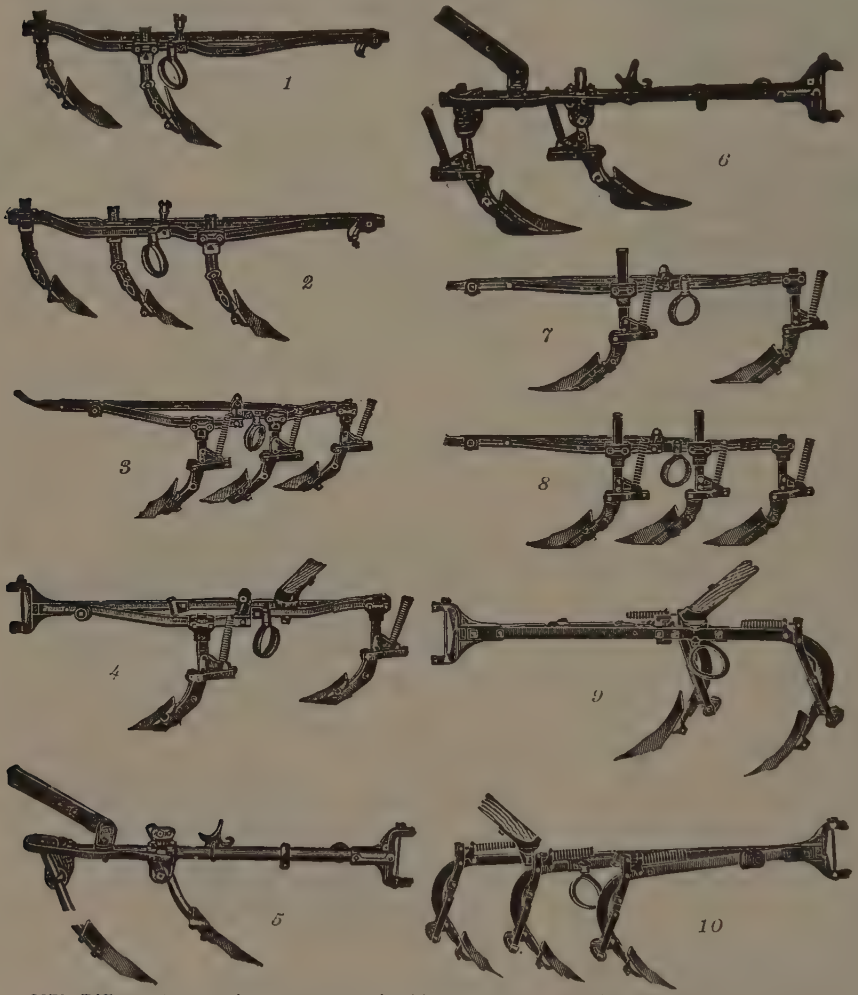


2270. Walking single-row four-shovel tongue cultivator.



2271. Riding single-row four-shovel cultivator.

intensive cultivation. In the opinion of many farmers in the corn-belt, increasing the number of shovels over six not only increases the draft but the difficulty in operating. The cultivator shovels are bolted directly to a shank. The shank is usually attached to the beam so that it may be raised or lowered. Where no provision is made for taking the shock caused by the shovel striking stones, roots, or stumps, the shank is hung by one bolt and fastened into place by means of a wooden peg. Thus when the shovel strikes an obstruction, the wooden peg breaks and allows the shovel and shank to turn back without breaking the beam. Fig. 2272 illustrates several arrangements of cultivator gangs.



2272. Different types and arrangements of cultivator gangs: *1*, steel beam, four-shovel; *2*, steel beam, six-shovel; *3*, steel beam, V-spring trip, six-shovel; *4*, steel beam, V-spring trip, four-shovel; *5*, pipe beam, four-shovel; *6*, pipe beam, spring trip, four-shovel; *7*, steel frame, V-spring trip, four-shovel; *8*, steel frame, V-spring trip, six-shovel; *9*, steel beam, universal spring trip, four-shovel; *10*, steel beam, universal spring trip, six-shovel.

Corn is usually cultivated three or four times. At the first cultivating the corn is usually very small and the operation consists mainly of killing weeds and stirring the soil. The shovels are usually turned so as to throw the soil away from the corn, and fenders are provided to protect the corn from clods and soil which are thrown toward it as the cultivator shovels tear through the soil. At the second plowing the shovels are not turned quite so much and it depends largely on the size of the corn whether the protecting fenders are used. But at the time of second plowing the weeds are usually thicker and the soil drier and harder so that the operation is usually a difficult one. The third plowing is often the "laying by" plowing. Corn is, however, often not laid by until the fourth and sometimes the fifth plowing. At this plowing the shovels are turned so as to throw the soil toward the corn, hilling it up around the roots. An objection made to the shovel-cultivator for laying by is that it cuts the corn roots. A surface cultivator is now used for this purpose which, it is claimed, does not cut the corn roots but throws the earth well toward the corn. Fig. 2273 illustrates a cultivator of this type.

Disc-cultivators are also used for cultivating corn and other row crops. The discs may be regulated to throw the earth toward, or away from, the corn. Fig. 2274 illustrates a cultivator of the disc type. Another type of single-row cultivator is the single-row "go-devil" which is equipped either with curved knives or discs and operates usually on wooden runners. This cultivator is often used for the first and second cultivation of listed corn. Fig. 2275 illustrates a "go-devil" of the disc type.

Two-row cultivators of both the disc and shovel types are now in use. It has been found that these implements require considerable practice for satisfactory operation. In addition, the rows must be straight and parallel and the weeds few. It is difficult to cultivate satisfactorily where irregularities in the rows are encountered. The draft also is practically double that of a single-row cultivator. On the other hand, it is contended that they do good work under proper conditions. The writer's experience with a two-row disc-cultivator in listed corn was satisfactory for the first plowing. Fig. 2276 illustrates a two-row combination disc- and shovel-cultivator. There are many such combination machines in use on single-row work, especially for listed corn. Fig. 2277 illustrates a two-row shovel-cultivator.

There are many other special types of cultivators adapted to different special kinds of work. Fig. 2278 illustrates a cultivator which is especially adapted to orchard cultivation. It is impossible here to cover all the types, but they all have practically the same purpose in view.

It is important that cultivators be well taken care of and that their operation and adjustment be studied so as best to adapt them to the requirements of a certain kind of cultivation. Cultivator shovels should be kept in good condition. They should scour the same as the moldboard-plow and should, therefore, not be permitted to become rusty. They are usually soft-centered with hard smooth face.

Conclusion.

It has been attempted in the above to describe only those tillage implements which have long been in common use on progressive farms and have undergone a steady development, and to illustrate examples of common types, not to recommend any of them.

The actual construction of the different types is touched on but briefly, but it is hoped that the discussion will be sufficient to give one at least a general idea as to the common types of tillage tools and their operation. As regards maintenance, it has long been known that tillage implements will not operate satisfactorily if not well taken care of. They should be protected from the weather and bearings should be well oiled both when in use and when not in use. Scouring surfaces should be protected from rust. And lastly, in the choice of tillage implements, considerable judgment should be exercised. Only strongly built machines should be selected. Bearings should be boxed to protect them from dust and dirt. Convenient and easy adjustment and operation may well be considered. It is also often true that a dollar spent on a good machine is worth several spent on a poor cheap one.

2273. Surface cultivator.

It is thought that a certain amount of study and investigation along the line of tillage machinery will be advantageous to any prospective farmer and may be a source of additional information to the old experienced farmer.

Robert W. Trullinger.

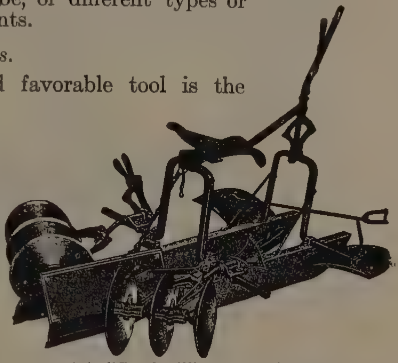
Tools for the orchardist.

Orchard tools may well be classified into three groups,—cultural, pruning, and harvesting implements. The first group comprises, with a few exceptions, the usual agricultural tools commonly used in a region for soil culture and probably require only a brief discussion. The implements used in pruning and in harvesting have been developed for a more specialized type of work and should be considered more in detail. No particular brand or make of tools will be recommended in this article but the writer will endeavor in some cases to point out the defects or the good points, as the case may be, of different types or classes of implements.

2274. Disc-cultivator.

Cultural implements.

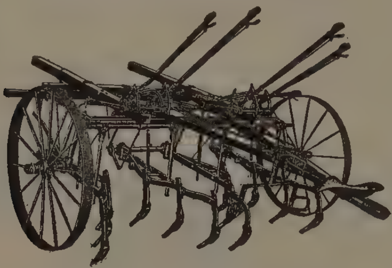
An ancient and favorable tool is the plow, in the long development of which extended engineering skill has been expended. It might be supposed that in its development a highly specialized type would have been evolved for the rather exclusive use of the specialized industry of the fruit-grower. Such, however, is not the case. In the huge mountain orchards of the Appalachian range, one still finds the old shovel-plow used extensively and doing efficient service. Many of the orchards have been planted on newly cleared land and about the only implement which can successfully dodge stumps and tear up the root-bound soil is a strong oak-beamed narrow-pointed shovel-plow. For working the ground close to the tree, a long-beamed shovel-plow is used, so constructed that the plow sets off to one side, enabling both horse and driver to walk well away from the row. Between this crude tool and the heavy three- four- or six-bottom gangs hauled by a tractor, are all kinds of deep-tillage implements used in the orchard. The average fruit-grower with a moderate-sized orchard, carrying a good cover-crop to be worked up each spring, will still cling to the modern two-horse plow. In light soils a cover-crop may be satisfactorily incorporated into the soil with a disc-harrow or a light three-bottom gang-plow.


2275. "Go-devil" corn-cultivator.

2276. Double-row disc- and shovel-cultivator.

A tool well adapted for this work is the cutaway type of the disc-harrow. This machine will chop up and work into the soil a heavy cover-crop and put the surface into a fine tilth at the same time. In old sod orchards where the roots are so near the surface that plowing is difficult, the cutaway will often work up the surface into a sufficiently good condition to act as a mulch. It is not advisable to use less than an 18- or 20-inch disc, as the large size is a comfort when heavy work is to be done and the draft for light work is not appreciably greater than in the smaller sizes. For cultivating trees, the reversible extension type is to be preferred, as it enables one to throw earth either toward the trees or away from them.

The greatest advance in cultural implements for the orchard is found in the harrows, cultivators, and the like, used for shallow cultivation to maintain a dust mulch. The advent of low-headed trees brought about the extension harrow adapted for working under low-hung branches. Not only are extensions used, but in some cases they are covered with guards to lift the branches and prevent injury from contact with the working parts of the harrow. In maintaining the dust mulch, frequent but shallow tillage and a finely pulverized soil are essential. To meet these conditions, the harrow manufacturers have designed wide-cutting but light-draft tools, making it possible to work lightly a large area with a minimum amount of horse-power. Very many forms of teeth are used, some designed for pulverizing, others for leveling and others simply for stirring the surface.

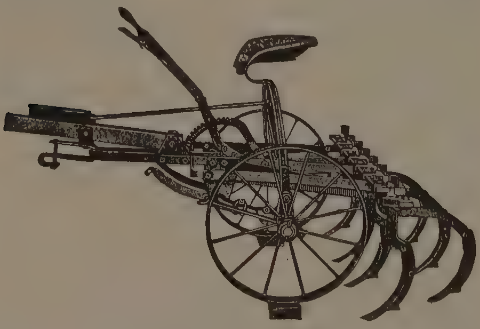


2277. Double-row shovel-cultivator.

The character of the orchard soil will determine, to a large extent, the type of shallow cultivator used. In soil free from stone or stumps and not uneven as to surface, the light tools, Acme or Kimball type, may be successfully operated, as may also the extra-wide (12 to 18 feet) spike-tooth and spring-tooth harrows. In rough or stony land, or among stumps, the orchardist must be content with the narrow but strongly built float or semi-float spike- or spring-tooth harrows.

The larger orchardists have recently developed an active interest in mechanical power for working the orchard. It seems true unquestionably that the tractor will eventually largely supersede the horse and mule in orchards of 100 acres and over. The cost of horse-labor and man-labor is constantly increasing and the cost of mechanical power is steadily becoming lower, so it seems to be only a matter of time when the latter will come into common usage. At present the tractor is of value only upon comparatively smooth land, free from boulders and stumps.

Some of the lighter tractors, when tested in West Virginia orchards, were unable to stand up under the strain. In other cases, the heavier types of tractors developed so much power that it was difficult to get cultural tools strong enough to stand the strain imposed upon them on rough or uneven lands. To strike a boulder or stump would usually mean the breakage of something. Both the "caterpillar" and the ordinary wheel-driven types give good satisfaction when conditions are favorable for their use, and the choice of design depends upon the local conditions.



2278. Orchard cultivator.

One interesting development of the mechanical power is found in the motor cultivator. This light and cheap outfit may be attached to almost any two-horse harrow or cultivator and will work efficiently in small orchards where the large tractor might prove unwieldy.

Pruning implements.

The implements used in pruning fall naturally into four classes: hand-shears and knives, long-handled shears, pole-pruners, and saws. No attempt will be made to consider different makes of these implements but the various types of each may be discussed with considerable freedom.

For a pruning-knife, the average orchardist will consider nothing but some sort of pocket- or clasp-knife. Those having rigid blades and handles are both inconvenient and dangerous to carry when not in use. In picking out a clasp-knife for pruning, one should choose either a slightly crooked (hawk bill), or a straight-edged blade. The hook in the blade causes the knife to "hang to the limb" when cutting toward the point and lessens the danger of slipping and cutting the wrong branch. The handle should be fairly thick and large enough to enable one to get a comfortable grip on it. The narrow metal handles sometimes seen are unmanageable and a forerunner of blisters and ill temper.

Great ingenuity has been displayed in designing hand-shears, but it seems that more thought has been expended in making an elaborate handle than upon the principles governing an effective cutting blade. Projections, loops and guards upon the handles are only a source of annoyance and hindrance. The simple, graceful, yet powerful handles of the American Rieser and California types are satisfactory and convenient in every respect. A poor spring in the handle will cause much trouble by slipping out or by being easily broken. Experience has demonstrated the superiority of the curved double brass spring over either the round or flat spiral springs. The fact that every catalogue of pruning-shears quotes prices upon extra spiral springs indicates their weakness.

The most important feature in a pruning-shear is the cutting part. The California pattern, which is probably more extensively used than any other, has a rather full rounded blade, well formed for cutting toward its base, but is a trifle too blunt at the point, a feature which sometimes causes it to slip off a limb when not securely gripped. The bluntness or roundness has a tendency to interfere with rapid pruning in young trees by making one open the jaws wider each time to receive the limb nearer the base of the blade. This difficulty has been overcome largely in the Swiss and American Rieser patterns in which the blade is made more tapering. These latter shears are somewhat finer pointed than the California pattern and can be used with greater ease to remove limbs from crowded crotches. With this exception, there is little to choose from between these two excellent types of shears. The French shears give good satisfaction, but have no advantages over the ones above mentioned. The straight-bladed types lack in cutting power and are poorly shaped for working in narrow crotches or where limbs are thickly crowded. The latter objection applies with equal force to the Connecticut and Henry patterns and the parrot-headed type, while one using the Lenin pattern will frequently find it almost impossible to prune closely where limbs are close together. The double-cut pruner has one objectionable feature in the fact that curved blades compel the wide openings of the handles to receive the limb. Anyone who has pruned will recognize how this will slow up the work and unduly tire the hand.

Long-handled shears are designed for lopping off heavier branches than can be cut with the hand-shears.

Much the same principles of blade-construction apply here as in the hand-shears, the thing to be considered being, first, ability readily to grasp the branches even though closely crowded, and secondly, power to make the cut. The draw-cut type is undoubtedly the most powerful and fairly well designed for grasping the limb. These shears are heavily built and the weight is sometimes objectionable. The double-cut type has blades so curved that it requires a wide opening of the handles to accommodate even a small limb. Of the other types, the tapering blade and Cartright patterns are the best, as they combine power and ease of operation through a high degree of efficiency.

Pole-pruners are designed for light pruning on such limbs as might be difficult to reach by hand-pruners and are specially adapted for rather small trees, such as peach, pear, cherry, plum and young apple trees. There are three types,—the pole-hook, pole-saw and pole-shear. Many of these are used in combination on the same tool. The blade in the pole-shear is often too light and is easily sprung out of shape in orchard work. The more elaborate shears and combination tools are usually somewhat cumbersome and unhandy in the orchard. The chisel-points used on some tools are of little if any value. For working in shrubs and brambles, it is difficult to find a more satisfactory tool than the bramble-hook.

2279. Types of step-ladders.

It seems to be a prevailing opinion regarding pruning-saws that the "Duplex" or double-edged saw should not be allowed in the commercial orchard. Even the most careful pruners will frequently gash the wrong limb with the back of the saw. The saw that comes nearest to filling all qualifications for pruning must be rather wide near the handle to give rigidity, and taper to a narrow point to allow close work between branches. The teeth should be of only moderate size but should have a wide set. Some prefer the swivel-saws but it requires practice to make a straight cut with them. The tapering swivel is of little use as the back makes it difficult to cut through a large limb. The California draw-cut type has many advocates and will cut rapidly, but it is adapted for small trees rather than general orchard use.

Harvesting implements.

Harvesting implements naturally group themselves under two classes,—those used in picking and those used in packing.

First among the picking implements comes the ladder. One of the early types of ladders consisted of a pole about 4 inches in diameter split at the base and spread apart, and provided with short cross-arms or pins at 12- or 14-inch intervals from the bottom to the top. This ladder, which is still used in some regions, is not well adapted for orchard service by reason of the side arms catching in the branches and interfering with ease in handling. Of the ordinary ladders, the type which is drawn together to a point at the top is far superior to all the others. The pointed apex is easy to insert into a tree and will rest securely and safely in the crotch of a small limb, when a wide ladder would press inward and split off the limb. The base of the ladder should be well sprung to give stability when resting against a tree. The maximum limit of length which is practicable to secure in ladders of this type is 26 or 28 feet and even these lengths are cumbersome and difficult to handle. A modification of the ordinary painters' extension ladder with a pointed apex is probably the most convenient to use in picking the tops of trees 30 feet or more in height. One should pick such a tree once for the experience and then make a vigorous application of the pruning-saw some feet below the top.

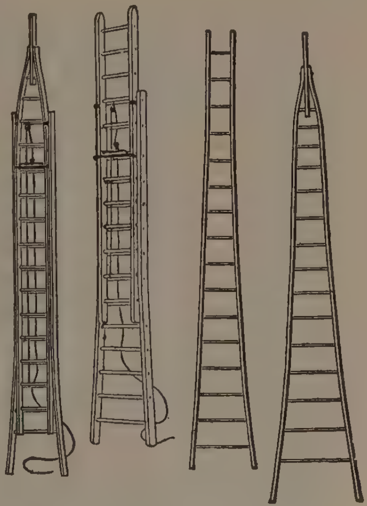
2280. Four-legged ladders, for use on level land.

For the picking of fruits from small trees, some type of step-ladder is used. The best kind for the commercial orchard is the tripod type in which the brace or support consists of a single leg. This will rest firmly upon uneven ground where it would be next to impossible to place a four-legged ladder securely. There are several forms of these ladders; those shown in Fig. 2279 are probably the most serviceable kinds. These ladders may be used as long as 10 or 12 feet, but 8 feet makes a more comfortable and practical length, particularly if the ground is slightly uneven. Some ladders are provided with an adjustable iron base for side-hill use or for service upon very uneven ground, which work fairly well but are rather heavy to carry, and the iron base sinks into the soil too much. Some peach-growers use a modification of the step-ladder in the form of a low platform on light legs. The four-legged ladders are shown in Fig. 2280; and forms of tree-ladders and extension-ladders in Fig. 2281.

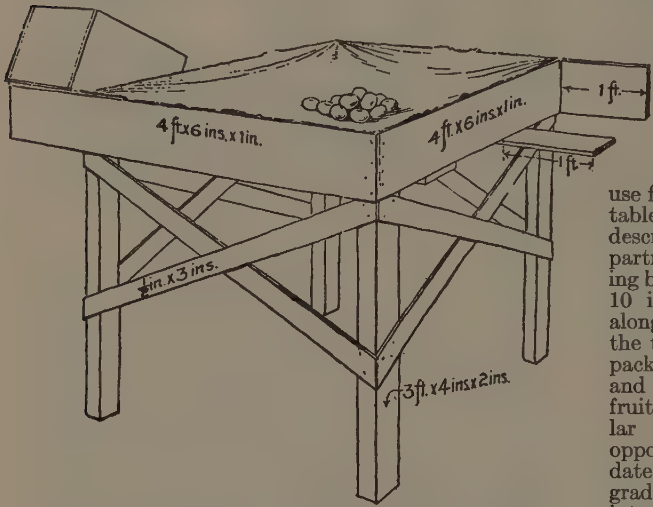
The ladders described above are the ones mostly used by the experienced orchardist. For the orchard of the amateur and home grower, many elaborate or modified forms are offered, but while these are interesting they give way to simple pattern when the grower learns how.

Another device that often appeals to the novice is the mechanical picker. Here many designs and styles may be offered, most of them consisting of a long pole with a cup at the end. The pole offers little opportunity for elaboration but in the form of cup, method of attachment, form of hook for dislodging fruit and other details, inventive genius has enjoyed an unrestricted field. Ingenious though these devices may be, their field of usefulness is extremely limited.

For picking apples, pears and peaches, the round, smooth-stave, swing-handle, half-bushel basket is probably the most


2281. Tree-ladders. At the left are two forms of extension-ladders

practical and widely used receptacle. The fruit will not bruise when placed in this, and the swinging handle enables one to let it down inside a barrel and empty the fruits without dropping them from a distance. Wire or rough-woven baskets cause unnecessary bruising because of their sharp and uneven surfaces. Many persons use a galvanized pail which discourages carelessness in dropping apples into the receptacle, as the noise can be heard for some distance.



2282. **A good packing-table for box fruit, with canvas bottom and racks at two diagonal corners for holding boxes.** (C. S. Wilson.)

Picking-bags are made in a variety of forms from the simple grain-bag hung over one shoulder on a strap attached at the top and bottom, to the carefully made apron-like pouch hung in front of the picker by straps over each shoulder. When used carefully, the fruit will not be badly bruised in the bags, but the average workman with a small sense of responsibility will bump the bag against the ladder and in descending will often let it rest from round to round to ease the weight upon his shoulder. It often happens in such cases that 90 per cent of the fruit is more or less bruised before it reaches the packing-tables.

In the packing of all kinds of fruit, very much depends upon the use of a good packing-table. If this table is not properly constructed, the speed and efficiency of the sorting-crew will be cut down and a poorly packed box or barrel will often result. The orchardists have realized this and are now using over practically the whole country the same type of table which by experience they have found superior to all others.

For the packing of apples or pears in barrels, the tilted, slat-bottomed table is almost universally used. The body of the table is from 3½ to 4 feet wide and from 6 to 10 feet in length. The sides and ends are of inch material 8 inches wide and the bottom is covered with slats 1 inch square running lengthwise of the table and spaced 1 inch apart. The legs are of 2 by 4 or slightly smaller material, 39 inches long at the lower end and 45 to 48 inches at the upper end. This allows sufficient height to place a barrel under the lower end and gives it enough pitch to keep the apples rolling down toward the lower end where the table is narrowed by a diagonal board to a funnel-like opening about 10 inches wide through which the fruit rolls to an apron over the top of the barrel. As the slack of the apron is filled, the packer lowers it carefully into the barrel, having meanwhile stopped the stream of apples by a gate, or with his hand.

The box-packers have practically standardized the type of table suited to their needs. The body is in the form of a square 4 feet on a side and covered by a canvas top which sags slightly and forms a receptacle to hold the fruit. The legs are 3 feet in length and should be of 2 by 4 material well braced. From opposite diagonal corners the sides and bottom pieces extend 12 inches to form a rest for the boxes. This table, illustrated in Fig. 2282, is often made much longer and the top divided into several compartments similar to the one described so that it would be adapted to use in a large packing-house. The fruit is first graded and each grade placed in a separate section so that the packer works with only one grade at a time.

The peach industry has not developed its type of packing-table to a form as standardized as has the apple industry. There is, however, a style of peach-packing table in rather general use for putting up the six-basket Georgia carrier. This table is somewhat like the long box packing-table described in the last paragraph, except that the compartments are 3 feet square and instead of the projecting box supports, a long shelf 10 inches wide is attached along the side 10 inches below the top. Upon this shelf the packers rest their carriers and reach over them for the fruit upon the table. A similar shelf is built on the opposite side to accommodate the baskets of the graders as they sort the fruit into several grades. Over the packing-table at a convenient height is usually suspended another shelf to hold extra dividers, baskets, and other materials.

2283. **Two simple screw barrel presses.**

Several types of box-presses are upon the market, but equally good ones may be built at home. The one illustrated in Fig. 2284 is a common type and is not difficult to construct. The iron clamps which may be easily made by a blacksmith are attached by pins and should be adjustable to accommodate boxes of different heights. Barrel-presses are of two kinds, lever and screw. They are equally good, the choice between the two being one of personal preference. The lever presses are a little more rapid and are also more tiring upon the operator. A narrow iron circle is preferable to the customary bar across the top, but this circle must not be large and unwieldy or it will interfere seriously with the operator's movements in placing the head. The simpler the construction of the press, the better. Two common types of screw presses are illustrated in Fig. 2283.

2284. **A press for box fruit. The clamps, worked by a foot-lever, press down the cover until it can be nailed.**

The mechanical grader is one of the most recent and probably the most significant developments in packing implements. The popularity of these machines is a clear indication of the spread of the movement for better packing throughout the country. It is impossible here to discuss the details of the various types of this machine (see *Packing*, Vol. V). In general they are so arranged that the fruit is carried over graduated holes, beginning with the smaller and ending with the largest sizes. In some cases these holes are in the form of a screen, in some a gradually widening groove or channel answers the purpose, while in still others ingeniously arranged spiral rollers or fingers force the fruit from one cup or hole to another until it is finally deposited in its proper receptacle. These machines are just emerging from the experimental stage and will doubtless be greatly improved in the near future, but it is worth noting that they are already giving good satisfaction. It is a safe prediction that in a few years they will be found in practically every up-to-date orchard of 10 acres or more in extent.

W. H. Alderman.

Machines and implements in vegetable-gardening.

The invention and perfection of tools specially adapted to particular uses and to the needs of different crops has had a profound influence on the extent of cultivation and the profits possible from vegetable-garden products. The character of the tool and implement equipment for market-garden and truck-farming purposes necessarily varies with the extent of the industry, the character of the soil, and the climatic conditions under which the work is conducted. The implements required by the gardener and truck-farmer may be grouped in the following way: First, soil-stirring implements such as those used in the preparation of the soil,—plows, harrows, levelers, clod-crushers, and so on.

Plows.—The ordinary moldboard plow is the best soil-stirring implement for use on restricted areas large enough to permit the use of horse-power. When the operations are of sufficient extent, the mounted plow which permits of working from one side of the land, instead of plowing around or back-furrowing, will be found to have decided advantages for garden use as it permits the preparation of a strip of land without making back-furrows or dead furrows.

Harrows.—To accomplish the various needs of soil-preparation, spring-tooth, spike-tooth, and disc-harrows should be available, and of the latter type there should be not only the ordinary disc- or cutaway-harrow but also several other types, some of which are shown in Figs. 2263–2265.

Levelers (Fig. 2268).—One of the most efficient levelers and clod-crushers is the planker, which can be made at home by placing three planks 10 or 12 inches wide so that the edge of one overlaps its neighbor 2 to 2½ inches and the three are firmly held together by bolting them to strong cross-pieces placed about one-fourth the length of the planks from either end. In irrigated sections, a different type of leveler is essential, but this need not be considered in the equipment for gardens located in humid areas. In gardens of good size a roller will also be found of decided advantage.

2285. A hand seed-sower.

The second class of soil-stirring implements comprises those used for crop-culture. Those that can not be dispensed with are the five-tooth cultivator, equipped with teeth differing in shape and size to meet the requirements of the various crops. The spike-tooth harrow (Fig. 2261), which has a similar frame but has numerous slender teeth in place of the blades of the one above mentioned, is another almost indispensable implement. Beside these horse-drawn implements, special tools, such as seed-drills for particular crops to be operated either by hand (Fig. 2285) or horse-power, will be needed. A battery of seed-drills is sometimes devised, for sowing several rows at a time. These are similar to fertilizer-distributers, which permit the operator to broadcast the fertilizer over the whole width of the row or to scatter it as a side-dressing near the base of the plants in adjacent rows. The implements needed for hilling, cultivating, or digging particular crops are to be determined by the character and extent of the crops grown.

Hand implements for cultural purposes.—Implements for hand work are quite as essential as the more expensive and more effective horse-drawn inventions and no garden can be successfully cultivated without a variety of hand-hoes, such as broad, pointed, and scuffle-hoes as well as an equipment of wheel-hoes with adequate attachments for performing the various operations necessary to the successful culture of small garden plants. Besides these, hand-weeders, dibbles, and trowels cannot be dispensed with.

2286. The hand wheel-hoe.

Among the special soil-stirring implements worthy of consideration are the following:

The Meeker disc-harrow.—The successful germination of small seeds depends more upon the preparation of the soil than any other single factor. The market-gardener has a number of small-seeded plants to handle and the quick and adequate preparation of the soil is an important matter. Before the Meeker disc-harrow came into use, the work of preparing a seed-bed for small seeds had to be done by hand. By the use of this implement, the final preparation of the seed-bed can be accomplished by the use of horse-power in as satisfactory a manner, in much less time and at less cost, as it can be done by hand. This implement fines, levels, and compacts the surface soil. In fact, it does the work of the steel-tooth garden-rake in an extensive way.

The wheel-hoe, shown in Fig. 2286, of which there are many modifications, has played an important part in the evolution of modern truck- and market-garden industries. In the hands of a skilled operator, it can be made to perform a major portion of the operations possible with the hand-hoe or broad hoe and the amount of execution possible is multiplied many fold.

The scuffle-hoe, which is a very slight modification of the ordinary hand-hoe or broad hoe, as shown in Fig. 2287, has not only minimized the effort needed to accomplish certain results but has at the same time placed at the disposal of the skilful operator a more effective implement. The combination of these two factors, conservation of effort and increased efficiency, should mean lessened cost in the operation to which the tool is adapted.

Next to the soil-stirring implements, those which distribute the seed either in drills or hills, as the special crop may require, and those which distribute fertilizers to stimulate the growth of such crops, bear a very intimate relation to the success of any horticultural enterprise.

The perfection of reliable row- and hill-dropping drills for sowing extensive garden areas has greatly reduced the cost of producing many crops. The combination of seed-sowers by the use of special carriages, which are used in sowing spinach and kale on four- or five-row beds, or for planting large areas of hoe-crops such as beets, carrots, onions, radishes, or even cabbage, has greatly augmented the uses of the seed-sower and reduced the cost of seed-sowing.

The adaptation of fertilizer-distributing devices to the seed-drill still further reduces the labor-cost involved in the production of those crops requiring or permitting the distribution of fertilizers with the seed. Such inventions make it possible to substitute brute-force for man-power to a marked degree, thus increasing the efficiency and productive capacity of the man.

Another but somewhat more complicated device which lends itself in a number of labor-saving ways to the work of the market-gardener and truck-farmer, is the McWhorter fertilizer-distributer. This device is built for hand- and horse-power. It is so adaptable as to be readily adjusted for sowing fertilizers broadcast, or in drills, or as side-dressing to plants in rows. Truck-growers have long ago learned that in order to secure best results, fertilizers should be applied at particular periods in the life of the plant as well as in definite quantities in a special way. This implement meets these several needs more completely than any other fertilizer-distributer yet devised.

One of the minor implements worthy of mention in this connection is the celery-hiller. In those sections in which autumn celery is extensively produced for storage, the crop is partially blanched before it is stored. Until recently this blanching was chiefly accomplished by banking the plants with earth. When done by hand, this is a long, tedious and labor-consuming task, but with the aid of the celery-hiller operated by horse-power, human effort has been largely replaced and the cost of the operation has been correspondingly reduced. The onion-topper is another device which, like the celery-hiller, has reduced the amount of irksome and expensive labor in handling a crop.

2287. Various forms of hand-hoes. The common square or broad hoe runs through the cut. Above it is a weeder and one form of scuffle-hoe. Below at left is a common kind of scuffle-hoe; and below it is a hand-cultivator. Other special hoes are shown.

It often happens that a recombination of elements results in a device of special merit in accomplishing important results. A combination of seed-drills is an achievement of this character which has solved an important problem in connection with the planting of spinach on raised beds. The climatic conditions, the texture of the soil, and the drainage requirements of the spinach plant have made it necessary that the crop be grown on four- to six-row raised beds. After these have been prepared, the tramping of operators to sow the seed with ordinary hand seed-drills would be objectionable, the work would be difficult and expensive. The battery of drills operated by horse-power has solved the problem for spinach as well as for planting sugar-beets and the sowing of onion seed for sets. In fact, in some cases a tractor has supplanted the battery of seed-drills.

Some of the implements that have had an epoch-marking influence on the crops, the special problems of which they were designed to meet are:

Transplanter.—The degree of perfection which has been attained in the modern transplanting devices has practically taken all the "backache" out of the extensive culture of all transplanted crops which are grown far enough apart to permit the use of a slow team to propel the planter. Such crops as cabbage, cauliflower, sweet potatoes, tobacco, and strawberries lend themselves to planting by this type of implement. Such crops as onions and celery, which are also transplanted, cannot be successfully handled with the models now on the market. The reason for this is due to the close planting distances required by such crops. It is not the proximity of the rows but the distance between the plants in the row that prevents the success of the machines now available. Preliminary tests that have been conducted with motor-driven implements of this character indicate that the solution of the problem lies in this field, for motor-driven devices can be geared to travel at any desired speed, but draft animals, while sometimes exasperatingly slow, cannot be trained to go slow enough to permit operators to set plants as close as 4 to 6 inches apart in the row.

The potato-planter.—The invention and perfection of this device has removed the operation of potato-planting from the domain of crew labor when potatoes are grown on an extensive acreage, to the domain of extraordinary extensive field-planting operations. It has reduced the man-labor requirements at potato-planting season so that a very slight increase in labor is capable of accomplishing what on a hand basis would be almost impossible in many sections where potato-growing now thrives. There are two general types of potato-planters which, for convenience, may be designated the "one-man" and the "two-man" types. Each of these machines has special advantages. The one-man type is less expensive to operate than the two-man type, but since the operator must depend upon the precision of a mechanical device unaided by personal supervision to secure the distribution of the seed, and since vacancies in the field tend rapidly to reduce the yield of the crop without reducing the cost of cultivation, the grower should consider carefully whether or not saving the labor of an extra man at planting-time is really a gain or a loss at harvest-time. The one-man type of machine, which uses pickers that puncture the seed-pieces, is liable to be an important factor in spreading certain types of tuber diseases. If such machines are employed, extreme caution should be exercised to eliminate from the seed-stock all tubers carrying diseases capable of communication from seed-piece to seed-piece by means of the metal pickers. The two-man machine costs more to operate, as it requires two instead of one man. If the seed has been carefully cut and the feeder attends to his job, this machine should give a perfect distribution and a corresponding stand. These devices are provided with another time- and labor-saving feature in the form of a fertilizer-distributing device. These attachments are so arranged as to place the fertilizer in the row, either deeper than the seed-piece or to scatter it into the drill in which the seed-piece is dropped.

The potato-digger.—Of the special implements designed to increase the efficiency of horse- and man-power expended in handling the potato crop, none has proved more of a boon to the grower than the potato-digger. It has made it possible to accomplish by means of horse-power in a given time what it would take several men to perform; to harvest large acreages at low cost in an incredibly short time; factors of great economic advantage considered from the point of cost as well as from that of safely gathering and storing the crop. It often happens in the northern potato-growing areas that the interval between the first killing frost, which is the signal for all hands to begin digging, and the time when actual freezing temperatures occur, is very short. It is therefore imperative that the facilities for digging and storing the crop be capable of accomplishing large tasks in short periods of time. The large, strongly built diggers upon which six horses are sometime used are implements of this type.

The pea-viner.—The invention of the pea-viner promoted the culture of garden peas from a minor place in the market-garden and on the truck-farm to the position of an acreage crop to be harvested with machinery and carried to the cannery. It made pea-canning a factory enterprise instead of a side line to market-gardening and truck-farming.

Implements and devices which assist the grower in the production or preparation of his crop for market are of great economic importance, although often simple in design and relatively inexpensive. Such tools are well illustrated by the better types of hand-weeders, dibbles, and transplanting trowels. The asparagus-buncher, is a simple and inexpensive device which enables the asparagus-grower to accomplish two important ends—offering his product in uniform standard-sized bunches and of such length as the trade demands. Some markets and special trades require stalks of extra length. By the use of the buncher, a standard once established can be uniformly maintained.

While this by no means exhausts the list of special implements used in the production and preparation of vegetable crops for the market, it serves to point out the place which some of these implements and tools hold in the commercial production of these crops, as well as suggesting in a general way the fundamental equipment of a place devoted to the production of vegetable crops.

L. C. Corbett.

Brief lists of implements for greenhouse and grounds.

The purpose in using tools for working the soil, either in the greenhouse, garden, lawn or on the farm, is to secure efficiency and also to save time and labor. Soil-working tools for greenhouse use are few and very practical. In many cases, the operator requires specially constructed tools for the work. The necessity for tools is also modified by the way in which the plants are grown and trained. In an article of this kind, the principles of operation of the endless list of greenhouse and lawn tools cannot be discussed; but a list can be suggested of the kinds of mechanical helps that the gardener most needs.

Many simple methods have been introduced to eliminate crowding and irregular growing in commercial and also in private houses, where bench-growing is conducted to any extent. There have come into use, within recent years, wires stretched horizontally over beds of roses and carnations, to which the vertical wires are fastened by clips. The method is good, as it looks neat and prevents irregular growth of the plants and admits use of proper tools for cultivating. For this tillage, the Eureka weeder, with short and long handles, is about the best, being made of flexible steel with narrow teeth, thus preventing seriously disturbing the roots when used for cultivating and weeding. The method of running the horizontal wires from end to end of the staging is by fastening them to a cross-bar of ¾-inch-diameter galvanized pipe, so constructed and braced as to form an anchor at the elevation that accommodates the height of the plants. Wire pot-hangers are convenient for overcrowded spaces; also for such plants that do best by being suspended and given abundant light and air. These supports may themselves be classed with greenhouse devices and implements, and they determine to a considerable extent the character of the hand tools that may be used on the bed or bench.

The watering-can is perhaps the most important requisite in the greenhouse or conservatory, but for the commercial house the hose is used entirely for watering and spraying. The long-spout can, fitted with brass tubing for attaching the rose or sprinkler, is the best. The special low can of four-quart size is used for watering seed-pans and boxes which are often placed at an elevation above the benches. The number of forms of watering-pots now available is considerable and represents excellent adaptation of means to ends.

Fumigators are necessary devices against insects. The combined fumigator and vaporizer acts in a double capacity, generates tobacco vapor as well as smoke, and prevents burning, which is often caused by the dry smoke. The fumigating lamp is used for vaporizing nicotine extract. Any apparatus of a lamp type will accomplish this work successfully. The brass syringe with its varied-sized caps, coarse and fine, for spraying or syringing and sold for watering seed-pans and boxes, is still in general use. Pressure sprayers are a greater convenience than the syringes and much more efficient for applying insecticides.

Among many important requisites for the greenhouse, the thermometer is an indespensable factor, as are also flower-pots, fern-pans, orchid-pans, orchid-baskets, seed-pans, and flats of wood used for seed-sowing and also transplanting seedlings, soil-sifting sieves for hand use, specially constructed wheel-barrows for greenhouse use, pot-washing machinery from the old style scrubbing-brush to the revolving brush machine of greater power and capacity which is used by the commercial florists.

In large commercial establishments, particularly for vegetable-growing, where the bench and staging are no longer used, the soil is handled the same as in the open, with either the spade-fork or plow, but in houses with side benches and large center staging, the soil is removed and replaced by hand carrying-boxes operated by two men, and in modern and extensive establishments by tilting cars running on a continuous cable. The very coarse soil is broken up and sifted through large riddles, 6 feet long and 3 feet wide and standing on an angle.

Tools for the lawn.

The finished lawn requires constant attention. It does not demand a great variety of tools, but they should be practical and efficient. Of the lawn-mowers, the most recent is the gasolene motor, which has the great advantage of doing the work of mowing and rolling in early spring without disfiguring the lawn, as is the case when using the horse lawn-mower. Steam- and gasolene-power lawn-mowers have been in use for several years, and have hitherto been very heavy and unwieldy; however, in the recently introduced machines, the weight is no greater than the horse-power 30- and 36-inch-cut mowers. The operator usually walks in the rear where he has full control in guiding the machine and regulating the power. In large park areas, private or public, the ordinary farm mowing-machine may be used; and in some places sheep may be employed to crop the grass, as on golf-courses. The old-fashioned grass scythe still has many uses about large lawns.

The lawn-sweeper for hand- and horse-power is a lawn accessory not in general use, but it does finished work, particularly in late summer and fall, when the fall and other coarse grasses make their appearance, and prevents their seeding for the following year's crop.

Hand lawn-mowers of low- and high-wheel makes are now used in all parts of the world where lawns are to be found. Without the hand lawn-mower, the tennis-court and the putting-greens of the golf-links could not be kept in proper condition for use. The cropping of grass for appearance serves two purposes: it induces thick growth and insures an even surface.

The lawn-roller is the first lawn tool used with advent of spring. It closes the surface of the lawn which has been honeycombed by the frosts and freezing during the winter months, firms the soil and grass roots into close proximity, and also presses down the mole-runs. After sowing grass seed, whether in the already established lawn or in a new one, the rolling process is essential. Every horse- or other lawn-mower is equipped with a roller and can be used as a roller only.

Dock-extractors, dandelion-lifters, steel spuds and knives for cutting plantain are all used for exterminating objectionable weeds, which infest lawns. Scythes and grass-hooks (sickles) are the grass-cutting tools to be used where the lawn-mower cannot be employed. Grass-shears and border-shears are essential for cutting grass along the edges of foot-paths, walks, flower-beds, and also along the edge of carriage-roads. Lawn-shears are used for cutting grass under fences and under trees that grow close to the ground. Grass-edging knives and narrow spades are also used for cutting along borders and beds in the spring to secure an even edge.

2288. Various commendable forms of lawn and garden rakes, forks and hoes.

The leaf- and rubbish-cart, the leaf-rack of wire placed on a broad-tired wheelbarrow, make excellent vehicles of man-power to transport all kinds of rubbish, tree branches and leaves from the lawn to the deposit for such. Lawn-rakes for leaves, scarifying rakes for reseeding and removing moss surfaces in shaded portions of lawns are useful. Lawn-sprinklers are obtainable for the small grass-plot, and for large areas of almost indescribable patterns and capacity, stationary and revolving.

For even distribution of fertilizers and grass seeds, the use of the "velvet lawn seeder and fertilizer sower" is recommended. These machines are so constructed that they cut shallow grooves in the sod, sowing the seed directly into the openings to insure germination, also covering and rolling in the same operation. The fertilizer machine is arranged with a comb similar to a rake, thus scarifying the lawn before the distribution of dry fertilizer, as bone, sheep-manure, nitrate of soda, ashes, ground lime or plaster.

Tools for the garden.

Garden tools are in endless variety and there are special types for either light or heavy soils. The spade is still the best tool for the heavy soils, and the digging-fork for light soils; the hoe persists for all soils. The scuffle-hoe is standard for cultivating and weed-cutting; the Warren hoe for cultivating, furrowing and ridging; the common garden hoe in one, two and three prongs for cutting weeds and breaking the soil; the square and half-moon hoe are used principally for cutting weeds and leveling the surface (Fig. 2287). Steel garden rakes, narrow and wide (Fig. 2288), are necessary for leveling broken soil. Steel-bow rakes are useful for handling coarse cloddy soil.

Wheel-hoes, and cultivators with adjustable teeth for cultivating, discs for breaking clods, plows for ridging and furrowing, and also for opening the earth for planting and sowing, are the most practical garden tools, being great labor-savers. When properly and frequently used, they will keep a garden neat and clean. Seed-drills are not practicable for a small garden, but for the market-garden they are most important, both for uniformity and economy in sowing the seed, obviating thinning by hand. The hand-thinning is an expensive operation, wasting the plants that are pulled out, and injuring what are left. The modern seed-drill is so constructed that it will drop seed at intervals as well as distribute them in a continuous line. This form is known as the hill-dropping drill. Some drills are equipped with interchangeable cultivating tools. The market-gardener does not consider this feature practicable, and therefore prefers separate drills and cultivators; but for hotel and private gardens the combined tool is used.

All vegetable seeds, except lima beans, can be sown with seed-drills; they open the furrow, sow the seed, cover, press it down and make the mark for the next row to be sown, all in one operation. The first row being marked out with garden-line, the marking-iron is set at the required distance. The double wheel-hoe and cultivator is the market-gardener's favorite, as it can straddle the row and cut from each side, thus throwing to center of row. The operator then rakes out the center, following between the rows with teeth attached to the hoe to break the soil. The hand-plow is a favorite tool for the private garden. It can be set at different depths.

The wheelbarrow-drill in 14- and 16-foot lengths is the most uniform distributer of grass seeds. Over large areas, it is arranged with an agitator inside to force the seed through the openings. The lawn-seeder is equipped with discs which cut shallow openings into which the seed drops. Fertilizer-drills are used, as already indicated, for the field, garden and lawn, and distribute evenly and in the required quantity.

J. Otto Thilow.

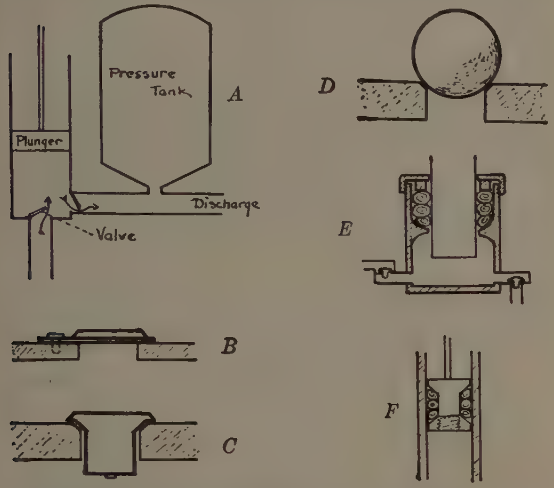
Spraying machinery and tools (see also pp. 1057–1060).

In recent years, the appliances and devices for the application of sprays to destroy insects and fungi have become numerous and much specialized. As the pests to be met are many and very different, so is the machinery of the most diverse patterns. Certain standard practices, however, have developed a line of implements that meets perhaps four-fifths of the needs, and some of these constructions may be briefly considered here. Spraying is now one of the established practices in the growing of plants.

Pumps.

The spray-pump is the ordinary lift-pump found in most wells to which has been added a means of regulating the discharge, thus changing the lift-pump to a force-pump. If a tight-fitting plunger moves up in a cylinder, it pushes in front of it a certain amount of air and an equal amount rushes in behind the plunger to fill the space. If the lower end of the cylinder is placed in water, as the plunger moves upward air is still driven out at the top but, since none can now enter at the bottom, there is a tendency to create a vacuum and the atmospheric pressure outside the cylinder forces the water up toward the plunger.

One may swing a door open in one direction but it closes tightly against the jamb in the other direction. If a similar arrangement, called a valve, is put at the bottom of the cylinder, water can then enter but can not run back and the water which enters the cylinder is thus held. If a discharge-pipe is now placed at the lower end of the cylinder, as shown in Fig. 2289, *A*, and a valve placed in this which swings so that water can flow out, but not into the cylinder, our simple pump will be completed. On the upward stroke of the plunger one valve opens and the other closes; on the downward stroke this action is reversed and the water is driven out the discharge-pipe.



2289. ***A*, diagram of a simple pump; *B*, the clapper valve; *C*, the poppet valve; *D*, the ball valve; *E*, an outside-packed pump; *F*, an inside-packed pump.**

The water from such a pump would come in spurts with each stroke of the plunger. If an opening is made in the bottom of an air-tight chamber, or tank, and this connected with the discharge-pipe, we have a means of preventing these spurts and maintaining a steady pressure at the discharge. When the piston moves downward and water is sent into the discharge-pipe, some of it is forced up into this air-chamber, compressing the air as it enters. When the plunger starts backward, this compressed air can then expand and force out the water. Thus, part of the time, water is leaving the discharge directly from the push of the plunger and part of the time from the expansion of the air in the pressure-tank.

There are three general types of valves: (1) *The clapper valve* consists of a flat plate covering the valve opening and hinged on one edge so as to swing in the manner of a door (Fig. 2289, *B*). Frequently the face of the plate is covered with rubber or leather. Except in a few of the cheaper hand-pumps, this valve is not found in modern spray-pumps. (2) *The poppet valve* is one of the most widely used forms, especially on the cheaper pumps. It consists of a flat plate with a tongue projecting at right angles and acting as a guide to hold the plate in place over the valve-opening (Figs. 2289, *C*, and 2290). A flake of rust or a particle of the spray mixture is liable to catch under the plate and prevent the valve from closing tightly. (3) *The ball valve* has a metal ball resting on the round opening (Fig. 2289, *D*). The upward movement of the liquid raises the ball but downward pressure only holds it more firmly in place. Usually a cage is constructed over the ball to prevent it from falling out of place. This type has generally proved the most satisfactory. The constant shifting of the ball tends to grind the valve-seat smooth and prevent any foreign particles from holding up the valve off the seat.

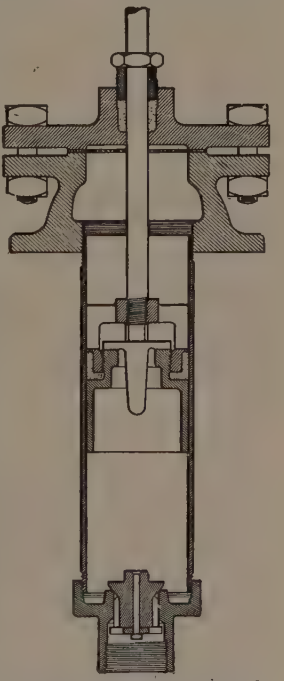
The air imprisoned in the pressure-tank acts as a spring to equalize the discharge. If the spray pulsates, it shows that the tank is too small or that it has become filled with water instead of air. Hand-pumps with a relatively long time between strokes of the plunger require a larger pressure-tank than do power-pumps, especially those having two and three cylinders. Most tanks are cast-iron and are very heavy; also, with cast-iron, there is always danger that a thin place will give way under pressure and cause serious trouble. Sheet-steel tanks are lighter and better. All power-pumps and many hand-pumps are supplied with a pressure-gauge. This is usually attached to the pressure-tank.

It is essential that a relief-valve be supplied since most power-pumps can easily be made to develop a pressure too high for the pressure-tank and hose to stand with safety. These valves are so constructed that they may be set to act at any desired pressure. The usual type is a ball or poppet valve held in place by a powerful spring whose tension can be regulated by a set-screw. When the pressure of the liquid on the valve becomes greater than the push of the spring, the valve is raised and the liquid then passes back through a pipe to the spray-tank. Such valves frequently cause trouble by the uneven wearing of the valve or valve-seat and the corrosion of the spring and working parts.

A few pumps are now supplied with relief-valves so arranged that when the valve is raised the pressure-tank and discharge are cut off from the pump, and the liquid leaving the pump flows freely back into the spray-tank. This causes no wear on the relief-valve and, since the pump does not have to work against pressure while the valve is in action, it leads to a considerable saving in power.

If valves held without loss, and no material leaked past the plunger-packing, the discharge of the pump would be equal to the area of the piston-head multiplied by the length of the stroke. Valves always leak back to a greater or less extent and the packing is seldom entirely tight, so that the actual and theoretical discharge are not the same. The difference between the two is called the "slippage." This will sometimes run as high as 50 per cent when the valves are not fitting tightly.

In using a hand-pump, it is less tiring to make a few strokes against heavy resistance than to make many strokes against a lighter resistance. For this reason pumps designed for hand use should have relatively large capacity. On the other hand, large capacity should not be obtained by increasing the diameter of the plunger beyond a certain point. A 2-inch plunger when working against 100 pounds pressure requires over 300 pounds of energy and even with the well-planned leverage of the long pump-handle this is about the maximum which may be demanded of the man on the handle.

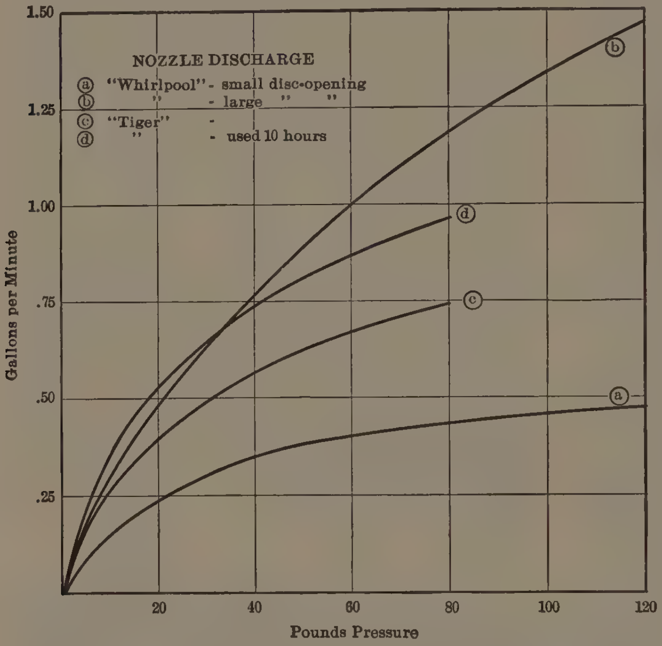


2290. Section of single-acting pump-cylinder showing poppet valves and inside packing.

In most pumps there is a narrow space left between the piston and the inner wall of the chamber. This is filled with some one of the many kinds of packing. One of the cheapest of these is made of loosely rolled tow strings and is sold as "candle-wicking." The best kinds are combinations of canvas and rubber. It is poor economy to buy cheap packing. The best does not last very long and the time lost in replacing poor packing would pay the slight extra cost of the better grades many times over.

No other part of the pump requires as frequent attention as the packing, therefore it is important that pumps should be so designed as to give ready access to the packing and also that some means should be provided for keeping it tight against the plunger.

Considering the packing only, pumps may be divided into two classes: outside-packed and inside-packed. An outside-packed pump is one in which the packing is set on the inside of the pump-cylinder and presses against the outside of the plunger (Fig. 2289, *E*). Such packing may usually be reached without removing the plunger. An inside-packed pump is one in which the packing is on the face of the plunger and presses against the inside of the pump-cylinder (Figs. 2289, *F*, and 2290) thus necessitating the removal of the plunger before it can be renewed.



2291. Diagram of the pressure and nozzle discharge. The amount of spray discharged increases rapidly at low pressures but more slowly at higher pressures. The amounts differ with different makes.

All parts, such as valves, plungers, and cylinder lining, which come in contact with spray materials, should be of brass, as this does not corrode so rapidly as steel. For inside-packed pumps, a bored cylinder is truer than a drawn tube and so pumps much easier because of the decreased friction.

A single-action pump is one which draws in the liquid as the plunger moves in one direction and drives it out as the plunger moves back. There are only two valves on such a pump. When two single-acting cylinders are used on the same pump it is called a two-cylinder, or duplex pump; one with three such cylinders is called a triplex pump.

A double-action pump is one in which the plunger, as it moves forward, pushes the liquid out ahead of it and at the same time draws in liquid back of it, then, as the plunger moves back, this second amount of liquid is pushed out and a new charge drawn in behind the plunger. Thus, a complete forward and backward movement of the plunger should discharge twice the capacity of the cylinder. Such a pump requires four valves and always has the packing on the face of the plunger.

Nozzles.

Spray liquids were first applied in a solid stream, though this was usually fine enough to be broken into drops by the resistance of the air. The next step forward was to place an obstruction at the end of the nozzle so that the stream, striking against this, was spattered out in fine drops. This method is still in use in the bordeaux nozzle, a device that gives a fan-shaped spray which at high pressures—two hundred pounds or more—is mist-like. It is not adapted to fungicides, but may be used in applying poison sprays.

In eddy-chamber nozzles, the liquid is thrown into a whirling, or cyclonic, motion in an eddy-chamber from which it is discharged through a small opening. Particles leave this opening in a direction tangent to their previous rotation, thus producing a cone of spray more or less uniformly filled. There are two ways in which the rotating motion is secured in the eddy-chamber: in one, the liquid enters the chamber through openings which have much the same pitch as the thread of a screw; in the other, the liquid enters through a passage tangent to the outer edge of the eddy-chamber. The screw-thread nozzles are usually straight nozzles, that is, the lines of entrance and exit are in the same direction, and are best adapted to use in the orchard. The tangent-entry nozzles are usually at right angles to the hose or spray-rod. Some of them are well adapted to field-spraying.

At low pressures the quantity of liquid discharged by a nozzle increases rapidly with increases of pressure, but at higher pressures the increase in discharge grows less as the pressure increases (see Fig. 2291). As the pressure increases, the size of the spray particles decreases.

The front face of all eddy-chambers is made by a thin disc in the center of which there is a round hole, called the discharge-disc opening. The smaller this opening, the finer are the particles of spray and also the smaller the volume discharged in any given time. A change from a small to a large opening may double or triple the discharge. The wear of a week of spraying may so enlarge the disc-opening as to increase the discharge from 50 to 100 per cent.

With hand-pumps it is usually desirable to use the lowest pressure which will give a good spray; therefore, with such pumps, the nozzle-discs should frequently be renewed and only those with small openings used. The discs cost but a few cents. Even with the same size of disc-opening, different makes of nozzles give a satisfactory mist-spray at various minimum pressures, ranging from as low as thirty to as high as one hundred pounds; therefore a knowledge of the minimum pressure at which a nozzle may be used is desirable when one is using a hand-pump where the pressure may, at times, run low.

Sufficient emphasis has not been laid upon the importance of securing the nozzle best adapted to each purpose. From what has been said above, it is readily seen that no small part of the success of the spraying, especially when hand-pumps are used, depends upon this factor; also the cost for labor and for materials may be decreased largely by judicious selection of nozzles and discharge-discs. One may thus regulate the amount and fineness of the spray according to the size and character of the trees to be sprayed, the outfit used, and the speed of the men who direct the nozzles.

Spray-hose.

The ordinary spray-hose is made up of one to seven layers of canvas embedded in rubber. The five- and seven-ply are the best for use with power-pumps but the three-ply may be used with hand-pumps.

For spraying purposes, it is not advisable to use a hose of more than ½-inch diameter. The added weight of the larger sizes makes them too awkward to use. For the trailing hose on a power-rig one of ⅜-inch diameter is best, but for the hand-pump the ½-inch size should be used because the loss of power through friction is less in the larger size.

When one expects to use trailers, and this should always be the plan in the apple orchard, the trailing hose should be long enough so that the tower-man can spray one tree while the trailer is finishing another. Fifty feet is the usual length for the apple orchard.

The couplings are the parts to which the hose is attached and which screw into the spray-rod and to the discharge-pipe of the pump. Improperly constructed couplings may cause considerable annoyance by permitting the hose to pull off. The shank over which the hose slips should be long enough so that two hose-bands may be used to clamp the hose upon it. The holding power of the shank is increased if the surface is ridged.

Additional equipment for orchard-spraying.

With most of the spray-nozzles now in use, it is necessary to bring the nozzle within 3 or 4 feet of the branch to be sprayed, or at least to raise it as high as the branch and let the spray drift with the wind. The use of extension spray-rods is a great help in this. The rod usually consists of a bamboo cane with an iron or aluminum core. The iron core is stronger and cheaper but because of its greater weight it is not so desirable as the aluminum, especially for the longer rods. An 8-foot rod is usually long enough for peaches, pears, and low-headed apples, but in many of the older orchards in New York and New England the 10 and 12-foot rods must be used.

With most of the sprays and especially so with the first codlin-moth spray, it is desirable to drive the liquid down on the tree with one of the rods. To do this it is necessary that one man be placed in a tower which is built over the pump or water-tank. The height of the tower depends upon the height of the trees to be sprayed. Usually the tower floor is from 5 to 7 feet above the hubs. If a high tower is put on a light rig there is danger of tipping over on rough ground. Many towers are now built with an iron framework and some of these fold back upon the tank when not in use. See pages 1057–1060; also page 1295.

The orchard spray rig usually carries from 100 to 200 gallons of spray solution. Various types of tanks are used for this purpose. The usual one is a half-round tank with the rounded part resting on the trucks; round tanks standing on end, and metal tanks are also used. For temporary use in a cheap rig, two fifty-gallon oil-barrels can be used.

Most of the spray mixtures contain matter in suspension and so some means of agitating the liquid is necessary. A common method is to place two paddles so that they will swing back and forth just over the bottom of the tank and connect them by a rod to the handle of the spray-pump. In some power-sprayers a shaft is run through the tank and two propellers are placed at opposite ends, each driving the liquid toward the center.

Types of spray-rigs.

The use of the hand-pump is confined to the garden, to young trees and small orchards. It is possible to spray 4 or 5 acres of mature apple trees with a hand-rig and do the work well, provided an efficient pump is used, but with such rigs it is usually necessary to use one more man than with power-rigs and to go somewhat slower. If a careful estimate of the relative costs were made before the hand-pump is abandoned for the power-rig, many would still continue to use the slower method and, even when a power-pump is purchased, the hand-pump should be kept in good condition to use in emergencies and when the ground is too soft for the heavier outfit.

If only a few bushes are to be sprayed, one-quart syringes, costing less than a dollar, can be secured. These work on the principle of the atomizer. For the garden and a few trees, bucket-pumps are satisfactory and inexpensive though it usually requires two men to use one. Some very satisfactory one-man pumps are now manufactured on the same principle as that used in the pressure-tank of the larger pumps. An air-tight tank, holding several gallons, is half filled with the spray mixture and the remaining air is compressed by an air-pump till the desired pressure is obtained.

The barrel-pump is the commonest form of hand-pump. Its popularity is due to its being cheap, compact, sold ready to use, and having sufficient capacity for the small home-orchard. On the other hand, the up-and-down motion of the handle is very tiring and high pressures can not be maintained for any length of time.

Separate pumps, mounted on a low base and operated by the back-and-forth movement of a long, upright handle are much easier to use and will develop a very satisfactory pressure. Such a pump, either with two cylinders or double-acting, will run four low-pressure nozzles and, by using one or two barrels for the spray-tank, an efficient outfit can be provided at a reasonable cost.

The traction-pump may be driven by the rotation of the axle for field-spraying, for the vineyard, the bush-fruit plantation, or for young trees where it is possible to keep the rig moving most of the time, but it is not possible to secure sufficient power in this way to spray large trees. The greatest trouble with many of the rigs of this type which have been on the market has been that they were too complicated and, therefore, troublesome to use, and costly. The present tendency is to make rigs which are much simpler. Usually a good type of hand-pump is used and is connected to the axle by means of a pump-jack or gearing. It is necessary to have a large-size pressure-tank in order to keep a uniform spray.

When the traction-sprayer is used for field-crops and occasionally in the vineyard-spraying, the nozzles are attached to an adjustable spray-boom. When such a boom is used, care should be taken to see that the sprays from adjacent nozzles overlap before reaching the plants to be sprayed.

Gas-engine rigs are for the large commercial orchard. If the engine is to be used to run the spray-pump only, it does not need to be over two and one-half horse-power and many engines are in use which develop but a single horse-power. Some of the rigs which are planned to run saws and grinders have as high as three and one-half horse-power but this greatly increases the weight.

Simplicity of construction is one of the most desirable features, as it means less trouble in running and fewer parts to wear out. A certain degree of lightness is also desirable, provided it is not secured by a sacrifice of needed strength. Heavy, cast bases are entirely unnecessary as the desired stability can be secured by lighter angle-irons. Most power rigs have a water-cooled engine and the consensus of opinion seems to favor this type. There are, however, one or two excellent air-cooled engines on the market that have given very satisfactory service. The demands that are put upon the engine are variable and for this reason a good governor is an important aid in maintaining a uniform pressure and avoiding engine-racing. It is probably for this reason—ease in governing speed—that the hit-and-miss spark is much more commonly used than the jump spark.

The lighter and cheaper rigs are frequently made by connecting an engine of about one horse-power with some one of the more efficient hand-pumps but on most of the power outfits the pumps are especially designed for this use and are of large capacity. Because of the greater steadiness of the discharge-pressure, the more uniform amount of power required from the engine, and their greater capacity, the triplex pumps are more generally used than the duplex.

Pump and engine are connected in various ways: with some a belt or chain is used, others are connected by gears, while still others are directly connected by a shaft in which a universal joint is usually placed to avoid trouble should the alignment not be exact. It is always advisable to have them so arranged that the engine can easily be disconnected and used independently. It is quite important that pump and engine should be so placed and the pump so designed that all valves are readily accessible and also that the plunger-packing can be reached and replaced quickly.

Spray-tanks of three sizes are used, 100, 150, and 200 gallons. Two hundred gallons of water weigh over 1,600 pounds and when this is added to the weight of the rig it frequently becomes impossible to haul a loaded sprayer of this size over soft ground; on the other hand, if the water-supply is not readily available, too much time is spent in filling the smaller tanks. The larger number of the more expensive outfits with large-capacity pumps have the largest size of tank and when the ground is too wet only half a tankful is used.

In spraying orchards on steep hillsides, it sometimes is impossible to use the tower without tipping over the rig. To avoid this, some manufacturers put out sprayers with the tank hung low so as to bring the center of gravity down nearer to the axle of the truck.

A few rigs have been made in which the liquid is placed in an air-tight tank that is connected to a cylinder of compressed carbon dioxide gas, such as is used in all soda-water fountains. The expansion of the gas entering the liquid-chamber supplies the necessary pressure. These sprayers give satisfaction when used with bordeaux mixture but, when used with lime and sulfur to which has been added arsenate of lead, a chemical action takes place with the gas which releases soluble arsenic and thus causes serious burning on the foliage sprayed.

Some growers, whose orchards are on steep hillsides and where the land is too rough to take a sprayer of the usual weight, have had satisfactory results from the use of compressed air. Two metal tanks are mounted on a low two-wheeled truck. One of these is filled with the spray solution and, with a compressor which is mounted at the filling-platform, air is pumped into the second tank till a pressure of 300 to 400 pounds is reached. This pressure is then gradually turned into the liquid-tank as the solution is sprayed out. The greatest part of the cost is in the engine and compressor, but if these are used to run several sprayers the final cost is not high. There are some mechanical difficulties still to be overcome before these rigs are entirely satisfactory, yet they illustrate a method that has much to commend it.

Tools, repair parts and extras.

There are few operations on the farm in which the efficiency of the work depends as much upon the time at which it is performed as in spraying. This makes it essential that care be taken to prevent loss of time through minor troubles. The value of time spent in hunting for a certain tool to tighten a connection may be sufficient to buy the tool many times over. The first requirement is a kit of tools consisting of hammer, two wrenches,—one a pipe-wrench,—screw-driver, cold-chisel, and pliers. A collection of nuts, bolts and washers and a few feet of fine and heavy wire should be added to this. A supply of durable packing sufficient to repack all the pump-cylinders should be on hand at all times. It is well to have a piece of rubber gasket-cloth from which washers and gaskets for unions and other connections can be cut. A supply of new nozzles, nozzle-washers and especially nozzle-discs is essential. The breaking of an extension-rod is of such frequent occurrence that it is desirable to have one in reserve for such emergencies. Wherever hose is used an extra length should be carried.

With a power rig, the ignition system is usually the cause of most of the trouble. Batteries need to be replaced at least once in a season and, with a jump spark, a new spark-plug is occasionally needed. It seems almost needless to say that a plentiful supply—and liberal use—of oil and cup-grease is necessary, yet many machines are injured by lack of this.

In using a traction-sprayer for different field-crops and especially if the same sprayer is used in the vineyard, it is frequently desirable to change the arrangement of the nozzles. With a hack-saw, file, ¼-inch pipe thread-cutters, a few feet of ¼-inch pipe and a few couplings, nipples, unions and elbows, this can quickly be done.

Mixing-platforms, boilers, filling devices.

In most cases where bordeaux mixture is used, it is made on the farm as it is needed. In such cases the work is simplified by the use of a mixing-platform with the floor high enough so that the liquid can be poured directly into the spray-tank when the rig is driven to the platform. There should be space for at least four barrels. Such a platform should be placed so that water is readily available. If there is no windmill or power-driven pump, the platform should be directly over a well with the pump mounted on the floor.

A similar platform is very convenient where lime-sulfur is to be made on the farm, using steam for the boiling. The boiler can be placed on the ground or in an adjacent building and the steam piped to each barrel. For this work any boiler may be used which can develop ten or fifteen pounds pressure.

When lime-sulfur is to be made by direct heat instead of steam, any standard feed-cooker or simply a large iron kettle can be used. When any considerable amount of liquid is to be boiled, it adds greatly to the convenience if water can be piped directly to the kettle and if the lime-sulfur can be emptied directly into barrels by a siphon or a discharge-pipe from the boiler.

It is not uncommon for it to take longer to drive from the orchard to the water-supply, fill the tank and return than it takes to spray out the tank. Efficiency in spraying necessitates a convenient water-supply. If the mixing-platform is near enough, it can be used as a reservoir from which a tank-load can quickly be secured. Some of the manufacturers are now equipping rigs with either an auxiliary filling-pump or a device working on the principle of the injector and taking the power from the spray-pump. These are very convenient where an elevated supply of water is not possible. Where a nearby water-supply can not be secured it is best to haul the water to the sprayer in tank-wagons or in barrels.

R. D. Anthony.

MACKÀYA: *Asystasia.*

MACLEÀNIA (after John Maclean, British merchant at Lima, Peru, patron of botany). *Ericàceæ.* About a dozen species of shrubs in the mountains from Mexico to Peru, useful for ornament under glass but little known in cultivation. They have clusters of brick-red or crimson, tubular flowers each an inch or more long, and often bear tinted foliage.

Leaves evergreen, alternate, short-stalked, entire: corollas strongly 5-angled, and the 5 tips short, triangular, erect or spreading and more or less yellow; stamens 10, much shorter than the corolla; disk ring-like or not evident; ovary 5–6-celled, the style filiform; ovules many.—One species, *M. insignis*, is currently offered abroad. Macleanias are probably of difficult cult. *M. speciosissima* in a large pot on a shelf near the glass, so that its branches may hang gracefully, should be a very striking subject. *M. pulchra* has the same habit and color of fls., but is perhaps less desirable. *M. punctata* is perhaps the most desirable of those with erect branches and stiff habit. This may be tried in a warmhouse border, with good drainage and shallow soil, as some of these macleanias have thick fleshy roots and the fibrous parts of the roots are said to keep near the surface.

insígnis, Mart. & Gal. Young foliage on spring growths with tints of red; a small evergreen shrub: lvs. 1–2 in. long, oblong or elliptic, obtuse or subacute, coriaceous: fls. axillary, scarlet, the cylindrical corolla 1½ in. long; calyx short, minutely 5-toothed; corolla-lobes small and spreading; filaments united to form a tube. Mex. B.M. 7694. G. 32:351; 36:517.—A handsome plant both in foliage and fl. for greenhouse. Said to have been first discovered growing epiphytically on oaks at an elevation of 4,000–6,000 ft. in Province of Vera Cruz.

A number of macleanias mentioned in the literature do not appear to be regularly in the trade, as: *M. angulàta*, Hook. Lvs. ovate, rather coriaceous, obtuse and entire, those on the young shoots delicate and with a deep tinge of red: fls. axillary, in 3's; corolla nearly 1 in. long, bright red with a yellow limb. contracted at the mouth, with 5 prominent angles or ridges. Peru. B.M. 3979. H.U. 4, p. 327.—*M. longiflòra*, Lindl. Near M. angulata, but with longer and narrower lvs., and the fls. less contracted at the orifice and the lobes not yellow. B.R. 30:25. H.U. 6, p. 100.—*M. púlchra*, Hook. Branches long and drooping: lvs. rather large, glossy, elliptic or oblong, short-petioled, 5-nerved: fls. aggregated in the axils, large, about 1¾ in. long, the corolla-tube bright scarlet and the limb yellow. Colombia. B.M. 5465.—*M. punctàta*, Hook. Lvs. somewhat secund, sessile or practically so, oval, obtuse and entire, glossy and dotted: fls. crowded in upper axils, on red clavate peduncles; corolla 1 in. long, swollen below, rose-red and the upper part white tinged with yellow. Andes. B.M. 4426. G.W. 12, p. 774.—*M. speciosíssima*, Hook. Most beautiful plant in bloom: straggling shrub, with long pendent branches: lvs. distichous, 2 in. or more long, ovate or oblong-ovate, obtuse, entire: fls. many, drooping in axillary fascicles; corolla 1¼ in. long, bright scarlet, yellow above, contracted below the small limb. Colombia. B.M. 5453.

L. H. B.

2292. Osage orange fruit.—Maclura pomifera. (×½)

MACLÈYA: *Bocconia.*

MACLUDRÀNIA. *Moràceæ.* A bigeneric hybrid between *Maclura pomifera* var. *inermis* and *Cudrania tricuspidata.* (See Vol. II. p. 911.) *M. hýbrida*, André, is a small tree with yellowish furrowed bark and short woody spines: lvs. alternate, glabrous, violet beneath, oval, long-acuminate.

MACLÙRA (after Wm. Maclure, an American geologist). Syn. *Tóxylon. Moràceæ.* Osage Orange. Bowwood. Tree chiefly grown as a hedge plant, also planted as an ornamental tree for its handsome bright green foliage and the conspicuous orange-like fruit.

Deciduous, with milky sap: branches with axillary thorns: lvs. alternate, entire, slender-petioled, with minute stipules: fls. diœcious, minute, apetalous; calyx 4-lobed; the staminate pedicelled, in pendulous racemes on spur-like branchlets of the previous year; stamens 4; pistillate sessile, in axillary dense globose heads on short peduncles; ovary 1-celled with a long filiform plumose stigma: drupelets oblong, collected into a globose compound; fr. mamillate on the surface.—One species in N. Amer. It is sometimes described under Toxylon, but this name is replaced with Maclura by the "nomina conservanda" of the international rules.

The osage orange is a medium-sized spiny tree with spreading branches, forming an open irregular head, with rather large bright green leaves changing to clear yellow in fall and with inconspicuous greenish flowers followed by greenish yellow orange-like but inedible fruits in the pistillate tree. It is hardy as far north as Massachusetts. It is not particular as to the soil; its roots are very long and voracious feeders. Much planted for hedges chiefly in the Middle West. The bark of the root is used as a yellow dye; that of the trunk sometimes for tanning leather. In Europe the tree is sometimes grown as food for the silkworm. Propagation is usually by seeds, which germinate readily; also by root-cuttings and by greenwood cuttings under glass.

pomífera, Schneid. (*M. aurantìaca*, Nutt. *Tóxylon pomíferum*, Raf.). Fig. 2292. Tree, sometimes to 60 ft., with furrowed dark orange-colored bark: branchlets light green, soon glabrous: spines 2–3 in. long: lvs. ovate to oblong-lanceolate, acuminate, soon becoming glabrous, lustrous above, 2–6 in. long: racemes of staminate fls. 1–1½ in. long; heads of pistillate fls. ¾–1 in. across: fr. subglobose, 4–5 in. across, ripening in autumn and soon falling. May, June. Ark. to Texas. S.S. 7:322, 323. G.C. III. 16:693. G.M. 33:808, 809. V. 437. Var. **inérmis,** Rehd. (*M. aurantìaca* var. *inérmis*, André). A form with spineless branches. R.H. 1896, p. 33.

Alfred Rehder.

The osage orange, before the advent of wire fences, was an extremely popular hedge plant, meeting general requirements better than any other plant suitable to our climate. It is used considerably, and when properly attended to from the start makes a hedge in a short time of a fairly defensive nature. Most dealers in tree seeds keep seeds of the osage orange, and those who grow the plants procure the seed in spring, drilling it in rows. The osage orange grows readily from seed, even when the latter is a year old. The sowing in rows gives the seedlings a chance to become stocky by fall, and plants 2 feet high the first year are not uncommon. These one-year-old plants are quite good enough for hedging. Nurserymen who grow them for sale usually dig the plants in the fall, storing them away in a cool cellar, the roots buried in sand. They are then sorted into two grades, which compose first- and second-class plants. At the time of grading, the tops are chopped off somewhat, leaving about 6 inches of length only. This fits them for planting without more cutting.

The place where a hedge is desired should be well cleared of all weeds. If cultivated for a year in advance, so much the better, as it will make the keeping down of weeds a much easier task.

There are two ways of planting a hedge; viz., single row and double row. The double row is made by setting the plants 9 inches apart each way, the plants in the second row coming between those in the first row, forming a zigzag line. The single row, however, is good enough, and is much easier to cultivate and keep clear of weeds. In single rows set the plants 6 inches apart.

The soil need not be over-rich for the osage orange. The plant is a strong grower naturally, and soil in fair condition will give a growth more tractable to form a good hedge than a rank growth from rich soil.

When dug, the osage plants have very long roots, and the ends of these may be chopped off without disadvantage. If the plants are held in bunches and the roots chopped to an even length, the setting will be an easy task. The tops will have been already cut off if treated in the way above suggested.

Beyond cultivation of the plants, nothing is required the first year. By fall a good growth should have been made, and toward spring this should be cut back, leaving about 6 inches of the young growth. The season following, more care must be given to forming a hedge. When in full growth, say in July, shear off the tops of the plants. This will cause the side shoots to develop; and it is these side shoots which will form the base of the hedge. Another light trimming should be given when growth is over for the season, to bring the plants into a hedge shape. Much the same work will be required every year,—a trimming when growth is in full swing to make the hedge bushy, and another later on to shape it.

The proper shape for a hedge is the conical form, though it may be flat-sided or in any shape desired, provided the upper branches never overlap the lower.

Of late years a system of planting the osage orange differing from the one described has been followed by some. Strong two-year-old plants are procured and are planted in a slanting position. As the new growth is made it rises in an upright way as usual, and this produces a lattice-like appearance of the branches, and a very strong hedge. It is certainly stronger than a common hedge, and yet a common one properly looked after forms a defensive fence, meeting all requirements, and costs not nearly so much as the other. See *Hedges*.

Joseph Meehan.

MACÒDES (from *makos*, length; on account of the long labellum). *Orchidàceæ*. A small group of orchids of the habit of Anœctochilus.

Terrestrial herbs, with few variegated petioled lvs. at the base, and small fls. borne in a long raceme: sepals and narrower petals spreading; labellum ventricose, with 2 small lateral lobes and 2 calli inside, turned to one side; column short, twisted in the opposite direction, with 2 narrow, erect appendages.—Two or 3 species, with cult. requirements similar to those of Anœctochilus.

Pétola, Lindl. (*Anœctochìlus Veitchiànus*, Hort. *A. Pétola*, Hort.). Fls. greenish, inconspicuous: lvs. ovate, 2–3 in. long, reticulated, with golden yellow veins. Java. R.B. 21:61. G. 27:55. O.R. 17:73.

javánica, Hook. f. Sts. creeping or suberect, 6–8 in. long, rosy red: lvs. 3 in. long, 2 in. wide, dark velvety green above, with the nerves pale green and with white reticulations, reddish on the lower surface: fls. orange-red, white-tipped. Java. G.C. III. 39:216. B.M. 7037.

George V. Nash.†

MACROCHÓRDIUM (*long* or *large tube*). *Bromeliàceæ*. A few S. American plants usually referred to Æchmea. *M. strictum*, Beer, is referred by Mez to *Æchmea bromeliæfolia*, Baker. (See p. 222, Vol. I.) The species is characterized by white-scurfy lvs., simple dense, woolly spikes overtopping the foliage: fls. with yellowish green calyx and small exserted purple-black petals. *M. luteum*, Regel & Lind.= *Æchmea calyculata; M. pulchrum*, Beer, and *M. tinctorium*, De Vriese, also =*Æchmea bromeliæfolia*.

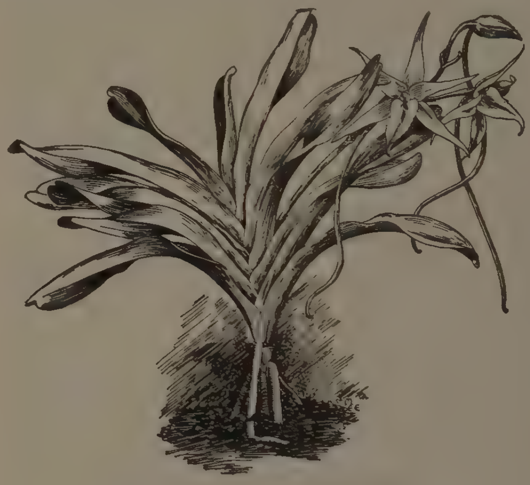
MACROPÌPER (*long* or *large piper*). *Piperàceæ*. A few shrubs of the Pacific Isls., by some included in Piper, but separated by the monopodial rather than sympodial growth of the flowering shoots, and by minor characters. Probably none is in the trade, although a form of the following is mentioned in recent horticultural literature. *M. excélsum*, Miq. (*Pìper excélsum*, Forst.). Glabrous densely branched aromatic shrub or small tree to 20 ft., in Tahiti, Norfolk Isl., New Zeal., and elsewhere: branches jointed and swollen: lvs. alternate, stalked, broad-ovate or broader, 7-nerved, yellow-green, the petiole winged below: spikes dense, solitary or in 2's, bearing minute unisexual fls.; stamens 2 or 3; stigmas 3 or 4: fr. small yellow berries, densely compacted. Var. *aùreo-pictum*, Hort., has a large cream-colored or yellow blotch on the lf. G.Z. 21, p. 74.

For *M. methysticum*, Hook & Arn., and further discussion, see *Piper*.

L. H. B.

MACROPLÉCTRUM (Greek, *long-spurred*). *Orchidàceæ*. Caulescent plants, in habit and cultural requirements like Vanda, with numerous distichous leaves, the flowers with long spurs.

Sepals and petals similar, spreading; lip rigidly attached to the base of the column, entire; column short and thick; pollinia 2, upon separate and distinct membranous caudicles.—Several species in Madagascar and the Mascarine Isls. In *M. sesquipedale*, the long spur or tail-like appendage is sometimes 18 in. long. Darwin predicted when he saw the plant first that a moth would be found some day in Madagascar with a tongue long enough to reach down to the nectar, and it was, years afterward.



2293. Macroplectrum sesquipedale.

sesquipedàle, Pfitz. (*Angræcum sesquipedàle*, Thouars. *Aëránthus sesquipedàlis*, Lindl.). Fig. 2293. Sts. 2–3 ft. tall: lvs. oblong-ligulate, 12 in. long and up to 2 in. broad, unequally 2-lobed: peduncle 2–5-fld.; fls. 5–7 in. across, fleshy, ivory-white; sepals and petals similar, acuminate; lip oblong-ovate, cordate, acuminate, irregularly serrate. Madagascar. A.G. 13:217. A.F. 7:831. Gn. 2, p. 5. F.S. 14:1413. B.M. 5113. G.M. 38:294; 47:494; 49:95. O.R. 9:49. C.L.A. 17:429. G. 18:365. G.C. III. 45:399. Gn.W. 10:421. Gt. 58, p. 55. J.H. III. 44:337; 64:393.

Leònis, Nash (*Angræcum Leònis*, Veitch. *Aëránthus Leònis*, Reichb. *Angræcum Humblòtii*, Reichb. f.). Lvs. falcate, fleshy, equitant, flattened laterally: raceme of 8 or less white fls., 2–3 in. across, on winged pedicels; sepals and petals lanceolate; lip cordate, cuspidate; spur 4–6 in. long, curiously bent a part way down in the direction of the fl. Comoro Isl. G.C. II. 24:80, 81.

George V. Nash.

MACROSCÈPIS (Greek, *long* or *large*, and *to cover*). *Asclepiadàceæ*. Tropical American climbers, somewhat grown in the warmhouse.

Tall twining, setose-hirsute: lvs. opposite, large, cordate: cymes crowded; fls. rather large and usually showy; calyx about 5-parted; corolla-tube ovoid or broadly cylindrical and constricted at the throat;

limb 5-lobed, spreading; scales of the crown 5, inflexed under the throat of the fleshy corolla; stamens inserted near base of tube, the filaments connate into a short tube: follicles hard and thick.—Species few.

ellíptica, N. E. Br. Twining, long-hirsute: lvs. 6–7 in. long, elliptic, cuspidate-acuminate, cordate at base, long-petioled: fls. 8–10 in an umbel, each fl. about 1 in. diam., resembling those of *Hoya carnosa* in shape, soft velvety brown; sepals about ⅛in. long, oblong-lanceolate; corolla 5-lobed, green at the throat; lobes of the crown fleshy, deltoid, incurved, whitish. Brazil.

L. H. B.

MACROSTÍGMA: *Tupistra.*

MACROTÒMIA: *Arnebia (A. echioides)*, by some kept as a distinct genus.

MACROZÀMIA (Greek, *long* or *large, Zamia*). *Cycadàceæ.* Cycas-like plants, grown under glass and suitable for the open far South.

The genus is less allied to Cycas than to Dioon and Encephalartos, from which it is distinguished by the following characters: lvs. pinnate: scales of the female cones peltate, the shield thickened, ascending, usually produced into an erect, acuminate blade. It is to Austral. what Encephalartos is to S. and Cent. Afr., but that genus differs, according to Bentham, in much more rigid habit and very obtuse or truncate cone-scales. It is closely allied to the American Zamia, which differs in its cones and the articulate attachment of the pinnæ. —A dozen and more species in Austral., which, like most of the members of this order, make noble foliage plants for private conservatories. They have the trunk and lvs. of cycas, except that the pinnæ have no midrib but are more or less distinctly striate, especially on the under side, with several parallel equal veins, the whole lf. occasionally twisted in some species, but not constantly so in any one. The treatment in this account is adapted from Bentham.

Macrozamias are representative rather than useful subjects, and not frequently seen. They combine poorly in any scheme of plant and flower decoration; but as single specimens, they always attract attention, and in a grouping of similar subjects, or with aloes, agaves and yuccas they make an effective combination. Their culture is easy. Sandy soil, with charcoal, to keep the soil sweet, ordinary greenhouse temperature, plenty of water during the growing season, which corresponds to our summer, and rest in winter, are the essentials. (T. D. Hatfield.)

A. *Pinnæ very narrow, often nearly terete: cones small, rarely above 4 in.; fr. very woolly.*

Paulo-Guiliélmi, Hill & Muell. (*M. plumòsa*, A. Mohr.). Trunk short, scarcely protruding from the ground, bearing the woolly bases of old petioles: lvs. 1–3 ft. long, the rachis narrow and often flat on top; pinnæ many, very narrow or even almost terete, contracted at the base: male cones about 3 in. long; females about 4 in. long and half as thick. R.H. 1877, p. 254. G.Z. 20, p. 64.

AA. *Pinnæ flat, inserted on the margins of the rachis, contracted at the base: cones 4–10 in., glabrous.*

B. *Rachis of lvs. usually raised longitudinally between the pinnæ: cone-scales much flattened.*

spiràlis, Miq. Trunk short: lvs. 2–4 ft. long: pinnæ with mostly longitudinal insertion, flat, straight or slightly falcate, to 8 or 10 in. long, slightly contracted and callous at base, lower margin slightly decurrent, marked on underside with parallel longitudinal veins: male cones 6–10 in. long, with much flattened scales; female cones usually shorter and thicker than the males, the scales with incurved short point. G.C. III. 13:74. —*M. cylíndrica*, Hort., Bentham considers a doubtful variety of *M. spiralis*, being smaller, with the narrow foliage nearly of *M. Paulo-Guilielmi*, but with a glabrous trunk and more terete rachis. *M. coràllipes*, Hook. f., has the callous base of the pinnæ bright red. B.M. 5943. G.Z. 21, p. 170.

BB. *Rachis of lvs. very flat between the pinnæ and often broad: cone-scales very thick.*

Miquélii, F. Muell. Typically with base of petioles woolly, rachis broad and flat and cone-scales thick, but variable: lvs. 2–4 ft. long; pinnæ usually longer than in *M. spiralis*, straight or falcate, the longitudinal veins finer and less prominent: male cones 6–8 in. long, cylindrical; female about as long and thicker, the scales mostly with a long point. *M. Mackénzei* is apparently a form of this species. G.Z. 22, p. 49.

AAA. *Pinnæ inserted by their broad base along the center of the upper surface of the rachis, scarcely separated by a very narrow line: cones large, pubescent, the scale points broad and often recurved.*

Peroffskyàna, Miq. (*M. Perowskiàna* and *M. Dénisonii*, F. Muell.). Large, the trunk 18–20 ft. high and 1 ft. or more diam.: lvs. 7–12 ft. long, with angular petioles; pinnæ 1–2 ft. long and ½in. broad, the parallel veins finely marked and very obscure, only slightly contracted at base: male cones ovoid, 4–6 in. long and 3–4 in. diam.; females 8–16 in. long and very thick.

Wilhelm Miller.
L. H. B.†

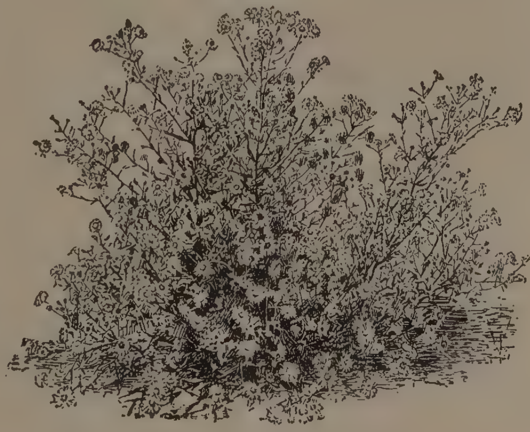
MADDÈNIA (after Major E. Madden, who wrote on Indian botany). *Rosàceæ*, subfam. *Prùneæ.* A genus of 5 shrubs or small trees allied to Prunus, especially to the section Padus, differing chiefly in the polygamous apetalous fls. with usually 10 small sepals, the staminate often with 2 abortive pistils; stamens 25–40. Only the following species is in cult., and has proved hardy at the Arnold Arboretum, but has no particular ornamental qualities. Cult. like Prunus. **M. hypoxántha,** Koehne. Shrub or small tree, to 20 ft.: branchlets sparingly hairy: lvs. membranous, oblong to lanceolate, acuminate, cordate to broadly cuneate at the base, doubly and sharply serrate, glabrous above, pubescent on the veins and bright or yellowish green beneath, 3–6 in. long, with 12–20 pairs of veins: racemes long-peduncled, dense and short; calyx about ⅓in. long, with 10 unequal small teeth, stamens about 25: drupe subglobose, black, little over ⅓in. long. May; fr. in July. W. China.

Alfred Rehder.

MADDER: Root of *Rubia tinctorum.*

MADEIRA VINE: *Boussingaultia.*

MÀDIA (*Madi*, the Chilean name of the common species). *Compósitæ.* Yellow-flowered herbs confined to the western part of the American continent, sometimes grown in the flower-garden.



2294. Madia elegans.

The nearest genus of garden value is Layia, from which Madia is distinguished by the following characters: involucre deeply sulcate, bracts strongly infolding and thus inclosing the achenes of the rays which are laterally compressed: achenes of the disk fertile or sterile. Their fls. are remarkable for closing in the sunshine, and opening in the morning or evening. Species about a dozen.

They are all called tarweeds from their glandular, viscid, heavily-scented foliage, the common tarweed of California being var. *congesta* of *M. sativa*, which is a useful annual plant for sheep pastures in dry, warm soil. *M. elegans* is an interesting ornamental annual. It has a graceful open habit (see Fig. 2294) and distinct flowers (Fig. 2295), which become more numerous as the summer advances.

A. *Rays showy.*

B. *Plant annual: lvs. chiefly alternate: pappus none.*

élegans, D. Don. Figs. 2294, 2295. Height 1–4 ft.: lvs. linear or lanceolate, mostly entire: rays acutely 3-lobed, yellow throughout or with a brown spot at the base. Calif. and Ore. to Nev. B.M. 3548. B.R. 1458.—Needs a shady place.

2295. Madia elegans. (Natural size)

BB. *Plant perennial: lvs. mostly opposite: pappus present in disk-fls.*

madioìdes, Greene (*Anìsocárpus madioìdes*, Nutt. *Màdia Núttallii*, Gray). Slender, not over 1–2 ft.: lvs. linear-lanceolate, sometimes dentate: heads paniculate, usually short-stalked. Woods, Brit. Col. to Monterey, Calif.

AA. *Rays inconspicuous, about 2 lines long.*

satìva, Molina. A glandular and sticky, heavy-scented annual about 1–3 ft.: lvs. from broadly lanceolate to linear: rays 5–12, with honey-yellow ligules about ¼in. long. Ore., Calif., Chile, perhaps native in S. Amer.

N. Taylor.†

MÆSA (from *maáss*, the Arabian name of *Mæsa lanceolata*). *Myrsinàceæ.* A group of about 100 shrubs found throughout the tropical and subtropical regions, except Amer., differing from all other Myrsinaceæ in the many-seeded fr. and the half-superior ovary. Lvs. alternate, petioled, entire or serrate, without stipules: fls. small, white, in axillary racemes or panicles, rarely terminal; calyx 5-lobed; corolla campanulate or urceolate, 5-lobed; stamens affixed to the corolla-tube, opposite the lobes, included; ovary half-superior, 1-celled, with many ovules on a central placenta; style cylindric with capitate stigma: fr. berry-like, many-seeded, crowned by the persistent calyx and style. The following species are occasionally grown in S. Calif. and *M. argentea* as a greenhouse shrub in botanical gardens in Eu. Prop. by seeds and probably by cuttings. **M. argéntea,** Wall. Large shrub with stout branches, densely brownish pubescent while young: lvs. membranous, elliptic to elliptic-oblong, dentate, dull green above and more or less pubescent on both sides, 4–8 in. long: fls. white, scarcely ⅙in. long, in short racemes ½–1 in. long: fr. globose, whitish, ⅙in. across or less. Himalayas. **M. índica,** Wall. Tree, to 30 ft.: lvs. coriaceous, glabrous, elliptic, dentate, about 5 in. long: racemes axillary, shorter than lvs. India. Bears edible berries. **M. macrophýlla,** Wall. Shrub, 6–14 ft.: branches pubescent: lvs. broadly elliptic, softly hairy on both surfaces, dentate, to 6 in.: racemes panicled, often as long as lvs.: berries rusty red, not edible. India.

Alfred Rehder.

MAGNÒLIA (after Pierre Magnol, professor of medicine and director of the botanic garden at Montpellier, 1638–1715). *Magnoliàceæ.* Woody plants grown chiefly for their showy white, pink or purple flowers and also for their handsome foliage; mostly spring-blooming.

Deciduous or evergreen trees and shrubs, with rather stout branches marked with conspicuous lf.-scars: lvs. alternate, entire; the stipules usually adnate to the petiole and inclosing the young successive lf.: fls. terminal, solitary, the buds inclosed in a stipular spathe; sepals 3, often petaloid; petals 6–15; stamens and carpels numerous, the latter connate into a spindle, developing into a cone-like somewhat fleshy or leathery fr., with dehiscent, 1–2 seeded carpels; the large, usually scarlet seeds often suspended for a time from the fr. by thin threads.—About 35 species in N. and Cent. Amer., Himalayas and E. Asia. The wood is close-grained, usually light and satiny, but not durable; that of *M. hypoleuca* is much used in Japan for lacquered ware; the bark and fr. of some species have been used medicinally as a tonic and stimulant.

The magnolias are highly ornamental and popular, with large white, pink or purple, rarely yellowish flowers, often fragrant; the cone-shaped fruits are often pink or scarlet and very decorative. Most of the deciduous species are fairly hardy, at least in sheltered positions, as far north as northern New York and Massachusetts, and *M. acuminata*, *M. Kobus* and *M. stellata* even farther north, while *M. Campbellii* is the most tender. Of the evergreen species, *M. grandiflora*, one of the most beautiful native trees, is precariously hardy north to Philadelphia. The Asiatic deciduous species are among the most showy and striking of the early-flowering trees and shrubs; the earliest is the shrubby *M. stellata*, blooming in mild climates in March, and after this *M. denudata* comes into bloom, closely followed by *M. Soulangeana* and after this *M. liliflora*. The handsomest of the deciduous species is probably *M. hypoleuca*, with the very large leaves silvery white below and with showy, sweet-scented flowers; also the American *M. macrophylla* and *M. tripetala* are conspicuous by their very large foliage. The magnolias are usually planted as single specimens on the lawn, and there are, perhaps, no plants more striking against a background of dark green conifers. Some species, as *M. grandiflora* in the South and *M. acuminata* farther north, are fine avenue trees. The magnolias thrive best in somewhat rich, moderately moist and porous soil, preferring sandy or peaty loam, but some kinds which usually grow naturally on the borders of swamps, as *M. glauca*, thrive as well in moist and swampy situations. Transplanting is difficult and is most successfully performed just when the new growth is starting. Propagation is by seeds sown immediately or stratified, and by layers of last year's growth put down in spring and tongued or notched. Layers are usually severed and transplanted the following spring, but as many of them die after transplanting, it is a safer way to take them off early in July, when the new growth has ripened, plant them in pots and keep in a close frame until they are established. Varieties and rarer kinds are often veneer- or side-grafted in early spring or summer on potted stock in the greenhouse or frame; as a stock *M. tripetala* is perhaps the best on account of its better fibrous roots, which render transplanting safer, but *M. acuminata* is also a good stock. Sometimes increased by greenwood cuttings taken with a heel and handled under glass.

Magnolias in the South.

Evergreen kinds. (P. J. Berckmans.)

Among the finest magnolias cultivated in the South are the two native evergreen species, *M. grandiflora* and

LXVII. Magnolia Soulangeana, the commonest hybrid magnolia in the North.

M. glauca, and the exotics *M. Coco* (*M. pumila*) and *M. fuscata*, the last being now referred to Michelia. *Magnolia grandiflora* is a noble tree. It is native of the middle and southern sections of Georgia, South Carolina, Alabama, Louisiana and the upper districts of Florida, and is recognized as one of the grandest of all broad-leaved evergreen trees. In its native habitat it attains a height of 75 to 100 feet, with very large, oval or lanceolate coriaceous leaves. The latter vary, however, from very broad to rather narrow, some with a rusty under surface, others quite smooth. The flowers vary also in size, the largest frequently measuring 10 to 12 inches in diameter when fully expanded; others do not attain more than half that size. They appear early in May, in some sections during the latter part of April, and continue until the end of June. Some trees produce a few flowers during August, and even as late as October, but these are exceptions. Each flower lasts from two to four days, when the petals fall and the cone-like fruit appears. This gradually increases in size until September, when the bright coral-red seeds are detached and hang on long filaments. The seed should be gathered when fully ripe, put in dry sand until February in the South, then in moist sand for a week or ten days, when the resinous cuticle can be removed by washing. Sow the cleaned seed in a box or coldframe, and as the plants show their second leaves pot off in small pots. In July, give a larger-sized pot, and the plants will be sufficiently large to plant in permanent place during the following autumn or winter. It is always advisable to take pot-grown plants, as they succeed better than plants taken up with bare roots. Magnolias are voracious feeders, and require rich soil and an abundance of plant-food. Their roots extend to a great length, and to bring out the stately beauty of this tree they should be given ample space. The wood is white, and valued for cabinet-work. There are many forms cultivated in European nurseries, their main characteristics being in the size and form of the leaves and size of flowers. They are propagated by grafting, either by inarching or cleft- or tongue-graft. The latter should be done under glass, taking two-year-old pot-grown seedlings. The fragrance of the flowers varies also, some flowers being more pungent than others, but, as a rule, the fragrance is pleasant. The principal varieties are *M. grandiflora* var. *gloriosa*, with flowers often measuring 14 inches in diameter; foliage broad and massive, brown on under surface. The tree seldom grows beyond 40 feet. Var. *præcox*, or early-flowering. Var. *rotundifolia*, with very dark green roundish leaves, rusty underneath.

Magnolia glauca, the sweet bay, is an evergreen tree in the southern states, becoming deciduous northward. It attains a height of 30 feet in rich bottoms or swampy lands: leaves oval, long or elliptical, with a glaucous under surface: flowers white, 3 to 4 inches in diameter, very fragrant, and produced from May to July. This tree is not sufficiently appreciated as an ornamental in landscape gardening.

Magnolia Coco (*M. pumila*, or *Talauma pumila*) is a very dwarf Chinese species, seldom growing more than 4 or 5 feet high: leaves smooth, elliptical, sharp-pointed, coriaceous: flowers 1 to 1½ inches in diameter, white or slightly tinged green, with six to nine fleshy petals, which drop soon after the flowers expand. The fragrance is intense at night, and resembles a ripe pineapple. It thrives best in a rich, partially shaded soil, but a frost of 10° below the freezing-point will injure it. It is therefore best to grow it as a conservatory plant. Propagate by ripened wood cuttings in bottom heat. As this plant is in bloom during nearly the whole year, and its delicate fragrance is unsurpassed, it is strange that it is so little known.

Deciduous kinds. (L. A. Berckmans.)

Magnolia acuminata (cucumber tree) is an upright-growing variety, with spreading branches, especially desirable for the upper sections, where it attains an immense size: leaves oblong, bright green: greenish yellow flowers produced in late spring.

Magnolia cordata is an exceedingly rare variety found only near Augusta, Georgia, and the western part of South Carolina: leaves oval: flowers about 3 inches long, lemon-yellow. Forms a small tree. Does well in sandy soil.

Magnolia denudata (Yulan) is a native of China with pure white flowers produced in early spring before the leaves appear. It attains an ultimate height of not more than 20 feet.

Magnolia Fraseri has leaves 8 to 12 inches long and produces white flowers 3 to 4 inches wide. This is a hardy variety and is especially adapted to the upper section. Attains a height of 25 to 50 feet. Found naturally from Virginia to Florida.

2296. Magnolia Thompsoniana. (×¼)

Magnolia Kobus, from Japan, is of pyramidal growth with short and slender branches: leaves 4 to 5 inches long: flowers pure white, appearing before the leaves. A desirable early-flowering species.

Magnolia macrophylla (great-leaved magnolia) is a symmetrical-growing variety with wide, spreading branches, growing naturally as far south as Florida: leaves 18 to 24 inches in length, 9 to 10 inches wide, bright green above, silvery beneath: flowers 10 to 12 inches in diameter, white, disagreeable odor. Tree attains a height of 20 to 50 feet.

Magnolia Soulangeana (Soulang's magnolia) is a magnificent tree of garden origin and is supposed to be a hybrid between *Magnolia liliflora* and *Magnolia denudata:* leaves dark green, expanding after the flowers have passed: flowers large, cup-shaped, creamy white, more or less suffused with pink; blooms in March: hardy: ultimate height, 25 feet. Var. *nigra* (dark-flowered magnolia) is a variety of vigorous and robust growth: flowers large, dark purple, several shades darker than *Magnolia liliflora*, a free bloomer; begins to bloom in March and blooms spasmodically during the entire summer. In var. *Lennei* (Lenne's magnolia) the flowers are deep crimson on the outside; blooms a little later than the type. Var. *speciosa* is almost identical in color with the species but more cup-shaped and petals broader.

Magnolia stellata (*M. Halleana*, starry magnolia) is of dwarf habit: flowers semi-double, pure white and very fragrant. Blooms from two to three weeks earlier than any other magnolia; very hardy.

Magnolia tripetala (umbrella magnolia) is a tree 20 to 40 feet high: leaves dark green, light underneath: flowers 8 to 10 inches in diameter, white: leaves 10 to 21 inches long, 6 to 8 inches broad. Found from Pennsylvania to Mississippi.

INDEX.

acuminata, 11.
alba superba, 20.
Alexandrina, 20.
angustifolia, 15.
auriculata, 2.
borealis, 18.
Brozzonii, 20.
Campbellii, 23.
Coco, 16.
conspicua, 21.
cordata, 11.
cyathiformis, 20.
Delavayi, 14.
denudata, 19, 21.
discolor, 19.
elongata, 21.
exoniensis, 15.
fœtida, 15.
Fraseri, 2.
galissoniensis, 15.
glauca, 5, 12.
gloriosa, 15.
gracilis, 19.
grandiflora, 15.
grandis, 20.
Halleana, 22.
hypoleuca, 6.
Kathariniana, 15.
Keiskei, 22.
Kobus, 18.
lanceolata, 15.
Lennei, 20.
liliflora, 19.
longifolia, 12.
macrophylla, 1.
major, 5.
Nicholsoniana, 7.
Niemetzii, 20.
nigra, 19.
Norbertiana, 20.
obovata, 6, 15, 19.
oxoniensis, 15.
Oyama, 10.
parviflora, 8, 10.
præcox, 15.
Pravertiana, 15.
precia, 21.
pumila, 16.
purpurascens, 21.
purpurea, 19.
pyramidata, 3.
rosea, 22.
rotundifolia, 15.
rustica, 20.
salicifolia, 15, 17.
Soulangeana, 19, 20.
speciosa, 20.
splendens, 13.
stellata, 22.
stricta, 15.
Thompsoniana, 5.
Thurberi, 18.
tripetala, 4.
triumphans, 20.
Umbrella, 4.
virginiana, 12.
Watsonii, 9.
Wilsonii, 8.
Yulan, 21.

KEY TO THE SPECIES.

A. *Blossoms appear after or with the lvs.: fr. subglobose to oblong, cone-like, usually symmetrical.*
B. *Foliage deciduous.*
C. *Fls. white, large.*
D. *Base of lvs. cordate.*
E. *Lf.-buds and branches tomentose: lvs. scattered, 20–30 in. long*.................. 1. **macrophylla**
EE. *Lf.-buds and branches glabrous: lvs. crowded at the end of the flowering branchlets, 5–12 in. long.*
F. *Lvs. acute: tips of mature carpels nearly straight*... 2. **Fraseri**
FF. *Lvs. obtusely pointed: tips of mature carpels incurved*................ 3. **pyramidata**
DD. *Base of lvs. narrowed, rarely rounded or subcordate.*
E. *Length of lvs. 5–24 in.; lvs. crowded at the end of the branches: buds and branchlets glabrous.*
F. *Filaments whitish: fr. 2½–4 in. long.*
G. *Fls. 8–10 in. across: lvs. 12–24 in. long*........ 4. **tripetala**
GG. *Fls. 5–6 in. across: lvs. 5–9 in. long*.......... 5. **Thompsoniana**
FF. *Filaments purple: fr. 5–7½ in. long*............ 6. **hypoleuca**
EE. *Length of lvs. 3–7 in.; lvs. scattered.*
F. *Shape of lvs. elliptic-oblong to oblong-lanceolate, 3–5 in. long.*
G. *Under side of lvs. glabrous except the rufous-pubescent midrib*..... 7. **Nicholsoniana**
GG. *Under side densely silky tomentose*....... 8. **Wilsonii**
FF. *Shape of lvs. oval to elliptic, sparingly appressed pubescent beneath or glabrous, 4–7 in. long.*
G. *Peduncles and petioles glabrous or nearly so: fls. short-stalked*...... 9. **Watsonii**
GG. *Peduncles and petioles pubescent: fls. slender-stalked*..............10. **parviflora**
CC. *Fls. greenish or yellow: lvs. 7–10 in. long, sometimes rounded or subcordate at the base*..........11. **acuminata**
BB. *Foliage evergreen (half-evergreen or deciduous N. in No. 12).*
C. *Petals 6–12; fls. upright.*
D. *Lvs. glabrous or silky pubescent beneath.*
E. *Number of petals 9–12: deciduous or half-evergreen.*12. **glauca**
EE. *Number of petals 7 or 8: evergreen trees.*
F. *Length of lvs. 5–7 in., obtusely acuminate: petals 1½ in. long*......13. **splendens**
FF. *Length of lvs. 8–12 in., usually rounded: petals 4 in. long*.............14. **Delavayi**
DD. *Lvs. ferrugineous-pubescent beneath: petals 6–12, 3–5 in. long*.....................15. **grandiflora**
CC. *Petals 6; sepals green; fls. nodding, globular, 1½ in. across*........16. **Coco**
AA. *Blossoms appearing before the lvs. (with the lvs. in No. 19): fr. cylindric, unsymmetrical, usually curved and twisted.*
B. *Sepals 3, narrow and much shorter than petals.*
C. *Fls. white.*
D. *Lvs. oblong-lanceolate or narrow-elliptic, broadest below the middle, membranous*........17. **salicifolia**
DD. *Lvs. obovate to obovate-oblong, broadest above the middle, chartaceous*................18. **Kobus**
CC. *Fls. purple, rarely nearly white.*
D. *Sepals much shorter than petals, green, lanceolate; petals purple outside*.................19. **liliflora**
DD. *Sepals usually half as long as petals, usually petaloid; fls. sometimes nearly white*......20. **Soulangeana**
BB. *Sepals and petals alike.*
C. *Petals 9, usually white: lvs. obovate, 3–6 in. long*..............21. **denudata**
CC. *Petals 9–18.*
D. *Lvs. obovate-oblong, 2–3½ in. long: fls. 3 in. across, usually white*.......................22. **stellata**
DD. *Lvs. elliptic to elliptic-oblong, 5–12 in. long: fls. 6–10 in. across, pink outside* ....23. **Campbellii**

1. **macrophýlla,** Michx. LARGE-LEAVED CUCUMBER TREE. Tree, to 50 ft., with spreading branches: lvs. oblong-obovate, blunt, subcordate-auriculate at the base, glaucescent and finely pubescent beneath, 1–3 ft. long: fls. cup-shaped, fragrant, 10–12 in. across; petals 6, oblong-obovate, thick, purplish at the base, 6–7 in. long: fr. broadly ovate, rose-colored, to 3 in. long. May, June. Ky. to Fla., west to Ark. and La. S.S. 1:7, 8. B.M. 2981. G.F. 8:165. Gn. 22, p. 28; 24, p. 509; 33, p. 539. F.R.S. 1, p. 14. F.E. 14, p. 23. G.C. III. 28:324. Gn. M. 7:230.

2. **Fràseri,** Walt. (*M. auriculàta*, Lam.). Tree, to 40 ft., with wide-spreading branches, quite glabrous: lvs. spatulate-obovate, cordate-auriculate at the base, acute, glaucescent beneath, 8–20 in. long: fls. 6–9 in. across, sweet-scented; petals 6–9, oblong-obovate, contracted below the middle, 4–5 in. long: fr. oblong, bright rose-red, 3–5 in. long. Va. to Fla., west to Miss. S.S. 1:11 and 12. B.M. 1206. Gn. 22 p. 27; 24, p. 511; 44, p. 935. F.E. 33:1071. Gn.M. 5:150. C.L.A. 5:494.

3. **pyramidàta,** Pursh. Slender tree, to 30 ft., with ascending branches, glabrous: lvs. obovate-spatulate, cordate-auriculate at the base, abruptly narrowed into a blunt point, glaucescent beneath, 5½–8½ in. long: fls. 3½–4 in. across; sepals much shorter than petals; petals 6–9, oblong-obovate, gradually narrowed toward the base: fr. oblong, bright rose, 2–2½ in. long. June. Ga. to Fla. and Ala. S.T.S. 1:51. S.M. 324. B.R. 407. L.B.C. 11:1092.

4. **tripétala,** Linn. (*M. Umbrélla*, Lam.). UMBRELLA TREE. Tree, to 40 ft., with spreading branches, forming an open head: lvs. tapering toward the base, oblong-obovate, acute, pale and pubescent beneath when

young, 12–24 in. long: fls. 8–10 in. across, of a disagreeable odor; petals 6–9, oblong-obovate, 4–5 in. long; sepals recurved, light green: fr. rose-colored, ovate-oblong, 2½–4 in. long. May. Pa. to Ala., west to Ark. and Miss. S.S. 1:9, 10. Gn. 22, p. 27; 24, p. 509; 33, p. 539. C.L.A. 5:494.

5. **Thompsoniàna,** Sarg. (*M. glaùca* var. *màjor*, Sims. *M. glaùca* var. *Thompsoniàna,* Loud.). Fig. 2296. Hybrid of *M. glauca* and *M. tripetala.* Shrub or small tree: branches and buds glabrous: lvs. oval to oblong, acute, glaucescent beneath and pubescent when young, 5–9 in. long: fls. white, fragrant, 5–6 in. across; sepals shorter than the petals, yellowish. June, July. G.F. 1:269 (adapted in Fig. 2296). B.M. 2164. Gn. 24, p. 511.—Of garden origin; tenderer than either one of the parents.

6. **hypoleùca,** Sieb. & Zucc. (*M. obovàta*, Thunb.). Fig. 2297. Tree, to 100 ft. high, with broad, pyramidal head: branches purplish: lvs. obovate to obovate-oblong, obtusely pointed, glaucous and appressed pubescent beneath, 8–14 in. long: fls. 6–7 in. across, cup-shaped, fragrant, with 6–9 petals; stamens with purple filaments: fr. oblong-cylindric, scarlet, to 8 in. long. May, June. Japan. G.F. 1:305 (adapted in Fig. 2297). Mn. 3, p. 73. B.M. 8077. F.S.R. 3, p. 251. S.I.F. 1:39. G. 27:659. Gn.M. 5:151. G.W. 3, pp. 85, 87. M.D. 1904:1; 1912, p. 337.—One of the most beautiful of the deciduous species, the under side of the lvs. being almost silvery white; about as hardy as *M. macrophylla.* The name *M. hypoleuca* is used here, instead of the oldest name, *M. obovata,* to avoid confusion, as the latter name has been applied erroneously by most botanists to the plant named here *M. liliflora* (for further remarks on the nomenclature of this and other species, see Sargent, Plant. Wilson. 1:400, 403, 406).

7. **Nicholsoniàna,** Rehd. & Wilson. Shrub or small tree, to 20 ft.: branchlets sparingly pubescent: lvs. slender-petioled, elliptic-oblong to obovate-oblong, acute or short-acuminate, glabrous above, glaucescent beneath and glabrous except the densely rufous-pubescent midrib, 3–5 in. long.: fls. white, cup-shaped, about 4 in. across; sepals and petals usually 12, the inner row shorter; filaments and carpels red: fr. oblong-cylindric, 1⅓–2 in. long. June. W. China.

8. **Wìlsonii,** Rehd. (*M. parviflòra* var. *Wìlsonii*, Finet & Gagnep.). Shrub or small tree, to 20 ft.: branchlets pubescent: lvs. slender-petioled, elliptic-lanceolate, rarely elliptic-ovate, acute or short-acuminate, sometimes subcordate at the base, glabrous above, densely silky tomentose beneath, 3–5 in. long: fls. white, cup-shaped, fragrant, 4–5 in. across; sepals and petals usually 9, of equal size; filaments and carpels red: fr. oblong-cylindric, about 2½ in. long. June. W. China.

2297. Magnolia hypoleuca. (×⅓)

9. **Wàtsonii,** Hook. Closely allied to the former: almost glabrous, except lvs. beneath when young: lvs. obovate to oblong, 4–7 in. long: fls. short-stalked, 5–6 in. across, with 6–9 petals: carpels many. June. Japan. B.M. 7157. G.C. III. 16:189; 17:517. Gt. 48:1459. Gng. 1:8. Gn. 24:508 (as *M. parviflora*) probably belongs here. G.M. 34:305. Gn.M. 5:151. R.B. 31, p. 258. C.L.A. 5:495.—Very handsome in bloom; the beauty of the large, sweet-scented fl. is much heightened by the crimson center, formed by the bright colored stamens.

10. **parviflòra,** Sieb. & Zucc. (*M. Oyàma,* Kort). Small tree: branchlets and buds appressed pubescent: lvs. elliptic to obovate-oblong, obtusely pointed, glaucescent beneath and pubescent at first, 4–6 in. long: fls. long-pedicelled, cup-shaped, white, with large pink sepals, 3–4 in. across, fragrant; petals usually 6; stamens crimson: carpels few. June. Japan. B.M. 7411. Gn. 54, p. 177; 60, p. 81. F.S.R. 2:88. G. 33:373; 36:591. Gng. 1:8; 3:3. G.M. 38:66.

2298. Magnolia glauca. (×¼)

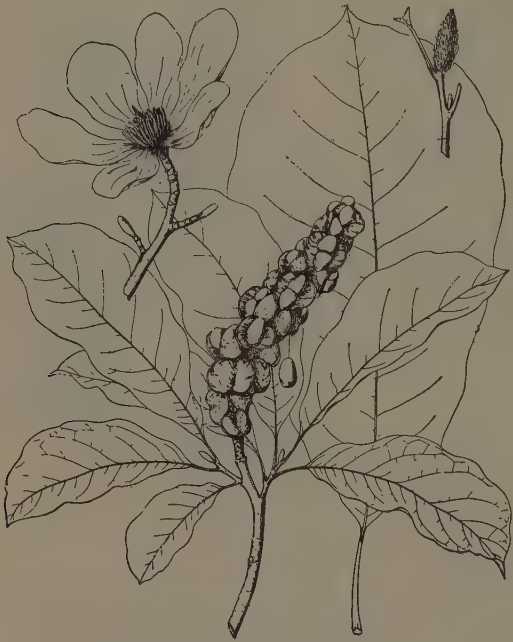
11. **acuminàta,** Linn. Cucumber Tree. Tall, pyramidal tree, to 90 ft.: lvs. oval to oblong, shortly acuminate, rounded or acute at the base, soft pubescent and light green beneath, 6–9 in. long: fls. greenish yellow or glaucous green, about 2–3½ in. high, with upright petals: fr. cylindric, pink, 3–4 in. long. May, June. N. Y. to Ga., west to Ill. and Ark. S.S. 1:4 and 5. B.M. 2427. L.B.C. 5:418. Gn. 24, p. 509. F.E. 20:64 (pl. 102); 32:331. R.H. 1912, p. 427. Var. **cordàta,** Sarg. (*M. cordàta,* Michx.). Lvs. broader, rounded or sometimes cordate at the base: fls. smaller, canary-yellow. S. C., Ala. S.S. 1:6. B.M. 2427. L.B.C. 5:474. Gn. 22, p. 27; 24, p. 509.

12. **glaùca,** Linn. (*M. virginiàna,* Morong). Sweet, Swamp or White Bay. Beaver Tree. Fig. 2298. Attractive shrub or small tree, evergreen S.: lvs. oval to oblong-lanceolate, glaucous beneath and silky-pubescent at first, 3–6 in. long: fls. white, globose, fragrant, 2–3 in. across; sepals nearly as large as petals, spreading; petals 9–12, roundish obovate: fr. pink, 1–2 in. long. May, June. Mass. to Fla. near the coast, in the S. extending west to Texas. S.S. 1:3. Em. 2:603. L.B.C. 3:215. R.H. 1894, p. 347. G.F. 10:403. C.L.A. 5:493. G.W. 14, p. 205. Gng. 4:342. Gn. 78, p. 378.—A very desirable shrub, with handsome, glossy foliage and sweet-scented, creamy white fls. Var. **longifòlia,** Loud., has lanceolate lvs. and continues blooming during a longer time than the type.

13. **spléndens,** Urban. Laurel Sabino. Evergreen tree, to 80 ft.: branchlets appressed-pubescent: lvs. ovate or elliptic-ovate, obtusely acuminate, rounded at the base, glabrous and glossy above, covered with a lustrous silky tomentum beneath, 4–7 in. long: fls. on stalks ¾ in. long; sepals 3, green, obovate-oblong; petals about 8, white, obovate, 1¾ in. long: fr. oval, about

½in. long. June–Aug. Porto Rico.—Suited for tropical and subtropical regions only.

14. **Delavàyi,** Franch. Evergreen shrub or tree, to 30 ft.: branchlets glabrous: lvs. ovate to ovate-oblong, obtuse and usually mucronate, rounded at the base, glabrous above except the midrib, puberulous beneath and pruinose, pubescent on the midrib, 8–13 in. long: fls. creamy white, fragrant; sepals 3, oblong, 3½ in. long; petals about 7, oblong-obovate or spatulate-obovate, 3¼–4¼ in. long: carpels tomentose below: fr. ovoid-oblong, 4¼–5½ in. long. July. W. China. B.M. 8282. G. 35:639.—Probably as hardy as *M. grandiflora.*



2299. Magnolia Kobus var. borealis. (×¼)

15. **grandiflòra,** Linn. (*M. fœtida,* Sarg.). Bull Bay. Tall evergreen tree, to 80 ft., of pyramidal habit: branchlets and buds rusty-pubescent: lvs. thick and firm, oblong to obovate, glossy above, ferrugineous-pubescent beneath, sometimes glabrous at length, 5–8 in. long: fls. white, fragrant, 7–8 in. across; sepals large, petaloid; petals 6–12, obovate; stamens purple: fr. oval or ovate, rusty brown and pubescent, 3–4 in. long. May–Aug. N. C. to Tex. S.S. 1:1, 2. Gn. 22, p. 28; 24, pp. 509, 511; 33, p. 538. J.H. III. 52:237. G. 2:567; 9:225; 19:153; 36:187. G.W. 3, p. 377. F.E. 17:788, p. 781. Var. **angustifòlia,** Loud. (var. *salicifòlia,* Hort.). Lvs. lanceolate, wavy. Var. **lanceolàta,** Ait. Lvs. oblong-lanceolate or oblong-elliptic, less rusty beneath. B.M. 1952. L.B.C. 9:814. There are many other named varieties, as: var. **gloriòsa,** Hort., with fls. to 14 in. across and broad lvs.; var. **rotundifòlia,** Hort., with very dark green roundish lvs.; var. **prǽcox,** Hort., early-flowering; var. **obovàta,** Nichols., with obovate-oblong lvs.; var. **Kathariniàna,** Bedelian, with very broad lvs. and smaller fls. with narrower petals; var. **galissoniénsis,** Hort., one of the hardiest forms; var. **Pravertiàna,** Hort., of stubby pyramidal habit; var. **exoniénsis,** Loud. (var. *strícta,* Hort. *M. oxoniénsis,* Hort.), of vigorous growth and narrow pyramidal habit: lvs. oblong-elliptic, usually rusty beneath: fls. somewhat contracted. Blooms early and freely.

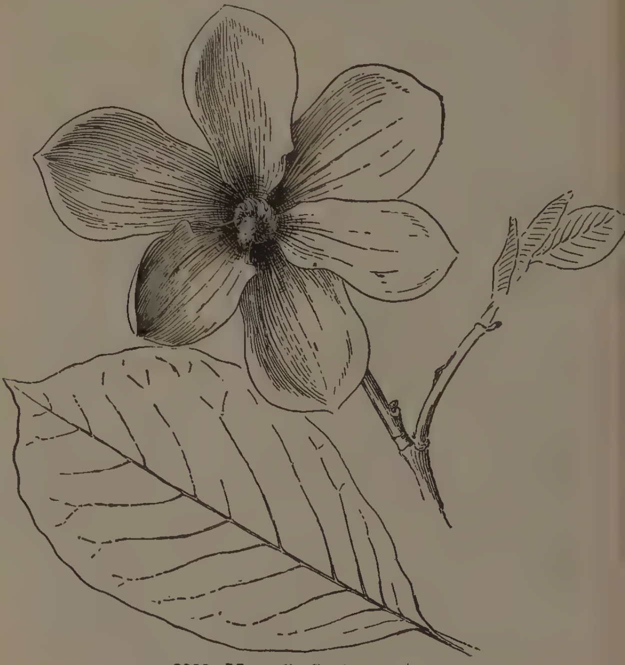
16. **Còco,** DC. (*M. pùmila,* Andr. *Talaùma pùmila,* Blume). Shrub, to 12 ft.: lvs. elliptic-oblong, acuminate, glabrous, glaucescent beneath, 3–6 in. long: fls. axillary, nodding on short-curved pedicels, globose-ovate, white, fragrant, about 1¼ in. across; petals 6. China. B.M. 977. G.W. 14, p. 220.—Cult. S.

17. **salicifòlia,** Maxim. Slender tree, to 20 ft.: branchlets and buds glabrous: lvs. elliptic-ovate to ovate-lanceolate, acuminate, sometimes bluntly so, broadly cuneate at the base, yellowish green above, glaucescent beneath, glabrous, 3–6 in. long: fls. short-stalked, about 5 in. across, white; sepals lanceolate, greenish white, half as long as petals; petals 6, narrowly oblong-obovate, 2–2½ in. long: fr. cylindric, 1½–3 in. long. April. Japan. B.M. 8483. G.C. III. 51:223. G.F. 6:67. S.I.F. 1:40. M.D.G. 1910:542, 543. Gn. 78, p. 196.

18. **Kòbus,** Thunb. (*M. Thúrberi,* Hort.). Tree, to 80 ft., with narrow pyramidal head: branchlets glabrous, slender: lvs. broadly obovate, abruptly pointed, tapering toward the base, pubescent below at first, 3½–6 in. long: fls. 4–5 in. across; sepals very small and narrow; petals 6, spreading, thin, 2–2½ in. long: fr. slender, dark brown, 4–5 in. long. April, May. Japan. B.M. 8428. G.C. III. 37:264. S.I.F. 1:39. M.D.G. 1902:529. S.T.S. 2:126. —One of the hardiest species but less showy; seems not to flower very profusely. Var. **boreàlis,** Sarg. Fig. 2299. Larger lvs., fls. and frs. than the type. G.F. 6:66 (adapted in Fig. 2299).

19. **liliflòra,** Desrouss. (*M. obovàta,* Willd., not Thunb. *M. díscolor,* Vent. *M. purpùrea,* Curt. *M. denudàta,* Schneid., not Desrouss.). Usually large shrub, with stout branches: lvs. obovate or oval-obovate, acute or acuminate, pubescent beneath at first, 4–7 in. long: fls. large, campanulate, white inside, purple outside, scentless; petals broad, obtuse, somewhat fleshy, about 3½ in. long; sepals small, ovate-lanceolate, greenish yellow: fr. brownish, ovate-oblong. May, June. China, Japan. B.M. 390. Gn. 22, p. 485; 24, p. 511; 46, p. 49. F.E. 9:611; 17:528 (pl. 74). Var. **grácilis,** Rehd. (*M. grácilis,* Salisb.). Smaller shrub, with slender branches, narrower lvs. and smaller fls., dark purple outside. Var. **nìgra,** Rehd. (*M. Soulangeàna* var. *nìgra,* Nichols.). Fls. dark purple outside, pink inside (Gn. 25:276).

20. **Soulangeàna,** Soul. (*M. denudàta* × *M. liliflòra*). Fig. 2300. Intermediate between the parents. Popular



2300. Magnolia Soulangeana. (×¼)

large shrub or small tree: lvs. obovate to obovate-oblong: fls. large, campanulate, white, more or less purplish outside, often fragrant; sepals usually colored, sometimes almost as long, sometimes hardly half as long as petals, rarely small and greenish. May. A.G. 15:283. B.R. 1164. Gn. 59, p. 241; 66, p. 76; 76, p. 135. F.R. 8:3. R.H. 1912, p. 373. F.E. 15:482 (pl. 51). Gt. 5:166 and 168. Var. **Lennéi,** Rehd. Nearer to *M. liliflora.* More shrubby: fls. large, deep crimson outside, late. F. 1864:25. V. 5:196. G. 26:316. G.M. 53:1031. G.L. 24:7. Var. **Niemétzii,** Hort. A fastigiate form.

There are many other named varieties, varying in color and flowering-time, as var. **Alexandrìna,** Hort., fls. outside toward the base deep purple, white inside, one of the earliest (Gn. M. 5:149. R.B. 26:217. R.H. 1912, p. 370); var. **álba supérba,** Hort., white (G. 33:449); var. **Brozzònii,** Hort., fls. white, shaded purple (G. 34:429, 431); var. **cyathifórmis,** Hort. Rinz., cup-shaped, light purple; var. **grándis,** Hort. Rinz., white, outer petals purple at base and in the middle; var. **Norbertiàna,** Hort., white and light purple, one of the latest to bloom; var. **rústica** (*M. rústica fl. rùbro,* Hort.), deep purple outside (F.S.R. 1:16. G. 29:201); var. **speciòsa,** Hort., white, striped purple outside; var. **triúmphans,** Hort., pink toward the base outside. These hybrids are among the most popular magnolias on account of their early, bright-colored fls.: they are showier and hardier than the preceding species.

21. **denudàta,** Desrouss. (*M. précia,* Correa. *M. conspícua,* Salisb. *M. Yùlan,* Desf.). Fig. 2301. Tree, to 50 ft., with spreading branches: lvs. obovate or obovate-oblong, shortly pointed, pubescent beneath when young, 4–7 in. long: fls. large, campanulate, white, sweet-scented, about 6 in. across; petals and sepals almost alike, 9, concave, fleshy, 3–4 in. long: fr. brownish, 3–4 in. long, slender. April, May. Cent. China. B.M. 1621. L.B.C. 12:1187. G.C. III. 9:591.; 36:59. Gn. 21, p. 311; 23, p. 138; 24, p. 511; 31, p. 505; 34:667; 45, p. 365; 46, p. 145; 51, p. 474. G.M. 31:289; 36:386; 44:181. G. 26:47. C.L.A. 3:173. M.D.G. 20:253. G.W. 14, p. 206.—One of the most showy species. Var. **purpuráscens,** Rehd. & Wilson (*M. conspícua* var. *purpuráscens,* Maxim.). Fls. rose-red outside, pale pink within. Var. **elongàta,** Rehd. & Wilson. Lvs. longer and larger: fls. larger, white.

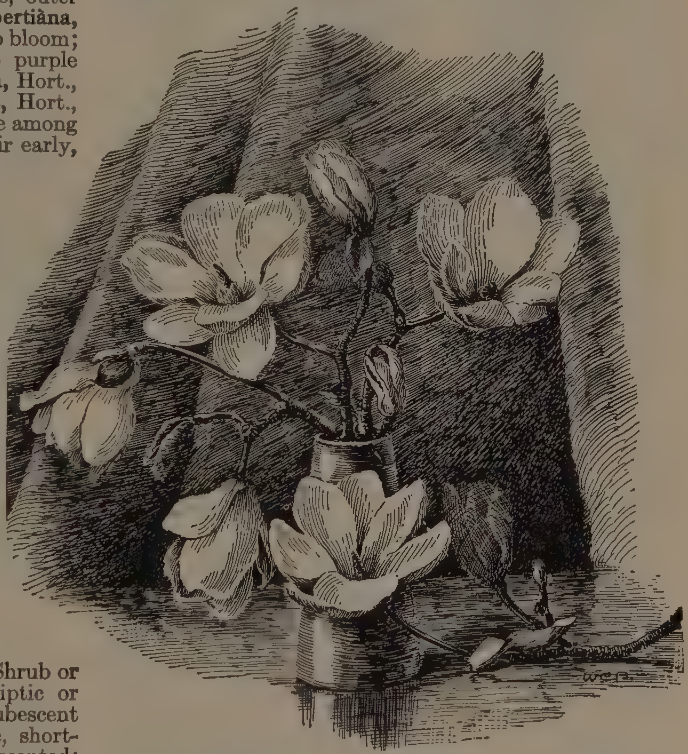
22. **stellàta,** Maxim. (*M. Halleàna,* Hort.). Shrub or small tree, with spreading branches: lvs. elliptic or obovate to oblong-obovate, obtusely pointed, pubescent beneath when young, 2–5 in. long: fls. white, short-stalked, numerous, about 3 in. across, sweet-scented; petals narrow-oblong, 9–18, spreading and afterward reflexed: fr. with only few fertile carpels. March, April. Japan. B.M. 6370. R.H. 1878:270. Gn. 13:572; 61, p. 379; 75, p. 240; 77, p. 145; 78, p. 117. G.F. 9:195. G.C. III. 7:617; 17:521; 39:260, 261. Gng. 2:57. A.F. 6:305. F.E. 9:611; 15, pl. 318, 616 (pl. 53). G.M. 38:489; 44:180; 50:293; 57:769. Gn.M. 3:267; 5:141, 150. Gn.W. 20:15. Gt. 52, p. 409. M.D.G. 1909:289. G.W. 5, p. 113; 14, p. 207. F.M. 1878:309.—Quite hardy and very free-flowering; it begins to flower when hardly 2 ft. high. Var. **ròsea,** Hort. Fls. blushed outside. R.B. 30, p. 85. J.H.S. 27, p. 865. Var. **Keìskei,** Makino. Densely branched shrub: fls. smaller, purple outside. Not yet intro.

23. **Cámpbellii,** Hook. f. & Thoms. Tree, to 80 ft.: lvs. elliptic-oblong or ovate, abruptly acuminate, glaucous beneath and silky pubescent when young, 5–12 in. long: fls. cup-shaped, 6–10 in. across, white and pink inside, shaded with crimson outside; petals obovate, 9–15: fr. greenish brown, 6–8 in. long. May. Himalayas. B.M. 6793. F.S. 12:1282–5. Gn. 48:142; 53, pp. 167, 305. G.C. III. 23:89; 42:4. F.S.R. 2:296. G. 35:175. Gn.W. 23:552. J.H. III. 42:117; 62:145.—Beautiful tree, hardy only S.

M. compréssa, Maxim.=Michelia compressa.—*M. Dawsoniàna,* Rehd. & Wilson. Tree, to 35 ft.: lvs. subcoriaceous, obovate, glossy above, glabrous beneath, 3–6 in. long: fr. cylindric, 4 in. long: fls. unknown. W. China.—*M. fuscàta,* Andr.=Michelia fuscata.—*M. globòsa,* Hook. f. & Thoms. Allied to M. parviflora. Tree, to 40 ft.: lvs. ovate, fulvous-pubescent on the veins beneath, 5–9 in. long: stamens and pistil bright red: fr. oblong, 2 in. long. Himalayas.—*M. officinàlis,* Rehd. & Wilson. Closely related to M. hypoleuca. Branchlets yellowish: lvs. obovate, to 1½ ft. long: stamens shorter: fr. oblong-ovate, 4–5 in. long. Cent. China.—*M. Sargentiàna,* Rehd. & Wilson. Tree, to 75 ft.: lvs. subcoriaceous, obovate, glabrous above, pubescent beneath, 4–7½ in. long: fr. cylindric, 4–6 in. long: fls. unknown, said to be rosy red and about 8 in. across. W. China. Var. *robústa,* Rehd. & Wilson. Lvs. oblong-obovate, 6–9 in. long: fr. to 7½ in. long.

Alfred Rehder.

MAGYDÀRIS (old Greek name). *Umbelliferæ.* Two perennial herbs of Spain, Sicily and N. W. Afr., one of which is offered abroad as an ornamental plant. Lvs. pinnate or pinnatisect, the segms. large, dentate or cut: fls. white in compound many-rayed umbels, with the many bracts of the involucre and involucels linear or lanceolate; petals obovate and inflexed at the apex and more or less 2-lobed: fr. oblong, tomentose. **M. tomentòsa,** Koch, has lvs. pinnatisect, tomentose beneath, nearly or quite glabrous above: bracts of involucre elongated-linear and undivided: fr. ovate, the carpels very obtuse and tomentose.



2301. Magnolia denudata, commonly known as M. conspicua.

MAHÉRNIA (anagram of *Hermannia*). *Sterculiàceæ.* One very fragrant herb-like plant in greenhouses, and perhaps one or two others are cultivated. By some united with Hermannia.

Calyx campanulate, 5-cleft; petals 5, with hollow claws, twisted in the bud; stamens 5, opposite the petals, the filaments prominently enlarged or dilated at about the middle (and thus differing from Hermannia, which has no sudden enlargement in the filaments), the anthers long; ovary 5-loculed, ripening into a coriaceous caps. with many seeds.—More than 30 herbs and subshrubs of S. Afr., mostly with incised lvs. and drooping, bell-shaped fls.

verticillàta, Linn. (*M. odoràta,* Hort., not of botanists, which is *Hermannia Presliana*). Honey-Bell. Fig. 2302. A frequent plant in conservatories, and sometimes seen in window-gardens and collections: half woody, very diffuse and straggly, not making a central leader, the terete crooked sts. scabrous: lvs. small, much cut into linear divisions, with deep-cut stipules: fls. ¾in. or less long, nodding, usually about 2 together, from axillary shoots, sweet, fragrant, honey-yellow.—Free bloomer in winter and spring. Of easy cult. Prop. by cuttings. A very pretty twiggy bush for the cool greenhouse. The branches are long and flexible, so that specimens may be trained into any form. It may also be used for hanging-baskets. It is of easy cult. in pots, but lifts badly.

2302. Mahernia verticillata. (×⅔)

glabràta, Cav. Lvs. dentate or dentate-pinnatifid (not so finely cut as in the last), covered with stellate down: trailing, not odorous.—It is doubtful whether the plant cult. under this name is the *M. glabrata* of botanists.

L. H. B.

MAHOE, MOUNTAIN: *Hibiscus elatus.*

MAHOGANY: *Swietenia.* **Mountain M.:** *Cercocarpus.*

MAHÒNIA (after Bernard M'Mahon, a prominent American horticulturist; 1775–1816; see Vol. III, p. 1586, for a biographical sketch). Syn., *Odostèmon. Berberidàceæ.* Ornamental woody plants grown chiefly for their handsome evergreen foliage and for their large panicles of yellow flowers. Usually united with Berberis.

Evergreen shrubs, rarely small trees: lvs. alternate, odd-pinnate, rarely 3-foliolate, with minute subulate stipules: fls. yellow, in many-fld. racemes or panicles springing from the axils of bud-scales; sepals 9; petals 6 with nectaries at the base; stamens 6; ovary 1-celled with usually few ovules: fr. a dark blue and bloomy, rarely red berry, with usually few small seeds.—About 45 species in N. and Cent. Amer. and E. and S. E. Asia. From Berberis with which it is often united, it is easily distinguished by the pinnate lvs. and the unarmed branches, also by the large infl. springing from the axils of bud-scales and by the 9 sepals. Monograph by Fedde in Engler, Bot. Jahrbücher 31:30–133 (1901).

The mahonias are very handsome evergreen shrubs spreading usually by suckers, with large leaves and yellow flowers in conspicuous panicles appearing in spring and followed by dark blue bloomy berries. Most of the species are tender, but *M. repens, M. Aquifolium, M. nervosa, M. pinnata* var. *Wagneri* are hardy as far north as Massachusetts, but the foliage is liable to be scorched if exposed to the winter's sun, though *M. repens* is more resistant and is rarely burned. *M. japonica* will succeed if planted in sheltered situations. *M. pinnata* is a most beautiful evergreen species, but it requires protection from cold winds, and the winter's sun. *M. repens* is the best evergreen species we have. It spreads rapidly and the foliage is rarely burned, and the numerous clusters of showy yellow flowers render it most attractive at the end of May. They prefer a humid soil and a position sheltered from strong winds and from the hot sun. They are easily transplanted and some, particularly *M. repens* and *M. nervosa,* spread considerably by suckers. Propagation is by seeds sown soon after maturity or stratified and sown in spring, or by suckers which are freely produced in most species, also by cuttings of half-ripened wood under glass and by layers.

INDEX.

Aquifolium, 1, 2, 3.
Bealii, 6.
fascicularis, 3.
Fortunei, 7.
Fremontii, 8.
glumacea, 4.
gracilis, 1.
gracillima, 6.
Herveyi, 2.
japonica, 6.
juglandifolia, 1.
macrocarpa, 2.
nana, 2.
nepalensis, 5.
nervosa, 4.
nutkanus, 1.
pinnata, 3.
repens, 2.
rotundifolia, 2.
trifurca, 6.
Wagneri, 3.

A. *Racemes many-fld., usually dense.*

B. *Lfts. rounded or truncate at the base, rarely cuneate, ovate to ovate-oblong.*

C. *Texture of lvs. leathery; lfts. 3–9, sometimes 13.*

D. *Petiole about 1 in. long; lfts. 3–9.*

1. **Aquifòlium,** Nutt. (*Bérberis Aquifòlium,* Pursh. *Odostèmon nutkànus,* Rydb.). Fig. 2303. From 3–6 ft.: lfts. 5–9, oblong or oblong-ovate, dark green and lustrous above, spinulose-dentate, 1½–3 in. long: racemes erect, fascicled: berries blue, small. May. Brit. Col. to Ore. B.R. 1425. L.B.C. 18:1718. P.M. 9:5. G. 12:721; 28:143. G.M. 44.659. Gn.W. 23:361. Var. **juglandifòlia,** Jouin. Lfts. usually 7, the lowest pair usually close to the base of the petiole, often subcordate at the base, smaller and of thicker texture, teeth smaller, accumbent; rachis usually red. Var. **grácilis,** Jouin (*M. grácilis,* Hort., not Fedde). Lfts. 5–9, oblong-ovate, cuneate at the base, spinose-serrate with small teeth, slightly lustrous above, 2–3 in. long. There are also forms with variegated lvs., with yellow foliage and with the young foliage bright red.

2. **rèpens,** Don (*Bérberis rèpens,* Lindl. *B. Aquifòlium,* Brit. & Brown. *B. nàna,* Greene. *Odostèmon Aquifòlium,* Rydb.). Rarely over 1 ft. high, stoloniferous: lfts. 3–7, roundish ovate or ovate, pale or glaucous and dull above, spinulose-dentate, 1½–2½ in. long: fls. and fr. as in the preceding. Brit. Col. to Calif. and N. Mex. B.R. 1176. L.B.C. 19:1847.—Hardier than the preceding species, but less handsome. Var. **rotundifòlia,** Fedde (*Bérberis rotundifòlia Hèrveyi,* Hort.). Lfts. usually 5, broader, often suborbicular, nearly entire or finely and sparingly serrate. Var. **macrocárpa,** Jouin. Frs. thicker and lvs. less opaque.

2303. Mahonia Aquifolium. (×⅓)

DD. *Petiole usually very short; lfts. 7–13.*

3. **pinnàta,** Fedde (*Bérberis pinnàta,* Lag. *M. fasciculàris,* DC. *B. Aquifòlium* var. *fasciculàris,* Bean). Two to 6 ft.: lfts. 7–13, ovate or ovate-lanceolate, undulate at the margin and with few spiny teeth,

grayish green and somewhat lustrous above, 1–2½ in. long: fls. in short, fascicled racemes: fr. blue. Calif., N. Mex. and Mex. B.M. 2396. B.R. 702. Var. **Wágneri,** Jouin. Lfts. 7–11 with 4–5 teeth on each side, dark green above and slightly lustrous, light green beneath. M.D. 1910, p. 89.—This variety is about as hardy as *M. Aquifolium,* but grows taller and is very desirable. Possibly a hybrid with *M. Aquifolium.*

cc. *Texture of lvs. rigid; lfts. 9–25.*

d. *Sts. scarcely exceeding 1 ft.*

4. **nervòsa,** Nutt. (*Bérberis nervòsa,* Pursh. *M. glumàcea,* DC.). Dwarf shrub: sts. with long pointed, husk-like bud-scales: lvs. on stalks 1–4 in. long; lfts. 9–19, lance-ovate, remotely spiny-toothed, 3–5-ribbed, pale green, 1–3 in. long: racemes elongated, erect: fr. oblong, blue. Brit. Col. to Calif. B.M. 3949. L.B.C. 18:1701. B.R. 1426. P.M. 7:55.

dd. *Sts. 5–12 ft. tall: lvs. very short-stalked.*

5. **nepalénsis,** DC. (*Bérberis nepalénsis,* Spreng.). Lfts. 5–25, ovate-oblong, all of nearly equal size, cuneate or rounded at the base, sinuately toothed, with few spiny teeth, lustrous above, 2–4 in. long: racemes to 10 in. long. India, chiefly Himalayas. Gn. 63, p. 94. A.G. 18:355.

6. **japónica,** DC. (*Bérberis japónica,* Spreng. *B. Beàlii,* Fort.). Lfts. 9–13, roundish or ovate, the terminal one larger, usually truncate or subcordate at the base, with large remote spiny teeth, dull or slightly lustrous above, 2–5 in. long: racemes 3–4 in. long, fascicled: fr. bluish black. China, Himalayas, in Japan only cult. B.M. 4846, 4852. Gn. 63, p. 72. F.S. 6:79. Gn.M. 2:19. H.F. 5:168. G. 2:299; 29:341 and J.F. 3:278 (as *B. nepalensis*).—Very effective by its large bold foliage; has proved hardy at the Arnold Arboretum in sheltered positions. Var. **trifùrca,** Schneid. (*B. trifùrca,* Forbes). Lfts. 4 in. long and 2 in. broad, 3-pointed at the apex and with a few teeth at the base. Var. **gracíllima,** Fedde. Lfts. smaller, about 2 in. long and ¾ in. broad.

bb. *Lfts. cuneate at the base, lanceolate.*

7. **Fórtunei,** Fedde (*Bérberis Fórtunei,* Lindl.). Shrub, to 6 ft.: lfts. 5–9, narrow-lanceolate, spinose-serrate with small appressed teeth, 2–5 in. long: racemes erect, fascicled, to 6 in. long. China. F.S. 3:291*b*. J.H.S. 1846:300.

aa. *Racemes few-fld.: lfts. rigid, 3–7.*

8. **Fremóntii,** Fedde (*Bérberis Fremóntii,* Torr.). Fig. 2304. Shrub, 5–12 ft.: lfts. 3–7, ovate or oblong, with few strong, spiny teeth, blue-green, dull, ½–1 in. long: racemes loose, 3–7-fld.; pedicels slender: fr. at least ½ in. across, inflated and rather dry, blue. W. Texas to Utah, Ariz. and Calif. G.F. 1:497 (adapted in Fig. 2304).

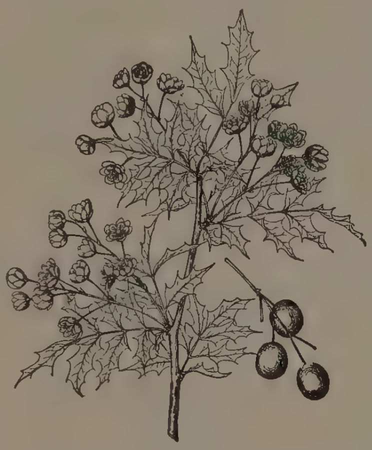
M. argùta, Hutchins. (Berberis Hutchinsonii, Rehd. B. arguta, Ball, not Schneid.). Shrub, to 5 ft.: lfts. 9–11, lanceolate, entire or with few teeth: fls. in pendulous racemes, 12–16 in. long. Probably from Cent. Amer. B.M. 8266. Gn. 72, p. 481.—*M. brévipes,* Rehd. (Berberis brevipes, Greene). Allied to B. repens, but much smaller in every part: lvs. short-petioled; lfts. usually 7, broadly elliptic-oblong, 1–1¾ in. long: racemes short, few-fld. Alberta.—*M. grácilis,* Fedde (Berberis gracilis, Hartw.). Allied to B. pinnata. Lfts. ovate to lanceolate, finely serrate or entire, 1–2 in. long, lustrous. Mex., Texas.—*M. hæmatocárpa,* Fedde (Berberis hæmatocarpa, Wooton). Very similar to B. Fremontii, but the terminal lft. longer than the lanceolate lateral ones: fr. red. Colo. and New Mex.—*M. heterophýlla,* Schneid. (B. heterophylla, Zabel, not Juss. B. toluacensis, Hort.). Possibly M. Aquifolium ×M. Fortunei. Lvs. long-petioled; lfts. 5–7, lanceolate, 1½–3½ in. long, ⅓–1 in. broad, spiny-toothed, lustrous. Of unknown origin.—*M. pállida,* Fedde (Berberis pallida, Benth.). Lfts. 9–13, ovate to ovate-lanceolate, 2–3½ in. long, spinose, dark green above, grayish beneath: racemes compound, loose. Mex. R.B. 30:16.—*M. pùmila,* Fedde (Berberis pumila, Greene). Allied to M. repens. A foot high or less: sts. upright, rigid, not sarmentose: lfts. 1–5, thick, ovate to round-ovate, coarsely spiny-toothed, reticulate: racemes short: berries smaller, very glaucous. Calif., Coast Range.—*M. tenuifòlia,* Fedde (Berberis tenuifolia, Lindl.). Lfts. 3–7, lanceolate, entire: racemes nodding, very long and loose. Mex. B.R. 30:26.—*M. trifoliolàta,* Fedde (Berberis trifoliolata, Moric. B. trifoliata, Hartw.). Allied to B. Fremontii. Lfts. 3, sessile, rigid, pale; coarsely spiny-toothed: racemes short, few-fld. Texas to Mex. B.R. 31:10. F.S. 1:56.—*M. Wilcoxii,* Rehd. (B. Wilcoxii, Kearny. Odostemon Wilcoxii, Heller). Allied to M. Aquifolium, but lfts. smaller, very coriaceous, oval or ovate with only 3–5 spreading spiny teeth on each side. Ariz.

Alfred Rehder.

MAIÁNTHEMUM (Greek, *Mayflower*). Syn. *Unifòlium. Liliàceæ.* Small spring-blooming woodsy perennials, good for colonizing.

Convallaria-like, with slender rootstocks and 1–3-lvd. sts. that are 3–8 in. or more high and bear a few white 4-parted small fls. in a raceme; segms. separate or practically so, spreading or reflexed, deciduous; stamens 4, inserted at base of segms; ovary 1; style 1. 2-lobed: fr. a globular 2-celled and 1–2-seeded berry.—Species 2 (by some considered only 1), in the cool parts of northern hemisphere. They make interesting mats or colonies in shady places. *M. canadénse,* Desf. (*Unifòlium canadénse,* Greene), native in moist cool woods from Newfoundland to N. C. and west, usually has 2 (1–3) ovate or ovate-lanceolate sessile or very short-petioled lvs. on the st. and many radical lvs. in the spreading colony, cordate at base with narrow sinus: raceme 1–2 in. long, usually many-fld., rather dense; fls. white, the segms. longer than the stamens: berry pale red, speckled: foliage dies in summer. *M. bifòlium,* DC. (*M. Convallària,* Web.) is the European and Asiatic species: lvs. 2, stalked, triangular-cordate: st. 6–8 in. high from a filiform root: raceme spike-like. Var. *kamtscháticum,* Jepson, Calif. to Alaska and Siberia, is 4–14 in. high, often stout: lvs. ovate or triangular-cordate, the petiole of the lower one sometimes longer than the blade, the radical lf. very long-petioled and almost as tall as fl.-st.

L. H. B.



2304. Mahonia Fremontii. (×⅓)

MAIDENHAIR FERN: *Adiantum.*

MAIDENHAIR TREE: *Ginkgo.*

MAIZE: *Corn* and *Zea.*

MAKART DECORATIONS and bouquets are dried grasses and everlastings, whether dyed or not. The celebrated painter, Hans Makart, once decorated his salon with dried palm leaves, pampas grass and the like, to the delight of the Emperor of Austria, who visited the artist's studio; hence the name. See *Everlastings* and G.C. III. 6:714.

MALACOCÁRPUS (Greek, *soft* and *fruit*). *Cactàceæ.* A genus commonly combined with Echinocactus. As usually understood, it consists of globose plants: fls. slightly funnel-shape, usually yellow; ovary with scales bearing in their axils bristles and wool; stigma-lobes red: fr. soft, rose-colored or crimson. Six species have been assigned to this genus; but if it is to be retained, more species are doubtless to be referred to it. It is native of the east coast of S. Amer. **M. Sellòwii,** Schum., is offered in the European trade under the name of *Echinocactus Sellowii.*

J. N. Rose.

MALACÓTHRIX (Greek words, meaning *soft hair*). *Compósitæ.* Annual and perennial herbs of W. N. Amer., one of which is listed; species probably 20: leafy-stemmed or scapose, usually with a radical cluster of lvs.: heads yellow, white or pinkish, peduncled, usually nodding in bud; receptacle naked or bristly; fls. all ligulate, hermaphrodite: achene short, terete, ribbed, with soft pappus-bristles. **M. califórnica,** DC. Annual, acaulescent, bearing single rather large light yellow heads on scapes 4–6 in. high: lvs. prominently woolly when young, pinnatifid, the lobes linear to almost filiform: involucre-bracts narrow-linear or subulate, in about 3 series. Sandy soils, Calif.

L. H. B.

MALAY APPLE: *Eugenia Jambos.*

MALCÒMIA (Wm. Malcolm, English horticulturist of the eighteenth century). Also written *Malcolmia,* but it was originally spelled Malcomia. *Cruciferæ.* Flower-garden annuals.

Malcomia is a genus of branching herbs, the branches often prostrate: lvs. alternate, entire or pinnatifid: fls. white, purplish or reddish, in a loose raceme; petals long and linear or long-clawed: pods rather terete, long or awl-shaped; seeds in 1 series or in 2 series at the base of the cells, not marginate.—Species about 30, Medit. region.

marítima, R. Br. VIRGINIAN STOCK. MAHON STOCK. Figs. 2305, 2306. St. erect, branching: lvs. elliptic, obtuse, entire, narrowed at the base, pubescence appressed, 2–4-parted: pedicels rather shorter than the calyx; fls. shades of lilac and red to white, the limb veined: pods pubescent, long-acuminate at the apex. Medit. region. B.M. 166 (as *Cheiranthus maritimus,* showing red fls., changing to purple before fading). J.H. III. 59:30.—It is a charming hardy annual of the easiest cult. growing about a foot high, with a more branching and open habit than the common stock (Matthiola), and 4-petaled fls. each about ¾in. across. Red, white and crimson-fld. kinds are offered in Amer., while rose and lilac fls. appear in the mixtures. There seem to be no double forms. It is an excellent plant for the front of a border, as it may be easily had in bloom from spring to fall by means of successional sowings. Seeds are best sown in the fall, as they give earlier bloom. Seeds may be sown thinly.

2305. Malcomia maritima.—Virginian stock, Crimson King.

M. bícolor, Boiss. & Heldr. Low, about 6 in., pubescent: lvs. oblong-lanceolate to ovate, nearly entire: fls. pink, yellowish at base. Mountains, Greece. Gt. 1:226.—*M. littòrea,* R. Br. Six to 12 in.: lvs. hoary, lance-linear, nearly entire: fls. large, pink-purple, the spreading limb not prominently veined. W. Medit. region.

WILHELM MILLER.
L. H. B.†

MALLÒTUS (Greek, *woolly,* from the long white spines on the fruit of some species). *Euphorbiàceæ.* Trees or shrubs, some rarely cultivated for their economic products, but very little known as horticultural subjects.

Leaves alternate or in a few species opposite, broad, simple, palmately nerved: fls. diœcious, small, in spikes or panicles; calyx valvate or imbricate; no petals, disk or rudiment of ovary in the staminate fls.; stamens numerous, anther-cells oblong; the 3 styles almost free at base, elongated; ovules 1 in each cell: caps. separating into 2–3 parts.—About 80–90 species in the Old World tropics. Related to Mercurialis and Macaranga.

japónicus, Muell. Arg. (*Rottlèra japónica,* Spreng.). A small, rather scurfy tree with large, ovate, alternate, glabrous or glandular, subtrilobed, reddish lvs.: spikes branched, terminal; fls. 2–3 lines wide; stamens 60–70: caps. ½in. diam., pubescent with weak prickles. Japan and China. R.H. 1894, p. 103.

philippinénsis, Muell. Arg. MONKEY-FACE TREE. KAMILA TREE. Lvs. broadly ovate, rough, entire or nearly so, alternate: caps. not prickly but covered with red-brown glands which furnish the kamila (or kamala) dye of commerce, used in dyeing silks. India to Austral.

J. B. S. NORTON.

2306. Malcomia maritima. (×¾)

MALLOW: *Malva rotundifolia,* and other species.

MALLOW, FALSE: *Malvastrum.*

MALÒPE (name used by Pliny for some kind of mallow). *Malvàceæ.* Flower-garden annuals.

Glabrous or pilose herbs, with entire or 3-parted alternate lvs., and peduncled often showy violet or pink or white axillary fls. subtended by 3 large cordate distinct bracts: calyx 5-parted; column of stamens divided at the top into many filaments: carpels numerous, 1-seeded, congested into a head, indehiscent.—About a dozen species have been described, probably reducible to 3, in the Medit. region. They are of simple cult. in any ordinary garden soil; sow early.

trífida, Cav. Fig. 2307. Plant 2–3 ft. high, bearing rose and purple fls. 2–3 in. across, the center usually darker, blooming most of the summer: lvs. 3-nerved, 3-lobed, dentate, glabrous; lobes acuminate: peduncles axillary, 1-fld. Spain, N. Afr. Gn.W. 25:584. H.U. 2:166. Var. **grandiflòra,** Paxt. (*M. grandiflòra,* F. G. Dietr.), is said to be superior to the type, with fls. large, deep rosy red, veined inside darker. Gn. 21, p. 145. P.M. 1:177. G.W. 15, p. 215. Var. **álba,** Hort., has white fls. Var. **ròsea,** Hort., has rose-colored fls. G. 27:563. Seeds are offered separately in white, rose and red.

malacoìdes, Linn. An old garden annual, but apparently not now cult. to any extent: 1–3 ft.: lvs. oblong-ovate to lanceolate, crenate or pinnatifid, tapering or cordate at base: fls. large, purple-violet, solitary. Var. **ròsea,** Hort., has rose-red fls. S. Eu., Asia Minor.

L. H. B.

MALORTÌEA (E. von Malortie, Germany). *Palmàceæ.* A small group of diminutive palms of Cent. Amer., by some authorities referred to Reinhardtia as a subgenus, with 6–12 stamens. They are spineless plants, with alternate lvs. which are simple or 2-lobed at the end, margins entire or dentate or erose on the ends: fls. unisexual, in branched spadices or spikes that arise from the lower axils. They are warmhouse subjects, and useful where very small palms are desired, as in a Wardian case.

M. grácilis, Wendl. Sts. slender, ringed, 18–24 in. or more high: lvs. slender-petioled, about 9 in. long and broad, split to the rachis at the top, and the 2 halves lobed, the lobes entire or notched, split near the rachis to form holes: spadix erect, branched, bearing scattered sessile male and female fls.; stamens 10–12. Guatemala. B.M. 5291. *M. símplex*, Wendl. Slender cespitose little palm, with oval slender-petioled mostly simple lvs. which are acuminate-toothed and more or less shallow-notched at the apex: spadix few-branched, with sessile fls. Costa Rica. B.M. 5247.—*M. Tuérckheimii*, Damm. Height about 16 in., the sts. thin and about 1½ lines thick and bearing a crown of about 15 geonoma-like dull green lvs.: lf.-blade cuneiform, 6 in. long and 2 in. broad, not bifid, with 19 veins either side of midrib and the blade somewhat folded between them, the margin crenulate; petiole about 1 in. long. Guatemala, 4,500 ft. altitude. G. W. 12, p. 99.—Recent.

L. H. B.

2307. Malope trifida. (×¼)

MALPÍGHIA (Marcello Malpighi, 1628–1693, distinguished naturalist at Bologna, who wrote on the anatomy of plants). *Malpighiàceæ.* Trees and shrubs, sometimes grown under glass for ornament, but known mostly from the Barbados cherry, cultivated in the American tropics.

Leaves opposite, short-stalked, glabrous or tomentose, entire or spiny-toothed: fls. axillary and terminal, clustered or corymbose, rarely solitary, red, rose or white; calyx with a pair of thick glands on the back of some or all the 5 sepals; stamens 10, all perfect, the base of filaments glabrous; ovary 3-celled; styles 3, distinct: drupe 3-pyrenous, not winged, the stones with 3–5 crests or wings on the back.—Species 30–40 in Trop. Amer., extending as far north as S. Texas. Small describes 29 species in N. Amer. Fl. XXV, p. 152 (1910).

glàbra, Linn. Barbados Cherry. Fig. 2308. Shrub, 6 ft., glabrous, the branches slender: lvs. ovate to elliptic, entire, usually pointed, having a few biscuspidate hairs which disappear early: umbels 3–5-fld.; fls. ¾in. across, rose-red, the petals erose or fringed: drupes red or scarlet, about the size of a cherry, acid, with thin skin, used for jam and preserves; seeds large, 4-angled. S. Texas to N. S. Amer.; W. Indies. B.M. 813.—Widely planted in tropics, and offered in S. Fla. Prop. by cuttings, and seeds germinate readily.

mexicàna, Juss. (*M. guadalajarénsis*, Rose). Lvs. ovate to obovate-lanceolate, either acute or obtuse, pubescent or tomentose: cymes one-third to one-half length of lvs.; fls. purplish, about ¾in. across; sepals ovate to ovate-lanceolate, densely pubescent: fr. nearly globose, red. Mex.—Offered in S. Calif.

coccígera, Linn. Lvs. oval or ovate to suborbicular, obtuse, rounded or emarginate, mostly sinuate-dentate, glabrous at maturity, shining above: cymes short-peduncled; fls. pink; sepals oblong or ovate-oblong, with large glands: drupe nearly globose, red. W. Indies.—Listed in S. Fla. as a good holly-like plant useful for dwarf hedging.

L. H. B.

MÀLUS (Greek for *apple*). *Rosàceæ.* Apple. Most botanists prefer to unite the apple and pear in the one genus Pyrus; this is the method of Bentham & Hooker in "Genera Plantarum," and of Focke in Engler & Prantl's "Pflanzenfamilien," although the recent excellent work of Schneider, "Handbuch der Laubholzkunde," keeps them distinct, as do some of the recent American authors. The evident botanical distinctions between the two groups are slight, apparently not sufficient for easy or clear determination by the unprofessional student. These differences lie in the usual presence of grit-cells in the fruits of Pyrus and their usual absence in Malus; in the hypanthium of the former being nearly closed by a cushion, and in the latter free or open; in the cavity about the stem of the fruit in Malus, a contrast which does not hold in Pyrus; and in the styles of Pyrus being distinct or nearly distinct, whereas in Malus they are more or less united. The different degrees of union of the styles has been made a basis for distinguishing the named varieties of apples among themselves, and the character does not appear to be important enough to be made the basis of generic separation. It is not impossible that the pears and apples may have had a different phylogenetic origin, but this fact itself would not be sufficient in generic description.—The apples are small trees and bushes, of some fifteen to twenty species in the North Temperate Zone. In this Cyclopedia, the cultivated apple species are described under *Pyrus;* the names of the leading species under Malus are as follows:

M. sylvestris, Mill.=*Pyrus Malus.*
M. prunifolia, Borkh.=*P. prunifolia.*
M. baccata, Borkh.=*P. baccata.*
M. coronaria, Mill.=*P. coronaria.*
M. ioensis, Brit.=*P. ioensis.*
M. Soulardii, Brit.=*P. Soulardii.*
M. angustifolia, Michx.=*P. angustifolia.*
M. Halliana, Koehne=*P. Halliana.*

L. H. B.

2308. Malpighia glabra—Barbados cherry. (×⅗)

MÁLVA (old Latin name from Greek, referring to the emollient lvs.). *Malvàceæ.* Various annual, biennial and perennial herbs, of considerable use in ornamental plantings.

From numerous allied genera, Malva is distinguished by the carpels in a single whorl: ovules solitary, ascending: bractlets 3, distinct: carpels not beaked or appendaged within. They are hirsute or nearly glabrous plants: lvs. angled, lobed or dissected: fls. solitary in the axils, or clustered, sessile or peduncled; petals 5, notched at the apex.—Species in the neighborhood of 30, in Eu., N. Afr., Asia; several are naturalized in N. Amer.—Few of the mallows are generally in the trade. The most common one is *M. moschata,* although *M. crispa* is frequently seen in gardens for its tall striking growth. They require no special cultural treatment. The genus has been more closely defined in recent time, and some of the plants that belong in Callirhoë, Malvastrum, and Sphæralcea are still likely to be listed under Malva.

2309. **Malva moschata.** (×⅖)

A. *Fls. large and showy, 1½–2 in. across.*

B. *Fr. downy, not wrinkled.*

moschàta, Linn. Musk Mallow. Fig. 2309. Perennial, 1–2 ft. high, with simple pubescence: st.-lvs. 5-parted and the parts 1–2-parted or cleft, the lobes being linear (lf.-formation variable): fls. rose or white; calyx with long, simple hairs. Eu.; cult. and escaped. R.H. 1851: 381.—A good old garden subject, with fls. varying in color shades, and run wild in grass along roadsides. The white-fld. garden form is often listed as var. **álba.**

2310. **Malva rotundifolia.** (×½)

BB. *Fr. glabrous, minutely wrinkled or veiny.*

Álcea, Linn. Much like *M. moschata,* but st.-lvs. only once 5-parted or 5-cleft, with incised or toothed lobes: fls. deep rose to white; calyx densely stellate-pubescent. Eu.; cult. and escaped. B.M. 2297. Gn.W. 4:745. (pink, veined deeper). Var. **fastigiàta,** Koch (*M. fastigiàta,* Cav. *M. Morénii,* Pollini). Lvs. less incised; upper st.-lvs. 3-fid; intermediate ones 5-fid; lobes oblong, unequally dentate. B.M. 2793. Gn. 75, p. 432.

BBB. *Fr. prominently wrinkled-veiny.*

sylvéstris, Linn. Biennial (perhaps sometimes annual or perennial), 2–3 ft. high, rough-hairy, branching: lvs. rather sharply 5–7-lobed: fls. purple-rose, large; petals 3 times length of calyx. Eu., Temp. Asia, waysides N. Amer. A.G. 13:471. Var. **mauritiàna,** Mill. (*M. mauritiàna,* Linn.), has long been cult. in cottage gardens abroad as the Tree Mallow. It is taller, smoother and has more obtuse lobes. Var. **zebrìna,** Hort. (*M. zebrìna,* Hort.), has variable fls., usually white striped with purple.

AA. *Fls. small and inconspicuous, whitish.*

B. *Lvs. not curled at the margins.*

rotundifòlia, Linn. Fig. 2310. Common Mallow. Sts. trailing from a strong, deep root: lvs. rounded kidney-shaped, crenate; lf.-stalks very long: peduncles rather slender.—Common biennial or perennial weed, not cult.: intro. from Eu. and now common in barn-, yards and waste places. The flat wrinkled fruits are known to children as "cheeses." Also locally called "shirt-button plant."

BB. *Lvs. curled or puckered at the margin.*

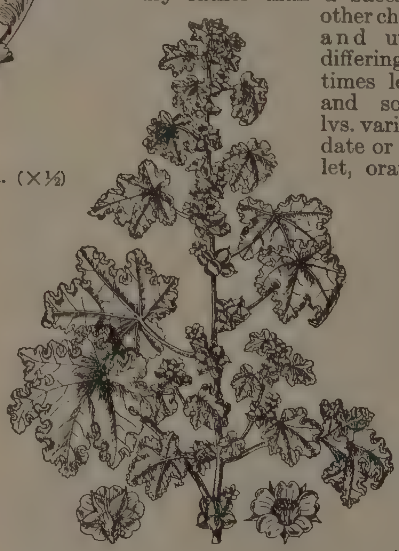
críspa, Linn. Curled Mallow. Fig. 2311. Unbranched annual, 4–8 ft. high, leafy from base to top: lvs. rounded, 5–7-lobed or -angled, attractively crisped and curled: fls. clustered, almost sessile. Eu.; sparingly escaped from old gardens. Gn. 2, p. 315.—The elegantly crisped lvs. are sometimes used for garnishing dishes. Generally self-sows in gardens. It provides a stately subject where stiff straight forms are desired; the sts. sometimes attain a thickness of 3 in. at the base.

M. campanulàta, Paxt.=Malvastrum.—*M. capénsis,* Linn.=Malvastrum.—*M. coccínea,* Nutt.=Malvastrum.—*M. involucràta,* Torr. & Gray=Callirhoë.—*M. lateritia,* Hook.=Malvastrum.—*M. miniàta,* Cav.=Sphæralcea.—*M. Papàver,* Cav.=Callirhoë.—*M. pedàta,* Torr. & Gray=Callirhoë.—*M. umbellàta,* Cav.=Sphæralcea.

Wilhelm Miller.
L. H. B.†

MALVÁSTRUM (name made from Malva). *Malvàceæ.* False Mallow. Mallow-like herbs grown with perennials.

From Malva and its allies it differs in having short or capitate stigmas on the style-branches rather than longitudinal stigmas, and a single whorl of carpels. From Malvaviscus it differs in having a dry rather than a baccate fr., and in other characters. Herbs and undershrubs of differing habit, sometimes low and diffuse and sometimes tall: lvs. various, entire, cordate or lobed: fls. scarlet, orange or yellow, short-peduncled or nearly sessile, axillary or in terminal spikes; calyx-like involucel wanting or of 2 or 3 bracts; calyx 5-cleft; petals emarginate or entire; styles 5 or more: carpels few to many, 1-ovuled, nearly or quite indehiscent and falling away



2311. **Malva crispa.** (×⅙)

from the axis at maturity.—Some 70–80 or more species, in Amer. and S. Afr. The garden species are perennials of easy cult., blooming in the hot weather.

A. *Fls. white, with eye.*

hypomadàrum, Sprague. Shrubby, sometimes reaching 10 ft., slender-branched, free-flowering: lvs. variable, usually 3-lobed and more or less toothed, sparsely soft-hairy on both sides: fls. white with rose-purple eye, about 1½ in. across, axillary, solitary or 2 or 3 together; petals obliquely obovate, retuse; calyx-lobes ovate, acuminate and ciliate; bractlets 3, spatulate-linear, ciliate. S. Afr. G.C. III. 43:394; 44:92. B.R. 295 (as *Malva capensis*).—This species was founded as late as 1908, although in cult. in Great Britain for a century under other names, as *M. capense, M. virgatum, M. grossulariæfolium.* Prop. by cuttings under glass in late spring, giving bloom in a cool greenhouse the following season.

AA. *Fls. colored.*

capénse, Garcke (*Málva capénsis,* Linn.). Shrubby and branchy, slightly viscid: lvs. ovate-oblong, somewhat 3-lobed and angled, unequally toothed: fls. 1–2 on axillary peduncles, purple; involucel variable in size, the bracts lanceolate to ovate-lanceolate and shorter than the ciliate calyx-lobes: carpels glabrous. S. Afr.—Offered abroad and also in S. Calif. Var. **Líndemuthii,** Hort., said to be a graft-variety procured by working *M. capense* on *Abutilon Thompsonii:* lvs. 3-lobed, yellow-variegated: fls. small, rose-red shaded violet. See also *Kitaibelia Lindemuthii,* p. 1738. It is doubtful whether *M. capense* is in cult.; the plants passing under this name may be *M. hypomadarum.*

laterítium, Nichols. (*Málva laterítia,* Hook.). Prostrate, hirsute, 6 in.: lvs. 3–5-lobed, truncate at base, the lobes cuneate to broad-oblong: fls. long-peduncled, solitary, brick-red; calyx-lobes ovate and spreading; involucel of 3 ovate bracts; petals round-cuneate, yellow at the base. S. Amer. B.M. 3846.—*Malva lateritia* is offered in England where the root is said to be hardy in ordinary winters, producing "very pretty peach-colored" fls. Useful for covering dry banks in the sun.

coccíneum, Gray (*Málva coccínea,* Nutt. *Cristària coccínea,* Pursh). A tufted canescent plant, 4–18 in. high, with running rootstocks: lvs. 1–2 in. across, pedately 3–5-parted or -divided, the narrow divisions again cut or cleft: fls. brick-red or coppery, in a short terminal raceme: carpels round-kidney-shaped, inclosed in the incurving calyx-lobes, 10–15, reticulated, indehiscent, 1- or 2-seeded. Neb. to Manitoba and west. B.M. 1673. Var. **grandiflòrum,** Hort., has large deep scarlet fls.

campanulàtum, Nichols. (*Málva campanulàta,* Paxt. *Málva purpuràta,* Lindl.). Two ft. or less high, hairy: lvs. pedately 3–7-lobed, the lobes deeply cut and toothed: fls. rose-purple, an inch across, in a loose terminal raceme, blooming until killed by frost; bractlets very narrow. Chile. B.M. 3814. B.R. 1362. G.C. III. 48:179; 52:193. P.M. 9:173, and R.H. 1843:325.

M. Gílliesii, Baker. More or less procumbent: lvs. hairy, palmately divided: fls. 1 in. or more across, bright red. S. Amer.—*M. spléndidum,* once listed, is probably M. Thurberi var. laxiflorum, Gray (M. splendidum, Kell.), in S. Utah to S. Calif. Shrub, becoming 12 ft. or more, gray-tomentose: lvs. roundish and mostly subcordate, 3-cleft or obscurely 3–5-lobed: fls. rosy pink, fragrant, rather loosely paniculate.

L. H. B.

MALVAVÍSCUS (Greek, *sticky mallow*). *Malvàceæ.* Shrubs and tall herbs, a very few of which are cultivated for ornament.

Usually hispid: lvs. alternate, entire, dentate, angled or lobed: fls. red, usually on axillary peduncles; petals erect and connivent or spreading in the upper half; column of stamens long and slender, exserted, only partially fertile: carpels fleshy outside, connate into a berry, later becoming dry and separating: involucel of 7–12 narrow bractlets.—Species 10 or 12, sometimes tree-like, in Trop. Amer., one reaching S. U. S. There is one species of gardens, *M. arboreus,* known to the trade as *Achania Malvaviscus.* It is a fine old greenhouse shrub with erect scarlet fls., which resemble an abutilon and never open widely. (Abutilon, however, has no involucre.)

The old *Malvaviscus arboreus* is one of the most satisfactory house-plants. It is not subject to insects of any kind, will stand a low temperature in winter, and blooms both winter and summer. When pot-grown, the plant is usually about 2 feet high, but outdoors it makes a strong branching growth, attaining 3 to 5 feet. The bright scarlet flowers remain a long time in perfect condition. The flowers open slightly at the top or not at all. This circumstance gave rise to the old name Achania, which means "not gaping." The plant needs a good light soil and thrives in a compost of fibrous peat and loam. Propagated by cuttings. The cultivator need not fear the appearance of white grains on the surface of the leaves, as they are a normal waxy secretion of the plant. (James Vick.)

2312. Malvaviscus arboreus. (×¾)

arbòreus, Cav. (*Achània Malvavíscus,* Swartz). Fig. 2312. Tall shrub: lvs. alternate, mostly 3-lobed, acuminate, heart-shaped at the base, toothed: fls. convolute in the bud, scarlet, never fully expanding; bractlets erect and narrow. S. Amer. B.M. 2305. L.B.C. 12:1155.—Cult. outdoors in S. Fla. and S. Calif.

móllis, DC. (*Achània móllis,* Ait.). Shrub, recommended for hedges in Calif.: lvs. cordate, soft and tomentose, obscurely 3-lobed: fls. scarlet, with somewhat spreading bracts. Mex. to Colombia. B.M. 2374.

Drúmmondii, Torr. & Gray. Tall perennial, to 6 ft. or more, somewhat tomentose, erect, simple or branched: lvs. round-cordate, mostly 3-lobed, as broad as long: fls. vermilion-red, 1 in. long, on axillary peduncles; bractlets of involucel narrow-spatulate; column of stamens becoming exserted: fr. berry-like, red, finally separable into carpels. Fla. to Tex. and S.—A good sun-loving plant.

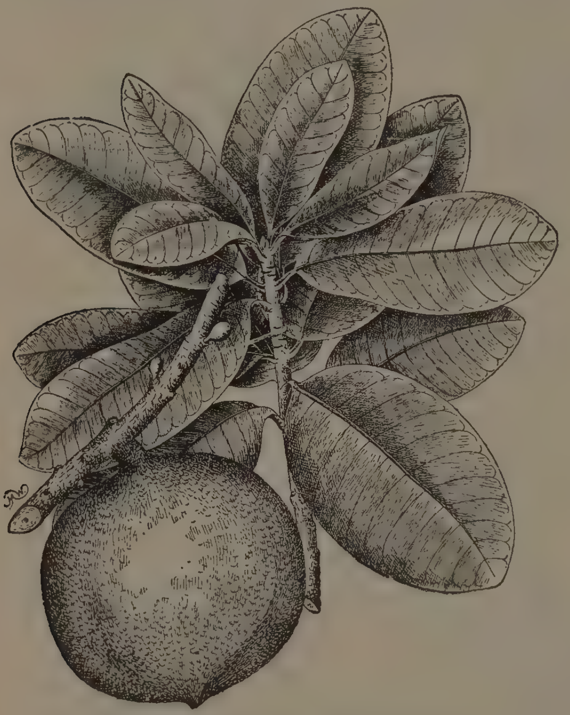
L. H. B.

MAMMÈA (from *mamey,* aboriginal West Indian name of *M. americana*). *Guttiferæ.* A very small group of tropical trees, of which *M. americana* is the only species of horticultural value. The genus is allied to the Malayan mangosteen (*Garcinia Mangostana*), but differs in its two-parted valvate calyx, closed before anthesis.

Mammea is characterized by rigid, coriaceous lvs., frequently pellucid-punctate: peduncles axillary, 1-fld., solitary or clustered; fls. polygamous; petals 4–6; stamens numerous; stigma peltate or broadly lobed; ovary 2–4-celled: fr. a drupe.—Species perhaps a half-dozen in the tropics of Amer. and Afr. but sometimes defined to include only one.

americàna, Linn. MAMMEE-APPLE. SANTO DOMINGO APRICOT. MAMEY. MAMEY DE SANTO DOMINGO. ABRICÓ DE PARÁ. Fig 2313. A large tree, 40–60 ft. or more in height, of upright, compact growth: lvs. oblong-obovate, entire, 4–8 in. long, 2–4 in. broad, rounded or blunt at the apex, coriaceous, deep green, glossy on the upper surface, marked with numerous fine transverse, reticulated veins and pellucid dots; petiole stout, ½in. or less in length: fls. solitary or clustered in the axils of the young shoots; petals white, fragrant; anthers oblong, laterally dehiscent: fr. globose, 3–6 in. diam., russet, seeds 1–4. A native of the W. Indies and N. S. Amer.

When grown on deep rich soils, the mammee-apple attains large proportions, and is one of the most beautiful and conspicuous trees in the West Indies. Its trunk sometimes attains a diameter of 3 or 4 feet, while its dense, erect but very broad crown is of a deeper, richer shade of green than that of most other trees. The large, oblong leaves appear as if varnished. The tree is cultivated for its fruit in the West Indies as well as on the mainland of tropical America. It is successfully grown in Florida as far north as Palm Beach, and though not common, fine specimens are occasionally seen at Miami and other points. While young it is very susceptible to frost. It has never been successfully grown in the open in California, so far as known, and is probably too tender for any section of that state.



2313. Mammea americana.—Mammee-apple. (×⅓)

The fruit is oblate to round in form, commonly 4 to 6 inches in diameter, the surface russet-colored and somewhat rough. The pliable leathery skin is ⅛ inch in thickness; if cut when green, a bright yellow mucilaginous sap exudes. Surrounding the one to four large, oval, rough seeds is the bright yellow flesh, juicy but of firm texture. The flavor is frequently compared to that of the apricot, and when the fruit is stewed or preserved the resemblance is rather striking. The pulp is sometimes sliced and served with wine, or sugar and cream, but is usually preferred by Europeans in the form of sauce, preserves or jam. The season of ripening in the West Indies is in the summer.

From the fragrant white flowers a liqueur is distilled in the French West Indies which is known as eau de créole or crème de créole. The wood is hard and durable, and is said to be well adapted to building purposes as well as cabinet-work; it is beautifully grained and takes a high polish. The resinous gum obtained from the bark is used to extract chigoes from the feet.

Propagation is usually by seeds, which germinate readily if planted in light sandy loam. While the tree prefers a rich well-drained soil, it succeeds remarkably well on the shallow sandy soil, underlaid with soft limestone, of the Florida east coast. Seedlings exhibit considerable variation, and do not, as a rule, come into bearing under six or seven years of age. Some asexual method should be utilized to propagate desirable varieties; inarching succeeds with the mangosteen, and should be applicable to this plant as well; budding might also be successful, performed as with the mango. Through selection of seedlings the fruit could be greatly improved; as an example, a seedling is known in the Isle of Pines in which the flesh separates readily from the seeds, although it normally adheres very closely.

F. W. Popenoe.

MAMMILLÀRIA (Latin, *mammila;* referring to the nipple-like tubercles on these plants). Often but not originally spelled *Mamillaria. Cactàceæ.* Globular or condensed small spiny cacti grown in greenhouses and some of the species in the open far South; mostly fanciers' plants.

Stems simple, branching or in a cluster from the root, commonly hemispherical or short-cylindrical, but often depressed or sometimes much elongated, the surface entirely broken up into tubercles (mamillæ): fls. usually short-funnelform, with naked or nearly naked tube and ovary, borne in the more or less woolly axils between the tubercles, or at the inner extremity of a narrow groove on their upper surface: fr. globose to linear-clavate, nearly always smooth and berry-like. The name Mammillaria is one of the generic names conserved by the Vienna rules of nomenclature, but there seems to be no justification for this except as a matter of convenience. The name Mammillaria, used for a cactus genus, was given by Haworth in 1812, but is antedated by the Mammillaria published by Stackhouse for a genus of alga. The alga name has long been reduced to synonony, but a recent study of its status seems to justify its reëstablishment. Mammillaria, as considered here, follows closely the treatment in Cyclo. Amer. Hort., but, as a matter of fact, it would be better to divide the group into 2 or more genera. Britton & Rose are preparing a monograph of the Cactaceæ in which these points will be discussed; but in the meantime, the old name Mammillaria will be retained.

The cultivation of Mammillaria differs in no respect from Echinocactus, which see.

INDEX.

acanthophlegma, 67.
Alversonii, 28.
ancistracantha, 10.
angularis, 71.
applanata, 82.
arida, 72.
arietina, 74.
arizonica, 28.
armillata, 50.
aulacothele, 9.
aureiceps, 62.
autumnalis, 75.
barbata, 42.
bicolor, 68.
Bocasana, 46.
borealis, 28.
Brandegei, 81.
Brownii, 14.
cæspititia, 6.
calcarata, 24.
candida, 44.
Caput-Medusae, 89.
carnea, 85.
Carretii, 58.
centricirrha, 74.
chlorantha, 28.
cirrhifera, 75.
conoidea, 26.
cornifera, 16.
cornuta, 29.
crassispina, 62.
crucigera, 80.
daimonoceras, 17.
dasyacantha, 7.
decipiens, 36.
deflexispina, 74.
densa, 34.
denudata, 39.
deserti, 28.
difficilis, 15.
dioica, 49.
discolor, 64.
dolichocentra, 63.
dumetorum, 37.
durispina, 6.
echinaria, 34.
echinata, 34.
echinoidea, 19.
Echinus, 18.
elegans, 67.
elephantidens, 30.
elongata, 34.
erecta, 11.
eriacantha, 59.
fasciculata, 54.
formosa, 70.
Foersteri, 74.
fragilis, 38.
fulvispina, 62.
fuscata, 62.
Gabbii, 81.
Galeottii, 57, 63.
globosa, 31.
Goodrichii, 49, 52.
Grahamii, 53.
Greggii, 38.
Guilleminiana, 36.
Haageana, 66.
Halei, 4.
Heeseana, 76.
hemisphærica, 82.
Heyderi, 82.
hidalgensis, 79.
Hirschtiana, 28.
impexicoma, 23.
insularis, 49.
Klugii, 67.
Krameri, 74.
Kunzeana, 47.
lasiacantha, 39.
Lehmannii, 9.
Leona, 35.
Lesaunieri, 65.
littoralis, 55.
longimamma, 31.
Macdougalii, 83.
macromeris, 8.
macrothele, 9.
Mainæ, 57.
mazatlanensis, 55.
meiacantha, 84.

INDEX, CONTINUED.

micromeris, 33.
minima, 34.
missouriensis, 5.
multiceps, 45.
mutabilis, 75.
neo-mexicana, 28.
Nickelsæ, 25.
nivea, 68.
nivosa, 78.
nogalensis, 12.
Nuttallii, 5.
Odieriana, 62.
Palmeri, 49.
Parkinsonii, 69.
pectinata, 22.
Petersonii, 76.
petrophila, 73.
Pfeifferi, 62.
phellosperma, 32.
plumosa, 40.
Pondii, 3.
Poselgeri, 1.
Potosina, 67.
pubescens, 6.
pusilla, 45.
pyramidalis, 62.
radians, 21.
radicantissima, 10.
radiosa, 28.
Radliana, 1.
raphidacantha, 10.
recurvata, 12.
recurvispina, 12.
rhodantha, 62.
robustior, 5.
robustispina, 14.
Roseana, 1.
rufispina, 6.
Rungei, 39.
sanguinea, 61.
Scheerii, 13.
Schmidtii, 74.
scolymoides, 20.
sempervivi, 88.
senilis, 41.
setispina, 2.
similis, 5.
simplex, 77.
sphacelata, 60.
sphærica, 31.
sphærotricha, 44.
spinosissima, 61.
stella-aurata, 34.
stellaris, 45.
strobiliformis, 6, 26.
subangularis, 71.
sulcata, 24.
tenuis, 34.
tetracantha, 63, 74.
tetrancistra, 32.
texana, 45.
texensis, 82.
Thornberi, 54.
Trohartii, 87.
tuberculosa, 6.
uberiformis, 31.
uncinata, 86.
venusta, 56.
vetula, 43.
viperina, 34.
vivipara, 27.
Wildiana, 48.
Wildii, 48.
Wissmannii, 5.
Wrightii, 51.

A. *Stamens and style exserted beyond the petals; fls. irregular, slender, tubular, somewhat curved and bilabiate.* (*Subgenus Cochemiea.*)

1. **Póselgeri,** Hildmann (*M. Roseàna*, Brandeg. *M. Radliàna*, Quehl.). Upright branches 1–1½ ft. long, 1½–3 in. diam.: tubercles rather remote, flattened and appressed, later spreading: radial spines 8; central 1, brownish, strongly hooked, 1–2 in. long, twice as long as the radials: fr. bright red, flat on the broad top and much shorter than the tubercles.

2. **setispìna,** Engelm. Upright branches 8–12 in. long, 2–4 in. diam., forming dense clumps: tubercles rather crowded, ovate, short: spines white with black tips; radials 10–12; centrals 1–4, stouter, the lower one strongly hooked, often twisted, 1½–2 in. long, 2 or 3 times as long as the radials: fr. red, much exceeding the tubercles. Low. Calif.

3. **Póndii,** Greene. Upright branches 10–15 in. long, 1½–2 in. diam., making much smaller clumps than the two preceding: tubercles short, ovate, not crowded; axils setose: spines in 3 series, outer 15–25, short, white; inner 5–8, brown, longer; central row 3, brown, usually 2 of them strongly hooked, 1 in. or more in length, much exceeding the other spines: fr. oval or obovate, dull purplish red, ¾in. long. Calif.

4. **Hàlei,** Brandeg. Upright branches 1½–2 ft. high, 2–3 in. diam.: tubercles rather crowded, short-conical from a broad base: spines sub- to 3-serrate, outer 15–25; centrals 6–9, darker, the lower one much stouter, an inch or more long, usually straight but sometimes hooked, twice as long as the other spines: fr. obovate, red. Calif.

AA. *Stamens and style shorter than the petals; fls. regular, short, tubular.*

B. *Tubercle on old plant with a narrow groove on upper side: fls. from the vertex of the plant.*

C. *Fr. red; seeds black.*

D. *Color of fls. yellow.*

5. **missouriénsis,** Sweet (*M. Núttallii*, Engelm.). Nearly simple, 1–2 in. diam.: tubercles cylindric-conical, loose and spreading, slightly grooved: spines white, weak, puberulent, not hiding the body; radials 12–17, spreading; central one longer and stouter, often wanting: fls about 1 in. long, yellow to fawn-color, with reddish streak; sepals fimbriate; petals acute or acuminate: berry red, the shape and size of a small pea; seeds black and pitted. Mont. to Kans. and E. Colo.

Var. **símilis,** Engelm. Cespitose, in clumps often a foot broad: spines fewer: fl. and fr. larger. Kansas River to Texas.

Var. **robústior,** Engelm. (*M. Wissmannii*, Hildmann). Almost simple: tubercles longer and looser: spines smooth, rather short and stout; radials 10–12; central 1: fls. even larger than in *M. similis*. Texas.

DD. *Color of fls. rose.*

6. **tuberculòsa,** Engelm. (*M. strobilifórmis*, Scheer). Ovate or cylindric, rather slender, somewhat dry of texture, the spines falling from the older tubercles, leaving them as dry, corky protuberances: tubercles short-ovate from a broad base; axils densely woolly: radial spines 20–30, slender, rigid, white; centrals 5–9, stouter, purplish above, the upper longer, erect, the lowest horizontal or deflexed: fls. 1 in. diam., pale purple: fr. ¾in. long, red, with a conical cap formed of the withered remains of the fl.; seeds brown. Texas.—Four varieties of *M. tuberculosa*, vars. *cæspitítia*, *durispìna*, *pubéscens*, and *rufispìna*, which have been distributed in European collections, doubtless belong here.

7. **dasyacántha,** Engelm. Simple, subglobose: tubercles terete, loose: radial spines 25–35, hair-like, white, with brownish apex; centrals 7–13, bristle-like, pale below, brown above, longer, the most interior one horizontal, sometimes wanting: seeds black, with nearly basal hilum. Texas.

CC. *Fr. green; seeds brown.*

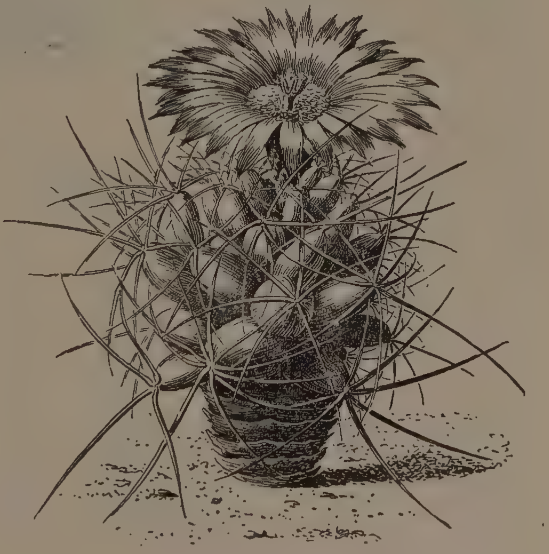
D. *The tubercles grooved only in upper half.*

8. **macrómeris,** Engelm. Fig. 2314. Low, usually soon proliferous, dark green: tubercles large and long, loose and spreading, but often incurved; groove rather short: radials 10–17, weak, slender and spreading; centrals at maturity usually 4, somewhat stouter and much longer, sometimes more than 2 in. long: fls. purple, often 3 in. in expansion; petals erose, mucronate: fr. with several scales on the ovary. Along the Rio Grande from New Mex. to Texas.

DD. *The tubercles grooved from top to bottom.*

E. *Glands 1 or more in the axils of the tubercles.*

9. **macrothèle,** Mart. (*M. aulacothèle*, Lem. *M. Léhmannii*, Otto). Sts. stout, attaining nearly 2 ft. height by 4 in. diam.: tubercles long, conical, at first upright, in age becoming even deflexed: spines all yellow; radials 6–8, spreading; centrals 1–2, longer and stouter: fls. 1½–2 in. broad. Cent. Mex.



2314. Mammillaria macromeris. (× ½)

10. **raphidacántha,** Lem. Sts. becoming 1 ft. or more long, 2–3 in. diam., often clavate: tubercles erect-spreading, somewhat flattened, often with 1 or 2 glands

in the groove: spines yellow in the young state, soon gray; radials 6–10; central 1, longer and stouter, straight or hooked in the same plant: fls. about 1 in. broad. San Luis Potosi, Mex.—The more constantly hooked form is *M. ancistracántha*, Lem. The recently described *M. radicantíssima*, Quehl., is very near *M. raphidacantha*, if not the same. It is found in the same locality.

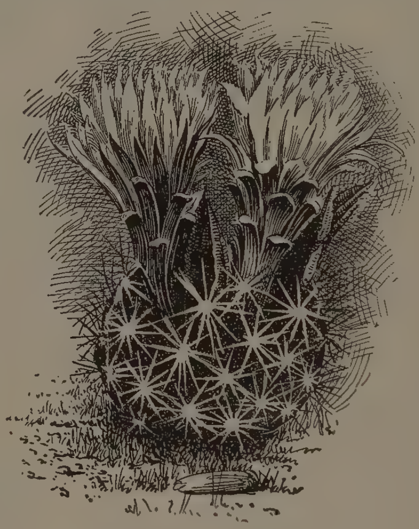
11. **erécta,** Lem. Branching from base and from decumbent sts., attaining 12 in. or more in height by 3 in. diam., bright green: tubercles conical, short, upright: spines all yellow; radials 8–13; centrals 4 or less: fls. 2–2½ in. diam. Cent. Mex.—In the groove close to the spines is often found, especially in the flowering area, a conspicuous honey-gland.

12. **recurvàta,** Engelm. (*M. recurvispìna,* Engelm. *M. nogalénsis,* Runge). Sts. depressed-globose and often deeply concave, 6–8 in. diam., forming large masses 1–3 ft. diam.: tubercles short, with usually a large gland in the groove near the apex: spines yellow or whitish, stiff, recurved-pectinate, interwoven and covering the whole plant; radials 18–20; central 1, rarely 2, recurved: fls. about 1 in. long, brownish outside. Near Nogales, Ariz., and southward in Sonora.

EE. *Glands none in the axils.*

13. **Scheèrii,** Mühlpf. (*Echinocáctus Poselgeriànus,* A. Dietr.). Sts. ovate-globose, 3–6 in. diam., usually simple: tubercles large and distant, deeply grooved, with 1–5 glands in the groove: spines stout, rigid, sometimes reddish; radials 6–16; centrals 1–5, stouter and longer, 1 very stout and porrect: fls. 2 in. long: seeds large for the genus. S. W. Texas and southward in Mex.—Muhlenpfordt described 2 species of Mammillaria under this name. The first one, founded in 1845, has purple fls., and is different from the one here described.

14. **robustispìna,** Engelm. (*M. Bròwnii,* Toumey). Much like the preceding, but tubercles teretish, no glands in the groove or sometimes a single one at apex: spines very stout; radials 10–15; central 1, longer, straight, curved or even hooked, rarely an additional straight upper one: fls. 2 in. long, with very slender tube: seeds large. Babuquibari Mts. south of Tucson, Ariz.



2315. Mammillaria vivipara. (×½)

15. **diffícilis,** Quehl. Sts. simple, nearly globose, 2½ in. diam.: radial spines 12–14; central spines 4. Mex.

16. **cornífera,** DC. Tubercles ovate, thick, rather crowded: radial spines 15–17, ashy white, 6 lines long; central 1, longer and stouter, erect, somewhat curved. Mex.

17. **daimonocèras,** Lem. Vertex impressed, very woolly: tubercles erect-conical: spines grayish; radials 20 or more, the upper accessory ones fascicled; centrals usually 3, stronger, the 2 upper divaricate and somewhat recurved, the lower horizontal or recurved. Mex.

18. **Echìnus,** Engelm. Differs from No. 17 in the less depressed shape and rather more numerous spines. S. Texas to Mex.

19. **echinoídea,** Quehl. A recent species, said to have come from Durango, Mex. It much resembles *M. Echinus.* It is also to be compared with *M. recurvata.* Fls. and fr. unknown. Not seen in Amer.

20. **scolymoìdes,** Scheidw. At length somewhat cespitose: tubercles conical, bent inward and imbricated: radial spines 14–20, whitish or horn-colored; centrals 1–4, longer and darker, the upper mingled with the upper radials, the lower stouter and bent downward: fls. 2 in. diam. Mex., south of the Rio Grande.

21. **ràdians,** DC. Sts. simple: axils naked: tubercles oval, large: spines white, rigid, subtomentose. Mex. R.B. 40:186.

22. **pectinàta,** Engelm. St. simple: tubercles quadrangular at base, conical above; areoles round-oblong: spines 16–24, yellowish, laterally compressed at base, stiff, pectinate, somewhat recurved: fls. 2½ in. diam.; petals broadest above, obtusish. Pecos River and Leon Springs, Texas.

23. **impexícoma,** Lem. Vertex deeply impressed, densely woolly: tubercles somewhat angulate; areoles round: spines 18–20, gray, rigid, covering the whole plant; very rarely a single porrect central. Mex.

24. **sulcàta,** Engelm. (*M. calcaràta,* Engelm.). Densely cespitose from the upper part of the groove: tubercles 7–9 lines long, ovate-oblong, with dilated base, somewhat imbricate, spreading in age: spines gray, rigid, subulate; radials 12–15, the upper 3–5, fascicled; central 1, recurved, wanting in younger plants: fls. 2½ in. in expansion, the tube red within; sepals not fringed. Texas, from the Brazos to the Nueces River.

25. **Níckelsæ,** Brandeg. (*M. Níckelsii,* Hort.). Very near the preceding, but radial spines more numerous, 14–18, the fascicled upper ones much longer than the lower, and no central. Mex., south of Laredo, Texas.

26. **conoídea,** DC. (*M. strobilifórmis,* Engelm.). Ovate-conical, with densely woolly vertex: tubercles short, usually densely appressed-imbricate in 8–10 spiral, rib-like rows: radial spines 10–16. straight and stout; centrals 3–5, stouter, blackish, the upper ones erect-spreading, the lower stouter, horizontal or deflexed: fls. about 1 in. in expansion, deep purple, paler outside: fr. short, buried and hidden in the axillary wool. N. E. Mex.

27. **vivípara,** Haw. Fig. 2315. Low and depressed globose, usually cespitose, forming large masses: tubercles terete and loose: radial spines 12–20, slender but stiff; centrals usually 4, but sometimes as many as 8, brownish, the upper erect-spreading, the lower stouter and deflexed: fls. bright purple, 1–1½ in. in expansion; stigmas mucronate. From S. Brit. Amer., through the upper Missouri region to E. Colo.

28. **radiòsa,** Engelm. Ovate or cylindrical, sometimes proliferous: tubercles terete: radial spines 20–30, white, with dusky apex, very unequal; centrals 4 or 5, stouter and longer, tawny, upper ones longer, lowest shorter and horizontal: fls. 1½–2 in. in expansion; stigmas obtuse. S. Texas and N. Mex.

Var. **neo-mexicàna,** Engelm. (*M. Hirschtiàna,* Haage f.). Lower, more or less proliferous from the lower grooves: radial spines 20–40, white; centrals 3–12, white below, blackish above.

Var. **boreàlis,** Engelm. Ovate or subglobose: radial spines 12–20; centrals 3–6, purple-spotted. Very near *M. vivipara.*

Var. **arizónica,** Engelm. Globose or ovate, large: tubercles long-cylindrical: radial spines 15–20, whitish; centrals 3–6, deep brown above: fls. large, rose-colored N. Ariz.

Var. **desérti,** Engelm. Low, simple, with slender nearly cylindric tubercles: radial spines 15–20; centrals

8–10, reddish tipped: fls. straw-colored, with purplish tips. Ivanpah, Calif.

Var. **chlorántha,** Engelm. Cylindrical, sometimes as much as 9 in. high: radial spines 20–25, almost in 2 series, gray; centrals 6–9, stouter, ½–1 in. long, reddish only at tip: fls. greenish yellow. S. Utah.

Var. **Álversonii,** Coulter. FOXTAIL CACTUS. Robust and branching, sometimes 10 in. long, glaucous: tubercles short and broad, somewhat angled, forming more or less distinct ribs: radial spines numerous; centrals 8–14, stout, spreading, blackish half-way down: fls. pink. S. E. Calif.

29. **cornùta,** Hildmann. Depressed-globose or hemispherical, small, grayish green: tubercles large, flattened and imbricated; areoles round: radial spines 5–7, stout, short, compressed, radiant, grayish, the upper longer; central 1, stouter, as long as the radials: fls. rose-red. "In age the spines fall off and the plant, covered with imbricated, scale-like tubercles, reminds one of a pineapple." Mex.

30. **elephántidens,** Lem. Rather large, glaucous green: tubercles very large and thick, becoming horizontal or deflexed and somewhat bilobed: spines 6–8, all radial, stout, yellowish or gray, appressed to the plant and somewhat recurved: fls. rose-color, 3 in. in expansion. Mex.

BB. *Tubercles never grooved on upper side.*

C. *Fls. large, yellow: tubercles elongated, of loose and soft texture.*

31. **longimámma,** DC. Cespitose, bright green, forming large, low clumps: tubercles sometimes more than 2 in. long: spines straight, pubescent; radials 7–10; central 1: fls. 2 in. or more in expansion. Mex.

Var. **uberifórmis,** Schum. Tubercles darker green: radial spines seldom more than 4; centrals none.

Var. **globòsa,** Schum. Tubercles dark green, very long: radial spines as many as 12; centrals 2–3.

Var. **sphǽrica,** Engelm. Tubercles about 1 in. long: radial spines 12–14; central 1. Texas.

CC. *Fls. small, usually white or red: tubercles not elongated.*

D. *Seeds black.*

E. *Base of seeds brown corky.*

32. **tetrancístra,** Engelm. (*M. phellósperma,* Engelm.) Ovate or ovate-cylindrical, rather large, simple or sparingly branched from the base: young axils sparingly setose: radial spines 30–60, in 2 series; exterior bristle-like, white; interior stouter and longer, dusky-tipped or purplish; centrals 1–4, longer, brown or blackish, sometimes all hooked, the upper ones sometimes straight: seed with a brown corky base. S. Calif. to Utah.

EE. *Base of seeds not brown corky.*

33. **micrómeris,** Engelm. Cylindrical-clavate, 1–6 in. high, covered by white spines: tubercles only ½ line long: spines on the body very short, many serial, successively shorter toward the center, not pungent; in the flowering area the upper tuft of spines having a clavate deciduous tip: fls. pinkish white, borne at the summit in a dense tuft of wool and spines, directly behind the apex of the tubercle: fr. red, smooth; seed black. Texas.

Var. **Gréggii,** Engelm. Larger in all its parts. This species and its variety really do not belong to Mammillaria although they are usually placed here by gardeners. Var. *Greggii,* which is really specifically distinct from *M. micromeris,* has been referred to Echinocactus, although superficially it has no resemblance to that genus. Weber constructed for these forms the genus Epithelantha, and this will probably be the best disposition to make of this group.

34. **elongàta,** DC. (*M. dénsa,* Link & Otto). Erect, 6–7 in. long, 1–1½ in. thick: radial spines 16–18, yellow; centrals none: fls. white or yellowish. Cent. Mex.—*M. viperìna,* Purpus, was recently distributed abroad, but has not been seen in this country. It is said to be a form of *M. elongata.* Fls. and fr. unknown.

Var. **echinàta,** Schum. (*M. echinàta* and *M. echinària,* DC.). Radials as many as 20, yellow; centrals 2–3, brown.—A stout form.

Var. **ténuis,** Schum. (*M. ténuis,* DC. *M. mínima,* Salm). Radial spines about 20, pale yellow; centrals none.—The most slender form, only ½in. thick.

Var. **stélla-auràta,** Schum. Sts. somewhat thicker: spines golden yellow; 1 central usually present.

35. **Leòna,** Poselg. Sts. stouter, glaucous, upper axils woolly: radial spines about 30, radiant, slender, white; centrals 6–12, much stouter; the upper ones longest, ivory-white at base, dove-color or bluish above. Nuevo Leon, Mex.

36. **decípiens,** Scheidw. (*M. Guilleminiàna,* Lem.). Irregularly cespitose, somewhat clavate, often rosy: tubercles cylindrical; axils sparingly bristly: radial spines 7–12, whitish; centrals 1–2, brown, longer; all slender. Mex.

37. **dumetòrum,** Purpus. Minute plants, less than 1 in. diam.: tubercles prominent, terete, bearing long white hairs in their axils; spines spreading, white except at the yellow bases: fls. 6–7 lines long. Cent. Mex.

38. **frágilis,** Salm. Sts. low, usually as broad or broader than high, extremely proliferous, the offsets so lightly attached that they soon fall by their own weight: radial spines 12–14 ,white; centrals none or 1, rarely 2, white, with dusky tip. Mex.

39. **lasiacántha,** Engelm. Low, usually globose or depressed-globose: tubercles slender, axils naked: radial spines as many as 40–80, feathery; centrals none. Texas.

Var. **denudàta,** Engelm. (*M. Rúngei,* Hort.). Larger, both plant and tubercles: spines naked.

40. **plumòsa,** Web. Densely cespitose, at length forming masses 6–10 in. diam.: axils long-hairy: radial spines about 40, feathered to the tip; centrals none.—This and the preceding are like feathery balls. *M. plumosa* is sold usually under the name of *M. lasiacantha,* to which it appears to be rather closely related. N. Mex.

41. **senìlis,** Salm. "Proliferous at base: axils not setose: tubercles crowded: spines all white; exterior very numerous, erect-spreading, hair-like, flexuous; centrals 4–6, a little stronger, the upper and the lower hooked." Chihuahua, Mex.

42. **barbàta,** Engelm. Globose-depressed: axils not setose: exterior spines very numerous, pilose; interior stronger, yellowish, 10–15; central solitary, stout-hooked, yellowish, not much longer than the others: fls. small, not remote from the center; sepals fimbriate; berry "green." Near Chihuahua, Mex.

43. **vètula,** Mart. Subglobose or becoming subcylindrical: axils not setose: radial spines bristle-like, at first 25–30, obliquely spreading, later twice as many and horizontal; centrals 1–3, yellowish brown, scarcely stouter or longer. Mex.

44. **cándida,** Scheidw. (*M. sphærótricha,* Lem.). At length cespitose, globose, becoming longer: vertex depressed: axils setose: radial spines bristle-like, more than 50, horizontal and interwoven; inner spines, 8, 10 12, or more, a little stouter and upright: fls. flesh-color or pinkish.

45. **pusílla,** DC. (*Cáctus stellàtus,* Willd. *M. stellàris,* Haw.). Low, globular, proliferous, making large masses: tubercles cylindrical, small and loosely spreading; axils with long, hair-like, tortuous bristles: radial spines 12–20, very soft and flexuous; centrals 4–6, yellowish, a little rigid, pubescent: fls. yellowish white. W. Indies.

Var. **múlticeps,** Salm. Larger: tubercles upright, crowded: radial spines numerous; centrals 6–8, slender, pubescent, reddish yellow. Mex.

Var. **texàna,** Engelm. Larger than the last: spines in 3 series; outer capillary, crisped, 30–50; interior 10–12, a little more rigid, pubescent, white; centrals 5–8, longer, stouter, pubescent, yellow at tip. Texas and adjacent Mex.

46. **Bocasàna,** Poselg. Depressed-globose, or a little lengthened, at length densely cespitose: axillary bristles as long or longer than the tubercles: radial spines 25–30, white, stiff at the base, each ending in a flexuous thread; centrals 2–3, slender, porrect, short, all yellow with brown tips, the hooked one brown nearly to the base, pubescent. Mex.

47. **Kunzeàna,** Bödeker & Quehl. Plants small, growing in cespitose clusters, light green: tubercles cylindrical, with bristles in their axils: radial spines about 25, white, delicate but stiff; central spines 3 or 4, yellowish brown, one of them hooked: fls. white, with the outer lobes rose-colored. Mex.

48. **Wìldii,** A. Dietr. (*M. Wildiàna,* Otto). Cespitose, forming hemispherical clumps: radial spines 8–10, very slender, white, spreading; centrals usually 3–4, a little stouter and longer, honey-yellow, brown at base, pubescent, 1-hooked. Mex.

49. **dioìca,** Brandeg. (*M. Goòdrichii,* of Calif.). Simple or cespitose from the base, ovate to cylindrical, 3–8 in. high: tubercles somewhat angular and leathery: radial spines 11–22, white, with brown or purple tips; centrals 1–4, longer and darker, the upper turned up among the radials, the lower porrect and strongly hooked: fls. often unisexual, yellowish white with rosy streak. Calif. and Low. Calif.

Var. **insulàris,** Brandeg. (*M. Pálmeri,* Coulter, not of Jacobi). Sts. densely cespitose, shorter: axils densely woolly: spines much whiter, usually all straight. San Benito Isl.

50. **armillàta,** Brandeg. Taller, often 1 ft. high, branching at base and along the st.: tubercles crowded: radial spines 9–15; centrals 1–4, nearly twice as long: fls. small, yellowish, scarcely spreading. Low. Calif.—The plant is marked by dark circular bands.

51. **Wrìghtii,** Engelm. Globose or depressed, top-shaped below: radial spines 8–12, white, pubescent; centrals 1–3, reddish black, scarcely longer than radials, all hooked: fls. about 1 in. long, purple. New Mex.

52. **Goòdrichii,** Scheer. Erect, cylindrical, branching at base: axils naked: radial spines about 12, white; centrals 4, white below, brown above, the 3 upper erect-spreading, the lower longer. Cedros Isl. and Low. Calif.

53. **Gràhamii,** Engelm. Globose or ovate, somewhat cespitose: radial spines 15–30, white, often dusky at tip, the upper ones shorter; centrals usually 4, usually blackish from a paler base, the 3 upper turned up among the radials, and, when pale, hardly to be distinguished from them; lower porrect: fls. rose-colored, 1 in. expansion: fr. nearly 1 in. long. From Texas to S. Calif. and adjacent Mex.

54. **fasciculàta,** Engelm. (*M. Thórnberi,* Orcutt). Plants sometimes growing in large clusters often containing many plants (as many as 110 have been noted): sts. cylindrical, usually 2–4 in. high but sometimes as much as 1 ft. high: radial spines 13–18, white, with dark tips: fls. broadly funnel-shaped, purplish; petals broad-acute. Ariz.—This species, although collected in 1848, has been poorly represented in our collections and unfortunately has recently been re-named. It is a very beautiful species.

55. **mazatlanénsis,** Schum. (*M. littoràlis,* Brandeg.). Plants growing in dense clusters, much branched at base: sts. globular to short cylindrical: spines numerous, usually brown and completely hiding the plant. West coast of Mex.; sometimes erroneously referred to Calif.—This species does not do well in cult.

56. **venùsta,** Brandeg. Globose or hemispherical, small, often cespitose: tubercles very thick and blunt, concave at the end, usually extremely glaucous: radial spines 9–15, stout, from pure white to white below and brownish above; central commonly 1, sometimes 2 or 3, the lower little longer and darker than the radials: fls. rose-color, 1½ in. in expansion: fr. scarcely juicy, nearly 1 in. long, circumscissile near the base. S. Low. Calif.

57. **Maìnæ,** Brandeg. Hemispherical to ovate, usually simple: tubercles somewhat incurved, glaucous, the lower part and the axils often bright rose-red: radial spines 10–15, yellowish becoming gray, the upper shorter; centrals 1–3, the upper shorter and smaller, turned upward, one of them sometimes hooked, lower central stout, strongly hooked, somewhat twisted, yellowish below, black at tip: fls. flesh-color: fr. shorter than the tubercles. Vicinity of Nogales, Ariz.—Sent out as *M. Galeottii.*

58. **Cárretii,** Schum. Simple, depressed-globose, rather small: radial spines spreading-recurved and interwoven, rather long, yellowish; central 1, slender, chestnut-brown, paler below: fl. whitish, with rosy streak in petals; sepals long-acuminate. Mex.—The only specimen seen has bristles in the axils.

59. **eriacántha,** Link & Otto. Cylindrical, elongated, ½ft. and more in height ("reaching 20 in.") by 2–2½ in. diam.: tubercles crowded, acutely conical: spines all pubescent; radials 20–24, pale yellow, bristle-like; centrals 2, stronger, nearly twice as long as the radials, golden yellow, one directed upward, the other downward: fls. yellow, small: fr. yellow. Mex.

60. **sphacelàta,** Mart. Sts. cespitose, cylindrical, 6 in. or more long, 1 in. diam.: tubercles short, conical from a broader, rhombic base: spines ivory-white with blackish tips; radials 12–18, horizontal-spreading; centrals 3–4, upright: fls. small, the petals acute. Mex.—The proper position of this and of the preceding species is still quite uncertain.

DD. *Seeds brown.*

E. *The tubercles not exuding milk when pricked.*

61. **spinosíssima,** Lem. Sts. cylindrical, reaching 1 ft. high and 2½ in. diam.: tubercles short, ovate-conic, somewhat tetragonal: radial spines 20–25, setiform, white, spreading; centrals 12–15, brownish red, stronger and twice the length of the radials. Mex.

Var. **sanguínea,** Haage. St. somewhat clavate, rather shorter and stouter: radial spines 18–20, spreading, white; centrals 8, only a little longer, but thicker and bulbous at base, white with brownish base and dark brown tip, the young ones dark blood-red. Mex.

62. **rhodántha,** Link & Otto (*M. Odieriàna,* Lem. *M. fulvispìna,* Haw.). St. long-cylindric or clavate, reaching more than 1 ft. high, usually 2-parted: axils bristly: radial spines 16–20, white, bristle-like, horizontal-spreading; centrals 4–6, rigid, white or yellowish, the upper black at tip. Mex.

Var. **pyramidàlis,** Schum. Central spines dark brown, the young ones ruby-red.

Var. **Pfeìfferi,** Schum. (*M. aurèiceps,* Lem.). Radial spines 25 or more, yellow; centrals 6–7, recurved spreading, golden brown.

Var. **crassispìna,** Schum. Radial spines 24–27, whitish; centrals 6–7, larger and stouter, more curved, darker.

Var. **fuscàta,** Schum. Axils naked; tubercles 4-angled at base: radial spines 25–28, radiant, bright yellowish brown; centrals 6, stout, strongly curved, the upper very long.

63. **dolichocéntra,** Lem. (*M. tetracántha,* Hook.). Subglobose (but said to reach a yard in height): tuber-

cles somewhat 4-angled; areoles elliptic or rhombic: radial spines none; centrals 4, slender, rigid, the upper curved upward, 1–1½ in. long, the 3 lower half as long, all grayish brown. Mex.

Var. **Galeóttii,** Foerst. Radial bristles 8–14, very short, soon falling; centrals 4, seldom 1 or 2 more, spreading, yellowish, with points, the upper and lower longest. Mex.

64. **díscolor,** Haw. Globose or ovate, glaucous: outer spines 16–20, white, radiant; interior 6, rigid, recurved, white below, black above, upper and lowermost very long. Mex.

65. **Lesaunièri,** Schum. Hemispherical or very short-cylindrical (habit of *M. Heyderi*): spines brownish, short; radials 11–13; central upright, stronger.

66. **Haageàna,** Pfeiff. Cespitose: heads small, at length cylindrical, slender: tubercles small, crowded; axils woolly: radial spines about 20, pure white, only about 1½ lines long; centrals 2, black, slender, elongated, upper 3, lower 4 lines long. Mex.

67. **élegans,** DC. (*M. acanthophlégma,* Lehm. *M. Potosìna,* Hort. *M. Klùgii,* Ehrb.). Simple, then proliferous and densely cespitose, depressed-globose, later lengthened: tubercles crowded, very small: radial spines more than 20, bristle-like, about 3 lines long, pure white, interwoven and covering the whole plant; central spines 2 (1–3), with brown tips, the one directed upward, the other downward, about twice as long as radials, in the axils abundant long white wool. Mex.

2316. Mammillaria meiacantha. (×½)

EE. *The tubercles exuding milk when pricked.*

68. **bícolor,** Lehm. Simple or proliferous: tubercles small, crowded, ovate-pyramidal: radial spines 16–20; centrals 2, less than 1 in. long, stouter, erect, black-tipped. Mex.

Var. **nívea,** Schum. Obovate proliferous tubercles conical: radial spines capillary; centrals 4, white, with dusky apex, upper one incurved, 1 in. long.

69. **Párkinsonii,** Ehrb. At length dichotomously divided: tubercles slenderly pyramidal; axils woolly and bristly: radial spines 20 or more, slender; centrals 2, 3, 4, rarely 5, brown-tipped, the upper ones 3–4 lines long, the lower 1½ in. turned downward. Mex.

70. **formòsa,** Scheidw. Nearly simple: tubercles 4-angled: radial spines 18–22, rather rigid; centrals 6, a little longer, stiffer, thickened at base, reddish or brownish tipped.

71. **angulàris,** Link & Otto (*M. subangulàris,* DC.). Densely cespitose: axils of the young tubercles setose as well as woolly: radial spines 3–7, the upper ones often very short, the lower one sometimes 3 in. long, occasionally a very long central present. Mex.

72. **árida,** Rose. Sts. usually simple, globular, deeply seated in the ground, 1–2 in. diam.: tubercles very milky, nearly terete: radial spines about 15, pale, with dark tips; central spines 4–7: fls. 6 lines long; petals cream-colored to a pale yellow: fr. clavate; seeds brown. Only known from the collection made by J. N. Rose on an island in the Gulf of California near La Paz in 1911.

73. **petróphila,** Brandeg. Sts. depressed-globose to short-cylindric, 6 in. high: tubercles milky, about 5 lines long: spines chestnut-brown or paler at base; radial spines 8–10; central spines 1 or 2: fls. greenish yellow. Mountains of S. Low. Calif.

74. **centricírrha,** Lem. (*M. arietìna,* and *M. deflexispìna,* Lem. *M. Foèrsteri* and *M. Kràmeri,* Mühlpf. *M. Schmídtii,* Sencke. *M. tetracántha,* Hort.). Copiously proliferous: tubercles pyramidal, 4-angular: spines irregular, mostly 4–6 radials and 1 central, sometimes only 1, sometimes 2 centrals with 1–2 very short radials or none; radials very stout, straight or curved, awl-shaped, reaching ¾in.; central stouter, sometimes nearly 2 in. long; young spines yellow. Mex.

75. **mutábilis,** Scheidw. (*M. autumnàlis,* Dietr. *M. cirrhífera,* Mart.). At length sparingly cespitose, depressed-globose or short-cylindric: tubercles pyramidal, 4-angled; axils with stout bristles in the wool: radial spines 1–6, very small; centrals 1–4, angled, flexuous, much longer, particularly the upper one, which reaches 2 in. Mex.

76. **Heeseàna,** McDow. (*M. Pètersonii,* Hildmann). Simple, glaucous or ashy green: tubercles pyramidal, 4-angled: radial spines 10–14, the 3 upper pure white and very short, the remainder longer and brownish-tipped; centrals 4, the upper ones erect and forming an elevated covering for the top of the plant, the lower one the longest, 2 in. long, and projecting. Mex.—Varies in color of spines.

77. **símplex,** Haw. Globose or short-cylindric: radial spines 12–17, the middle ones longest; centrals 4–5, somewhat longer, reddish: fl. brownish green without, yellowish or whitish green within: fr. red, ⅔in. long, clavate; seed brown.—This is the *Cactus Mamillaris* of Linnæus and the first species discovered. It has for many years been a desideratum in our collections, although various species have recently been referred to it, like *Mammillaria nivosa* and *M. pusilla.* It has recently been re-discovered on the Isl. of Curacao and in N. Venezuela. This is the only species known from the S. American continent.

78. **nivòsa,** Link. Grows in clusters of 25 or more specimens, forming clumps 2 ft. diam.: largest individual specimens sometimes 6 in. diam.: spines all yellow: tubercles very woolly in their axils: fls. cream-colored. Common on exposed cliffs of many of the W. India Isls. —A very beautiful species, but not often seen in cult.

79. **hidalgénsis,** Purpus. Sts. simple, cylindrical, sometimes 1 ft. high: radial spines none; central spines 4: fls. crimson. Cent. Mex.

80. **crucígera,** Mart. Sts. cylindrical, 4–6 in. high: tubercles closely set, with their axils full of white wool: radial spines numerous, 20 or more, bristle-like and spreading; central spines 4, yellowish: fls. crimson or purple. Mex.—An old species recently intro. into cult.

81. **Brándegei,** Coulter (*M. Gábbii,* Coulter). Depressed-globose to short-cylindric or clavate: tubercles slender: radial spines 9–16; centrals 1–4, sometimes shorter than the radials, and stout, sometimes longer and slender, white to brown: fls. reddish brown without, brownish green within: fr. clavate, white, tinged lilac. Cent. Low. Calif.

82. **Heỳderi,** Mühlpf. (*M. texénsis,* Lab.). Tubercles slender: spines short; radials 16–18, short, slender, white; central 1, darker, shorter than the lower radials, brown: fls. yellowish, with pale rosy streak in the petals. Ariz. to Texas.

Var. **applanàta,** Engelm. Body much depressed, summit flat or concave: radial spines 15–22. Texas.

Var. **hemisphǽrica,** Engelm. Top rounded: radial spines 9–12. N. E. Mex.

83. **Macdoùgalii,** Rose. Plants low and somewhat flattened on top, but very old plants nearly globular and then about 5 in. diam.: tubercles flattened dorsally, strongly angled: radial spines 10–12, white or somewhat yellowish, tipped with brown or black; central spines 2, stout, yellowish, with brown tips: fls. over an inch long, cream-colored: fr. red, clavate. Common in the mountains about Tucson, Ariz., where it was collected by D. T. MacDougal, for whom it is named. This species is related to the Texan species commonly known as *M. Heyderi.*

84. **meiacántha,** Engelm. Fig. 2316. Usually simple: tubercles rather large, sharply angled and 4-sided, pyramidal: radial spines 5–9, mostly 6, white or yellowish; central 1, rarely a second, shorter and darker than the radials: fls. whitish, with reddish streak. Texas.

85. **cárnea,** Zucc. Body dark green: tubercles rather large, pyramidal, 4-angled: radial usually none, rarely 1–2; centrals commonly 4, in upright cross, stiff, grayish, with darker tip, in young growth dark brown or reddish: fls. reddish flesh-color. Mex.

86. **uncinàta,** Zucc. Depressed-globose to subclavate: tubercles pyramidal, not strongly angled: radial spines 4–6, short, gray, dark-tipped; centrals 1, rarely more, longer and stronger, strongly hooked, dark. Mex.

87. **Trohártii,** Schum. Globose or depressed, small: tubercles very small, conical, scarcely angled: radial spines 5, white with dark brown tips, the lower longest; central 1, dark brown, stiff. Mex.

88. **sempervìvi,** DC. Globose, blackish green, axils woolly: tubercles short, angled: radial spines 3–7, very short, only found on young tubercles; centrals only about 2 lines long, stout, conical, reddish, later gray: fls. dull white with reddish streak. Mex.

89. **Caput-Medùsæ,** Otto. Depressed-globose, dull glaucous green, small: tubercles slender, angled at base: spines 3–6, very short, subulate, straight, reddish when young, later gray, pubescent: fls. whitish, red-streaked. Mex.

Mammillarias, in common with other cacti, run into many forms. Some of these forms may be valuable to the horticulturist, and yet not sufficiently distinct to warrant the giving of definite botanical names. The following names, not accounted for in the above review, are offered in the catalogues of American dealers: *M. Brándii.*—*M. brùnea.*—*M. cirrhífera longispìna* (see No. 75).—*M. Donátii.*—*M. filipéndula.*—*M. fuscàta Leòna* (see Nos. 35, 62).—*M. Lassòmeri*=M. Lesaunieri(?).—*M. melonácantha* is an uncertain garden name.—*M. montàna.*—*M. Nícholsonii*=M. Nickelsæ(?).—*M. Rebsamiàna.*—*M. recúrvens.*—*M. rigidispìna.*

The following species, mostly recently described, have appeared in foreign publications. None of them is being grown in Amer.: *M. Boedekeriàna,* Quehl.—*M. bombycìna,* Quehl.—*M. camptotrícha,* E. Dams.—*M. collìna,* Purpus.—*M. cordígera,* Heese.—*M. Emskoetteriàna,* Quehl.—*M. Joosensiàna,* Quehl.—*M. Knippeliàna,* Quehl.—*M. Múndtii,* Schum.—*M. napìna,* Purpus.—*M. pilispìna,* Purpus.—*M. ramosíssima,* Quehl.—*M. Ruèstii,* Quehl.—*M. Sártorii,* Purpus.—*M. Seideliàna,* Quehl.—*M. trichacántha,* Schum.—*M. unisèta,* Quehl.—*M. Verhærtiàna,* Boedeker.

The following species are likely to appear in the trade at any time: *M. ceratìtes,* Quehl. This species has been associated with M. Delætiana and M. durangensis, but it seems to be very close to M. conoidea. It has not yet been intro. into American trade.—*M. Delætiàna,* Quehl. Sts. club-shaped, about 3 in. high: tubercles grooved on the upper side: fls. large, pale yellow. Mex., sometimes credited to Calif.—*M. durangénsis,* Runge. Very beautiful species with small central fls. Does not grow well in cult.—*M. pseudoperbélla,* Quehl. A species recently intro. into Eu. Very close to M. elegans. Not yet cult. in Amer.

J. N. Rose.†

MANDARIN ORANGE: *Citrus nobilis* var. *deliciosa.*

MANDEVÍLLA (Henry John Mandeville, British minister at Buenos Ayres). *Apocynàceæ.* Tall climbers from the warmer parts of America, with large funnel-shaped, 5-lobed flowers which are yellow, white or rarely tinged violet.

Woody plants: lvs. opposite, penniveined: racemes simple, often 1-sided, loose, dense or reduced to 2 or 3 fls.; calyx 5-parted, with several glands inside at the base or 5 scales; corolla-tube cylindrical, funnel-shaped, or ovoid; lobes 5, broad, twisted; stamens fixed at the apex of the tube, included; disk of 5 lobes or scales; ovary of 2 distinct carpels; stigma thick: follicles erect or divergent, incurved and more or less cohering at apex, terete or angled.—Species 50 or more, Mex. to Argentina, but some of them probably to be referred to Echites or elsewhere. The species are little known as cult. subjects. The plants resemble Dipladenia, which see for cult.

suavèolens, Lindl. (*Echìtes funifórmis,* Gris., not Vell.). Sometimes called Chilean jasmine because of its climbing habit and large white or blush fragrant fls.: lvs. cordate, stalked, glabrous above, glaucous beneath; stipules pectinate: racemes with about 9 fls. each 2 in. across. Argentina. B.R. 26:7. B.M. 3797. G.C. III. 2:817. P.M. 16:289. R.H. 1845:167; 1913, p. 424. J.H. III. 48:413. G. 29:443. Some of the foregoing portraits may represent the following species, as the two have been confused.—Characterized by a pale, fleshy pectinate ring between the base of the calyx and corolla.

Tweedieàna, Gad. & Stapf. Much like *M. suaveolens,* differing in having glabrous branches, long-acuminate or almost caudate lvs., longer petioles, lanceolate bracts, more fragrant fls. with lanceolate sepals, brilliant white corolla-limb and green tube. Probably Argentina. R.H. 1913, p. 425.

Wilhelm Miller.
L. H. B.†

MANDRÁGORA (name used by Hippocrates, said to signify that the plant is hurtful to cattle). *Solanàceæ.* Mandrake. Old medicinal herbs.

A genus of three or four species, one of which is supposed to be the dudaim mentioned in Genesis, chapter 30. In America the name mandrake is applied to the mayapple, *Podophyllum peltatum,* but the mandrake of history is a plant with a large spindle-shaped root which was supposed sometimes to become forked and resemble the human form. In this condition it was used as an aphrodisiac. The plant was also called love-apple, and many superstitions about it still survive. The old herbals abound in fanciful pictures of the mandrake, one of which is reproduced in Fig. 2317. *M. officinarum* may be cultivated in the hardy border for its folk-lore interest. *M. autumnalis* is supposed by some to be the true mandrake. Both are natives of the Mediterranean region. *M. caulescens* is found in the Himalayas. The mandrakes are allied to belladonna (Atropa) and have poisonous qualities.

2317. Mandrake.
From an old herbal.
(See Mandragora).

Mandragoras are mostly stemless perennial herbs with thick roots and large, stalked, wavy-margined lvs., the later ones being usually narrower and entire, and rather large fls. varying from whitish through bluish violet and purplish shades: fls. purple, bell-shaped, about 5-cut, netted-veined and borne in clusters among the tufted lvs.; calyx deeply 5-cut; sinus of the corolla induplicate between the lobes; stamens 5: fr. a globose or oblong juicy berry.

officinàrum, Linn. (*M. officinàlis,* Mill. *Átropa Mandrágora,* Linn.). Mandrake. Lvs. ovate, the first obtuse, the others acuminate: calyx-teeth lanceolate, as long as the oblong berry. R.H. 1897, p. 131.

Wilhelm Miller.

MANDRAKE in America means the mayapple (Podophyllum) but the mandrake of history is *Mandragora,* above.

MANÉTTIA (Xavier Manetti, of the botanic garden at Florence, born 1723). *Rubiàceæ.* Twining plants sometimes grown under glass for the ornamental flowers.

Glabrous or villous graceful climbers, evergreen: lvs. stalked, usually long-acuminate: fls. small or rather large, axillary, solitary or in short corymbs or panicles, white, yellow or red; calyx-lobes 4, rarely 5, short or long, narrow or broad; corolla-tube short or long, terete or angled, straight or curved, glabrous or pilose within; limb 4- (rarely 5-) lobed, the lobes usually short and erect or recurved, valvate; stamens 4 or 5, inserted at the orifice or in the throat of the corolla; disk annular or cushion-like; style filiform, the stigma entire or bifid: fr. an obovoid or turbinate 2-grooved 2-celled dehiscent many-seeded caps.—Perhaps 40 species, in warmer parts of Amer.

This genus includes the common manettia vine, *M. bicolor* and *M. inflata*, which have scarlet tubular flowers an inch or more long, with five spreading yellow tips. They are twining plants and are often trained to pillars and trellises both indoors and out, as they bloom more or less the year round. They can also be trained into a bushy form. The manettia vine is a rather old-fashioned plant, and generally easy of culture. It is fairly satisfactory as a cool conservatory vine, but is an easy prey to red-spider and mealy-bug. The flowers are short-lived, and not the best for cutting. Some gardeners prefer it to cupheas or *Jacobinia penrhosiensis*. Manettias are propagated by cuttings of young growth inserted in sand with bottom heat. For summer use the vines should have a sheltered but sunny position.

Manettias are very useful as roof-plants, or for growing on rafters and pillars. They may also be grown into specimen plants trained on a wire trellis. They may be rooted in a temperature of 60° to 65°. Put them in sand about 1 inch apart, shading them from the sun. Roots will soon form, when they may be potted, singly, in small pots, in two parts loam, one of leaf-mold, and one of sand. When the plants have gripped the soil, pinch out their points to encourage them to break. Put a few thin stakes around the pot to which to tie the shoots until they are large enough to be trained in their permanent position. Never allow the plants to become pot-bound, until the desired size of pot is attained, and be careful that the shoots do not get all tangled up, as it would be difficult to separate them, when it is desired to train them on a trellis, or in some other desirable position. Loam two parts, equal parts sand, and flaky leaves, a small part of well-rotted manure, is a good potting medium, for all future pottings. The night temperature should never be less than 55°. In summer, the plants that are grown on a trellis, in pots, may be placed outdoors on a bed of ashes, until the middle of September. Syringe manettias freely, as this keeps red-spider in check. Other insect pests may be kept down by fumigating with hydrocyanic gas as advised for other plants. (George F. Stewart.)

A. *Corolla of practically the same color throughout.*

glàbra, Cham. & Schlecht. (*M. cordifòlia*, Hort., not Mart.). Glabrous, much branched, woody below: lvs. cordate-ovate-acuminate, very short-petioled, glabrous and shining: fls. single on elongated solitary peduncles, crimson; corolla 1½ in. long, clavate-funnel-shaped, quadrangular; limb 4-parted, the short segms. deltoid and revolute; disk cushion-shaped; stamens conspicuously exserted. S. Brazil, Paraguay, Uruguay, Argentina. B.M. 3202. B.R. 1866. P.M. 2:267. B. 2:87 (all as *M. cordifolia*). The true *M. cordifolia*, Mart., apparently not in cult., is pubescent, with spreading corolla-lobes and included stamens.

mìcans, Poepp. & Endl. Handsome, differing from *M. glabra* in larger fls. which are borne several together on short axillary branches; the corolla-lobes spreading, and anthers nearly sessile; and the petioles shorter: fls. bright red-orange. Andes region, Peru and Bolivia to Argentina. B.M. 5495.

coccínea, Willd. Probably not in cult., and its position apparently doubtful: twining: lvs. oval or ovate, long-acuminate, tapering to base: fls. scarlet (pinkish?), on rather stout bracted peduncles; corolla salver-shaped, the 4 lobes pointed and spreading-reflexed, the throat closed with yellow hairs and stamens included; disk hollow and adnate to calyx-tube; sepals apparently 8. Mex. to Colombia. B.R. 693.

miniàta, Lem. Twining, somewhat white-hairy: lvs. oval-elliptic, thick, the base long-attenuate and apex acute or subacuminate, grayish pilose above: fls. solitary or twin, long-peduncled, cinnabar-red shading to rose; corolla funnel-shaped, hairy, the lobes 4, pointed, spreading; stamens included. Probably Andean, and very likely not now in cult. F.S. 4:317.

AA. *Corolla yellow at apex.*

bícolor, Paxt. Twining, glabrous: lvs. nearly sessile, lanceolate, slightly glaucous, acuminate: fls. single on short axillary peduncles; corolla ¾in. long, little swollen at base, red below and yellow toward the top, the short lobes spreading-reflexed; calyx-lobes erect or spreading; style exserted. Brazil. P.M. 10:27.

inflàta, Sprague (*M. bícolor*, Hort., in part). Fig. 2318. Recently separated from the cult. *M. bicolor:* differs in its leafy reflexed calyx-lobes, the corolla swollen at base, more coarsely hairy, and the yellow part of corolla much smaller; anthers not apiculate; style (in long-styléd plant) about as long as corolla-tube. Paraguay and Uruguay. B.M. 7776 (as *M. bicolor*). G.C. III. 36:384.

L. H. B.

2318. Manettia inflata. (×⅓)

MANFRÈDA ("named after an ancient writer on simples whose work is in the Parisian library"). *Amaryllidàceæ*, tribe *Agavoídeæ.* Acaulescent bulbous plants, of somewhat the aspect of Polianthes, but with nearly straight usually solitary flowers; closely allied to Agave, and requiring similar culture.

Leaves thin, lance-oblong, usually denticulate, dying in winter: infl. a raceme; fls. nocturnal, greenish or purplish white, tubular with spreading limb and protruding style and stamens. Chiefly Mexican. Monograph by Rose in Contr. U. S. Nat. Herb. 8, Part I, 1903. The lvs. of most species are wavy or crisped at the margin.

A. *Lvs. pubescent.*

maculàta, Rose (*Poliánthes maculàta*, Mart. *Agàve pubéscens*, Regel & Ortg. *A. brachystàchys pubéscens*, Terr.). Lvs. brown-spotted: infl. 3 ft. high; fls. subsessile, 1¼ in. long; tube much longer than segm.; stamens long-exserted. S. Mex. Amoen. Bot. Monac. 19:13.

AA. *Lvs. glabrous.*

B. *Stamens little exserted.*

maculòsa, Rose (*Agàve maculòsa*, Hook. *A. maculàta*, Engelm.). Fig. 2319. Lvs. somewhat glaucous, mottled: infl. 3 ft. high; fls. subsessile, 2 in. long; tube somewhat longer than segm.; filaments in the throat. Texas. B.M. 5122. Bull. Soc. Tosc. Ort. 3. p. 308.

BB. *Stamens long-exserted.*

C. *Tube of perianth longer than segm.*

virgínica, Salisb. (*Agàve virgínica,* Linn. *A. pállida,* Salisb. *A. carolinénsis,* Lets. *A. Alibértii,* Baker. *Alibértia intermèdia,* Mar. *Alòe caroliniàna,* Hill. *A. virgínica,* Crantz). Lvs. green: infl. 3–5 ft. high, glaucous; fls. scented like mace, short-stalked, 2 in. long; tube thrice as long as segm.; filaments inserted at its base. S. U. S. Hardy. B.M. 1157. Jacq. Icon. 378. Lam., Encycl. 235. Hill, Hort. Kew. 13. Contr. U. S. Nat. Herb. 5, p. 155; 8, p. 15. Rep. Mo. Bot. Gard. 7:26, 27, 63. B.B. 1:445.—A form with mottled lvs. is var. **tigrìna,** Rose (*M. tigrìna,* Small. *Agàve virgínica tigrìna,* Engelm.).

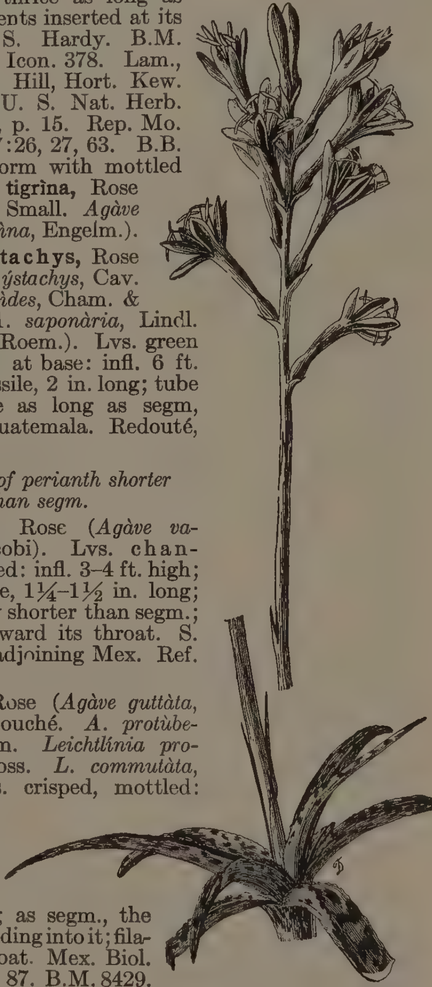
brachýstachys, Rose (*Agàve brachýstachys,* Cav. *A. polyanthoìdes,* Cham. & Schlecht. *A. saponària,* Lindl. *A. hùmilis,* Roem.). Lvs. green or reddened at base: infl. 6 ft. high: fls. sessile, 2 in. long; tube nearly twice as long as segm, Mex. and Guatemala. Redouté, Lil. 485.

CC. *Tube of perianth shorter than segm.*

variegàta, Rose (*Agàve variegàta,* Jacobi). Lvs. channeled, mottled: infl. 3–4 ft. high; fls. subsessile, 1¼–1½ in. long; tube slightly shorter than segm.; filaments toward its throat. S. Texas and adjoining Mex. Ref. Bot. 326.

guttàta, Rose (*Agàve guttàta,* Jacobi & Bouché. *A. protùberans,* Engelm. *Leichtlínia protùberans,* Ross. *L. commutàta,* Ross). Lvs. crisped, mottled: infl. 3 ft. high; fls. subsessile, 1–1¼ in. long; tube half as long as segm., the ovary protruding into it; filaments in throat. Mex. Biol. Cent. Amer. 87. B.M. 8429.

WILLIAM TRELEASE.



2319. **Manfreda maculosa.**

MANGEL-WURZEL. A race of beets with very large roots, grown for forage; usually shortened to mangel. Often called *Beta vulgaris* var. *macrorhiza.*

MANGÍFERA (from *mango,* common name of one species, and Latin, *to bear*). *Anacardiàceæ.* Tropical trees, of which *M. indica* is the only one well known horticulturally, and is cultivated throughout the tropics for its fruit, being naturalized in many regions. It is the mango of English-speaking countries, in its finer varieties one of the most delicious of all tropical fruits. Several other species also produce edible fruits, mostly, however, of indifferent value; their distribution is in nearly all cases limited. The Malay Archipelago is the home of nearly the entire genus, Malacca having a particularly large proportion of species. *M. indica* has been in cultivation since such a remote period that its exact origin is somewhat doubtful, but it has been considered by the best authorities to be indigenous to the Himalayan foothills of eastern India, extending possibly through Burma into the Malayan region.

Leaves alternate, petiolate, entire, coriaceous: fls. small, polygamous, in terminal panicles; calyx 4–5-partite; corolla 4–5-petaled; petals free or adnate to the disk, imbricate; stamens 1–5, rarely more, inserted just within the disk; in most species there is commonly only 1 fertile stamen, the remainder being more or less abortive or reduced to staminodes; ovary 1-celled, oblique, the style lateral: fr. a large fleshy drupe, with a compressed, fibrous stone.—A genus of about 30 species, natives of Trop. Asia. Several allied genera are of horticultural importance, notably Anacardium, which includes the cashew (*A. occidentale*), Spondias, of which several species are cultivated for their fruits, known commonly as hog-plum, Spanish plum, and so on, and Pistacia, which furnishes the pistacio nut; all tropical or subtropical in distribution. The genus Rhus, which includes the sumac and poison ivy, and is well represented in warm-temperate regions, is also a member of the same family.

índica, Linn. MANGO. Fig. 2320. A large tree, erect or spreading in habit, 30–90 ft. high, with oblong-lanceolate to elliptic lvs. 6–16 in. long, variable in breadth, glabrous, deep green, the margins sometimes undulate, apex commonly acute; petiole 1–4 in. long, swollen at the base: panicles a foot or more in length, pubescent, rarely glabrate; fls. yellowish or reddish, odorous, subsessile, staminate and hermaphrodite on the same panicle; sepals ovate-oblong, concave; petals twice as long as sepals, ovate, 3–5-ridged, the ridges orange; disk fleshy, 5-lobed; stamens 1 fertile, 4 reduced to staminodes of varying prominence; anthers purplish; ovary glabrous: fr. 2–6 in. or more in length, usually compressed laterally, greenish, yellowish or reddish in color. N. India, Burma, and possibly Malaya, as noted above. B.M. 4510. H.U. 3:193.

zeylánica, Hook. f. A tree, glabrous throughout: lvs. oblong-obovate to elliptic-lanceolate, usually rounded at the apex, 2–3½ in. long: panicle stout, longer than the lvs.; fls. on slender pedicels; sepals orbicular; petals short, elliptic-oblong, disk large; fertile stamen 1, with 6–8 staminodes; ovary slightly pubescent. Ceylon, up to elevations of 3,000 ft.—Closely approaches *M. indica,* but said by Hooker to differ in habit and foliage, the contracted panicle, fls. with longer pedicels, perfectly glabrous sepals, and short petals.

fœtida, Lour. BACHANG. AMBATJANG. A large tree, with elliptic-oblong to obovate lvs. 10–12 in. long, 3–4 in. broad, acute at base, acute to obtuse at apex; petiole stout, 1–1½ in. long: panicle large, stout, deep red; fls. subsessile; sepals ovate, obtuse; petals linear-lanceolate, reflexed, pink or red; stamens 5, 1 perfect, the rest shorter, imperfect; ovary glabrous, oblique, green, smooth, very fetid; flesh yellow, stone very fibrous. Distributed throughout the Malay Archipelago, where the fr. is eaten by the natives but is considered of very poor quality by Europeans.

odoràta, Griff. KUWINI. BUMBUM. A tree, glabrous throughout, or with panicles slightly pubescent: lvs. elliptic-lanceolate to oblong, 6–12 in. long, 2–4 in. broad, acute or acuminate; petiole stout, 1¼–1¾ in. long: panicle stout, green; fls. odorous; sepals ovate-oblong; petals linear-oblong, reflexed, greenish, suffused blood-red; perfect stamens sometimes 2, staminodes slender, capitate; ovary glabrous: fr. oblong, yellowish green, fetid, stone compressed, fibrous. A native of Malacca.—The fr. is said to be sweet, without any taste of turpentine.

cæsia, Jack. BINJAI. A large, stately tree, with stout branchlets: lvs. cuneate-obovate to elliptic, 6–16 in. long, 2½–3½ in. broad, somewhat glabrous; petiole ¼–1 in. long: panicle stout, much branched; fls. on short, stout pedicels; sepals broadly ovate, pubescent; petals erect, linear, concave, purplish; disk slightly lobed; perfect stamen 1, the imperfect ones reduced to teeth; style slender: fr. oblong-obovate. Malacca and other Malayan islands.—The frs. are eaten by the natives, but are said to be very poor.

verticillàta, Rob. Baúno. A large tree, 50 ft. or more in height: lvs. in whorls of 4, narrowly elliptic-obovate to obovate, glabrous, about 4–6 in. long, 2–3 in. broad; petiole 1–1½ in. long: panicles 8–12 in. long, tomentose; fls. on stout, tomentose pedicels; petals narrowly oblanceolate, bluish, margins inrolled; fertile stamen 1, staminodes 4, irregularly shaped: fr. oblong-oval to pyriform, 4½–6 in. long, yellowish green; stone large, very fibrous.—A recently described species from the southern Philippines. Its fr., which ripens in Aug. and Sept. is described by Wester as "very juicy, rich, subacid, quite aromatic, of excellent flavor, partaking of the flavor of the apricot and soursop combined." It is thought to be of considerable horticultural value.

The mango.

To millions of persons living within the tropics, the mango is of greater importance than is the apple to those of temperate North America. While this is especially true in southern Asia, where the mango has been grown from time immemorial, the last two centuries have seen the tree widely disseminated throughout the tropical regions of the New World, and playing an important rôle in the dietary of the inhabitants. In its finer varieties the mango is certainly worthy of a place among the world's best fruits; for beauty of coloring, delicate subtle aroma, and piquancy of taste it has few equals. Yet it must be remembered that it is only among the choicest varieties that these characters are found, and the inferior, fibrous seedlings, which have always constituted the larger part and are all too frequently considered by visitors to the American tropics as representative of the best to be found among mangoes, have little in common with some of the superb varieties of the Orient.

DeCandolle considered it probable that the mango has been in cultivation 4,000 years. At the present time it is found growing naturally in the tropical Himalayan region, from Kumaon to Bhutan, at altitudes of 1,000 to 3,000 feet, and in several other parts of India, while it is cultivated extensively throughout the peninsula, except in a few regions in which the climatic conditions are unfavorable. References to the mango in the early literature of India are said to be numerous, and it seems always to have been held in the highest esteem and even veneration; its flowers are employed in religious ceremonies, and in some places annual celebrations are held in its honor. In the fourteenth century, the Turkoman poet, Amir Khusru, wrote in Persian verse, "The mango is the pride of the garden, the choicest fruit of Hindustan; other fruits we are content to eat when ripe, but the mango is good in all stages of growth;" and the great Mughal emperor, Akbar, who reigned in the sixteenth century, planted near Darbhanga the famous Lakh Bagh, an orchard of 100,000 mango trees, some of which are said by Maries to remain to this day.

The dissemination of the mango throughout the tropical world seems to have been rather slow, considering the usefulness and importance of the fruit in India, but the difficulties in transporting seeds and plants in the early days, when travel by water was not rapid, must be remembered. Credit is probably due the Portuguese for carrying the mango to Africa, and later on to South America, where it is thought to have been first established in Brazil, but the date of its introduction to this continent is not definitely known. Within the eighteenth century it became scattered throughout the West Indies and on the mainland of Central America. At the present day it is found in nearly every tropical region of the globe, and in some places its culture has been extended into the subtropics; thus it is grown in the Canary Islands, Madeira, occasionally along the shores of the Mediterranean, in Australia, northern India and the Persian Gulf region, southern Brazil, and the southernmost part of the United States.

The English name "mango" is from the Portuguese "manga," which is itself considered an adaptation of the Tamil "man-kay" or "man-gay" which was formed by the earliest Portuguese settlers in India. Some writers consider that the Portuguese name had its origin in the Malay "mangga" or "mangka," but Rumphius traces the introduction of the latter into the Malay Archipelago from southern India, along with the fruit itself. In northern India the name is "am" or "amba," these forms or variations of them occurring in very early literature; in Sanskrit it is "amra." In the western hemisphere the common names are adaptations of the Portuguese "manga" (the tree "mangueira"); thus it is called in both English and Spanish "mango," in French "mangue" (the tree "manguier"), in Italian "mango," in German "mango" (the tree "mangobaum"), and in Dutch "mangga" (the tree "manggaboom").

2320. Fruits of the mango, Mangifera indica. (×⅕)

The tree is evergreen, and varies greatly in height and habit of growth. In India there are several kinds which are low-growing, almost prostrate in habit, but ordinarily the tree is erect, either with a broad, dome-shaped, umbrageous crown, or else with a tall, oval, more or less open crown and ascending branches. On deep rich soils the mango reaches immense proportions; one specimen with a trunk 25 feet in circumference and a spread of 125 feet has been measured in Bahia, Brazil. A height of 70 feet is not infrequently attained. Budded or grafted trees do not reach such large proportions, neither do seedlings on shallow soils.

The lanceolate deep green leaves are of leathery texture, varying in length from 6 to 16 inches or even more, and when crushed emit an odor of turpentine, pronounced in some varieties and almost lacking in others. Growth is made in periodic "flushes" from the terminal buds of the young branches; when a new flush makes its appearance its leaves are usually reddish or wine-colored, the color changing to green as the leaves mature. After the development of each flush there is usually a period of inactivity, following which another flush is made, each one varying in length from a few inches to a foot or more. The flowers, which are borne in large panicles a foot or more in length, produced in spring at the ends of the young branches, are yellowish or pinkish in color; there are sometimes 2,000 or even more on a single panicle, but only part of them are perfect, the mango being polygamous, i. e., producing on the same tree flowers in which both sexes are present and flowers which are unisexual. The staminate flowers greatly outnumber the perfect ones, as a general thing; there is, however, only one pollen-bearing stamen, the remaining four being abortive and represented by staminodes of varying prominence. The perfect flowers are easily distinguished from the staminate ones by the small obliquely round ovary, borne upon the swollen disk. The petals are ovate to lanceolate, commonly five in number.

In size and character of fruit the mango is extremely variable; there are varieties which are scarcely larger than a plum, and there are others whose fruits weigh as much as four or five pounds. The shape varies from round to long and slender, some of the commonest types being reniform, obliquely heart-shaped, oval, or elliptical. The skin is smooth, somewhat thicker than that of a peach, commonly yellow or greenish yellow in color, but in some varieties bright yellow overspread with scarlet or crimson, and of extremely beautiful appearance. Other types are uniformly pale lemon-yellow. The aroma is often delicious, spicy and tempting, and this added to the brilliant color, makes some of the finer varieties of the mango among the most attractive of all fruits. The stone is large, usually flattened, and in the ordinary seedling fruit covered with long, tough fibers, which extend from all sides into the yellow, juicy flesh. In the best grafted sorts there is no fiber and the fruit can be divided into halves, after making a longitudinal cut through the flesh, like a freestone peach.

The flavor, like that of many other tropical fruits, is difficult of description. Lady Brassey has likened it to a combination of apricot and pineapple, and others have compared it to the peach, yet neither of these comparisons conveys an accurate idea of the delicious piquancy and fragrance of a perfect mango, rich and sweet, yet never cloying, and overrunning with luscious juice. In seedlings there is often an objectionable taste of turpentine, especially in the skin; this, like the fiber, is done away with in the finer grafted varieties. However, it is sometimes true of the seedling fruit, as Jumelle remarks, that while "there are those who do not like it because it smells of turpentine, there are others who come to like turpentine because it reminds them of the mango."

The mango is preëminently a dessert fruit, yet it lends itself to an infinite variety of uses, chief among which, in India, is the manufacture of chutneys and preserves. Mango chutney, of which there are numerous kinds, such as Major Grey's, Colonel Skinner's, Lucknow, and Bengal Club, is exported from India in considerable quantities. The unripe fruit is used in its manufacture, together with various other ingredients, principally spices. The unripe fruit is also used to prepare a dish known in India as "mango phul," a sort of custard made with milk and sugar. The ripe pulp, properly spiced, is dried in the sun to form thin cakes known as ambsath, a product which is, according to Woodrow, "the special solace and delight of Indian students in foreign countries." In Cuba and other parts of tropical America, the fruit is extensively used for the manufacture of jams and preserves. Exquisite sherbets and iced drinks are made from it, the Cubans and Brazilians being especially skilful in preparing them. In recent years, canning factories have been started in India for the purpose of preserving the fruit in the same manner as peaches and pears are preserved in this country. There are varieties of the mango especially suited for culinary use, and others preferable as dessert fruits, just as with the more important temperate fruits.

In the United States, mango-culture has, in recent years, attracted considerable attention in southern Florida, where extensive experiments have been made with varieties from all parts of the world. In 1901 it was found that the tree could be successfully budded, and nursery stock began to be produced in sufficient quantities to permit of orchard plantings. The most extensive groves are found in the vicinity of Miami, on the lower east coast, but there are also numerous small plantations as far north as Palm Beach on the east coast, and at Fort Myers and other points on the west coast, extending as far north as Tampa Bay, where the trees are sometimes injured by frost, but nevertheless grow and fruit fairly well, especially in the vicinity of St. Petersburg. Florida has supplied nursery stock to plant several young groves in Cuba, the Isle of Pines, and Porto Rico as well.

In California, the culture of the mango is limited to the warmest locations, but fruit has been successfully produced at Sierra Madre, Santa Ana, Hollywood, and Santa Barbara. From past experiments, it appears that the tree is much better suited to the so-called frostless districts some distance from the seacoast than to such localities as Santa Barbara, for the reason that near the ocean there is not sufficient heat during the summer months to ripen the fruit. The dry climate of California seems to stunt the tree, and it develops much less rapidly than in the tropics, but with abundant irrigation it has made fairly good growth, especially in the deep sandy loam of some of the foothill regions. As to frost, the plants, when young, are easily injured by temperatures lower than freezing, but when they have attained a few years' growth they will withstand temperatures as low as 27° or 28°, provided they are not of long duration, without serious injury. Protection should be given wherever possible

Cultivation of the mango.

In regard to soil, the mango does not seem to be very particular, but respecting climate it is much more exacting. Deep rich soils, like many of those found in Porto Rico and Cuba, produce a more rapid growth and greater ultimate dimensions, but the shallow sandy soils, underlaid with soft limestone, which are found on the lower east coast of Florida, have so far proved satisfactory, the mango requiring less fertilizer under such conditions than the avocado or some other tropical fruits. In India some of the best mango districts have a deep rich alluvial loam, somewhat sandy in nature, and this can probably be considered the best of all mango soils.

Granting that the mango is grown in a region free from injurious frosts, the most important climatic factor is the amount of rainfall, especially in regard to the season in which most of it occurs. In general it may be said that the mango produces the largest crops and most brilliantly colored fruit in regions in which there is a well-defined dry season corresponding to the blooming and ripening season; damp, cloudy weather while the trees are in bloom, even without any actual precipitation, is very prejudicial, and it has been thoroughly demonstrated in Florida that the best crops are produced in seasons when the weather is dry and sunny during the blossoming period. Moist weather favors the spread of blossom-blight or anthracnose (*Colletotrichum gleosporioides*), a fungous disease that sometimes destroys all of the flowers. Many seedling mangoes, as well as some grafted varieties, often produce a second crop of flowers if the first is destroyed. Trees in Cuba have even been known to flower four times; on the other hand, some mangoes bloom only once in a season. Spraying with bordeaux mixture, made in the proportion of five pounds of copper sulfate and five pounds of unslaked lime to fifty gallons of water, is often employed to prevent the blighting of the flowers, several applications being given while the trees are in bloom, commencing with the appearance of the first flower-buds. It is also well to spray occasionally during the time the fruits are developing, to prevent infection which may lead to rapid decay when the fruits are picked and shipped to market.

Regions where the annual precipitation is from 30 to 50 inches, and where a very small proportion of this occurs during the flowering season, seem to be ideal for the mango. Even in such regions, however, difficulty is often experienced in forcing some varieties to bloom, the mango showing a marked tendency toward irregularity in its fruiting habits. In tropical countries, various methods have been devised to encourage the formation of flower-buds and setting of fruits, such as partly girdling the trunk, hacking the trunk, severe root-pruning, placing common salt around the tree, and smoking the tree during the blooming period by keeping a smudge burning under its widespreading branches. Most of these methods are out of harmony with modern horticultural practice, and of doubtful advisability, but it appears that something should be done in autumn to check vegetative growth and encourage the formation of flower-buds. Withholding all fertilizers at this season and moderate pruning of the roots may be suggested as of possible value.

In planting out young budded trees in orchard form, they should be set at least 30 to 35 feet apart, in holes prepared in advance. Late spring—April and May—is considered the best time for planting in southern Florida. During the first few years well-rotted stable-manure or sheep-manure can be used to encourage growth, but it should not be applied in large quantities, and after the trees reach bearing age the greatest care is necessary in applying fertilizers. For Cuban soils a fertilizer containing 3 per cent nitrogen, 10 per cent phosphoric acid, and 10 per cent potash has been recommended, fifteen to twenty-five pounds a year being given to mature trees. No fertilizers should be applied in fall or winter or during the time the trees are in flower. Little pruning is usually given the mango, though the trees may require some attention while young to encourage the formation of a symmetrical, well-branched head, which should not, however, be too dense. Grafted trees are usually spreading in form, and should be encouraged to remain so, especially in regions subject to occasional hurricanes.

Insect pests of the mango.

Of the insect pests attacking the mango, the fruit-flies (Trypetidæ) rank first in importance. Belonging to this family are the Mediterranean fruit-fly (*Ceratitis capitata*) which has so adversely affected the fruit-growing interests of Hawaii, the Queensland fruit-fly (*Dacus tryoni*), the mango fruit-fly (*Dacus ferrugineus*), the Mexican fruit-fly (*Anastrepha ludens*), which has become troublesome in Porto Rico. The females of these flies insert their eggs into the flesh of the fruit by means of a most efficient ovipositor, and the larvæ infest the fruit, rendering it unfit for human consumption, and in cases leading to premature ripening and decay. Control is difficult; the sweetened arsenical sprays have met with varied success, and natural control by parasites is now receiving attention. In India, the mango hopper (various species of Idiocerus) and the mango weevil (*Cryptorhynchus mangiferæ*), which latter has now been reported as doing considerable damage in Hawaii, are of importance as pests. Cleanliness in the grove by way of periodically gathering drops will prevent pupation of the fruit-flies and weevil and considerably reduce their numbers. In Florida, red-spider and thrips are responsible for extensive injury to foliage, leading to disturbances of the general health of the tree; but contact sprays, e. g., lime-sulfur or nicotine, properly applied, will effect complete eradication. Numerous scale insects have become injurious in certain localities and may be controlled by the use of kerosene emulsion, but the desirability of natural enemies such as the coccinelid beetles being present in the orchard must not be forgotten. A large bark-boring beetle (*Plocæderus ruficornis*) has been responsible for much damage to trees in the Philippines.

The mango crop.

The age at which budded or grafted mango trees will come into bearing depends upon the variety and upon several other factors, but they cannot as a rule be expected to produce fruit under three or four years from the time of planting, and in the case of some varieties this time is considerably extended. As to yield, some of the smaller-fruited varieties will produce several thousand mangoes in a single crop, when the tree is of mature size, while Mulgoba and other large mangoes are doing well when they produce a few hundred. Experience has been that the crop varies greatly in different seasons, and it has been impossible to fix a certain quantity as the average yield of any one variety. So much is dependent upon the weather at the time of flowering, with the consequent setting or dropping of flowers, that irregularities in bearing are all too common. Some mangoes, however, such as Cambodiana and Sandersha, have shown themselves much more dependable in this regard than others, and are especially valuable for this reason.

The fruit is picked when fully mature, but before it has commenced to soften on the tree. If allowed to remain on the tree too long, it is sometimes found that the flesh immediately surrounding the seed is unpleasant to the taste and of a peculiar gelatinous consistency. Shears should be used for picking, leaving a short section of the stem attached to the base of the fruit; this will dry up and fall off in a few days, but if the fruit is pulled from the tree the sap exudes freely from the stem end, disfiguring the surface.

The usual carrier used for mangoes in Florida is the tomato-crate, holding six small baskets. Each basket will contain six mangoes of good size, making thirty-six to the crate. The individual fruits are wrapped in tissue paper before packing, and excelsior is used above and below them as a cushion. Mangoes are shipped from south Florida to New York, Boston and Chicago, without difficulty, nearly always arriving in good condition if they were picked at the proper time. In recent years, the south Florida growers have received $9 a crate for Mulgobas. The season during which they are shipped from Florida extends from late July until the latter part of August. Some varieties begin to ripen early in July, while the later ones, such as Sandersha, extend the season until the end of September.

Propagation of mangoes.

The simplest vegetative method, and the one extensively used in India, is that known as inarching or grafting by approach. While this is the most certain of all methods, it is too slow and laborious to meet the demands of present-day nurserymen, when more expeditious means can be found. Consequently budding is rapidly taking the place of inarching in this country, and though requiring considerably more skill it has proven entirely practicable for nursery work.

Inarching is performed between a large tree of the variety which it is desired to perpetuate and young seedlings grown in pots or boxes. The seedlings are ready for inarching when ten months to a year old;

they should have stems slightly less than ½ inch in diameter. An easily accessible branch on the parent tree, of the same diameter as the stem of the seedling, should be selected for the cion, and the seedling in its pot placed upon a stage or support where the cion can be brought into close contact with it. The juncture where the inarch is made should be about 6 inches from the base of the seedling, and about a foot from the tip of the cion, which should be as straight and vigorous as possible. A thin slice of bark and wood about 3 inches long is removed from one side of the seedling stock, and a similar slice from one side of the cion; the cut surfaces are then bound closely together with waxed tape, or with raffia or soft string, and afterward covered with wax to exclude the air. Several months are required for a union to be effected, after which the top of the seedling is removed just above the juncture of stock and cion, and the cion is severed from the parent tree just below the juncture. Inarching is usually done in India at the beginning of the rainy season, but it can be successfully practised at almost any time of the year.

Seedling stocks for budding or grafting are easily grown. After removing the husk, the seed is planted in a 5-inch pot and barely covered with soil. As soon as germination takes place, the plants should be watched to see that not more than one shoot is allowed to develop; some mangoes are poly-embryonic and will produce six or eight shoots from a single seed. When the young plants are well started, which in Florida should be by early fall if the seeds were planted in midsummer, they may be set out in the field in nursery rows 2 feet apart, the plants 1 foot apart in the rows, and allowed to remain there until after they are budded. Field budding has been found much more satisfactory than budding in pots.

Several very distinct races of mangoes are known in cultivation, and as yet practically nothing has been done to determine which of these are of the greatest value as stocks, although there is every indication that this is an important question. In addition, some of the numerous other species of Mangifera may be of value for this purpose. As a general thing seeds of any variety are used, including those of the common "turpentine" mangoes, as they are called, which can usually be obtained in quantity at a very low price. The seeds should be planted as soon as possible after their removal from the fruit, as they do not retain their viability for many weeks. They are rather difficult to transport through the mails, especially when sent to distant countries.

The proper time for budding is when the plants have attained a diameter of stem as great as that of a lead pencil, or greater, and are just coming into flush, i.e., when the terminal bud is just starting to push out new growth. The budwood, which should be cut from vigorous, healthy trees, should be round, straight, smooth, and preferably of the second flush from the ends of the branches, the most recent flush of growth being discarded. The wood should be as dormant as possible, and the end of the branch from which it is taken should never show the wine-colored young leaves which are indicative of active growth. It is well to have wood which has hardened up sufficiently to have lost its bright green color and assumed a grayish cast.

The buds should be cut 1 to 1½ inches in length, with a straight, sliding motion of the knife, aiming, if possible, to keep the blade parallel with the budstick. A thin, keen blade is essential. The incision is made in the stock in the form of a T or an inverted T, exactly as in budding citrous trees, and the bud is inserted without any more pressure than necessary. A strip of waxed tape is then used to bind it firmly in place. Cheap muslin is used for making the tape; after being torn into strips about 6 inches wide it is made into rolls 1 inch in diameter and boiled in a mixture of one pound beeswax and one-fourth pound rosin.

Edward Simmonds, who has worked out the budding of the mango in south Florida, considers April and May the most propitious months for inserting the buds. In strictly tropical regions the work can probably be done at any time of the year when the stock plants are in proper condition.

At the expiration of three to four weeks, the top of the stock is lopped, providing the bud shows signs of having formed a union; lopping should not be close to the bud, as this has been found to be dangerous.

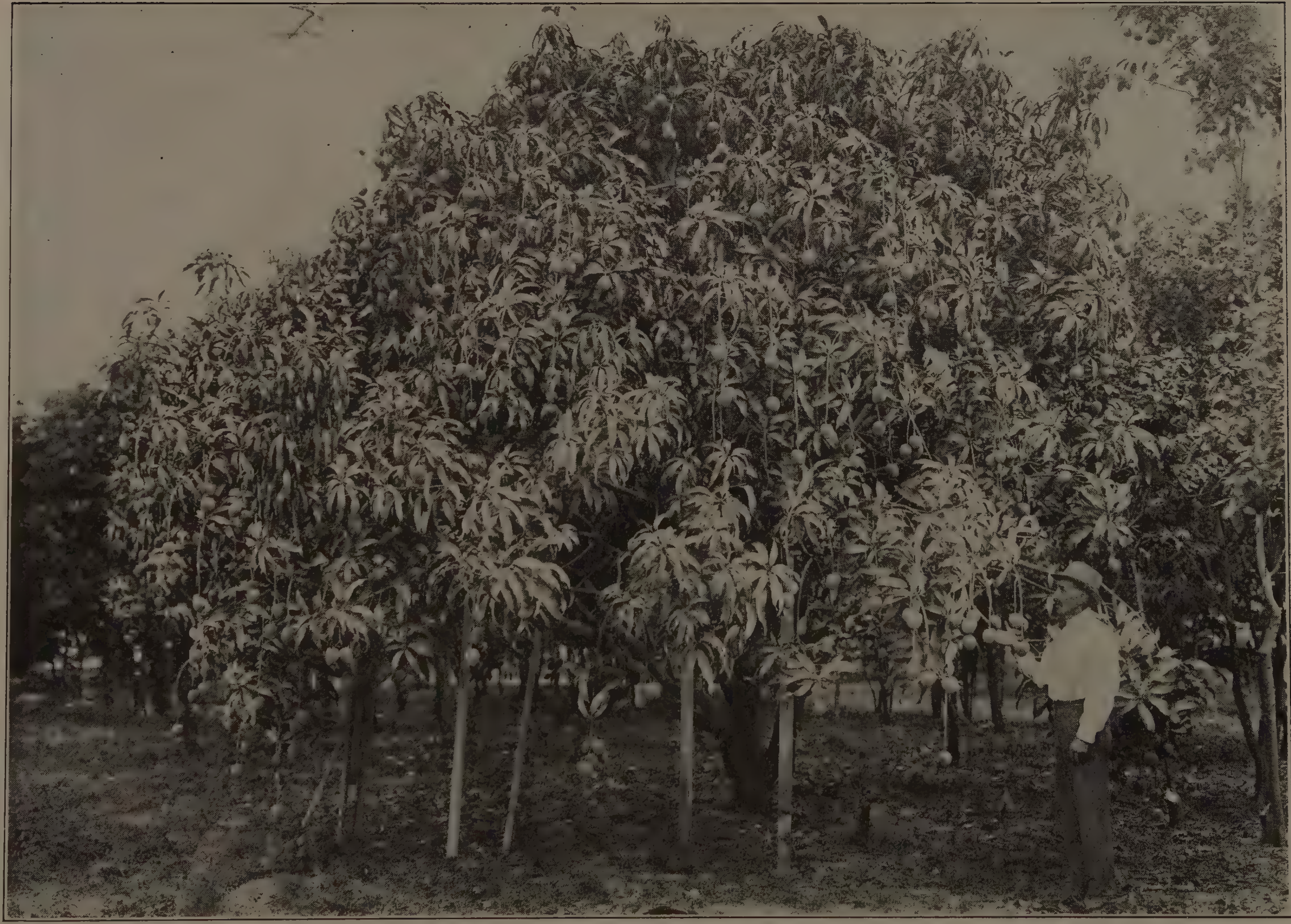
Large seedling trees are often worked over to choice varieties by cutting off several of the main branches a short distance from the trunk, and allowing a number of sprouts to come out. When these have reached the proper size they can be budded in the same manner as seedlings.

Races, types and varieties of mangoes.

In different parts of the world several very distinct races of mangoes are found, which tend to reproduce their racial characteristics when grown from seed, though showing minor variations in form of fruit and other characters. One of the best defined races is that from the Philippines, which appears to be closely allied, if not identical, with the Cambodiana from Indo-China; several more or less distinct seedling types of this race are known in the Philippines, notably Pahutan, Carabao, and Pico, and among these, in turn, are to be found slightly differing forms which when propagated by budding or grafting would constitute horticultural varieties. The Philippine race, which is polyembryonic, was brought to tropical America at an early day, doubtless by the Spaniards, and is the favorite in Mexico, where its seedlings are generally called "Manila mangoes," and in Cuba, where it goes by the name of "Filipino." In India, most varieties appear to belong to a mono-embryonic race which breaks up into more or less well-defined classes or types, of which there are in turn numerous horticultural varieties propagated vegetatively; thus of the well-known Bombay type, or group, as it has been called by some writers, there are several varieties, as also of the Langra, Malda and other types. In Jamaica the polyembryonic race known as No. 11 has become very popular because of the fact that it reproduces itself very closely when grown from seed (which most mono-embryonic mangoes fail to do) and has maintained its good quality for considerably over 100 years; it appears to be very closely allied to the Manga da Rosa of Brazil, and probably has other allies in the region from which it came. The relationships of the various races and types of mangoes has not as yet been thoroughly studied, and a good classification is lacking.

Of horticultural varieties there is an infinite and bewildering number, especially in India, where it appears to have been the custom to name almost every tree that produced fruit of superior quality; this has led to confusion and synonymy. One of the earliest Indian authorities on the mango, Maries, reported a collection of 500 varieties near Darbhanga, while large numbers of named varieties have been briefly described from many localities by various writers, bringing the number of published varietal names well up toward a thousand. Only a very limited number of these, however, such as the famous Alfonso or Alphonse of Bombay, have become well known and generally recognized.

The best Indian mangoes are probably not equaled in flavor and quality anywhere else in the world, though some travelers have professed a preference for the Philippine types, which are, indeed, very delicious. But the process of selection which has been going on in India for centuries, and the perpetuation of the best seedlings by inarching, has led to the existence of



LXVIII. A Paheri mango tree in fruit.—Florida.

remarkably fine mangoes in several parts of the Indian peninsula, most notably, perhaps, in the vicinity of Bombay, at Poona, at the Portuguese colony of Goa (where, in fact, it is thought by some writers that vegetative propagation of the mango was first introduced, the Portuguese having been instrumental in establishing this method which has meant so much to Indian horticulture), at Madras on the eastern coast, and in several districts toward the northern part of the peninsula, such as Malda, Darbhanga, Saharanpur, and Lucknow.

Grafted Indian varieties were first introduced to the United States in 1889, when the Department of Agriculture obtained from Bombay a collection of five kinds, which were placed with fruit-growers on Lake Worth, Florida, for trial. In the freeze of February, 1895, all save one of the trees perished; the surviving tree, a Mulgoba, came into bearing in 1898, and the superior quality of its fruit gave a marked stimulus to the cultivation of the mango in this country, resulting in the introduction of numerous other Indian varieties of reputed excellence. These have been added to by introductions from Indo-China, Ceylon, the Philippines, and other regions where good mangoes are grown. Among the best now grown in Florida and the West Indies are the following:

Mulgoba, which in delicate, aromatic flavor, smoothness and fineness of pulp, freedom from fiber, and attractiveness, must be placed in the very first rank. A good specimen will weigh about one pound, is broadly oval in shape, plump, clear yellow in color, blushed around the base with crimson-scarlet. Its season in Florida extends from July to the first of September. Unfortunately, it has proved irregular in its fruiting habits, and does not usually come into bearing as young as some other varieties. In some seasons considerable quantities of the fruit have been shipped from south Florida to northern markets, the growers realizing $9 a crate of thirty-six fruits.

Haden is a fruit very similar in general characteristics to Mulgoba, of which it is believed to be a seedling. It originated at Cocoanut Grove, Florida. Good specimens weigh sixteen to twenty ounces, and are highly colored. The flesh is scarcely as smooth as that of Mulgoba, and the flavor not quite so piquant, but nevertheless very good. Its season corresponds to that of Mulgoba.

Paheri (probably synonymous with Pairi, which is now considered by the best Indian authorities the correct spelling of the name) was introduced from India in 1902, and has been found of excellent quality in Florida. Near Bombay, India, it is considered the finest flavored of all mangoes, but because of the superior keeping qualities of Alfonso the latter is preferred commercially. It is a fruit of about twelve ounces in weight, oval, plump, orange-yellow in color, blushed with scarlet on the cheek, the flesh deep orange, very juicy, and of rich, spicy flavor. It ripens in Florida in July and August.

Amini is a smaller fruit than any of the above, averaging six or eight ounces in weight; in form it is oblong-ovate, in color almost identical with Mulgoba. The aroma is remarkably penetrating and agreeable, while the flavor is unusually spicy. The tree is more productive than some of the larger varieties, and seems slightly more resistant to blight. It is a little earlier than Paheri in season.

Cambodiana, mentioned above as a polyembryonic seedling race, was introduced to Florida about 1902, and several of its seedlings have been propagated by budding. While they cannot be considered equal in flavor and quality to the best of the Indian mangoes, the tree is much more regular in its fruiting habits. The race is characterized by an elongated, compressed fruit, frequently rather sharp at the apex, and of a light yellow or greenish yellow color. The flesh is yellow, juicy, of a pleasant flavor, but lacking the richness of Mulgoba or other good Indian mangoes, while the fiber is somewhat more abundant. In season it is a little earlier than Mulgoba.

Bennett is a select strain of Alfonso or Alphonse from Bombay which has been grown for several years in Florida. In quality it ranks very high, but it has been somewhat at a disadvantage in the markets because of its rather dull orange-yellow color. It is a fruit of about one pound in weight, oval to somewhat cordate in form, plump, with orange-yellow flesh and a seed almost entirely free from fiber. The season of ripening is July and August.

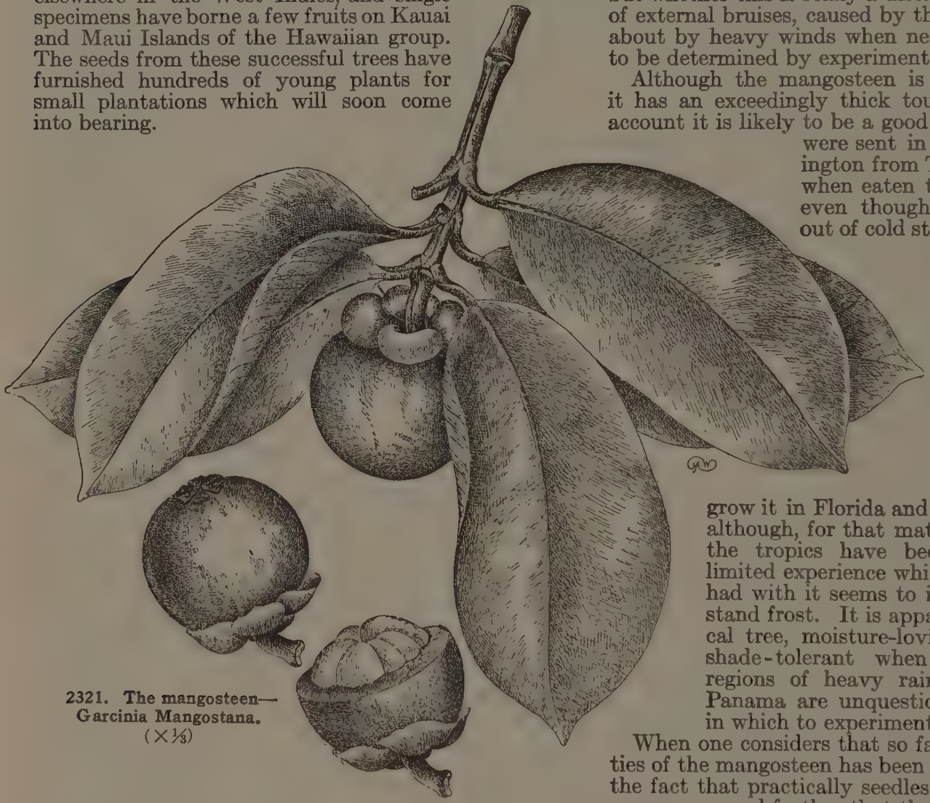
Sandersha is a very large fruit, frequently two pounds in weight, of elongated, somewhat curved form, orange-yellow in color. The flesh is free from fiber, and, when properly ripened, of pleasant flavor, though a trifle coarser than the best varieties. It is excellent for cooking, and because of its regularity in bearing is considered valuable. It ripens very late, beginning in late August and extending through September. F. W. Popenoe.

MANGOSTEEN (Fig. 2321), *Garcinia Mangostana* (which see), is a handsome fruit-tree 25 to 30 feet high, of compact growth, regular in outline, with dense, dark green foliage which reminds one slightly of the rubber tree. It grows slowly and comes into fruit late, not before eight or nine years of age. Its flowers are 1½ inches across with four rose-pink fleshy petals and a large superior ovary. In Ceylon the trees bloom twice, once in August, producing fruits which ripen in January, and again in January, producing fruits in July and August. In Trinidad the fruiting seasons are July and October. The January crop in Ceylon is a light one, however, not amounting to over 100 fruits to a tree, whereas the August crop amounts in good years to 500 or 600 fruits, according to Wright, of Mirigama, Ceylon. The fruits are borne from buds produced near the tips of short branches mainly on the outside of the tree, and are striking by reason of their persistent large leathery light green calyx-lobes.

This delicious fruit is about the size of a mandarin orange, round and slightly flattened at each end, with a smooth, thick rind, rich red-purple in color, with here and there a bright, hardened drop of the yellow juice which marks some injury to the rind when it was young. As these mangosteens are sold in the Dutch East Indies,—heaped up on fruit-baskets, or made into long regular bunches with thin strips of braided bamboo,—they are as strikingly handsome as anything of the kind could well be, but it is only when the fruit is opened that its real beauty is seen. The rind is thick and tough and in order to get at the pulp inside, it requires a circular cut with a sharp knife to lift the top half off like a cap, exposing the white segments, five, six or seven in number, lying loose in the cup. The cut surface of the rind is of a most delicate pink color and is studded with small yellow points formed by the drops of exuding juice. As one lifts out of this cup, one by one, the delicate segments, which are the size and shape of those of a mandarin orange, the light pink sides of the cup and the veins of white and yellow embedded in it are visible. The separate segments are between snow-white and ivory in color and are covered with a delicate network of fibers, and the side of each segment where it presses against its neighbor is translucent and slightly tinged with pale green. The texture of the mangosteen pulp much resembles that of a well-ripened plum, only it is so delicate that it melts in the mouth like a bit of ice-cream. The flavor is quite indescribably delicious. There is nothing to mar the perfection of this fruit, unless it be that the juice from the rind forms an indelible stain on a white napkin. Even the seeds are partly or wholly lacking and when present, are very thin and small.

Notwithstanding the fact that it has for at least two generations been called the "queen of fruits" and that Queen Victoria offered a prize of ten pounds for the first fruits which should be brought to her from India, there appears to be nowhere in existence what would be called a large orchard of mangosteens. It is hard to understand why the culture of so delicious a fruit as the mangosteen should not have been better understood by horticulturists.

In the Dutch East Indies, Java and Sumatra in particular, it is planted by the natives in their kampongs as a dooryard tree. In Malacca and the Straits Settlements there are a few small orchard plantings owned chiefly by the Chinese. In Burliar Gardens in the Nilgiri Hills of Madras Presidency, British India, a few trees are growing. The native chiefs of the Sulu Archipelago have scattered plantings of mangosteen trees. A few small plantings have been made in Ceylon, notably a small orchard at Mirigama. Father D'Adran, a noted Bishop of Cochin-China, established an orchard of 300 to 400 trees at Lai Thiou not far from Saigon. Trees of it have grown and fruited in the Botanic Gardens of Jamaica, Trinidad, Dominica, and probably elsewhere in the West Indies, and single specimens have borne a few fruits on Kauai and Maui Islands of the Hawaiian group. The seeds from these successful trees have furnished hundreds of young plants for small plantations which will soon come into bearing.



2321. The mangosteen—Garcinia Mangostana. (×⅓)

The reason for this very inadequate distribution of so remarkable a domesticated fruit-tree seems to lie in the difficulty which the young plants seem to have in establishing themselves. If the seedlings are not shaded, the first pair of young leaves is generally injured and the plants stunted or even killed outright. It is thought that horticulturists do not yet understand the root-system of the magnosteen and that when it is understood, a vast extension of the culture of this fruit will take place. This may come about through the use of stocks which are less particular in their soil-requirements. Geo. Oliver's experiments have proved that the mangosteen can be successfully inarched upon a number of the related species of the same genus. On *Garcinia xanthochymus*, which is a much more vigorous tree and grows on many types of soil, and is apparently quite at home in Hawaii, Natal, Madeira, Cuba, and many other localities in the subtropics it seems to grow successfully. As 169 species of garcinias have already been described, the probability is great of finding a suitable stock for the mangosteen.

The best orchards of mangosteen in Ceylon and Singapore have been established on soils characterized by a high clay content, combined with a large percentage of coarse material, with a very small amount of silt, and upon locations where the water-table comes to within 6 feet of the surface. The impression is current that the mangosteen requires a wet but well-drained soil and a very humid atmosphere. While the former statement appears to be true, the latter is not so, for the tree which has fruited on the Island of Kauai is in a dry but irrigated part of that island, with only 6 inches of rainfall, where it has to be irrigated twice a month.

The diseases of the mangosteen are not yet known. It is likely to have its own specific diseases, and when transplanted to new environments, may be attacked by new parasites. Fruits are frequently found with drops of yellow gamboge inside which make them unpalatable, but whether this is really a disease or merely the result of external bruises, caused by the fruits being knocked about by heavy winds when nearly mature, will have to be determined by experiment.

Although the mangosteen is a very delicate fruit, it has an exceedingly thick tough rind, and on this account it is likely to be a good shipper. Fruits which were sent in cold storage to Washington from Trinidad were excellent when eaten twenty-one days later, even though they had then been out of cold storage over a week. The fact that when one of a shipment of fruits decays, its rind hardens instead of becoming soft, is an important point in its favor.

Just how much cold the mangosteen can stand has not yet been determined. Repeated attempts to grow it in Florida and California have failed, although, for that matter, many attempts in the tropics have been unsuccessful. The limited experience which horticulturists have had with it seems to indicate that it will not stand frost. It is apparently a strictly tropical tree, moisture-loving and more or less shade-tolerant when young, adapted to regions of heavy rainfall; Porto Rico and Panama are unquestionably excellent places in which to experiment with its culture.

When one considers that so far no selection of varieties of the mangosteen has been made, notwithstanding the fact that practically seedless fruits are of frequent occurrence, and further that the tree belongs to a large genus of fruit-bearing trees, at least fifteen of which are known to bear edible fruit, some of them as large as small melons, and that these are scattered in Australia, the Malay region, South China, Africa, Brazil, and Central America, some of them being able to withstand light frosts, it becomes evident that in the development and breeding of the mangosteen and in the discovery of a suitable stock for it, there lies a most promising field for horticultural research.

David Fairchild.

MANGROVE. A name applied to certain small trees that grow along tropical and semi-tropical seacoasts and produce many trunks or rooting shoots whereby the plant holds its place or marches on tide-flats. The name is usually restricted to *Rhizophora*

Mangle (*Rhizophoraceæ*), which grows in tropical America and the seacoasts of Florida. The black mangrove is *Avicennia nitida* (*Verbenaceæ*) of the Gulf coast and tropical America; and the name mangrove is applied to species of this genus in other parts of the world. For an account of the curious propagation of the Rhizophora, see page 980, "Cyclopedia of American Horticulture."

MANICÀRIA (name derived from the word for *glove*, because of the spathe). *Palmàceæ*. Two or 3 species, or perhaps only 1, in Trop. S. Amer., little cult., allied to Geonoma. They are robust unarmed palms with more or less pinnatisect or entire lvs.: fls. large, rose-ochroleucous, heavy-scented, on many branching tomentose spadices: fr. very large. *M. saccífera*, Gaertn., has lvs. simple or split with age, dentate, 30 ft. long and 4–5 ft. broad, transversely furrowed, crowning an erect deeply ringed trunk: fls. of both sexes on the same spadix, the latter 3–4 ft. long: fr. 3-lobed. Lower Amazon and elsewhere. A striking palm with its immense simple lvs.

MÁNIHOT (native Brazilian name). *Euphorbiàceæ*. Tropical trees and shrubs cultivated as ornamentals and for important economic products.

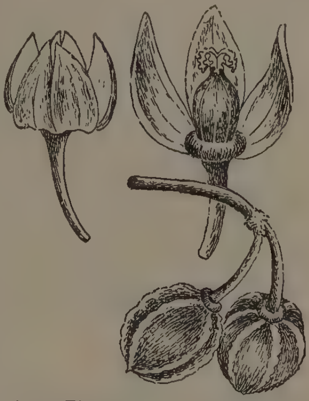
Usually glaucous and glabrous or nearly so: juice milky: lvs. alternate, entire to lobed or sometimes almost palmate: fls. large for the family, monœcious, in terminal or axillary racemes or panicles, apetalous; sepals united, at least at the base, imbricate, often petaloid; stamens 10; ovules 1 in each of the 3 cells; seeds carunculate.—About 130 species, all American and mostly in Brazil. Related to Jatropha and Ricinus. Although the plan of the infl. is different, several species of Manihot and Jatropha are otherwise so similar that they have been placed first in one genus and then in the other. Monogr. by Pax, in Engler's Pflanzenreich, hft. 44 (1910).

The cassava plant, *M. utilissima*, has been cultivated as a food plant since prehistoric times by the natives of Brazil. There are many varieties in cultivation and these are not known in the wild state. The plant is a perennial shrub in the tropics, and resembles somewhat the castor bean. The abundant starch in the large fleshy roots which grow in a cluster at the base of the stem gives it its food value. It is used in various ways as food, including the manufacture of tapioca, Brazilian arrow-root, and the like.

The roots contain more or less hydrocyanic acid which is often sufficient to render them deadly poisonous in the raw state. It is rendered harmless by heating or is pressed out with the juice in preparing the roots for food. The more poisonous varieties are generally known as bitter cassava, those with less of the acid as sweet cassava, but the amount of the poison varies with seasons and other conditions. Varieties of *M. dulcis* var. *Aipi* are also grown as sweet cassava in the tropics but are generally not very productive. *M. carthaginensis* is also sometimes used as cassava.

Cassava is grown in some of the warmer parts of the United States chiefly as a stock feed. It does best in light, but rich sandy soil. It is propagated by cuttings. Just before frost the more mature parts of the canes are cut and buried till spring and then cut into 4- to 6-inch pieces and planted 4 feet each way. The cultivation is similar to corn. In tropical countries the cuttings may be made and planted at any time. Some varieties, especially early maturing ones, may be grown from seed. The roots are left in the ground till used, as they decay quickly when harvested. The yield is from six to ten tons of roots to an acre, or even more. For further information on cassava, see "Cyclopedia of Agriculture," Vol. II, p. 227, and Farmers' Bulletin, United States Department of Agriculture, No. 167.

Manihot Glaziovii and other species have long been utilized for rubber in the wild state in Brazil. Some years ago this species was planted extensively in various tropical lands out of its natural habitat, the general result being a low yield of rubber and disastrous failure of the enterprise. In recent years, plantations under proper conditions have given much better results. This is the chief source of the ceara rubber, so called from the town of Ceara in Brazil. Other species are also worked for rubber in the native woods of Brazil. *M. dichotoma* and *M. piauhyensis* are also being grown in rubber plantations with success. All the ceara rubber species grow in dry situations with little summer rainfall. *M. piauhyensis* is more shrubby and adapted to light sandy land and *M. dichotoma* to rough heavier soil. *M. heptaphylla* is also grown to some extent for rubber on light soil.



2322. Flowers and fruit of Manihot utilissima. (Enlarged)

The ceara rubber trees are grown from seed, but may be raised from cuttings. The seed is planted about 1 inch deep in good soil and kept moist till the seedlings are well established. The germination is slow and irregular, taking from three weeks to six months. Filing the seed-coat to hasten germination has been tried but often encourages decay. The young plants are cut back and transplanted into the field after the stem has hardened. They grow rapidly, the taller species like *M. Glaziovii*, reaching 16 feet in ten months. The smaller ones may yield a full crop in four years after planting. (See Ule. Notizbl. Bot. Garden, Berlin, 5, 1908.)

Some species of manihot are occasionally grown in greenhouses mostly for the tropical effect of the foliage. They are grown in light but rich soil and do best in a dry room. They are propagated easily from seeds but are usually grown from cuttings of young but firm wood in sandy peat under glass with bottom heat.

A. *Bracts over 1 in. long, ovate to broad-lanceolate: calyx glabrous, ¾in. long: shrubs or small trees.*

piauhyénsis, Ule. Tree, 6–20 ft. high: lvs. 5–7-parted, practically to the base, the lobes obovate-cuneate, obtuse, entire, mucronate, somewhat pubescent, 3–4 in. long: fls. racemose: caps. wing-angled. S. Brazil.—Cult. for rubber.

heptaphýlla, Ule. Tree, 6–20 ft. high: lvs. 3–7-parted almost to the base, the lobes obovate-oblanceolate, some of them pandurately or sinuately 1–2-lobed near the apex, 4–5 in. long, acuminate, mucronate: fls. in short racemes: caps. subterete, not wing-angled. S. Brazil.—Cult. for rubber.

AA. *Bracts much smaller, usually narrower.*

B. *Lvs. not peltate.*

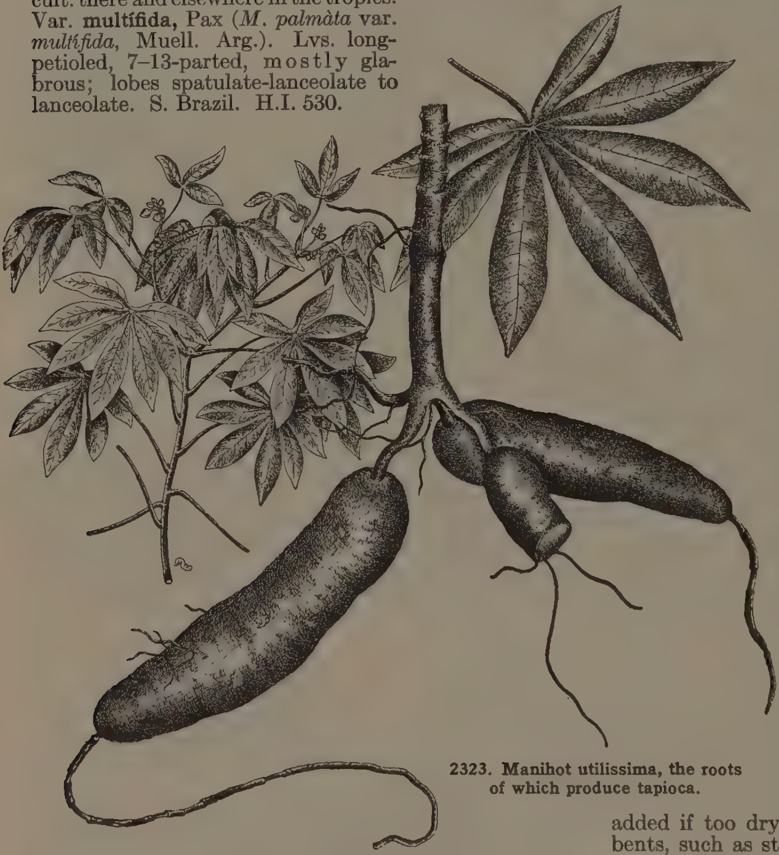
C. *Lf.-lobes entire.*

palmàta, Muell. Arg. (*Játropha palmàta*, Vell.). Shrubby: lvs. deeply 5–11-parted, glabrous, base cordate; lobes of leaves, 3–5 in. long, lanceolate, acuminate; stipules small, deciduous: fls. racemose to sub-paniculate; calyx ¾in. long, glabrous: caps. not wing-angled. S. Brazil.

utilíssima, Pohl (*Játropha Mánihot*, Linn., in part. *Jánipha Mánihot*, HBK.). Bitter Cassava. Mandioca. Manioc. Tapioca Plant. Sweet Potato Tree, and many other names in different tropical countries. Figs. 2322, 2323. An herbaceous shrub

3–9 ft., or small tree in the tropics: roots fleshy, in a basal cluster: lvs. somewhat pubescent, deeply 3–7-parted; lobes 3–8 in. long, lanceolate, acuminate; stipules small, entire: fls. paniculate; calyx less than ½in. long, pubescent inside: caps. wing-angled. Brazil. B.M. 3071.—Cult. in many varieties and naturalized in various tropical lands.

dúlcis, Pax (*Játropha dúlcis,* Gmel.). Shrub, 3–12 ft. high: roots similar to the preceding species but generally smaller: lvs. deeply 3–13-parted; lobes lanceolate to obovate; stipules narrow, pointed, subentire: fls. paniculate; calyx ½–¾in. long, pubescent inside: caps. not wing-angled. Var. **Âipi,** Pax (*M. Âipi,* Pohl. *M. palmàta* var. *Âipi,* Muell. Arg.). Sweet Cassava. Aipi. Younger parts pubescent: lvs. 3–7-parted: lobes obovate to elliptical-lanceolate. Wild in Brazil and cult. there and elsewhere in the tropics. Var. **multífida,** Pax (*M. palmàta* var. *multífida,* Muell. Arg.). Lvs. long-petioled, 7–13-parted, mostly glabrous; lobes spatulate-lanceolate to lanceolate. S. Brazil. H.I. 530.



2323. Manihot utilissima, the roots of which produce tapioca.

cc. *Lf.-lobes sinuate or pandurate or shallowly lobed near the apex, acuminate.*

carthaginénsis, Muell. Arg. (*M. Jánipha,* Pohl. *Játropha carthaginénsis,* Jacq.). Yuquilla. Tree: lvs. 5–7-lobed; lobes lyrate-sinuate; stipules entire: fls. racemose; calyx glabrous, about ½in. long: caps. not wing-angled. S. Texas to Venezuela in sandy soil.

dichótoma, Ule. Tree: lvs. deeply 3–5-parted; lobes broad, entire to sinuate or pandurate; stipules denticulate: fls. in short racemes; calyx ¾in. long, pubescent inside: caps. wing-angled. S. Brazil. H.I. 2876, 2877.

bb. *Lvs. peltate.*

Glaziòvii, Muell. Arg. Ceara Rubber Tree. Manisoba. Tree, up to 40 ft. high: lvs. deeply 3–5-lobed; lobes 3–4 in. long, entire, ovate-oblong to elliptical, short-acuminate; stipules denticulate: fls. paniculate; calyx glabrous, about ½in. long: caps. not wing-angled. S. Brazil and cult. and naturalized in many tropical countries. Jour. Bot. 18:321.

M. diversifòlia, Muell. Arg.=Jatropha integerrima, Jacq.

J. B. S. Norton.

MANURE (from old French *manœvrer,* to cultivate by hand; connected with Latin for *hand* and *work*). In the broadest sense, manure is any substance applied to the soil for the purpose of increasing productivity. The excrements of animals, mixed or unmixed with straw or other absorbents, are usually spoken of as barn-manures. Commercial manures or "fertilizers" are usually concentrated forms of nitrogen, potash and phosphoric acid, mixed or unmixed (see *Fertilizers*); green manures are living plants plowed under to furnish humus and increase productivity; amendments are substances, such as lime, which may increase the growth and healthfulness of plants by improving the physical condition and modifying the chemical reactions of the soil. In general farming, barn-manures are usually applied in the raw or unrotted state; in horticulture, rotted or partially rotted. Horse-manure is used for hotbeds, while cow-manure, mixed with soil, is best for forming a moist rich potting earth. Dung, the solid voidings of animals, after weathering for a time, is also a valuable addition to potting earth. Florists often keep a number of dairy cattle that an abundant supply of bovine manure, which is so valuable in floriculture, may be at hand. Commercial manures are used in small quantities, either direct or in solution. Nitrogen stimulates the vegetative system and tends to produce rapid growth and dark foliage. Phosphoric acid, among other effects, has that of producing well-developed plump seeds and fruits; potash may augment these effects, as well as increase and intensify the color of the bloom.

Barn-manures are more highly prized than formerly. Waste of their valuable constituents is now largely avoided either by applying them to the land day by day, as they are produced, or by more rational methods of caring for them until they are partly rotted or opportunity is afforded for most suitable application to the land. Covered yards or pits are now sometimes used for temporarily storing manures, where they can have water added if too dry and if likely to "firefang;" or absorbents, such as straw, dry muck, gypsum and the like, may be used if they are too watery. When bedding is abundant, the animals may take their exercise in the covered yard, as they will solidify the manure by tramping it, thereby diminishing loss by too rapid fermentation. Both salt and gypsum conserve plant-food in manures when spread over the mass from time to time in small quantities. The quantity and value of manure made by domestic animals is not realized by those who allow it to be scattered over large open barnyards or allow it to remain for considerable periods under the eaves of the barn. Extended experiments at the Cornell Experiment Station showed that the following amounts of excrements were produced daily for each 1,000 pounds of live weight of animal:

	Pounds
Sheep	34.1
Calves	67.8
Pigs	83.6
Cows	74.1
Horses	48.8
Fowls	39.8

Animals fed on a highly nitrogenous or narrow ration (as 1:4), as were the pigs in the above investigations, consume large quantities of water and produce a large amount of manure, the weight of which often exceeds the amount of food consumed; while those fed on a carbonaceous or wide ration (as 1:9) consume comparatively little water and produce less weight of manure.

Some conditions affecting the production of manure and its value may be stated as follows: If the plant-food value of manure is computed at the price that is paid for the same constituents in fertilizers, it is found that the value of manure produced by animals is equal to 30 to 50 per cent of the cost of their food. Young animals produce poorer manure than mature ones. The excrements of animals which give a product, as milk or young, are poorer than those from non-productive animals. The more abundant the ration the less complete the digestion and the greater the value of the manure produced. Concentrated and nitrogenous foods result in richer and more valuable excrements than unconcentrated or carbonaceous foods. Liberal salting and excessively succulent foods diminish the value a ton of manures. The amount and kind of bedding affect not only the quantity but the value a ton. Animals kept in cold quarters drink little water, digest their food closely and produce a manure relatively small in amount and poor in quality.

Rich manures are relatively more valuable to the unit of contained fertility than poor ones, because their fertilizing constituents are more quickly available than are those of poor ones. Plants receive greater benefit from extra nourishment in the early stages of their growth than when they approach maturity. Coarse low-grade manures should be weathered or rotted to improve their availability, even though some loss may occur. A unit of plant-food in high-grade fertilizers or well-preserved rotted manures is worth more than in low grades. The valuable constituents in farm-manures are not so quickly available as they are in high-grade fertilizers, but they have an additional value, since they furnish humus, lighten the soil, inoculate it with nitrifying organisms and increase its power to hold moisture, while assisting in liberating the mineral constituents of the soil. The value of manure as set down below is determined by investigations during the winter months, and the nitrogen, phosphoric acid and potash are computed at 15, 6 and 4½ cents a pound, respectively. The indirect beneficial effects of manure are considered an equal offset for the slightly less availability of their plant-food constituents as compared with fertilizers:

Kind of manure.	Value a ton.
Sheep	$3 30
Calves	2 17
Pigs	3 29
Cows	2 02
Horses	2 21

Limited amounts of bedding were used in the tests from which the foregoing figures were made.

Kind of animal.	Value a year.
Fowls (1,000 pounds of)	$51 10
Sheep " "	26 09
Calves " "	24 45
Pigs " "	60 88
Cows " "	29 27
Horses " "	27 74

Usually these animals are kept in the stables but half of the year, and inevitably some loss will occur; therefore it will be safe to estimate the recovered value a year at one-third to one-fourth of the above.

Heretofore the waste of the valuable constituents of manures in the United States has been very great. Until recently, large open barnyards have been the rule. In the northern and central parts of the United States the rainfall exceeds 30 inches per annum. Many barnyards contain from ¼ to ½ acre. One inch of rainfall equals 113 tons of water an acre. If this be multiplied by thirty, a fairly accurate estimate is secured of the water which largely passes through or over the manure and carries off its most soluble and hence most valuable constituents. The loss of value in manures exposed at Ithaca, New York, in loose heaps of two to ten tons, during six months, was as follows:

	Per cent
1889. Horse-manure	42
1890. Horse-manure	62
1890. Cow-manure	30
1889. Mixed, compacted	9

Even in horticulture, where a more liberal use of manure than in general farming is admissible, too much reliance is often placed on manures and too little on tillage. Manures may furnish plant-food, improve the physical condition of the soil, conserve and increase heat and moisture. Ten to twenty times as much food as the plants can utilize is frequently applied at one dressing, which is poor economy, since manures give best results when applied in moderate quantities, in a well-rotted condition and in close contact with the seed. Growth and development are more largely determined by the amount of moisture than by the amount of plant-food. Five tons of preserved barn-manure contain of nitrogen, phosphoric acid and potash, sixty, thirty and forty-five pounds, respectively. Twenty-five bushels of wheat, with straw, contain forty-five pounds of nitrogen, eighteen pounds of phosphoric acid, and twenty-seven pounds of potash. Most soils contain large amounts of unavailable or difficultly available plant-food. Manures should be used largely to feed plants between the time the nutrients in the seed have been exhausted and that when the plants have secured a firm hold on the soil by manifold rootlets. Except when otherwise most suitable and convenient, fresh manures should be spread thinly in the autumn or early winter on the surface where plants are growing, thus imitating nature's methods of maintaining and increasing productivity.

It is usually found to be both difficult and expensive to maintain productivity by means of barn-manures supplemented with light applications of fertilizers. In this case, unless plant-food can be secured from outside sources easily, recourse should be had to green-manuring. In some cases this is the cheapest and the best method of rejuvenating old, weedy, tired lands. By raising and plowing under two crops—one at least a legume—in one season many weeds may be destroyed, quantities of humus and nitrogen added, and inert plant-food transformed into readily available forms. At the same time the soil is improved physically and its power to pass the free water of precipitation through its subsoil is augmented while the tendency to puddling is diminished. Added humus and tillage combined hasten nitrification and the liberation of inert mineral plant-food while imparting to the land a greater capacity to hold moisture by capillary action. See *Fertility*.

I. P. Roberts.

MAPÀNIA (an aboriginal name). *Cyperàceæ.* Grass-like or sedge-like plants, sometimes grown under cover for the foliage effects.

Stem very short, bearing long and often striking lvs.: scapes mostly leafless, bearing congested infl.: spikelet of 6 (sometimes 5) glumes: fr. a bony nut either dry or succulent.—There are perhaps 50 species in the tropics of both hemispheres, comprising strong often tall-lvd. perennial herbs. Two species, apparently good pot subjects, have been listed in recent years. *M. pandanæfòlia*, Hort., is represented as dracena-like, caulescent, 3–4 ft. high, with long narrow graceful stiffish lvs. 24 in. long by 1 in. wide. G.C. III. 21:349. Gt. 46, p. 523. It is perhaps *M. Pandanophýllum*, Schum. & Hollr., which is *M. hypolytroìdes*, Benth., of

Malay peninsula to Austral. (*Pandanophýllum hypolytroìdes*, F. Muell. *Hypólytrum Pandanophýllum*, F. Muell.). This much-named plant is separated by C. B. Clarke as *Thoracostàchyum hypolytroìdes*, Clarke, a genus differing from Mapania in its corymbose rather than congested spikes. The lvs. are described as 4 ft. long and 1–2 in. broad, with scabrous edges: lowermost involucral bracts 1–2 ft. long and ½–1 in. broad, tapering to long points: spikelets very numerous, whitish.

Apparently the only other species recently offered regularly is *M. hùmilis*, Naves & Vill. (*M. lùcida*, N.E. Br.). Rhizome short and woody, terminating in a short st. or crown bearing a top of densely equitant lvs., which are 2–3 ft. long, 3-nerved, sharp on margins and keel: scapes from the lower axils, the mature infl. ovoid, the bracts shorter than the head. India.

L. H. B.

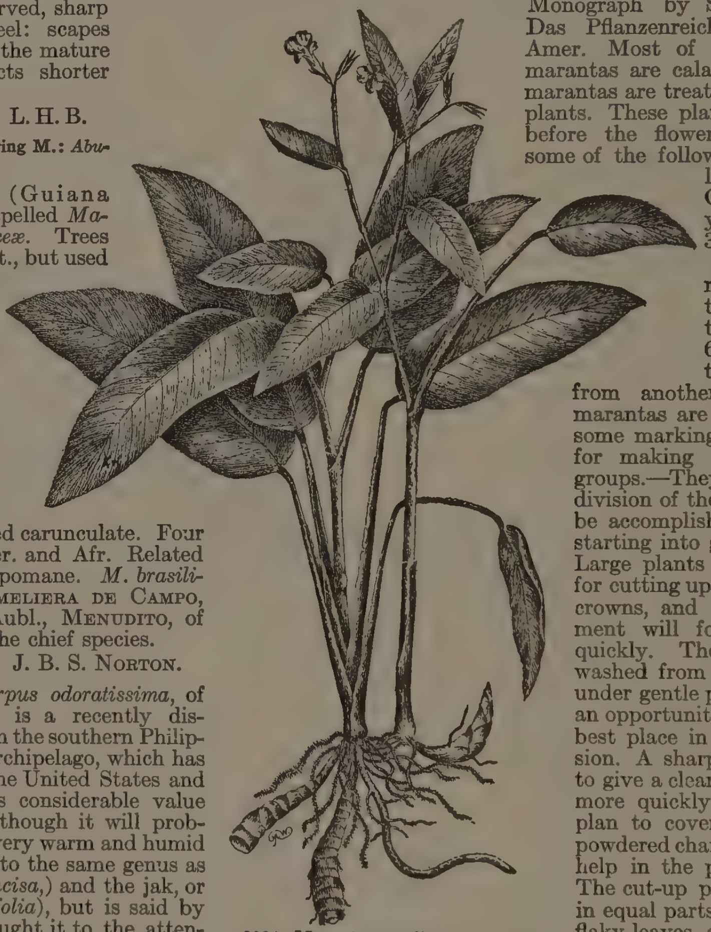
MAPLE: *Acer.* **Flowering M.:** *Abutilon.*

MAPROÙNEA (Guiana name). Sometimes spelled *Maprounia. Euphorbiàceæ.* Trees and shrubs, not in cult., but used for medicine and the like, in their native land. Glabrous: juice milky: lvs. entire, pinnately veined: infl. terminal; fls. apetalous, monœcious; staminate calyx 2–3-lobed, lobes imbricate; stamens 1–3, filaments connate; ovary 3-celled; 1 ovule in each cell: seed carunculate. Four species in Trop. Amer. and Afr. Related to Stillingia and Hippomane. *M. brasiliénsis*, St. Hil., Marmeliera de Campo, and *M. guyanénsis*, Aubl., Menudito, of Trop. S. Amer., are the chief species.

J. B. S. Norton.

MARANG, *Artocarpus odoratissima*, of the family *Moraceæ*, is a recently discovered fruit-tree from the southern Philippines and the Sulu Archipelago, which has been introduced to the United States and is thought to possess considerable value for tropical regions, though it will probably succeed only in very warm and humid climates. It belongs to the same genus as the bread-fruit (*A. incisa*,) and the jak, or jack-fruit (*A. integrifolia*), but is said by Wester, who first brought it to the attention of horticulturists, to produce a fruit superior in quality to the Philippine forms of either of these. The tree is medium-sized, and similar in habit to the bread-fruit, with large, dark green, entire or trilobate leaves 18 to 24 inches long by 10 to 12 inches broad. Wester describes the fruit as "large, about 6 inches long and 5 inches in equatorial diameter, roundish oblong, regular, thickly studded on the outside with soft greenish yellow spines ⅓ inch in length; rind thick and fleshy; flesh white, sweet, rich, juicy, aromatic and of good flavor, separated into segments (of about the size of a grape) clinging to the core, each segment containing a seed; the seeds many, whitish, ⅓ by ⅗ of an inch, smooth, separating readily from the flesh. When the fruit is ripe, by passing a knife around and through the rind, with a little care the halves may be separated from the flesh, leaving this like a bunch of white grapes." It is said to ripen during August in the Philippines. For species related to *A. odoratissima*, Blanco, see the article *Artocarpus*, pages 401,402, Vol. I.

F. W. Popenoe.

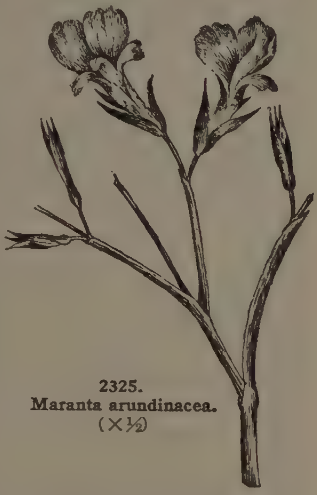


2324. Maranta arundinacea. (×⅛)

MARÁNTA (B. Maranta, Venetian Physician and botanist, died 1754). *Marantàceæ.* Greenhouse pot plants, grown mostly for the foliage.

Perennial herbs, tall or low, erect or prostrate, the flowering part more or less branched: lvs. petiolate, radical and cauline: fls. racemose or paniculate; sepals 3, equal, lanceolate or lance-oblong; corolla more or less tubular, usually enlarged or gibbous at base, the 3 lobes subequal and somewhat hooded at the apex; 2 exterior staminodia petal-like, usually obovate, showy; ovary 1-celled by abortion.—Species 23 in the Monograph by Schumann (hft. 11, Das Pflanzenreich, 1902), in Trop. Amer. Most of the plants cult. as marantas are calatheas; and the true marantas are treated the same as those plants. These plants are often named before the flowers are known, and some of the following plants may belong to the genus Calathea. The genus yields arrow-root (p. 397).

The culture of maranta is that of calathea, which is detailed in Vol. II, p. 619; but the directions may be reviewed from another experience. The marantas are grown for the handsome markings of the leaves, and for making complete foliage groups.—They are increased by division of the crowns, which may be accomplished just as they are starting into growth in the spring. Large plants are the best to use for cutting up, as they have strong crowns, and under proper treatment will form a plant more quickly. The loam should be washed from the root with a hose under gentle pressure. This gives an opportunity to see where is the best place in the crown for division. A sharp knife must be used to give a clean cut, which will heal more quickly. It is also a good plan to cover the cut part with powdered charcoal, which is a great help in the prevention of decay. The cut-up pieces may be potted in equal parts of the fiber of loam, flaky leaves, and sharp sand; add also a small part of broken charcoal. The pot should be big enough to admit the roots without breaking or crushing them and they must be supplied with good drainage.—Marantas like abundance of moisture at their roots. The water, however, must pass freely through them, otherwise they soon get into a sour stagnant condition. Divided plants should be kept in a temperature of not less than 65° and the house must be kept in a humid condition by light syringing, and dampening between the pots on the bench, and in the paths. Change the air in the house by ventilating, as soon as the thermometer reaches 75°. Shade the plants from early spring until late autumn, as the bright sunshine will soon destroy the foliage and make the plants unsightly. Repotting is not necessary until the following spring.—In December, January and February, marantas may be allowed to get quite dry at the roots before watering. By this treatment they seem to start into a more vigorous growth, when they get a shift into a larger pot early in March. Established plants may be potted in a rather rough soil consisting of the fiber of loam two parts, flaky leaves one part, a small part of good sharp sand and another part of dried cow-manure. Add a sixth part of broken-up charcoal to the whole compost. Pot moderately firm, by pressure of the hands, and raise the crown a little in the center. In summer, admit plenty of air during the day, and leave a crack of top air on all night. This insures a strong healthy growth, and the plants may be used for decorative work, without suffering any damage. Tropical plants have been brought into disrepute by what may be termed the sweat-box treatment, which is entirely unnecessary. A soft flabby growth is the result of such usage. When in active growth, marantas may be watered with manure-water. Cow-manure water and soft-coal soot agree well with them. An ordinary handful to a 2½-gallon watering-pot will be found to be sufficient. Apply after watering twice with clean water. If marantas are well syringed under the leaves, insect pests are not troublesome. If they obtain a foothold, sponge the leaves with some reliable insecticide. (George F. Stewart.)



2325. Maranta arundinacea. (×½)

A. *Lvs. green, pubescent beneath*

arundinàcea, Linn. Figs. 2324, 2325. Branched, 2–6 ft. high, tuberous: lvs. ovate-oblong to ovate-lanceolate and pointed, at the base rounded or truncate: fls. white in an open cluster, the upper lip roundish; staminodia surpassing corolla. Trop. Amer.; naturalized in S. Fla. B.M. 2307.—One of the sources of arrow-root, the plant being often called Bermuda arrow-root. The starch is obtained from the roots. It thrives along the Gulf coast, although little cult. There is a form with lvs. variegated green and yellow.

AA. *Lvs. green, marked with strong parallel light-colored bars extending from midrib toward margin or with a whitish central stripe.*

spléndida, Lem. Glabrous: lvs. 2 ft. or less long, the blade large, oblong-lanceolate, with base subcordate or somewhat cuneate, short-acute at apex, above shining dark green and marked with pale green transverse bars, beneath violet-red. Brazil. I.H. 13:467, 468.—By some regarded as Calathea (*C. splendida*, Regel), but its position is doubtful. Resembles *Calathea Veitchiana*, but more robust.

AAA. *Lvs. blotched or banded with dark colors (sometimes contrasted with silvery colors).*

leuconeùra, Morr. Dwarf, the st. and lvs. about 1 ft. high, not tuberculate at base: lvs. oblong or broadly elliptic, usually obtuse or very short-acuminate, grayish green, white striped or banded along the veins, and marked with darker green, glaucous or purple beneath; outer staminode white, obovate and emarginate. Native in Brazil.

Var. **Massangeàna,** Schum. (*M. Massangeàna*, Morr. *M. bícolor* var. *Massangeàna*, Hort.). Lvs. smaller, beautiful purple beneath: fls. somewhat smaller, the sepals about ⅙in. long: staminode deep violet, somewhat 3-lobed.

Var. **Kerchoveàna,** Morr. (*M. Kerchoveàna*, Hort.). Lvs. larger, glaucous or red-spotted beneath: fls. larger; staminode entire.

bícolor, Ker (*Calathèa bícolor*, Steud.). A foot or so high, the st. tuberculate at base: lvs. linear-oblong or elliptic, rounded or subcordate at the base, more or less wavy on the margin, abruptly short-pointed, light purple below, pale glaucous green above, with a relatively light-colored central band and very dark green or brown-green blotches midway between the rib and the margins. Brazil. B.R. 786. L.B.C. 10:921.

See *Stromanthe* for *M. sanguinea, M. Porteana.*

See *Monotagma* for *M. smaragdina.*

See *Ctenanthe* for *M. Kummeriana, M. Luschnathiana, M. Oppenheimiana, M. setosa.*

See *Ischnosiphon* for *M. bambusacea* (M. bambusæfolia?), *M. major.*

See *Calathea* (some of them in the supplementary list) for *M. Alberti, M. albo-lineata, M. argyrea, M. Bachemiana, M. Baraquinii, M. Chantrieri, M. chimboracensis, M. eximia, M. fasciata, M. fascinator, M. Gouletii, M. hieroglyphica, M. illustris, M. insignis, M. Lageriana, M. Legrelliana, M. leopardina, M. Lietzii, M. Lindenii, M. Makoyana, M. medio-picta, M. micans, M. musaica, M. nitens, M. ornata, M. picta, M. princeps, M. pulchella, M. regalis, M. roseo-lineata, M. rosea-picta, M. Sanderiana, M. tigrina, M. tubispatha, M. Vandenheckei, M. Veitchiana, M. virginalis, M. vittata, M. Wagneri, M. Wallisii (Wallichii?), M. Warscewiczii, M. Wiotii, M. zebrina.*

Other marantas with Latinized trade names are in recent lists, but not all of them are identifiable botanically. *M. amábilis.*—*M. argéntea*, "large oblong silvery gray lvs., marked with narrow lines of green."—*M. bélla*, Bull (Calathea bella, Regel, which is probably the correct name). Stemless: lvs. about 6 in. long, oblong, acutish, whitish green above, pale purple beneath.—*M. Clósonii.* Lvs. dark green, variegated with pale yellow. Brazil.—*M. Goveniàna.*—*M. iconífera* (a form of Calathea Makoyana?), has lvs. about 6 in. long, obliquely oval, yellowish green, with oblong, deep green spots or bars. Brazil.—*M. Liebrechtsiàna.* Lvs. large, oval, green, decorative. Congo. Clinogyne (?).—*M. Lùbersii.* Foliage reticulated with yellow.—*L. Lujaiàna.* Lvs. handsome, long-stalked, purple beneath. Halopegia (?).—*M. mosélla.*—*M. orbifòlia*, "strong grower, olive-green with broad silvery bands."—*M. Sagoriàna.* Dwarf: lvs. oblong, pale green, with oblong-oblique, deep green bars on each side of the midrib. S. Amer.—*M. Spitzeriàna.*—*M. triúmphans.*—*M. undulàta*, Lind. & André (properly Calathea undulata, Regel). Six to 8 in. high, compact: lvs. ovate-oblong, the blade about 4 in. long, subcordate and unequal at base, very short-pointed, the surface undulate, beneath purplish, above deep shining green, with a whitish feathery stripe through the center. Peru. I.H. 19:98.

L. H. B.

MARÁTTIA (name from J. F. Maratti, an Italian botanist of the 17th century). *Marattiàceæ.* A genus of large, coarse-lvd. stipulate tropical ferns with the large fleshy sporangia borne in boat-shaped groups on the under surface of the lf. The species are strong-growing and ornamental, some of them reaching considerable size. Besides the following, there are several American species which deserve cult. For cult. requirements, see Angiopteris, p. 1214.

2326. Marattia fraxinea. (×⅛)

fraxínea, Smith (*M. élegans*, Endl.) Fig. 2326. St. erect, tuberous: lvs. bipinnate, 6–15 ft. long, the stalks often 1 in. or more thick; pinnules 4–6 in. long, ½–1½ in. wide, of a leathery texture and naked surfaces: receptacles submarginal. W. Afr. to Malaysia and New Zeal.

M. Stanleyàna, Hort., has not been sufficiently described to be identifiable.

L. M. UNDERWOOD.

MARCGRÀVIA (Georg Marcgraaf, born 1610, a very early writer on Brazilian natural history). Sometimes spelled *Marcgraavia* and *Marcgrafia*. *Marcgraviàceæ;* by some authorities included in *Ternstrœmiàceæ.* Climbing epiphytic shrubs, one of which is offered abroad as a warmhouse plant: lvs. entire, short-stalked, coriaceous: fls. in terminal umbels or racemes, the corolla cap-like and falling as a single piece; sepals 6, 2 smaller; stamens mostly many (sometimes as few as 12): fr. globose to ovoid, more or less fleshy, with numerous seeds. Species probably 40, many of them recently described in Trop. Amer. **M. umbellàta,** Linn., W. Indies and S. Amer., is a polymorphous plant, the sterile shoots creeping and rooting: lvs. on the rooting shoots distichous, nearly sessile, cordate and emarginate, on the other shoots oblong to linear: fls. greenish, umbellate: fr. with red pulp: clings to trees by roots.

MARCHÁNTIA (Marchant, French botanist). *Marchantiàceæ.* A common liverwort (one of the Bryophyta; see p. 6, Vol. I) spreading its lf.-like forking thallus on moist earth. *M. polymórpha,* Linn., has been offered by dealers in native plants, the sods of it being sold for colonizing in rock-gardens. It frequently grows on damp sills and walls in greenhouses. The flat thallus is often 4–5 in. long and 1 in. or more wide, from which rise peduncles 1 in. high, bearing the antheridial disk or shield and the star-like carpocephalum on similar stalks 1–3 in. high.

MARGUERITE, a popular name for certain daisy-like plants, the word related in origin to the Greek for *pearl,* as also *margaritaceous,* "pearly;" from the same root is derived the personal name Margaret and others. In florist's usage, the marguerites are species of Chrysanthemum. Blue marguerite is *Felicia amelloides,* and Reine marguerite of the French is the China aster. There are two types of marguerites, the common one, or Paris daisy, with coarse green foliage, and the glaucous marguerites, with finer cut glaucous foliage. The former, *Chrysanthemum frutescens,* is better for cut-flowers. The latter, *C. anethifolium,* is probably better for large specimens.

Marguerites are standard useful plants with florists and in the conservatories of amateurs, being of easy culture and remarkably free from enemies. They are cultivated for two distinct purposes,—for cut-flowers and for specimen plants, young plants being used for the former purpose, and older ones for the latter. For cut-flowers, the cuttings are rooted in spring, and the florists usually keep the plants in pots all summer outdoors, though this is not necessary for amateurs, and flowers are produced during the following winter. It is sometimes said that marguerites do not lift well in the fall after being planted out all summer in the garden, and that unrestricted root-room makes the plants too large for the best production of cut-flowers. The principles underlying the matter are as follows: In turning plants out of pots into the open ground in spring, a plant that has filled its pot well with roots tends to make a much more compact root-system in the garden than the plant that had but few roots in its pot, and the former plant is easily lifted in the fall and with less damage to the roots. As a matter of fact, marguerites do not belong to the class of plants that are difficult to lift in the fall, and it is only a question of starting the cuttings early enough in spring to get the plant moderately pot-bound before it is planted out into the open ground. Specimen plants are most attractive in the second winter following the spring in which cuttings were struck. After that they are likely to become too large and straggling. While in the garden, the flowers should not be allowed to form, if the main object is high-grade cut-flowers in quantity for the winter. Old plants that are unfit for further use in the conservatory may be turned out in summer and will furnish scattering bloom all summer, though the flowers are likely to be rather small. If there were sufficient demand, it could be easily managed to have flowers in every month of the year. It is a great pity to cut marguerites without any foliage. The rule is that all flowers look best with some foliage, especially their own. With a little forethought, just as many flowers can be secured, and they will look much prettier and last longer. There are very few conservatories without some marguerites. An excellent plan is to have a number of plants in 6-inch pots from cuttings struck the previous spring. A plant looks bad at first when the flowers have been removed on sprays a foot long, but in a short time they are ready for cutting again. With a little management, a succession of flowers can be maintained without making all the plants thin or unsightly. Such sprays will last a week or two in water, and the opening of the larger buds is an additional feature of beauty which is lost if flowers are cut with short stems and without foliage. (Robert Shore.)

MARGYRICÁRPUS (Greek, *pearly fruit;* referring to the white berries). *Rosàceæ.* South American sub-shrubs, of which *M. setosus* is a heath-like plant cult. in rockeries for its numerous small white berries, which are seen to best advantage against dark background. The nearest genus of garden value is Acæna, which has fls. on heads or spikes, while those of Margyricarpus are solitary and axillary. Branching shrubs with inconspicuous fls. which are sessile and have no petals: lvs. alternate, crowded, overlapping: calyx-tube persistent; lobes 4–5; ovary 1, in the calyx-tube, with very short style; ovule solitary, hanging from the top of the cell: fr. a coriaceous achene.—Species a half-dozen and more, in temperate parts of mountains and south to Patagonia.

setòsus, Ruiz. & Pav. Pearl Fruit. Low-growing little evergreen (about 1 ft.): lvs. odd-pinnate with subulate more or less reflexed lfts.: fls. very small, green, sessile in the axils: fr. white, showy and persisting for some time, small. Peru, Chile.—Hardy in England. Intro. in S. Calif.

M. hýbridus is offered abroad as a "pretty evergreen alpine shrub thickly studded with rose-colored berries." L. H. B.

MÀRICA (meaning doubtful; perhaps from the verb *to flag*). *Iridàceæ.* Tropical plants allied to Iris, but with shorter-lived flowers and convolute inner segments.

Rootstock a short rhizome: lvs. sword-shaped, 2-ranked: fls. blue, yellow or white, very fugitive, in clusters on a flat and lf.-like peduncle, 2–4 in. across, the outer segms. large, white or blue, the inner ones smaller, fiddle-shaped, with beautiful coloring; stamens short and erect, the filaments distinct: caps. oblong, 3-valved, many-seeded.—About a dozen perennial herbs, in Trop. Amer. and 1 in Guinea (Afr.) They are planted in the fall, and are hardy with winter covering in the warmer parts. The genus is nearest to Cypella, but the style-crests are petal-like, while in Cypella they are spur-like or flattened; in Cypella the lvs. are plicate rather than distichous and the rootstock is bulbous.

A. *Outer segms. white, or marked at the base with brown and yellow.*

grácilis, Herb. Lvs. 6–8 in a tuft, sword-shaped, 1–1½ ft. long, ½–1 in. broad: peduncle long and flat, bearing fls. at some distance from the end and sometimes taking root from the top; fls. 2 in. across; outer segms. obovate, white, with cross-marks at base of yellow and brown; inner segms. small, reflexed, blue. Mex. to Brazil. B.M. 3713. Gn. 63, p. 37.

Northiàna, Ker. Lvs. about 8 in a tuft, sword-shaped, bright green, about 2 ft. long and 1½–2 in. broad: peduncle 3 ft. long, as broad as the lvs., with about 2 clusters near the apex; fls. 3–4 in. across; outer segms. pure white and obovate, variegated on the claw;

inner segms. with violet tip and variegated claw. B.M. 654. I.H. 42:40 (var. *splendens*). Gt. 61, p. 91. G.L. 26:137. Gn. 65, p. 289. F.S.R. 3:52.—Handsome; a good subject for a basket.

AA. *Outer segms. blue.*

cærùlea, Ker. Lvs. 6–8, sword-shaped, 1–1½ in. broad and 2–3 ft. long: peduncle long, as broad as the lvs., bearing 2–4 fl.-clusters: spathes 2–3 in. long, the outer valves green and lanceolate: fls. 3–4 in. across, bright blue or lilac, the outer segms. 1–1½ in. across and variegated at base with transverse bars of yellow, white or brown, the inner segms. with recurved blue point. Brazil. The African *M. Sàbinii*, Lindl., Baker considers to be probably only a form of *M. cærulea*, and intro. into Upper and Lower Guinea. B.M. 5612 (as *Cypella cærulea*). B.R. 713. Gn. 25, p. 313; 33:56. J.H. III. 49:17.

Hélenæ, Worsley. Related to *M. cærulea:* fls. nearly 5 in. across, blue and white, on long lf.-like scapes: drooping segms. or "falls" much longer than in *M. cærulea*, somewhat narrower, indigo-blue, the reflexed apices measuring 2½ in. long; standards much more distinctly vittate, deep velvet-blue in 2 marginal stripes with a keel of white of equal width between them; plant also hardier, withstanding some frost. Brazil.

L. H. B.

MARIGOLD. The original kind is the pot marigold, the dried flowers of which are used to season soups. It is also cultivated for ornament. See *Calendula officinalis*. The **French Marigold** is *Tagetes patula;* the **African,** *T. erecta*. The African marigolds are mostly pure lemon- or orange-colored; the French ones have these colors and brown also, and are often striped. For **Cape M.** see *Dimorphotheca*. For **Fig M.** see *Mesembryanthemum*. **Marsh M.** is *Caltha palustris*.

MARIPOSA LILY: *Calochortus*.

MARIPOSA TULIP: *Calochortus*.

MARJORAM, SWEET: *Origanum*.

MARKET-GARDENING is the growing of vegetables for commercial purposes by the employment of the most skilful methods. It is one of the most intensive types of vegetable-gardening. Land values, where market-gardening is practised, are usually high, and it is necessary to secure large returns to the acre in order to realize a profit on the investment. The crops which receive most consideration by market-gardeners are beets, onions, celery, lettuce, radish, carrot, parsley, endive, and other vegetables which are usually planted close together and cultivated with hand wheel-hoes.

Truck-gardening, or truck-farming, is the growing of vegetables for market by the employment of extensive methods. Less intensive methods are followed in truck-gardening than in market-gardening. Land values are lower and it is unnecessary to obtain large cash returns to the acre in order to make the business profitable. The trucker relies mainly on such crops as the cabbage, tomato, sweet corn, asparagus, pea, bean, cucumber, watermelon, muskmelon, sweet potato, and other crops which require liberal spacing and which are usually cultivated by horse-power.

Market-gardeners are usually located near the towns or cities in which the vegetables are sold, although there are exceptions; truckers, as a rule, are remote from market. The best examples, and the most extensive areas, of market-gardeners are near the large cities —New York, Philadelphia, Boston, Chicago, Baltimore, Washington, San Francisco, Toronto, and Quebec.

Vegetable-forcing is the growing of vegetables under glass, or canvas, or in specially constructed houses which are heated by artificial means.

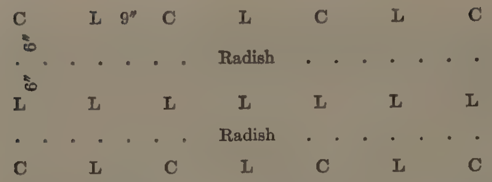
In choosing a location for market-gardening, too much attention cannot be given to the market demands of the locality and how fully they are met by growers already operating in the community. There should be the best of roads and of transportation facilities to the markets to be supplied. Liberal supplies of stable-manure should be easily obtainable at reasonable prices. A sandy soil is a distinct advantage; it is easily cultivated, and with good management produces vegetables of the highest quality early in the season. On account of the uncertainty of an ample supply of rain throughout the season, crop-production will be made more certain and profitable by irrigation, and there should be no shortage in the water-supply. An abundance of pure water will also be needed in preparing the vegetables for market. The supply of labor should also be taken into account in the choice of a location.

High fertility of the soil is a prime factor in the successful operation of a market-garden. The land must be in the proper physical condition if crop-yields are to be satisfactory. Available plant-food must be present in adequate quantity throughout the growing season. Stable-manures are universally applied in large amounts by market-gardeners. It is not uncommon to apply forty or more tons to the acre. Such large applications annually increase the percentage of organic matter in the soil, thus providing the best physical, chemical, and bacteriological conditions for plant growth. While many gardeners rely wholly upon stable-manures as a source of plant-food, others find it profitable to employ commercial fertilizers, varying in amount from a few hundred pounds to two tons to the acre. Complete fertilizers are generally employed, and they usually contain about 4 per cent of nitrogen and from 7 to 10 per cent of each of the mineral elements—potash and phosphoric acid. Lime is often used to make heavy soils more friable, to prevent the ravages of club-root, and to maintain an alkaline condition in the soil, which is important from the standpoint of avoiding mal-nutrition diseases.

Market-gardeners usually do not attempt to cultivate large tracts of land. Occasionally, a man will handle 50 to 75 acres, but most of the growers have less than 25 acres and thousands of them less than 10 acres. By the employment of the most intensive methods, a living may be made on 2 or 3 acres, although most gardeners will do better on a larger area. Small areas require the use of more glass, in the way of hotbeds and coldframes or perhaps greenhouses.

Inasmuch as a livelihood must be made from a small area of land, it is necessary to keep every foot or inch of the place occupied with a crop throughout the growing season. The first crops are started early in the spring, just as soon as the ground is dry enough to work, and they follow each other in close succession until late in the fall. By skilful management, it is possible to grow four or five crops on the same land in one season. Companion-cropping is common among market-gardeners, and, in order to make the soil do its maximum duty, one crop is often planted before the preceding one is harvested. For example, immediately after the last wheel-hoe cultivation of beets, planted in rows a foot apart, rows of lettuce may be drilled midway between the beets. When the lettuce is about ready to harvest, carrots may be drilled between the rows, and these may be followed by some other small crop, and so on until late autumn. When companion-cropping is practised, it is important to have straight rows, so that there will be uniformity in the spacing between the rows. This is essential if wheel-hoes are to be used in the most effective manner, and straight rows also make a more attractive garden.

The greatest variety of companion-cropping plans may be practised. The following plan, with C representing cabbage, L, lettuce, and R, radish, shows the possibilities of this system:



In considering intercropping plans, the gardener should be well informed concerning the requirements of each crop,—its habit of growth, soil-adaptation, space-requirement, susceptibility to disease and insect depredations, time of maturing, and the like.

The outlook for market-gardening in America was never more encouraging than at the present time. Great advances in prices need not be expected, but the rising prices of meats will unquestionably favorably influence the market for vegetables. Our markets are demanding the highest quality of vegetables, and every gardener should attempt to grow the best and to place it on the market in the most attractive condition. Profits in market-gardening depend quite as much upon the grower's ability as a market-man as upon his skill in production.

R. L. WATTS.

MARKETING OF HORTICULTURAL PRODUCE. The growing and disposing of horticultural products have from earliest times been bound together. Within the past decade, the tendency to dissolve the marketing from the production has been developing very perceptibly. This division of labor has doubtless been due to the rapid increase in the amount of detail and skill required to do both producing and marketing successfully.

The business of disposing of horticultural products is now somewhat specialized and follows fairly well-defined lines. These may be described as (1) marketing directly to the consumer; (2) marketing indirectly or through middlemen of the many and various kinds; (3) marketing through coöperative associations.

Marketing directly to the consumer.

By this is meant sending the produce directly from the producing region. This is the simplest, easiest and most satisfactory of all ways. The producer, in this way, receives the best returns for his crop, and the consumer secures the produce for the most reasonable price and without the delays between harvesting and selling which very often cause serious deterioration. Many fruit- and vegetable-growers have worked up a satisfactory business by disposing of their products in this way. This is usually initiated by friends of one or both parties and later supplemented by cards inclosed in the package and by advertisements. It is a fairly common practice for fruit-growers to sell directly to an association of farmers in a grain or dairy region. A personal confidence between the grower and the consumer develops from this method of dealing, and so long as neither side destroys this confidence the customer becomes an advertising agent for the grower.

It was thought that the parcels-post system would stimulate direct selling. It has been practised to some extent, but there seems to be no very immediate likelihood that it will become a large factor for bringing the horticultural producer and consumer together. So many horticultural products are of a highly perishable nature, while many of a less perishable nature are too bulky.

In some cities, marketing directly to the consumer is done through city public markets, with satisfactory results to the producer and the consumer. These marketing centers are usually constructed by the cities, and for a small fee the farmers, gardeners and fruit-growers rent stalls or stands. Rules and regulations for the conduct of the business of selling are usually prescribed by the city government, and they are enforced by the superintendent of markets or other official in charge. The market is opened and closed and selling is active at designated hours. Usually all sales are made for cash and the buyer carries home all produce purchased. This marketing brings closely together, to their mutual benefit, the producer and consumer. As the overhead expenses of marketing are reduced to a minimum, the public markets have been important factors in reducing the cost of living in many communities.

Marketing indirectly or through middlemen.

A large part of the horticultural products are sold by the grower to jobbers, dealers and retail merchants. This is the next step in the evolution from direct selling. Much harsh criticism has been applied to the middleman; however, there can be no doubt but that he has an important place in the disposition and distribution of horticultural products. The marketing and distributing has rapidly become such an intricate, extensive and specialized business of itself that few fruit-growers can afford the time or have the business training or skill required to do this work well.

There undoubtedly always will be a place for the middleman in the distribution of produce so long as many kinds, grades and varieties of products similar in a general way are grown on small farms and sent to distant markets to be sold.

The middleman is, in reality, a distributor. It would be impossible for the men who grow the crop to place or distribute it in markets over the country so that it might be purchased at a reasonable price in many regions, and not permitted to accumulate in too large quantities in some markets while in others there would be a scarcity or nothing. Horticultural products are, in a large number of cases, highly perishable and markets must be provided some time in advance of the ripening of the crop. This requires capital, familiarity with trade in many sections, confidence, good-will, and wide acquaintance with the many outlets.

The general term "middleman" may include buyers, commission men, jobbers, dealers, brokers, auction companies, solicitors, speculators and distributing agencies.

(a) *Buyers and jobbers.*

The term "buyer" in the mind of the truck- or fruit-grower, in most producing sections, is any individual who is located at the shipping-stations and endeavors to buy produce from the grower as it is brought in from the gardens and farms. These buyers may be operating the business for themselves, endeavoring to get together a carload of mixed or similar products to be shipped or consigned to the market. They may be representatives of a jobbing or commission company, working on a salary or commission on the business accomplished. It is their entire purpose to buy the highest grade and best packed products at the lowest price that the grower will take for them. These buyers may buy one or several kinds of produce but usually they want but one kind and one grade. These men make a special business of buying one kind of produce at a time and many of them "follow the crop," i.e., begin in the southern states to buy when the crop is harvested and move north as the later crops are ready for market. This applies especially to strawberries, potatoes, peaches, and tomatoes. They do not have an office or permanent location and may or may not return to the same place season after season.

Carlot purchasers are classified as "jobbers." They usually have a permanent location, an office, scales, and other equipment and return season after season to the same place. This is especially true in some of the important potato-growing sections.

Some jobbers have a warehouse or store in the city and do a general fruit and produce business through the store, or by handling direct shipments from the producing center to the market.

(b) *Broker.*

The term "broker" is commonly applied to that class of middlemen who may buy supplies from shippers, commission men, or at auctions in the quantity and grade they desire and immediately resell it to retailers in small lots. A broker may have a business along a definite line, as citrous fruits or apples, developed in a section of a large city, and keep in close touch with the needs of his customers (usually men doing a small and mixed business and very frequently foreigners not familiar with the English language) and supply them from day to day. Frequently these men do a large business without an office or permanent headquarters or any equipment. They know each morning the needs of their customers for the day; and accordingly, buy the goods in large quantities, which are delivered directly from the purchasing-point to the retail dealer. The difference in the large-lot buying price and the small-lot selling price becomes the broker's profit.

(c) *Commission men.*

The field occupied by "commission men" in the produce trade is well defined and understood. It is an important one, and they are real factors in the distribution of produce of all kinds. The commission man, firm or company, has permanent headquarters in the produce-selling neighborhoods of the city, usually a store and necessary equipment, and rent cold-storage space as their needs require. They advertise and have agents or solicitiors located in the producing regions to induce the growers to ship to them all or only one kind of any produce they may grow, as fruit, vegetables, butter, eggs, and poultry. This is usually sold very shortly after it is received to customers who may be brokers or large consumers, as hotels; but usually they are proprietors of groceries, fruit-stores, or -stands. Such a method makes it necessary for the commission firm to keep in close communication with the two great classes, the growers and the consumers. They are in reality a go-between or connecting link between these two classes. They have, as a class, received for a long time very severe criticism for making false reports upon the condition of produce on its arrival to them and also for making untrue returns to the grower, but these instances are no different from those that probably exist in many other lines of business. There are many honest commission firms that have been very important factors in assisting growers to build up a profitable business. The grower must do his part honestly to give the commission man a chance, and the seller must work for the interest of his shippers. Sincere coöperation is necessary upon both sides. The best results have been obtained in cases where an honest, fair-minded grower has coöperated with an honest commission dealer over a series of years. If the grower packs his produce in a uniform way and gives the dealer the opportunity to develop a class of trade for that particular grade and to know about what he can depend upon receiving, he can secure and hold permanent customers.

The grower may very materially coöperate with the commission man and assist him to secure better prices if he adopts and consistently uses an attractive label on packages of superior produce. Buyers of all classes quickly learn to what extent they can depend upon a labeled or trade-marked package. Thousands of packages of fruits, oranges and lemons especially, are sold entirely upon the reputation behind the label upon the end of the box. A label once adopted and honestly used by a grower should not be changed or altered in any way; if so, any accumulated benefit will be quickly lost. It must be understood that large quantities of produce are sold to persons who cannot read the English language but will remember a picture or design in connection with a grade of produce.

Immediately after the produce is sold, the returns are made to the grower, accompanied with a statement showing the selling price, the commission for making the sale, the transportation, cartage, storage and other shipping expenses deducted.

(d) *Dealers.*

A group of men to be found in the produce trade may be classed as straight buyers or dealers. They are not so numerous as commission men, but in some lines of produce-handling are very important factors. These dealers usually buy produce direct and outright from the growers. It may be immediately sold, but it is frequently stored, and sold to the regular customers of the dealer. This type of marketing produce is often somewhat limited to such staples as apples, potatoes or onions, but may include the shorter-lived commodities as berries, peaches and green vegetables. It is straight direct dealing upon the part of the producer and the dealer. The producer knows exactly how much he will receive for the quantity of produce he has and the dealer knows the price he must charge his customers. It is the business of the dealer to keep well informed upon crop conditions and prospects in all parts of the country for the commodity he is specializing in, or those that may compete with it, and to keep the needs of his customers supplied with a grade of produce their trade demands.

Many growers have enjoyed such business relations with dealers over long periods of years, both parties coöperating and keeping in close touch with each other, resulting in their mutual good.

(e) *Auctions.*

In many of the larger cities, great quantities of produce are sold by auction. Companies may be organized by several men engaged in the general produce trade; by a group of producers; by a group of buyers; or they may be formed by independent companies. The charge for making the sale is a percentage upon the gross receipts and is not often more than 5 per cent, frequently less. These auctions are, in most cases, located in the large distributing centers, but in a few instances they are located at the producing region.

The large quantities of fruits and vegetables imported into the country are nearly all sold through the auctions, as are many of the products from the Pacific coast and other western regions; also from Florida and some other regions where products of one kind are extensively produced. Auction selling is a very rapid way of moving large quantities of produce in a short time. Frequently as many as fifty carloads are sold in a few hours.

Produce may be sent to the auction company by carlot growers, shippers, buyers, dealers, associations, or other receivers. It is purchased by men whose business it is to buy for large stores or chains of stores, brokers, or large consumers.

The auction company controls a warehouse where the produce to be sold is displayed; an auction- or salesroom where the actual selling is done, and offices. A list or manifest of the contents of the carload to be sold is forwarded by the shipper to the auction company and received some days in advance of the car. The cars are unloaded during the night and the produce systematically arranged in "lines;" i.e., citrous fruits, all of one variety, brand, and size are placed in a separate pile. The top package is opened for inspection. At a definite time, the wareroom is opened to buyers to permit an inspection of the produce before selling begins. Each buyer is provided with a list or catalogue which is compiled by the auction company from the car manifests received in advance, and contains a list and brief description of the produce to be offered for sale.

The following page from a fruit auction catalogue (reduced in size) will require some explanations:

LINES	MARKS	DESCRIPTION
	Ontario Cucamonga Fruit Ex.	Cal. Fruit-Growers' Ex. D. D. Black, Dist. Mgr.
		S. F. R. D. Car 11191 Upland Ventilated Lemons
355	240	8 Jumbos
356	270	13
357	300	1
358	300	148 Boxes
359	360	68
360		
361	Monogram Brand (Red Ball) 240	1 Jumbos
362	270	5
363	300	67 Boxes
364	360	25
365		

The heavy figures to the left indicate the "lines," and each "line" means a certain number of packages which are grouped by themselves in the warehouse and marked with a large chalk-mark on the floor in front of the pile, this number on the floor corresponding to the "line" number in the catalogue. The name and small label appearing under "lines," and "marks" correspond to those upon the packages and serve to assist buyers who are not familiar with the English language in identifying the fruit and catalogue description. In the column "marks" is given the size of the package or the number of fruits it contains; under "description," by whom it is shipped, the car number, and under what shipping conditions. (In this case "ventilated;" it might have been "iced" or "precooled.") This is important to the buyer as often the conditions under which the fruit has been shipped may be closely related to its condition, appearance, and subsequent keeping quality.

The blank spaces in the "description" column are used by the buyers to make memoranda on the condition, grade, and value, and used for reference as the selling proceeds.

At a definite time, the buyers assemble in the auction-room. The auctioneer announces any corrections to the catalogue which may be necessary and opens the whole page for sale, and the highest bidder may take his choice of any "line" or "lines" on the page. As these are sold, each man scratches them off, and the remainder of the page is then thrown open for bids. The buyer who bids highest will choose the best "line" or "lines" on the page. The selling is started again and the highest bidder takes the best remaining "line," and this continues until the page is sold. Usually the rules of the auction company require sales of not less than ten large or twenty small packages unless the number in the line may be less.

(f) *Local auctions.*

Produce is sometimes sold by ordinary auction at the shipping station. This local auction method, as it may be designated, became an important method in marketing peaches in the Catawba Island district of Ohio. It is reported to have originated with an attorney, as he observed the amount of time unnecessarily consumed by the buyers and growers trying to complete sales.

The method is simple and rapid. As the growers arrive at the shipping-stations, they line up their loads in order of arrival. The buyers stand upon a platform and inspect the fruit of each load as it comes to them and the auctioneer conducts the sale. The fruit is then delivered to the car, checked over and paid for by the buyer. The auctioneer's fee is paid by the grower. The extensive growers may load their own cars which would be sold in the same way, often bringing an extra price.

This system made it possible for the buyer to secure the variety and grade of fruit he desired and he could, in this way, more easily buy a carload that would be of uniform quality, or of any grade he wanted. The grower who had a superior grade of fruit or especially well packed would have it selected from the average run, and in this way might secure a better price. Sales could be made quickly and the time of the grower saved in a very busy season of the year. Combines of the buyers to hold the price down were possible, but could be broken by the growers refusing to sell on the auction and shipping the fruit themselves to commission men.

The method has recently been superseded in the Ohio peach-growing district by local coöperative associations that are successfully serving the needs of the growers.

(g) *Distributing agency.*

Within the past few years, the problem of distributing the large crops of produce has presented itself with increasing importance. Heavy crops of high quality fruits and vegetables have been successfully grown, but the task of getting them distributed to the consumer in a sound wholesome condition at a reasonable price has been the greatest problem. All of the usual ways of marketing have been used, but additional ways have been devised and have come into practice.

There are several types of distributing companies or agencies and newer ones are continually being devised, formed, and put into operation. One type is for several coöperative associations to unite and hire a salesman to assist their manager to get in communication with a large number of markets and consuming centers and in this way secure a wide distribution for the produce.

One type of distributing agency may be described as a company that receives carlot shipments of various kinds of produce from any point in the country, but especially from local coöperative growers' associations, and sells it through its selling agents who are located in all of the important markets in the country, but managed from one or two central offices. It is possible, under such a system, to secure a more even and desirable distribution of produce as the local selling agents keep in close communication with the main office. In the shipping season, the agency will have representatives at the shipping stations to assemble, inspect and forward the carlots upon telegraphic advice from the main office, who in turn are advised daily as to the general market conditions and prospects by the selling agency.

Shipments started from the producing center to a certain selling market may be diverted to some other market upon instructions received from the central office, and in this way an over or an under supply in any market may be avoided. After the sales are completed, the returns are rendered to the grower through the shipping agents.

Such a distributing system effectively and honestly operated will relieve the grower and local coöperative association of the difficulty and expense of marketing their crops, giving them their entire time for the details of the production and packing. A large force of capable selling agents to study the needs of many local markets should be competent to assist in distributing large quantities of produce in an efficient way.

Coöperative associations.

Groups of fruit- and vegetable-growers have formed coöperative associations with the idea of securing better results by working together in the packing, shipping and selling of their products rather than by operating independently.

The coöperative idea and spirit were first and most highly developed among the fruit-growers on the Pacific coast and other western regions. This may be accounted for because of the distance from the greatest consuming centers, making large shipments necessary from the standpoint of economy; the general uniformity of the crops grown, and the fact that many growers depend entirely upon one or two specific kinds of crops for their income; and possibly that the western growers might have been quicker to see the advantages of such a scheme of marketing.

Without question, more coöperative associations of fruit- and vegetable-growers have resulted in failures than successes, but the spirit of coöperation is strong and may be said to be growing, and the mistakes of the past are used to guide the future.

A coöperative association should be a non-profit organization. Membership should be open only to actual producers, and when a member ceases to be a producer he ought to be required to dispose of his share in the association. Many organizations, standing under the name of coöperative associations, are in reality owned and managed by a few men (not always growers) exclusively for profit.

The organization of a coöperative association adapted to the requirements of a body of fruit- or vegetable-growers is not elaborate nor difficult. The growers who desire to form an association may assemble and, after choosing officers and a board of directors (frequently five) from among their own number, are ready to select a name for the organization, adopt a constitution and by-laws and make rules and regulations respecting the management of the association. Contracts should be made between the association and every member, and all obligations upon both sides specified. Membership certificates or shares of stock are sold and the voting power of the members arranged. This may be the same for each member, but sometimes is based upon the acreage of the member's crop, or the quantity of produce shipped by him the previous season.

The board of directors hire a general manager, usually upon a stated salary, but in some cases for a percentage of the gross receipts, or in a few cases, the number of packages handled. His chief duty is to look after details and enforce the regulations adopted by the association. The board of directors usually decide upon the ways of grading, packing, shipping, names of brands and such matters (often methods of harvesting and time of harvesting). It is thought that this will lead to uniformity and attractiveness in the packed product.

The details of the management may vary with the aim of the members and officers, the locality and the commodity handled. There may or may not be a central packing-house where the fruit of the members is delivered for inspection, grading and packing. With some fruits, as citrus, it may be imperative, but with highly perishable fruits, as strawberries, it may be very undesirable. Without a central packing-house, packing must be done in the field by each member, but more efficient inspection and grading is possible at a central packing-house, and the result is that a more uniform product can be prepared. When the packing is done in the field by the individual members, the inspection must be done by an inspector hired by the association and under the direction of the general manager or board of directors. He usually does this work at the loading-station, and obviously cannot do as thorough work as could be done at the central packing-house. In some associations the inspectors give demonstrations and instructions to the members before the crop is ready to harvest. When this is done, the requirements and desires of the association are better understood by the individual. This practice is especially valuable at the beginning of a new organization, or among new members.

After the produce is properly packed and loaded into suitable cars, it is forwarded to the marketing point. The selling may be accomplished through agents employed by the association or be turned over to a commission firm, a distributing agency or sold to a dealer or consumer. Returns are made to the grower upon the pro rata basis known as "pools." The price received for all of the same kinds of produce shipped within the specified time, a day, week, two weeks, month or season, is "pooled." The operating expenses are deducted and the remainder divided upon the basis of the amount of each grade or brand of produce contributed by each member. Differences and dissatisfactions may arise over the "pool" system among the growers. The produce of one member may be sold in Minneapolis at a much better price than was realized from the produce of his fellow member in St. Louis.

In addition to the advantages that may be secured by disposing of produce through a successful coöperative association, is the large and important feature of the possibility of the management buying many supplies needed by the association members in large quantities, selling them to the members without profit. The saving thus secured on some supplies and in some regions is considerable and a strong argument in favor of a coöperative organization.

The reader who is specially interested in these associations, should secure from them copies of their constitutions and by-laws. These documents are now published, as examples, in many reports and books.

(a) *A California organization.*

The California Fruit-Growers' Exchange is the largest and most highly developed coöperative association of fruit-growers probably in the world. The form of organization is interesting and unique. About 12,000 fruit-growers of California are engaged in the production of citrous fruits and over 60 per cent are members of the California Fruit-Growers' Exchange,—a coöperative organization to provide facilities for these growers to distribute and market their fruit. There are three distinct divisions to the organization: (1) the local exchange; (2) the district exchange; (3) the central exchange. Each division has a clearly defined function and all are intimately related.

The local exchange.—There are about 150 of these local associations or exchanges located in the growing regions. They are non-profit corporations organized under the laws of California. Stock is issued to each member in proportion to his bearing acreage, to the number of boxes he ships, or in equal amount to each grower. The management is in the hands of a board of directors chosen from among the growers. A packing-house is owned or leased and properly equipped. No profits are accumulated nor dividends declared.

As the fruit is assembled in the packing-house, that of each member is kept separated until it is inspected and graded, which gives a basis for making the returns upon the "pool" system. An association may market any part of the crop at any time during the picking season they desire and, in some cases, this privilege is extended to the individual members.

The length of the "pool," whether a week or a month, depends upon the desires of the association. Each association has a brand name for each grade of its fruit, and this name and label is the exclusive property of the association. When a carload is ready for shipment, it is marketed through the "district exchange" of which the local association is a member.

The district exchange.—The local exchanges are federated into seventeen district exchanges, which are non-profit corporations. There may be one or more in a community, depending upon local conditions. Their function is to act as a clearing-house in marketing the fruit for the local exchanges through the California Fruit-Growers' Exchange and to act as a medium through which most of the business relations between the Exchange and local associations are handled.

The district exchange officers order the cars from the railroad and see that they are placed at the various local exchange packing-houses. They keep a record of the cars shipped by each local association, with their destination, and receive the money from sales through the head office and turn it over to the local exchanges. Other functions are to keep the growers informed through the head office of all phases of the citrous marketing business, and place this information before the local associations, where in turn it is passed on to the growers, and return the proceeds to the associations.

The central exchange.—The California Fruit-Growers' Exchange is a non-profit corporation formed by the seventeen district exchanges and managed by a board of seventeen directors, one from each district exchange. The headquarters is in Los Angeles. Its function is to furnish marketing facilities for the district exchanges at a pro rata share of the cost. The directors hire a general manager and assistants. Bonded sales agents for the principal markets of the United States and Canada are appointed and managed from this office. Telegraphic advice is received every day from these agents of the sale of each car, together with information on the conditions and prospects of the market. This information is sent daily in a bulletin form to the local associations. The business is on a cash basis and prompt accounting returns are made to the growers through the district exchange. Other functions are the attention to any litigation that may arise in connection with the marketing of fruit, handling all claims, conducting an advertising campaign and endeavoring to develop new markets. This work is supported by levying an assessment against each district exchange for the pro rata share of the expenses on a basis of the number of boxes shipped. In the Exchange, every shipper reserves the right to regulate and control his own shipments, to develop his own brands of fruit, to use his own judgment as to when and in what manner it shall be shipped and to what markets it shall be shipped, and the price he is willing to receive; reserving the right of free competition with all other shipments including the members of the same organization.

Membership in the Exchange is voluntary. A grower may withdraw from a local association at the end of the year; the local association may withdraw from the district exchange, and the district exchange may withdraw from the central exchange. One-third of the entire shipments are sold at public auction and the remainder through unrestricted private competition. There is no uniformity in price of the different brands.

The Exchange is organized in several divisions: Sales, Legal, Traffic, Advertising, Field, Insurance and Mutual Protection, and a Supply Department which furnishes materials used in packing-houses and groves at cost to members.

(b) *A Canadian organization.*

As the California Fruit-Growers' Exchange is the largest agricultural coöperation for marketing purposes in the United States, so the United Fruit Companies of Nova Scotia is a prominent example of successful coöperation by Canadian apple-growers. This company is located in the famous Annapolis Valley apple region of Nova Scotia. There are forty-eight coöperative companies in this Valley; forty are federated into a central association, which is incorporated under the name of the "United Fruit Companies of Nova Scotia, Limited." The membership of the subsidiary companies varies from ten to one hundred twenty, the average being about forty. Each company owns a warehouse or central packing-house where the fruit must be packed by experts under the direction of the company manager and an inspector sent from the central office, who has the authority to order repacking, if in his judgment it is necessary. Orchard- or home-packing by the individual members is not permitted. It is the business of each company manager to become acquainted with each member and with the type and grade of fruit he is growing. Before picking, the manager sends to the central office an estimate of the crop of his members and its condition. Pickers may be sent from the central office to assist the local growers. The picking and hauling is done under the direction of the local company manager. This rule has been found desirable to prevent large quantities of fruit from being delivered at the central packing-house unexpectedly. Fall apples may be hauled to the packing-house in unheaded barrels, as they are usually packed at once; but winter apples are delivered in tight barrels. Every barrel has the growers' name marked upon the side and a receipt is given for the quantity and variety delivered. The deliveries of every day are recorded in a book in which one or more pages are assigned to each member. On the left side are the series of columns, one for each variety, under which is recorded the date and number of barrels delivered. On the right page is a record of how these apples were graded or "packed out."

The business of marketing the entire output of all the subsidiary companies is performed from the central office, which is at Berwick. This office maintains and directs an organized force of salesmen. European sales are conducted through the London office and the South American business through the Buenos Ayres office. The apples of all the local companies are pooled and the returns made to all upon the average selling price of each grade of each variety.

Some of the advantages to the growers that have been brought about by the coöperation, in addition to better prices, are the convenience of an improved type of box-car especially adapted for shipping apples in extremely cold weather, and a shorter shipping time for transatlantic shipping, and better boats.

Coöperative buying is an important function of the association. The central office makes large purchases of supplies directly from the manufacturers, thus securing the lowest price, as all the cost of selling, bad debts and other expenses are eliminated. The supplies are shipped in carlots directly to the central packing-houses of the local companies and, upon arrival, the members are advised and come with their teams to haul home the goods they ordered. In 1914, over 300 carloads of fertilizers were purchased at a saving of $18,000 to the members; large quantities of other supplies were purchased, as pulp, heads, nails, grass, clover, vetch and oat seed, flour, feed, arsenate of lead, wire fence, lime-sulfur and tobacco sulfate.

As a further coöperative function, the central office handles all of the fire insurance business of the subsidiary companies of insuring the packing-houses and contents, thus saving the commission previously paid to agents. A weekly newspaper called the "Coöperative News" is published from the central office.

The total selling expenses in 1914 were exactly 4 cents a barrel, or 1⅓ per cent on the volume of business.

For discussions of methods of sorting, grading and boxing fruits and other products, see the article *Packing*, Vol. V.

H. J. Eustace.

MARKHÀMIA (after C. R. Markham, who intro. the Cinchonas into India). *Bignoniàceæ*. A genus of 10 African and 2 Asiatic tropical evergreen trees or shrubs with large opposite odd-pinnate lvs. usually with pseudostipules in the axils, glabrous or pubescent: fls. in large terminal or axillary panicles; calyx spathe-like, splitting on one side; corolla tubular-funnelform, usually yellow with red or purple stripes inside; stamens 4, included, with spreading anther-cells; ovary with 4 rows of ovules in each cell: caps. linear, loculicidally dehiscent into 2 leathery valves, the true septum small, with a much larger false septum in its middle parallel to the valves; seeds oblong, winged at the ends.—Only the following species is cult. in S. Calif. and it is, even without fls., a handsome foliage plant. Cult. like Radermachia, to which it is closely related.

platýcalyx, Sprague. Tree, to 40 ft.: lvs. ½–1 ft. long, with suborbicular pseudostipules ½–1 in. broad in the axils; lfts. 5–9, short-stalked, elliptic-oblong to obovate, abruptly and obtusely acuminate, entire or serrate, lepidote, 2–5½ in. long: panicles terminal or axillary, rather dense; calyx boat-shaped, pubescent and lepidote, ¾in. long; corolla yellow, inside striped red, lepidote, inside and outside, veined, the tube 1¼–1½ in. long, the elliptic-obovate lobes about ½in. long: caps. linear, 1 ft. long. Uganda. H.I. 28:2800.—Said to yield the finest timber in Uganda.

Alfred Rehder.

MARROW, VEGETABLE: *Squash.*

MARRÙBIUM (ancient name, referring to the bitter qualities). *Labiàtæ*. Hoarhound. Horehound. A familiar aromatic herb.

Marrubium comprises perennials branched from the base, mostly silky or woolly, with wrinkled and crenate or cut lvs., and many-fld. axillary whorls of small white or purplish fls.: calyx tubular, 5–10-nerved and with 5 or 10 awl-shaped teeth; corolla 2-lipped, the upper lip erect and notched or entire, the lower spreading and 3-cleft; stamens 4, didynamous, not exserted; ovary deeply 4-lobed (making 4 smooth nutlets), the style 2-lobed.—Species 30–40, in Eu., N. Afr. and extra-trop. Asia.; one widely naturalized in the U. S.

vulgàre, Linn. Common Horehound. Height 1–3 ft.: sts. ascending, woolly or tomentose: lvs. ovate to round-ovate, stalked: calyx with 10 recurved teeth, the alternate ones shorter: fls. whitish. Summer.—Now found as an escape from gardens in waste places of nearly every country of the world. Horehound is used in large quantities for confections and medicines for coughs and colds.

candidíssimum, Linn. Foliage silvery gray, flannel-like, the branches long: perennial: lvs. ovate, crenate: fls. whitish, in large many-fld. fascicles; calyx-teeth subulate, rigid, spreading, usually 5, but sometimes 6–10. Spain to Caspian Mts.

L. H. B.

MARSDÈNIA (William Marsden, 1754–1836, wrote a history of Sumatra). *Asclepiadàceæ*. Mostly twining shrubs of warm countries, a few of them sometimes planted for ornament; some of them medicinal and yielding dye and fiber.

The genus is allied to Stephanotis, which has large white fls., while those of Marsdenia are smaller and usually purplish, lurid, greenish or pallid. Lvs. opposite: cymes umbel-shaped, simple or branched, terminal or axillary; calyx 5-parted; corolla bell-, urn- or salver-shaped; lobes narrow or broad, overlapping to the right; crown of 5 scales: seeds comose, in a more or less fleshy follicle.—In tropical and subtropical countries around the world, the species probably being nearly 100. Genus rather heterogeneous.

Róylei, Wight. Lvs. 3–6 in. long, 2–4 in. wide, ovate-cordate, acuminate, pubescent or tomentose beneath; petioles 1½–2 in. long: cymes 1–1½ in. across; fls. 3–4 lines in diam.; corolla somewhat bell-shaped; lobes large, fleshy, pubescent; stigma not extended beyond the anthers. Himalayas, 4,000–5,000 ft. altitude.

macrophýlla, Fourn. Woody twiner: lvs. large, oval, acuminate, the base truncate or subcordate, glabrous, somewhat glaucous beneath: calyx deeply cut, the segms. large, oval, obtuse; corolla-tube glabrous, the limb spreading, and the lobes oval and short-ciliate on margin. Brazil; Paraguay (?).—Offered in S. Calif.

verrucòsa, Decne. Twining, the branches thick: lvs. broadly or nearly orbicular-cordate, abruptly acuminate, glabrous, glandular at top of petiole: fls. many, in a short cluster; corolla-lobes ovate, somewhat emarginate, barbed; lobes of corona lanceolate and fleshy. Madagascar.—Offered abroad.

M. Cundurángo, Reichb. f. (Gonolobus Cundurango, Triana), of Ecuador and Colombia, yields the medicinal condurango bark: liana: lvs. round-oblong, acute, hairy beneath: fls. whitish, the corolla somewhat campanulate.—*M. erécta*, R. Br., is fairly hardy at Arnold Arboretum: fls. white, fragrant: lvs. cordate-ovate. S. E. Eu., Syria.—*M. Ímthurnii*, Hemsl. A vigorous twining shrub with long hanging branches and fls. resembling a Hoya: lvs. ample, long-petioled, rather thick and soft and bullate (blistered), cordate-ovate: fls. about ½in. across, purple, hairy, in dense globular very short-stalked axillary umbellate cymes. British Guiana. B.M. 7953.

L. H. B.

MARSHÁLLIA (Humphrey Marshall, wrote "Arbustum Americanum," 1785, the first American work on trees and shrubs; also founded one of the first American botanic gardens). *Compósitæ*. Perennial North American herbs, useful in outdoor planting.

Tufted plants, growing about 1 ft. high, with entire lvs. and scapes bearing solitary rayless heads about 1½ in. across: involucre hemispheric or bell-shaped, its bracts narrow and green; fls. all perfect and fertile; pappus of 5–6 acute or acuminate scales.—About a half-dozen species. All may be grown in the open border in the N. and they may be prop. by division in the spring. Supposed to suggest the scabious. The blue anthers give a peculiar effect to the fls.

cæspitòsa, Nutt. Tufted, glabrous: lvs. spatulate-linear; upper ones linear: bracts of the involucre linear: disk-fls. pale rose or white: seeds inversely pyramidal, villous on the angles. Limestone soil, Mo., to Texas. B.M. 3704.

grandiflòra, Beadle & Boynton. Like the next except that the st.-lvs. are oblong-lanceolate and acute or obtuse. Moist soil, Pa. to W. Va. and N. C.

trinérvia, Walt. St. simple or branched, usually leafy about half way up: lvs. acuminate at the apex, narrowed to a practically stalkless base: fls. purplish sometimes whitish, pink; bracts of the involucre linear-lanceolate. Va., south.

N. Taylor.†

MARSH MALLOW: *Althæa officinalis.*

MARSÍLEA (Giovanni Marsigli, Italian botanist of last part of the 18th century, or Aloys Ferd., Graf von Marsigli, 1658–1730). *Marsileàceæ*. Aquatic flowerless plants related to ferns (about 40 species), with lvs. like 4-lvd. clover or oxalis, one species of which, **M. quadrifòlia,** Linn., is sold and is also run wild in the eastern states. It is a creeping plant, rooting in the mud on the margins of ponds and making an attractive cover. The petioles grow 3–5 in. tall, or taller in the water, and bear at the apex 4 bright green obcuneate or triangular lfts. The sporocarps or frs. are nearly sessile at the base of the petioles. Prop. easily by pieces of the runners, and is likely to become a weed. The young lfts. close at night. Eu. and Asia. Mn. 6, p. 107. **M. Drúmmondii,** A. Br. (Fig. 2327), is a greenhouse species needing moderate temperatures and pot cult. with abundance of surplus water in saucers or even set in a tank, partly submerged. Under the best conditions the long clover-like lvs. may reach a length of 18 in., and form a very attractive plant. The stalks and lfts. are covered with whitish hairs; the spores are borne in cases on separate stalks an inch or so long.

R. C. Benedict.

MARTINÈZIA (Rev. Dr. Baltasar Jacobo Martinez Companon, archbishop of Santa Fé, who sent many early collections of plants from Peru). *Palmàceæ,* tribe *Bactrìdeæ.* Ornamental feather-leaved palms, with spiny ringed trunks.

Leaves pinnate, the segms. broad, wedge-shaped, alternate or grouped, the apex truncate and ragged; petioles and rachis spiny, as are also the spadices and spathes of the infl.: fls. rather small, the calyx with 3 segms.; stamens 6, inserted in the disk: fr. globose, 1-celled, orange, scarlet or rose-pink.—Species about 8. Trop. Amer. G.C. II. 26:491.

Martinezias are beautiful palms, and make fairly good house plants but their spiny character is against their popularity. They must have a stove temperature. They do not require a great amount of soil. Light sandy loam, with plenty of sharp sand, is best. They need abundant moisture. They sometimes flower in cultivation, but the four kinds given below are distinct by their foliage and spines. Like all armed palms, they are slow to germinate, but after the first or second year they grow fairly fast. The commonest and best kind is *M. caryotæfolia,* which has fewer spines than the other species and, unlike many other palms, shows its true leaves at a very early stage. It resembles the fish-tail palms (Caryota), but the leaves are a lighter green and usually larger. *M. erosa* makes a better specimen at 5 to 6 feet than when small. It is much more jagged at the tips of the leaves. Being very spiny all over, it is less desirable. *M. Lindeniana* is more like the first. The spines are longer but not very numerous. *M. granatensis* is of coarser habit and slower growth, and desirable only for large collections. (H. A. Siebrecht.)

2327. Marsilea Drummondii.

A. *Lvs. divided into segms.*

B. *Segms. in groups.*

C. *Apex of segms. 3-lobed.*

caryotæfòlia, HBK. Sts. at length 30–50 ft. high but usually not over 6 in. thick: lvs. few, 3–6 ft. long, light green; lfts. in groups, 6–12 in. long, 4–6 in. wide at the apex: st., petioles, rachis and nerves below, densely clothed with long black spines: spadix about 18 in. long, appearing between the lvs.: fr. yellowish red, about ¾in. long. Colombia. G.C. 1872:181. B.M. 6854. F.R. 2:49.

CC. *Apex of segms. with a point projecting from the upper margin.*

Lindeniàna, Wendl. Sts. 9–15 ft. high: pinnæ in opposite groups of 4–6, the groups widely separated, long-wedge-shaped, 10–14 in. long, 8–10 times as long as broad, with a short, projecting point at the upper margin, the nerves ciliate-spiny toward the end; petiole densely covered with grayish brown hairs, with many rather large black spines 1–2½ in. long; rachis is also spiny above and below; midnerve of each segm. a trifle shorter than the lower margin and spiny beneath, like the rachis and lateral nerves: lvs. dark green above, lighter beneath; terminal segm. broadest: fr. rose-red. Mts. of Colombia, at an altitude of 6,000 ft.

BB. *Segms. in 2–4 pairs.*

eròsa, Lind. Lvs. with 2–3 pairs of narrow lfts. at base and a pair of broader ones at the apex, all oblique at the apex, bearing long, brown, needle-shaped spines on the veins and midrib; rachis cylindrical or obtusely angled, mealy, clothed with spines like those on the lvs. W. Indies. G.C. 1872:1297.

AA. *Lvs. bifid at the apex.*

granaténsis, Hort. (*M. granadénsis,* Hort.). Lvs. roundish oblong or roundish ovate, entire at the base, bifid at the apex, evenly toothed along the edges; petioles and rachis with dark brown, needle-shaped, spreading or reflexed spines, ½–1 in. long. Colombia.

M. truncàta, Brongn. Trunk about 20 ft.: lvs. 4–5 ft. long, spreading, the petiole and trunk covered with brownish black spines; lfts. smooth, prominently veined and beautifully dark green.—A fine showy Bolivian species scarcely known in the trade.

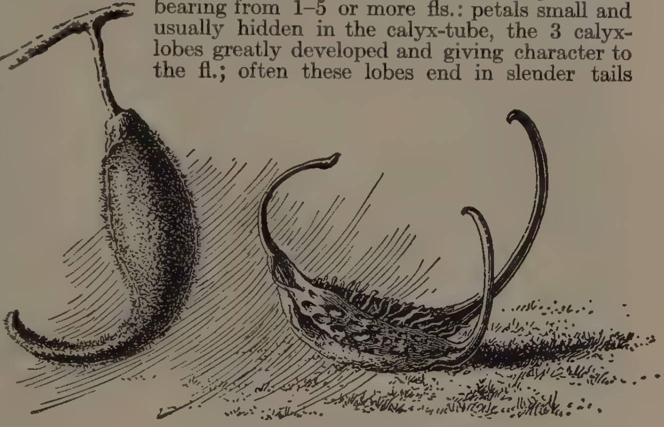
Jared G. Smith.
N. Taylor.†

MARTIUSÉLLA (after K. F. Ph. von Martius, German botanist, 1794–1868; traveled in Brazil 1817–20, wrote Historia Naturalis Palmarum and started the monumental work, Flora Brasiliensis, continued after his death by A. W. Eichler and I. Urban). *Sapotàceæ.* An evergreen small tree from Brazil with large alternate serrate lvs.: fls. small in axillary clusters; calyx 5-, rarely 4-parted; corolla rotate, 5–6-lobed; stamens 5, inserted at the base of the corolla opposite to the lobes and nearly as long as the corolla; sometimes with staminodes between the petals; ovary 5-celled with short style: fr. subglobose, 3–5-seeded; seeds compressed; cotyledons thin. Closely allied to Chrysophyllum which is chiefly distinguished by its smaller entire lvs., the longer corolla-tube, shorter stamens and the thick cotyledons, and also by the much-branched habit. The only species is **M. imperiàlis,** Pierre (*Theophrásta imperiàlis,* Lind. *Chrysophýllum imperiàle,* Benth. & Hook.). See also p. 767, Vol. II. Strict and simple, to 20 ft. high or more: lvs. obovate-oblong to oblong-oblanceolate, rounded at the apex, serrate with strong parallel veins, stellate-pilose beneath at first, becoming glabrous, 8 in. to 3 ft. long: fls. yellowish green, ¼in. across, pedicelled, in axillary sessile clusters: fr. subglobose, 1⅓ in. long, with a hard thick flesh; seeds chestnut-brown, lustrous, about 1 in. long and ¾in. wide. Brazil. B.M. 6823. I.H. 21:184. Gt. 13:453.—It can be grown outdoors only in frostless regions; sometimes cult. in greenhouses for its large handsome foliage. It flowers very rarely in cult., flowering first in 1885 after it had been in cult. for 40 years. Prop. is by seeds or by cuttings in March when the new growth is starting; the upper part of the plant is cut into as many pieces as there are lvs., the cuts being made just below the base of the lvs.; the cuttings are inserted in sand under glass with bottom heat; they usually take a long time to form roots.

Alfred Rehder.

MARTÝNIA (John Martyn, 1699–1768, professor of botany at Cambridge, botanical author). Including *Proboscídea*. *Martyniàceæ*. Coarse annuals and perennials from the warmer parts of America, a few of which are cultivated for pickles or for ornament.

Rank branchy plants of heavy odor, viscid-pubescent, mostly sprawling on the ground: lvs. large, likely to be opposite and alternate on same plant, petioled, broad and subcordate, entire or lobed: fls. large and funnelform-campanulate in short loose terminal racemes; calyx more or less swollen-campanulate, deeply and unequally 5-parted, often split on the anterior side; corolla violet-purple, pale yellow or whitish mottled, oblique, decurved, the limb somewhat bilabiate but the 5 spreading lobes nearly equal; fertile stamens 2 in the genus Martynia as defined by Stapf (Engler & Prantl, Die Pflanzenfamilien, including one species apparently not in cult.), and 4 in the genus or group Proboscidea which is here included in Martynia and to which the cult. species belong; ovary 1-celled, the 2 parietal placentæ extended inward and meeting at the middle as if 2-celled: fr. a 2-valved caps., more or less fleshy, hairy, with a long curving beak; seeds large.—Species about 8, U. S. to S. Amer. The closely allied Craniolaria (which see, in Vol. II) is distinguished by the long slender corolla-tube (*Martynia Craniolaria*, Glox.=*Craniolaria annua*). The trade names need revision.



2328. Martynia louisiana. (×⅓)

Martynias are sometimes grown in gardens for their bright large flowers, abundant foliage and odd pods. They are treated as half-hardy annuals. They are also grown in the vegetable-garden for the small tender pods which are made into pickles the same as cucumbers. The plants grow 1½ feet or more high, and spread widely. They should be started in a hotbed in the North and transplanted to the open. In the middle and southern states seed may be sown in the open 3 feet apart each way where the plants are to remain. They need a warm open soil and sunny exposure. The fruits have a very distinct appearance by reason of the long-curved horn which splits from the top as the capsule hardens.

A. *Lvs. more or less lobed: fls. purple or reddish.*

fràgrans, Lindl. (*M. formòsa*, Vilm. *M. violàcea*, Engelm.). Annual: less stout than *M. louisiana:* lvs. roundish to oblong-cordate, somewhat lobed and wavy-toothed, 3–5 in. broad: corolla campanulate, 1 or 2 in. long and wide, fragrant, reddish purple to violet-purple. Texas, New Mex., Ariz., N. Mex. B.M. 4292. B.R. 27:6. R.H. 1843:529.

AA. *Lvs. sinuate or perhaps dentate, not lobed: fls. mostly whitish or yellowish but sometimes purplish.*

louisiàna, Mill. (*M. proboscídea*, Glox. *Proboscídea Jussieùi*, Steud.). UNICORN PLANT. PROBOSCIS FLOWER. Fig. 2328. Annual, the ascending or prostrate branches 2–3 ft. long: lvs. roundish, cordate, often oblique, entire or obscurely wavy-lobed, 4–12 in. wide: fls. 1½–2 in. long, dull white or yellowish with mottles or spots of purple or yellow within, the corolla nearly as broad as long, the lobes obtuse: fr. 4–6 in. long at maturity, the beak equaling or exceeding the body. Native from Ind. to Utah and to Texas and New Mex.; naturalized farther east and north. B.M. 1056. V. 3:151.—The picture (Fig. 2328) shows frs. one-third the size at full maturity. The right-hand specimen shows the woody part, after all the soft parts have been macerated.

lûtea, Lindl. (*M. montevidénsis*, Cham.). Annual, 1½ ft., the plant pale, glandular-pubescent: lvs. cordate-orbiculate, subdentate, 5–7-nerved: fls. few, in erect terminal racemes, large, greenish yellow outside and orange inside; corolla funnel-shaped, the tube constricted: caps. woody, boat-shaped, cristate on back, 2-beaked at apex, the beaks 2 in. long. Brazil. B.R. 934. Perhaps not in the trade. L. H. B.†

MASDEVÀLLIA (Joseph Masdevall, a Spanish physician and botanist). *Orchidàceæ*. Orchids, not showy, but odd and often grotesque.

Pseudobulbs none: lvs. variable in size, oblong to linear, thick, sheathing at the base: peduncles bearing from 1–5 or more fls.: petals small and usually hidden in the calyx-tube, the 3 calyx-lobes greatly developed and giving character to the fl.; often these lobes end in slender tails several inches long; lip of the corolla short, articulate with the base of the winged or wingless column, in some species sensitive; pollinia 2, without caulicles.—More than 150 species, inhabitants of the American tropics, and various hybrid and garden forms. The species of the *M. coccinea* group are relatively simple in form, but are usually prized for their brilliant coloring. Those of the *M. Chimæra* group are remarkable for their fantastic shapes. Of late years many new kinds have been intro., and the genus is somewhat confused as to the specific limits of the various forms. Masdevallias are polymorphous, and herbarium specimens do not show specific characters well. See "The Genus Masdevallia," by Florence H. Woolward (1896).

Cultural directions. (R. M. Grey.)

Masdevallias are found growing at high elevations, ranging from 6,000 to 12,000 feet above sea-level, in northwestern South America and Central America, with a few sparingly distributed elsewhere over tropical America. These regions are generally subjected to two rainy seasons annually, often with very short intermissions. The atmosphere, though somewhat rarified, is very humid, the temperature in the shade seldom rising above 65° F., and often dropping to 40° in some districts. Heavy fogs are frequent, especially in the fore-part of the day, and during the greater part of the year the under-vegetation is in a saturated condition; the high winds prevalent in these districts, however, counteract to a great extent any evil influence which might otherwise arise from it.

The heat of our summer makes it quite impossible to imitate wholly the above conditions, but with a proper house, such as is afforded odontoglossums of the crispum section, very satisfactory results may be obtained and the many species will be found of comparatively easy culture. A low, well-ventilated, half-span house of northern exposure, with an upright stone or brick wall on the south side, is best adapted to them. The house should be provided with canvas roll-shading, supported on a framework elevated 15 or 18 inches above the glass in order that the cool air may pass freely beneath it. This will help to guard against solar heat during summer. Houses built partly below ground are not to be recommended, as the atmosphere soon becomes stagnant and inactive, causing the leaves to fall prematurely. When it is convenient, solid beds are preferable; benches, however, will answer the purpose very well, and when used should be covered about 2 inches deep with sifted ashes, sand or gravel; the benches and floors should be hosed down once or twice daily to afford all the cool moisture possible.

2329. Masdevallia coccinea. (×⅙)

In winter the temperature should range between 50° and 55° F. at night and about 60° during the day or 5° more on mild days, with weak solar heat and ventilation. Artificial heat must be dispensed with as early in spring as possible, and during summer the temperature kept as low as the weather will permit, ventilating freely, especially at night, when a light syringing overhead will also prove beneficial. Midday syringing in hot weather is often injurious and should be done with caution if at all. More benefit will result from hosing down the shelves and paths at intervals of three or four hours, as it will help to reduce the temperature.

Masdevallias need a great deal of water at the roots at all seasons, and the soil should never be allowed to dry out, as they have no fleshy pseudobulbs to protect them against extreme changes. Light syringing overhead during winter and spring in fine weather will assist in checking thrip and red-spider, and a weak solution of tobacco may be added with good effect.

The best season for repotting and basketing the plants is during November and December, and the best general compost is a mixture of clean peat fiber and sphagnum moss chopped rather fine and well mixed, some sections requiring in addition a portion of chopped sod. About one-third of the space should be devoted to clean drainage consisting of either broken charcoal or potsherds.

M. coriacea, *M. elephanticeps*, *M. Peristeria*, *M. Reichenbachiana*, and kindred species, grow best in small pots, and should have one-third chopped sod added to their potting compost. *M. macrura*, *M. Schlimii*, *M. tovarensis*, *M. amabilis*, *M. coccinea*, *M. Veitchiana*, *M. triangularis*, *M. polysticta*, *M. muscosa*, and the numerous other allied species, grow equally well in either pots or baskets, but should the latter be used it would be well to add a small portion of chopped sod to the compost to make it more firm and less porous; the sod has a cooling effect on the roots. *M. bella*, *M. Carderi*, *M. Chestertonii*, *M. Chimæra*, *M. Houtteana* and their allies nearly all have pendulous flower-scapes, and should be suspended from the roof in baskets in a compost of equal parts chopped peat-fiber and live sphagnum, with a little leaf-mold added. The flower-scapes often penetrate through the compost; for this reason little or no drainage should be used, as it may retard their progress.

To increase the stock the plants must be divided during the early winter; this will give them a chance to reëstablish themselves before the following summer. They must not be broken up into too small pieces, as it has a tendency to weaken them.

INDEX.

abbreviata, 27.
amabilis, 4.
armeniaca, 7.
atrosanguinea, 7.
Backhousiana, 43.
Barlæana, 6.
bella, 41.
Boddærtii, 2.
caloptera, 29.
calura, 17.
Carderi, 38.
Chestertonii, 44.
Chimæra, 43.
civilis, 11.
coccinea, 7.
cœrulescens, 7.
conchiflora, 7.
coriacea, 10.
corniculata, 15.
Crossii, 33.
Davisii, 5.
Denisonii, 7.
elephanticeps, 24.
Ephippium, 32.
Estradæ, 22.
grandiflora, 1, 2, 7.
Gravesiæ, 7.
Harryana, 7.
hieroglyphica, 23.
Houtteana, 39.
ignea, 2.
inflata, 15.
infracta, 37.
ionocharis, 13.
leontoglossa, 9.
Lindenii, 7.
lineata, 4.
macrura, 16.
maculata, 36.
Massangeana, 2.
melanopus, 28.
militaris, 2.
Mooreana, 24.
muscosa, 25.
nidifica, 14.
nycterina, 42.
pachysepala, 24.
pachyura, 30.
pallida, 19.
Peristeria, 12.
platyglossa, 8.
polysticta, 26.
psittacina, 39.
racemosa, 33.
radiosa, 40.
Reichenbachiana, 35.
Roezlii, 43.
rosea, 3.
rubra, 43.
rufo-lutea, 11.
Schlimii, 34.
Shuttleworthii, 18.
striata, 4.
superba, 2.
tovarensis, 31.
triangularis, 20.
triaristella, 45.
trochilus, 32.
Veitchiana, 1.
Wageneriana, 21.
Wallisii, 43.
Winniana, 43.
xanthina, 19.
xanthocorys, 18.

REVIEW OF THE SECTIONS.

SECTION I. Scape 1-fld.; calyx-tube rather narrow, tubular or somewhat funnel-shaped; labellum plane .... Species	1–7
SECTION II. Scape 1-fld.; calyx-tube broad, gibbous or basin-like; labellum plane .... Species	8–24
SECTION III. Scape several-fld.; labellum plane and narrow .... Species	25–37
SECTION IV. Scape mostly 1-fld., pendent or suberect; labellum saccate, or at least much broadened; tails very long .... Species	38–44
SECTION V. Scapes 1-fld. This section differs from all the others by the subterete lvs., and in having the tails inserted below the apex of each lateral sepal .... Species	45

SECTION I.

A. *Calyx-lobes glandular with minute papillæ* .... 1. **Veitchiana**
AA. *Calyx-lobes not glandular.*
  B. *Tail of the dorsal lobe hanging forward* .... 2. **militaris**
    3. **rosea**
  BB. *Tail of the dorsal lobe erect and straight* .... 4. **amabilis**
    5. **Davisii**
    6. **Barlæana**
  BBB. *Tail of the dorsal lobe reflexed and flexuous* .... 7. **coccinea**

1. **Veitchiàna**, Reichb. f. Tufted: lvs. 4–6 in. long, narrow: peduncle erect and slender, 1 ft. or more, with 2 or more bracts (the upper one remote from the fl.); calyx with bell-shaped tube, the expanding lobes 3 in. across, orange-red, with purple shades, glandular-hairy, abruptly contracted into short, narrow tails; petals white, hidden. Peru. B.M. 5739. C.O. 4*a*. Var. **grandiflòra**, Hort., has a dense hairy covering on the dorsal lobe of calyx; and also on the outer part of the lateral lobes, the inner part orange-scarlet. C.O. 4*b*.

2. **militàris**, Reichb. f. & Warscz. (*M. ignea*, Reichb. f.). Much like the last, but differs in having elliptic or elliptic-obovate lvs., which are long-petioled, and in the lateral calyx-lobes being only prominently pointed, not tailed, the dorsal lobe very narrow and hanging forward between the other two: color orange and

scarlet; petals white, exceeding the column. Spring. Colombia. B.M. 5962. I.H. 26:333. G.M. 52:283. C.O. 2. Var. **Massangeàna,** Hort. Lateral lobes longer: fls. larger. Var. **Bóddærtii,** Hort. Calyx yellow; lower lobes shaded with red on the upper surface. I.H. 26:357. Var. **grandiflòra,** Hort. Fls. rounded; lateral sepals brilliant vermilion, bordered with crimson and suffused with purple. Var. **supérba,** Hort., is advertised.

3. **ròsea,** Lindl. Lvs. oblong-spoon-shaped, keeled: peduncle drooping and slender, bearing a single fl.; calyx-tube 1 in. long, red and violet; calyx-lobes rose-lilac, with red tails; petals yellow, the lip hairy at the apex. Ecuador. G.C. III. 16:657. O.R. 4:113; 11:25. July, Aug.—A pretty and free-flowering species.

4. **amábilis,** Reichb. f. & Warscz. Lvs. 4–5 in. long, oblong- or spatulate-lanceolate, about half the length of the erect, usually 1-fld. peduncles: fls. varying from purplish crimson to yellow; lobes ovate-triangular, the lateral ones with short tails and the dorsal ones with a long and ascending tail; petals narrow, yellowish, longer than the column. Peru. Sept.–Dec. Var. **lineàta,** Lind. & André (var. *striàta,* Hort.), has yellowish fls., tinged and striped with red. I.H. 22:196.

5. **Dàvisii,** Reichb. f. Densely cespitose: lvs. oblong-lanceolate, 6–8 in. long, petioled, blunt at the apex: peduncle erect, about 10 in. long; calyx large, brilliant yellow, obscurely veined with deeper yellow; dorsal lobe triangular-ovate, prolonged in a tail; lateral lobes oblong-ovate, larger, united to below the middle, terminating in short tails; petals longer than the column, nearly hidden in the calyx-tube, pale yellow, the labellum yellow, shaded and spotted with red, with 2 obscure keels. Peru. B.M. 6190. C.O. 1.

6. **Barlæàna,** Reichb. f. Lvs. spatulate, acute: peduncle slender, nearly 1 ft. long; fls. scarlet; calyx-tube curved; dorsal sepals short-triangular, produced into a long tail; lateral sepals larger, semi-ovate; petals ligulate, white. Peru.—Reichbenbach states that the lateral sepals run internally one in another; they are connate in a straight line.

7. **coccínea,** Lind. (*M. Líndenii,* André). Fig. 2329. Lvs. spatulate, obtuse or retuse, 6–10 in. long: peduncle 1 ft. or more long; calyx crimson-magenta; dorsal lobe with a small, triangular base, prolonged into a long tail; lateral lobes oblong-ovate, scarcely prolonged; petals white, longer than the column. May. Colombia. B.M. 5990. I.H. 17:42. F.M. 1872:28. Var. **conchiflòra,** Veitch. Fls. large; lateral lobes of labellum rotund, concave. Var. **Harryàna** (*M. Harryàna,* Reichb. f.). Lateral lobes of calyx oval, falcate, the tips usually crossing or turned toward each other. May. F.S. 21:2250. C.O. 7. Var. **armenìaca,** Hort. Fls. apricot-yellow, veined with red; throat of the tube yellow. Colombia. Var. **atrosanguínea,** Hort. Fls. large, with the lateral sepals crimson spotted with magenta, points falcate, turned toward each other. Colombia. Var. **cœrulëscens,** Hort. Lateral sepals broadly semi-ovate, apiculate, crimson-magenta spotted with bluish purple. Colombia. Var. **Gràvesiæ,** Hort. Fls. white. Var. **grandiflòra.** Fls. large, rose-purple. Colombia. Var. **Dénisonii,** Hort. BULL'S BLOOD. Fls. crimson-purple.

SECTION II.

A. *Habit of scape drooping or deflexed.*
B. *Scape about as long as the lvs*........ 8. **platyglossa**
BB. *Scape shorter than the lvs*........... 9. **leontoglossa**
AA. *Habit of scapes erect or suberect.*
B. *Scape shorter than the lvs.*
C. *Lvs. linear to linear-oblong*......10. **coriacea**
11. **civilis**
12. **Peristeria**
CC. *Lvs. oblong to lance-oblong.*
D. *Fls. white or whitish, often spotted or lined*............13. **ionocharis**
14. **nidifica**
DD. *Fls. yellow or red*.............15. **corniculata**
16. **macrura**
DDD. *Fls. crimson*..................17. **calura**
BB. *Scape longer than the lvs.*
C. *Size of fls. rather small, with a broad, basin-like tube: plants dwarf.*
D. *Fls. mauve*..................18. **Shuttleworthii**
DD. *Fls. yellow, marked or spotted*...19. **xanthina**
20. **triangularis**
21. **Wageneriana**
DDD. *Fls. varicolored*..............22. **Estradæ**
23. **hieroglyphica**
CC. *Size of fls. larger, with a broad, deep, gibbous tube*............24. **elephanticeps**

8. **platyglóssa,** Reichb. f. Densely tufted: lvs. spatulate-lanceolate, narrowed into petioles, 3–4 in. long, as long as or longer than the drooping bracted 1–2-fld. peduncles: fl. small (1 in. long), pale yellow, nearly globular, the lobes pointed but not tailed, the dorsal one upcurved; ovary red; petals linear, as long as the column. Colombia (?) B.M. 7185.

9. **leontoglóssa,** Reichb. f. Tufted: lvs. oblanceolate, short-petioled, spotted beneath with red: peduncle deflexed, mostly shorter than the odd fls.; calyx narrow, the lobes gradually narrowed into fleshy tails or long points, semi-transparent, all of them greenish yellow outside and more or less hairy crimson-spotted within, the dorsal lobe not greatly unlike the others but often somewhat ascending; petals white with crimson lines. Colombia. B.M. 7245. C.O. 12.—The specific name ("lion-tongued") refers to the bearded lip.

10. **coriàcea,** Lindl. Lvs. linear-lanceolate, usually somewhat surpassing the erect, 1-fld., spotted peduncles, which are about 6 in. high: fls. fleshy, the calyx-lobes nearly equal and wide-spreading, triangular at base but gradually narrowed into long points or short tails; lobes greenish yellow and dotted crimson inside; petals white and crimson. Colombia. G.C. III. 21:95.—Lvs. 6–8 in. long, with purplish dotted petioles.

11. **cívilis,** Reichb. f. (*M. rùfo-lùtea,* Lindl.). Lvs. fleshy, linear, keeled, 5–6 in. long: peduncle less than 2 in. long, erect or nearly so; fls. solitary, rather large for the size of the plant, the deep calyx-tube purple at the base and yellow at the top, the long-pointed, flattened lobes yellow; petals small, white, the labellum dotted purple. Peru. B.M. 5476.

12. **Peristèria,** Reichb. f. Tufted: lvs. oblanceolate, sometimes retuse at the apex, 4–6 in. long, twice longer than the rather stout, erect, 1-fld. peduncles: fls. with 3 long, wide-spreading tails, which span 4–5 in., the tube somewhat gibbous beneath; back of the fl. greenish yellow; tails honey-yellow; throat and base of lobes spotted with crimson; petals linear-oblong, white. Colombia. B.M. 6159. F.S. 22:2346. C.O. 11.—Named from its resemblance to the dove orchid, Peristeria.

13. **ionócharis,** Reichb. f. Lvs. ovate-lanceolate, exceeding the erect peduncle: fl. whitish, purple-spotted at base, the lobes triangular-ovate, with yellow tails; petals cream-white. Peru.

14. **nidífica,** Reichb. f. Lvs. oval or oblong, about the length of or longer than the peduncle: fl. white, veined and dotted with crimson passing into yellow on the lobes, the lobes hairy and with long, slender tails, which are yellow in the lateral lobes and crimson in the dorsal lobe; petals white, with crimson lines. Ecuador.

15. **corniculàta,** Reichb. f. Sts. short and tufted: lvs. spatulate, very short-pointed, mostly exceeding the 1-fld. peduncles: fls. with yellow, inflated calyx-tube, which is spotted with brown and ribbed, bearing long, very slender brown tails; petals yellow. Colombia. Var. **inflàta,** Veitch. Paler in color, and with smaller spots; lobes broader and golden yellow. Colombia. B.M. 7476.

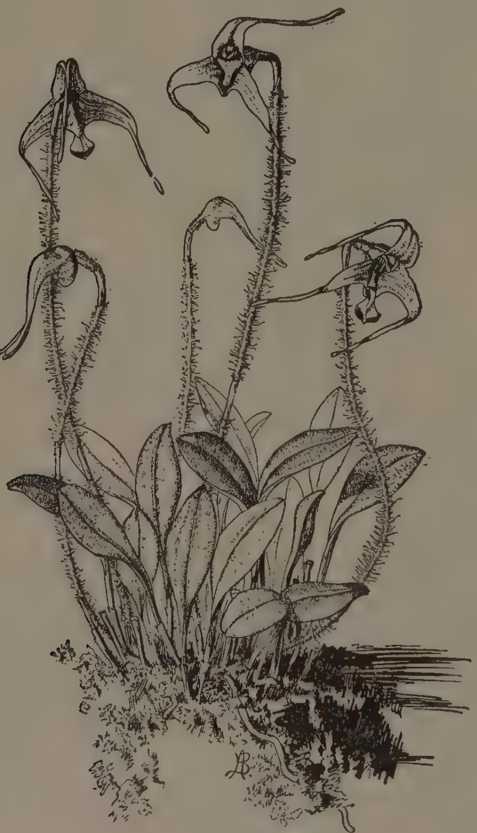
16. **macrùra,** Reichb. f. Sts. short and tufted, each bearing a solitary lf. and fl.: lvs. broadly spatulate or broad-oblanceolate, very obtuse or even retuse: peduncles 8–10 in. high, erect; fls. with 3 long tails, which span 8 in. from top to bottom; calyx-tube red-purple on the outside; lobes triangular-ovate in the basal portion, dull red and purple-spotted within, the cylindrical tails yellow, the lateral ones 7-ribbed; petals yellow, spotted brown. Colombia. B.M. 7164. C.O. 8.

17. **calùra,** Reichb. f. Lvs. mostly shorter than the peduncles, oblong-lanceolate: fls. glossy crimson, with slender, flat tails; dorsal lobe somewhat triangular at base, the lateral ones round-ovate; petals crimson, with white on tip and margins. Aug. Costa Rica.—A free-flowering species.

18. **Shúttleworthii,** Reichb. f. A small species, with lvs. only 2 in. long, on distinct petioles of equal length: peduncles several, 1-fld., sometimes overtopping the lvs.; fls. large (1 in. across and the tails 2–3 times as long), mauve, dotted with crimson; tails all yellow in the upper half, very slender, the upper one sometimes bent or hooked at the top; petals white. Colombia. B.M. 6372. I.H. 28:435. C.O. 6. Var. **xanthocòrys,** Reichb. f., has smaller fls. of pale yellow, dotted with brown or rose.

19. **xanthìna,** Reichb. f. Like the last, except that the fl. is yellow, with a purplish spot on the lateral lobes. Var. **pállida,** Hort., has fls. almost white. Colombia.

20. **triangulàris,** Lindl. Lvs. oblanceolate: peduncle erect, about 4 in. tall; fls. yellow, marked or spotted with purple, the tails dark crimson; lobes similar, triangular-ovate; petals white, the lip spotted with pink or purple and hairy. Venezuela.



2330. Masdevallia muscosa.

21. **Wagenerìana,** Lind. Very small, neat and attractive, tufted, 2–3 in. high: lvs. spoon-shaped: peduncles equaling or exceeding the lvs., nearly erect; fls. yellow and crimson-dotted, with slender yellow tails, the upper one inclined backward; lobes broad, cordate or ovate; petals yellow, odd in shape, the lip rhomboid and toothed. Venezuela. B.M. 4921.

22. **Estràdæ,** Reichb. f. Very densely tufted: lvs. and petioles 3 in. long, the blade broad, spoon-shaped, and often retuse at the apex: peduncle usually somewhat exceeding the lvs., erect, 1-fld.; fl. of marked colors—the upper concave lobe yellow at base and violet-purple above, the lateral lobes violet-purple at base and white or straw-colored above; tails filiform, yellow; petals white, very small. Colombia. B.M. 6171.

23. **hieroglýphica,** Reichb. f. Lvs. oval or oblong: peduncle short (about 3 in. long); fl. with tube yellowish at bottom, becoming whitish, marked with crimson; lobes triangular-ovate, all with long tails, the tail of the dorsal lobe hanging forward and marked with purple at its base; petals yellow. June. Colombia.

24. **elephánticeps,** Reichb. f. An odd species: lvs broad-spatulate, obtuse: peduncles 1 ft. long, erect; fl. single, parti-colored—the dorsal or upper lobe light yellow, the lateral ones ribbed and crimson; calyx-tube gibbous at the base below, all of them gradually produced into stout yellow tails (one of them often crimson), arranged so as to suggest the tusks and raised trunk of an elephant (whence the specific name). Colombia. F.S. 10:997. B.M. 7824. C.O. 10. Var. **pachysépala,** Reichb. f. (*M. Mooreàna,* Reichb. f.), has the dorsal lobe 3-nerved with crimson; tube spotted.

SECTION III.

A. *Lvs. covered with round papillæ: scape hairy*.......................25. **muscosa**
AA. *Lvs. smooth.*
B. *Fls. small, in many-fld. racemes; angles of the ovary crenulate or the petals toothed.*
C. *Color of fls. pale lilac*...........26. **polysticta**
CC. *Color of fls. white*..............27. **abbreviata**
28. **melanopus**
29. **caloptera**
CCC. *Color of fls. yellow*..............30. **pachyura**
BB. *Fls. larger, often expanding in succession: raceme several-fld.: angles of the ovary and petals entire.*
C. *Color of fls. white*..............31. **tovarensis**
CC. *Color of fls. yellow, dotted and shaded with brown or red.*
D. *Lateral sepals united, forming a boat-shaped cup*...........32. **Ephippium**
DD. *Lateral sepals nearly plane, at least not strongly cucullate.*
E. *Tails of the lateral sepals very short or none*.............33. **racemosa**
EE. *Tails of the lateral sepals long.*
F. *Lvs. broad, obovate-elliptic*..34. **Schlimii**
FF. *Lvs. oblong-lanceolate or oblanceolate.*
G. *Calyx-tube funnel-shaped, narrowed at the base*.............35. **Reichenbachiana**
GG. *Calyx-tube broader or gibbous at the base*.....36. **maculata**
37. **infracta**

25. **muscòsa,** Reichb. f. Fig. 2330. Lvs. oval-oblong, papillose: peduncle hairy, 3 times exceeding the lvs., with 1 yellow fl.; lobes triangular, with reflexed tails; petals narrow and yellow with a brown line in the center, the lip bearing a raised yellow disk and moving upward with a jerk when this disk is touched. Ecuador, Colombia. O. 1913:105.—Fls. ½in. across. See Leavitt, Plant World, April, 1906, from which Fig. 2330 is adapted.

26. **polystícta,** Reichb. f. Densely tufted: lvs. narrow-spatulate, obtuse and often retuse: peduncle exceeding the lvs., about 8 or 9 in. tall and many-fld.; fls. pale lilac, spotted with purple, the margins of the

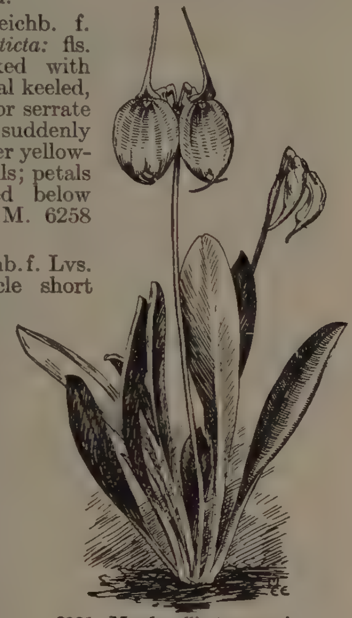
sepals ciliate but not serrate, the tails very slender and spreading (fl. 2–2½ in. across) and yellowish; petals spatulate and serrate. Peru. B.M. 6368. I.H. 22:199. R.H. 1880:250.

27. **abbreviàta,** Reichb. f. Lvs. oblong-lanceolate: peduncle many-fld., about 6 in. long; fl. white and freely dotted with red, the tails all deep yellow, the lobes serrate on the edges; petals white, longer than the column, serrate. Peru.

28. **melanòpus,** Reichb. f. Much like *M. polysticta:* fls. smaller, white specked with purple, the dorsal sepal keeled, the lobes not ciliate or serrate on the edges and very suddenly contracted into slender yellowish or dark-colored tails; petals linear-oblong, toothed below the apex. Peru. B.M. 6258 (as *M. polysticta*).

29. **calóptera,** Reichb. f. Lvs. oblong-ovate: peduncle short (5 or 6 in.), many-fld.; fl. white with crimson streaks, the tails all slender and orange; dorsal lobe keeled and somewhat hooded; the lateral ones ovate-oblong; petals white, crimson-keeled, serrate. Peru.

30. **pachyùra,** Reichb. f. Lvs. oval-oblong: peduncle erect, slender; calyx with triangular, short-tailed lobes, yellow, with transverse bars and spots of reddish crimson; dorsal sepal triangular, with a thick tail equaling the sepal in length; petals pale yellow. Ecuador. G.C. III. 22:255; 49:89. B.M. 8361.



2331. Masdevallia tovarensis. (×½)

31. **tovarénsis,** Reichb. f. Fig. 2331. Lvs. rather small, oblong-spatulate: peduncle 5 or 6 in. long, sometimes exceeding the lvs., 2-edged, several-fld.; fls. clear white and fragrant, the tails yellowish at the ends; dorsal lobe 1½ in. long, very narrow and produced into a reflexed tail; lateral lobes oval, gradually produced into tails shorter than that of the dorsal lobe; petals white. Dec., Jan. Colombia. B.M. 5505. I.H. 26:363. Gn. 48, p. 384. G.C. 1865:914; 1871:1421. J.H. III. 57:99. C.O. 13. O.R. 13:58.—One of the best of the genus.

32. **Ephíppium,** Reichb. f. (*M. trochìlus,* Lind. & André). Lvs. broad, oblong, 5–7 in. long: peduncle erect, about a foot long, sharply 3–4-angled, stout; calyx with the dorsal lobe cucullate, yellow, dotted with brown, ½in. diam.; lateral lobes united, forming a deep boat-shaped, chestnut-brown cup, with several ridges which are greenish outside; all the lobes pass into yellowish tails about 4 in. long; petals white. Colombia. B.M. 6208. I.H. 21:180. C.O. 9.—According to Index Kewensis, *M. trochilus* and *M. Ephippium* are distinct species. The former is described as having terete sts.

33. **racemòsa,** Lindl. (*M. Cróssii,* Hort.). Sts. creeping: lvs. oblong-ovate, much shorter than the several-fld. racemose peduncles: fls. membranaceous, orange with red lines, erect, 1 in. across, tails very short or none; lateral lobes ovate, blunt-pointed, curving outward so as to form a 2-lobed limb, the dorsal lobe ½in. long and pointed. Peru. C.O. 3.—Not a popular species. Requires a coolhouse.

34. **Schlímii,** Lind. Tufted: lvs. elliptic-obovate, petioled, a foot or less long, half shorter than the several-flowered peduncles: fls. dull yellow, mottled with bright brown, the tails yellow, about 1¼ in. across without the tails; tails 2–3 times longer than the body of the calyx-lobes, very slender; petals pale yellow, linear-oblong, equaling the column. Venezuela. B.M. 6740. G.C. II. 19:532.

35. **Reichenbachiàna,** Endres. Densely cespitose: lvs. oblanceolate, shorter than the several-fld. peduncles: fl. dark red on the outside, yellowish, with red veins on the inside, all the lobes with turned-back tails, the lobes triangular. Costa Rica.

36. **maculàta,** Klotzsch & Karst. Lvs. narrow-oblanceolate, nearly or quite equaling the erect several-fld. peduncle (which is 8–10 in. tall): fls. yellow-tubed, suffused or dotted with red, all the lobes produced into orange-yellow or greenish tails 2 in. long; lateral lobes crimson, with yellow on the margin, the tails drooping; petals yellowish. Venezuela. F.S. 21:2150.

37. **infrácta,** Lindl. Cespitose: lvs. oblong-lanceolate to narrow-lanceolate: peduncle about 6 in. long, several-fld.; calyx pink-purple; dorsal sepals cucullate, lateral sepals entirely united, forming a wide, gaping tube, with cucullate sides and apex, passing into slender, yellowish tails; petals whitish, dotted with pink-purple. Brazil. F.S. 23:2389.

SECTION IV.

A. *Fls. campanulate*.....................38. **Carderi**
AA. *Fls. not campanulate.*
B. *The fls. with cream-white ground, crimson-spotted*..................39. **Houtteana**
BB. *The fls. with yellow ground.*
C. *Free part of sepals orbicular, abruptly tailed*...............40. **radiosa**
CC. *Free part of sepals ovate, narrowed into the tail.*
D. *Inner surface of sepals glabrous*.41. **bella**
DD. *Inner surface of sepals with white hairs*................42. **nycterina**
DDD. *Inner surface of sepals with warts and hairs*............43. **Chimæra**
BBB. *The fls. with green or yellowish green ground*.....................44. **Chestertonii**

38. **Cárderi,** Reichb. f. Cespitose, with strong ascending foliage and hanging spotted 1-fld. peduncles: lvs. oblanceolate, 3–5 in. long: peduncles green-bracted, 3 in. long; fls. bell-shape, ¾in. across exclusive of the tails, white, with purple and yellow bars at the base; tails very slender and spreading, 1 in. long, yellow; petals small, white, linear-oblong and obtuse. Colombia. B.M. 7125.—A graceful and pretty species.

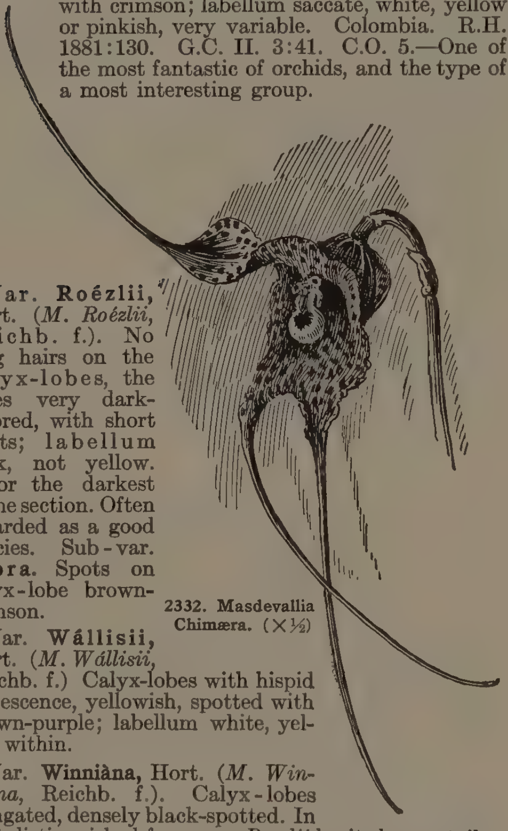
39. **Houtteàna,** Reichb. f. (*M. psittacìna,* Reichb. f.). Densely cespitose: lvs. linear to lance-linear, much exceeding the drooping or deflexed 1-fld. peduncles (which are 4–5 in. long): fls. creamy white, spotted with crimson, the long hanging tails brownish red; calyx-lobes semi-ovate to triangular, somewhat hairy (as are also the tips of the tails); petals white or pinkish. Colombia. F.S. 20:2106.

40. **radiòsa,** Reichb. f. Lvs. oblong or lanceolate: peduncle 2–3-fld., drooping or deflexed; fls. yellow, dotted and splashed with purple, the prominent tails all purple; petals yellow, purple-spotted, but the lip whitish. Colombia.

41. **bélla,** Reichb. f. Lvs. oblong-lanceolate, channelled, about 8 or 9 in. long, narrowing to the base: peduncle 1-fld., drooping or horizontal, ½ft. long, slender; fls. large and spider-like, triangular in outline, 3 in. across, with stiffish tails 4 in. long, of which the dorsal is recurved and the others standing forward and usually crossed, the fl. pale yellow, spotted with purplish or brown; petals white or yellowish. Colombia. Oct.–Dec. G.W. 4, p. 77. C.O. 14.—One of the best of the chimæras.

42. **nycterìna,** Reichb. f. Often confused with *M. Chimæra*, but a smaller and less showy plant: tufted: lvs. oblanceolate, somewhat fleshy, channelled, 6 in. long, not narrowed into a petiole: peduncle 1-fld., 3 in. long, drooping; fl. triangular, 2 x 3 in., with tails 3 in. long, hairy inside, brown-yellow and purple-spotted; petals yellow, with red spots, pouch-like, serrate. Colombia. I.H. 20:117, 118 (as *M. Chimæra*).—Odd.

43. **Chimæ̀ra,** Reichb. f. Fig. 2332. Tufted: lvs. oblanceolate-obtuse, 1 ft. long and 1½ in. wide: peduncle wiry, erect, lateral or pendent, several-fld., mostly shorter than the lvs.; fls. opening in succession; calyx-lobes ovate, yellowish, much spotted with deep crimson-purple, tapering into slender tails from 3–11 in. long, purple-brown; petals white, marked with crimson; labellum saccate, white, yellow or pinkish, very variable. Colombia. R.H. 1881:130. G.C. II. 3:41. C.O. 5.—One of the most fantastic of orchids, and the type of a most interesting group.



2332. Masdevallia Chimæra. (×½)

Var. **Roézlii,** Hort. (*M. Roézlii*, Reichb. f.). No long hairs on the calyx-lobes, the lobes very dark-colored, with short warts; labellum pink, not yellow. Color the darkest of the section. Often regarded as a good species. Sub-var. **rùbra.** Spots on calyx-lobe brown-crimson.

Var. **Wállisii,** Hort. (*M. Wállisii*, Reichb. f.) Calyx-lobes with hispid pubescence, yellowish, spotted with brown-purple; labellum white, yellow within.

Var. **Winniàna,** Hort. (*M. Winniàna*, Reichb. f.). Calyx-lobes elongated, densely black-spotted. In part distinguished from var. *Roezlii* by its longer tails.

Var. **Backhousiàna,** Hort. (*M. Backhousiàna*, Reichb. f.). Lvs. narrower than in the type: fls. large; calyx-lobes more round, paler, not so thickly spotted; tails short; labellum nearly white.—Perhaps a distinct species.

44. **Chéstertonii,** Reichb. f. Tufted: lvs. oblong or oblong-spatulate, 5 in. long and nearly or quite 1 in. wide, somewhat longer than the pendent, much-bracted, 1-fld. peduncles: fls. 2½ in. across, greenish yellow, spotted and streaked with purple, and bearing 3 spreading, greenish, more or less hooked, flattened tails 1 in. long; petals yellow, very small. Colombia. B.M. 6977.—Odd and distinct.

SECTION V.

45. **triaristélla,** Reichb. f. Lvs. about 2 in. long, in very crowded tufts: peduncles longer than the lvs., very slender, erect, wiry: dorsal lobe of calyx ovate, hooded; tail yellow; lateral lobes coloring throughout their length, linear, united, at length diverging into short yellow tails; petals yellow, with a red midline. Summer. Costa Rica.—One of the smallest of orchids.

The following have been offered in Amer., but most of them are imperfectly known. *M. cheiróphora.*—*M. Chélsonii*=M. amabilis ×M. Veitchiana.—*M. gibberòsa*=Scaphosepalum.—*M. Héndersoni.*—*M. punctàta*=Scaphosepalum.—*M. trificàta.*

M. Alcéste=M. Veitchiana × M. Asmodia.—*M. Armínii*, Reichb. f. Fls. with whitish tube, the free portion of sepals crimson-purple, the lateral with filiform yellowish tails 1–2 in. long. Colombia. J.H. III. 50:313; 61:577.—*M. burfordiénsis*, O'Brien. Fls. white, profusely dotted with claret-color; petals white, with purple lobes; lip purple.—*M. deórsum*, Rolfe. Fls. yellow, blotched bright red; dorsal sepal reflexed, contracted suddenly into a tail 2–3 in. long; lateral sepals gradually narrowed into shorter tails. Colombia. B.M. 7766. G.C. III. 28:395.—*M. Ortgiesiàna*, Hort. Scape 1-fld.; fls. pale greenish white.—*M. peruviàna*, Rolfe. Petals white, tinged with lilac; sepals light brown. Peru.—*M. Pourbaìxii*, Hort.=M. Veitchiana × M. Shuttleworthii. Fls. vermilion, flushed with orange-yellow, and marked with numerous brownish red dots. G.M. 47:373. Lind. 9:387.—*M. Schroederiàna*, Hort. Sepals abruptly contracted into yellow tails, the dorsal arched, the lateral much recurved, thickly 3-nerved, bullate, white marked with red. Peru (?). B.M. 7859.—*M. Tondùzii*, Woolward. Peduncle slender, 1-fld.; sepals connate at base, whitish citron-colored inside, elongated into slender yellow tails. Costa Rica.—*M. venòsa*, Rolfe. Perianth straw-yellow, densely spotted with dull purple; lip dull red-purple. Colombia.—*M. Xípheres*, Reichb. f. Allied to M. muscosa: fls. small, purple, on tall slender sts. Colombia.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

MASSÁNGEA (named for a Belgian horticulturist, M. Massange de Louvrex). *Bromeliàceæ.* A disputed genus; by Bentham & Hooker included in Caraguata, and by Mez combined with Guzmania. The single species admitted by Wittmack in Engler & Prantl, *M. musàica*, Morr., becomes *Guzmània musàica* (*Tillándsia musàica*, Lind. & André. *T. mosàica.* Hort. *Vrièsia musàica*, Hort.), by the Mezian disposition (see Vol. III, p. 1419). It is a good warmhouse subject.

MASSÒNIA (Francis Masson, 1741–1805, collector in S. Afr.). *Liliàceæ.* South African bulbous plants, of more than 30 species, allied to Allium; rarely grown as pot-plants in the greenhouse. Plants with 2 or 3 very broad opposite lvs., and a very short scape so that the usually white or greenish fls. are borne in a sessile or nearly sessile globose head at the surface of the ground surrounded by several membranaceous bracts: perianth with a cylindrical tube and narrow spreading or reflexed nearly equal segms.; stamens 6, inserted at the throat, the filaments more or less united at the base; ovary 3-celled and many-ovuled, becoming a membranaceous 3-valved caps. *M. pustulàta*, Jacq., has an ovoid bulb, 1 in. diam., ribbed tuberculate broad-oblong lvs., and greenish fls. in the cup of pustulate foliage; perianth-tube cylindrical, the segms. narrow and spreading; stamens long and upstanding. B.M. 642. G.C. III. 39:44.—An odd plant, requiring warm greenhouse conditions.

L. H. B.

MATRICÀRIA (*mater*, mother, from its use in diseases). *Compósitæ.* MATRICARY. WILD CHAMOMILE. Annual or perennial weedy herbs, often heavily scented.

From Chrysanthemum it differs mostly in the achenes, which are 3–5-ribbed on the interior face and ribless on the back; also in having a higher or more conical receptacle, and bracts in few rather than many series.—About 25 species in many parts of the world. The foliage is much cut or divided into thread-like divisions. The matricarias are border plants in cult., and others are intro. weeds. They are commonly confounded with species of Chrysanthemum and feverfew. The *M. exima plena* of the trade is a form of *Chrysanthemum Parthenium* (var. *tubulosum*). It is a good hardy annual, with white double heads, growing 2 ft. tall. Matricarias demand the care given to annual chrysanthemums. The three following are annuals or biennials.

inodòra, Linn. (*Chrysánthemum inodòrum*, Linn. *Pyrèthrum inodòrum*, Smith). Nearly or quite glabrous, branchy, diffuse annual, 1–2 ft. tall, from Eu.

and Asia: lvs. many, sessile, 2–3-pinnately divided or dissected: heads 1½ in. across, terminating the branches, with many acute white rays: achenes inversely pyramidal, with 3 conspicuous ribs. Not uncommon in fields eastward. Var. **pleníssima**, Hort. (var. *ligulòsa*, var. *múltiplex*, *M. grandiflòra*, Hort. not Fenzl), is a common garden plant with very double clear white large heads. It is floriferous, and the fls. are fine for cutting. G.C. II. 12:753.—It often persists and blooms the second year. Foliage little or not at all scented.

2333. Matricaria Chamomilla. (×¼)

parthenoìdes, Desf. (*M. capénsis*, Hort., not Linn. *Ánthemis parthenoìdes*, Bernh. *Chrysánthemum partheniòdes*, Voss). Annual, or biennial under cult., 2 ft. or less high, soft-hairy when young, but becoming smooth, bushy in growth: lvs. petiolate, twice divided, the ultimate segms. ovate and often 3-lobed: fl.-heads loosely corymbose, in the garden forms usually double, white.—A handsome plant, probably of Old World origin, useful for pots, and blooming till frost.

Chamomílla, Linn. (*Chamomílla officinàlis*, Koch). Wild Chamomile. Fig. 2333. Glabrous erect much-branched annual: lvs. 2–3-pinnate, with segms. short and very narrow-linear, giving the lf. a finely dissected appearance: heads rather large (nearly 1 in. across), on terminal peduncles, with 10–20 truncate white rays; bracts of involucre of about equal length, the edges scarious; receptacle without scales, elongating and hollow as anthesis advances: achene with 3–5 faint ribs and no border at top. Fields, Eu. and N. Asia; run wild in E. U. S.—Very similar in appearance to *Anthemis Cotula* (Fig. 219), but lacks the scales between the central florets and has a different odor. The name chamomile, or sometimes spelled camomile, is applied both in Matricaria and Anthemis. L. H. B.

MATRIMONY VINE: *Lycium.*

MATTEÙCCIA (from C. Matteucci, an Italian physicist). *Polypodiàceæ.* A small group of north temperate ferns with lvs. of two sorts, the sterile growing in crowns from erect rootstocks, and the fertile growing from the interior of the crown. Our species is known as the ostrich fern and is one of the most easily cult., as well as one of the handsomest of our native species. It multiplies rapidly by offsets sent out from the rootstock. Known also as an Onoclea or Struthiopteris. For cult., see p. 1217. For further botanical relations, see *Onoclea.*

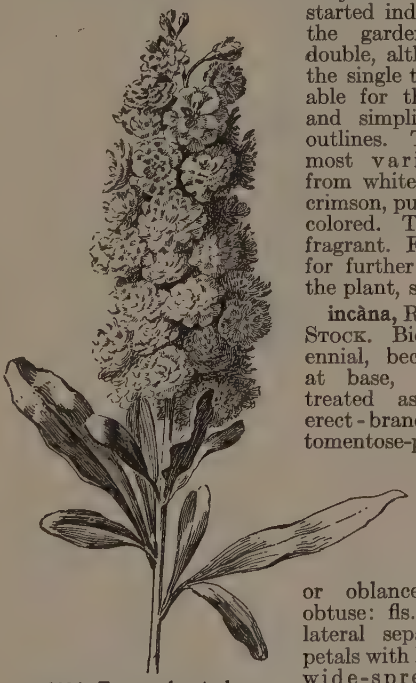
Struthiópteris, Todaro (*Struthiópteris germánica*, Willd. *Onoclèa Struthiópteris*, Hoffm.). Ostrich Fern. Lvs. (sterile) 2–6 ft. long, with the lowest pinnæ gradually reduced: fertile lvs. 1–2 ft. long, pinnate, with the margins of the pinnæ closely inrolled and covering the sori. Eu. and N. E. N. Amer.—Willdenow regarded the American species as distinct, but by most botanists it is considered identical with the European species.

L. M. Underwood.

MATTHÌOLA (Peter Andrew Matthioli, 1500–1577, Italian physician and writer on plants). Sometimes (and originally) spelled *Mathiola. Cruciferæ.* Stock. Gilliflower, when used at the present day, means Matthiola or sometimes Cheiranthus; formerly it designated *Dianthus Caryophyllus.* Familiar flower-garden and florists' subjects.

From Cheiranthus, the wallflower, this genus differs in its winged seeds, which are as broad as the partition, the stigma-lobes erect or connivent and often thickened on the outside, the silique not 4-sided (terete or compressed). Of Matthiolas there are probably 50 species, widely distributed in the Old World and Austral., 2 in S. Afr. They are herbs or subshrubs, tomentose, with oblong or linear-entire or sinuate lvs., and large, mostly purple fls. in terminal racemes or spikes.

The true stocks (Fig. 2334) are of this genus. The Virginian stocks are diffuse small-flowered annuals of the genus Malcomia (which see). Stocks are of two general types,—the autumn-blooming, Queen or Brompton stocks, and the summer-blooming, ten-weeks or intermediate stocks. By some persons these classes are made to represent two species, *M. incana* and *M. annua* respectively. It is probable, however, that they are garden forms of one polymorphous type. Even if distinct originally, it is not possible now to distinguish them by definite botanical characters.—Stocks are amongst the most common of all garden flowers. The two types cover the entire blooming season, particularly if the earlier ones are started indoors. Most of the garden forms are double, although some of the single types are desirable for the definiteness and simplicity of their outlines. The colors are most various, running from white through rose, crimson, purple and particolored. The flowers are fragrant. For culture and for further discussion of the plant, see *Stock.*



2334. Ten-weeks stock—Matthiola incana var. annua. (×⅓)

incàna, R. Br. Common Stock. Biennial or perennial, becoming woody at base, but usually treated as an annual: erect-branching, closely tomentose-pubescent, the sts. stiff and cylindrical: lvs. alternate, tapering into a petiole, long-oblong or oblanceolate, entire, obtuse: fls. with saccate lateral sepals and large petals with long claws and wide-spreading limb, borne on elongating stalks in an open, terminal erect raceme: siliques becoming 3–4 in. long, erect. Medit. region; also Isle of Wight.—*M. glabràta*, DC., is a glabrous form.

Var. **ánnua,** Voss (*M. ánnua*, Sweet. *M. græca*, Sweet). TEN-WEEKS, or INTERMEDIATE STOCKS. Fig. 2334. Annual, less woody, blooming earlier.—A shining-lvd. variety is known. Var. **autumnàlis,** Voss. Autumn-blooming or Brompton stocks.

bicórnis, DC. Half-shrubby, straggling annual or biennial: fls. smaller than those of *M. incana*, purplish or lilac, fragrant by night, closing by day: pod terete, long, 2-horned: lvs. pinnatifid, or the uppermost entire. Greece, Asia Minor. Gn.M. 3:226.

M. coronopifòlia, DC. Perennial, somewhat woody at base, hoary-pubescent: lvs. linear-oblong, sinuate-lobed or somewhat pinnatifid: petals wavy, vinous purple. Sicily. B.M. 7750.—*M. maderénsis*, Lowe. Woody at base, spreading: lvs. long-lanceolate, acute, soft-tomentose, usually entire: fls. pale violet, or violet-purple, rarely white, fragrant. Madeira. Gt. 1:354.—*M. pedemontàna*, Hort. Apparently a form of M. varia: fls. light rosy purple: decorative for the rock-garden. G. C. III. 53:149.—*M. sinuàta* var. *oyénsis*, Rouy. & Fouc. (M. oyensis, Ménier), is figured in B. M. 7703, where it is said that "the name oyensis has been corrupted in gardens to ohiensis and chinensis." The plant is from the Ile d'Yeu (Insula Oya, whence the name) on the coast of France. It is an annual or biennial, with sinuate-toothed lvs., hairy, and with large white fragrant fls. Not known to be in cult. in this country.—*M. vària*, DC., Italy and Greece, a variable species, some forms of which may appear in cult. Perennial: lvs. linear, obtuse, entire, canescent: petals oval, undulate, purplish.

L. H. B.

MAURÁNDIA (after Maurandy, professor of botany at Cartagena, Spain). Also written *Maurandya*. *Scrophulariàceæ*. Perennial herbs, grown for the showy flowers and for the climbing habit of some of them.

Botanically, this genus is near to the snapdragon, though the throat of the fl. is not closed. The plant known to the trade chiefly as *Maurandia antirrhiniflora* is now referred to Antirrhinum. (See *Antirrhinum*, Vol. I, p. 305, where this plant is described and figured.) It is a climber and requires the cult. of maurandia. Maurandias climb by the twisting of the lf.- and fl.-stalks. They are glabrous or pubescent: lvs. alternate, or the lower ones opposite, triangular or halberd-shaped, angular-lobed or coarsely toothed: calyx 5-parted; segms. narrow or broad; corolla-tube scarcely bulged or gibbous at the base, essentially funnelform, with bearded lines instead of a palate; posterior lip 2-cut; anterior lip variously parted; stamens 4, didynamous: fr. a caps. with winged or wingless seeds.—About 6 or 8 species of Mexican and Arizonian plants, mostly climbers, with showy, irregular trumpet-shaped fls., white, rose, purple and blue, the throat usually white or light-colored, somewhat 2-lipped.

2335. Maurandia Lophospermum. (×¼)

Perhaps the commonest cultivated species is *M. Barclaiana*, which is procurable in a greater range of colors than the others. Maurandias are desirable vines for winter-flowering in cool greenhouses, but since they bloom the first year from seed, they are almost wholly grown for summer bloom outdoors and treated like tender annuals. They have a slender habit and grow about 10 feet in a season. In autumn the vines may be taken up and removed into the house if desired. In some of the recently introduced species the habit is prostrate or pendulous rather than climbing.

Maurandias can be increased either by seed or cuttings. When grown from seed, the pans or flats should be given a liberal amount of crocks, and this covered with some coarse material. For a compost use four parts new loam, two parts leaf-mold, one part sand, well mixed together. Fill the pans to about ½ inch from the top, firming the material. For covering the seeds, screen some of the compost and cover about three times the size of the seed. Water with a fine rose. Place the pans in a house with a night temperature of 60°. Cover with glass and keep shaded until they start to germinate. When large enough to handle, pot off into 2- or 2½-inch pots, using the same compost, adding about one-fourth part of well-decayed cow-manure. When intended for the conservatory, they should be shifted along until they are in 6- or 7-inch pots. For these larger shifts use a compost of four parts of fibrous soil, one part each of cow-manure and leaf-mold, and a small amount of bone-meal. Maurandias can also be grown from cuttings taken any time after the middle of January, using an intermediate propagating-bed and grown on as above stated. For their general culture, they like a night temperature of 55° to 60° with a rise of 10° to 15° with sun heat. Water should be given when they show a dryness at the roots. On bright days they should receive a good syringing to keep the foliage clean and healthy. When they have filled the soil with roots, liquid manure given about once a week will keep them vigorous. Train the shoots and give them additional room as they may require. Maurandias are largely grown for baskets, vases and the like. The most troublesome insects are red-spider and aphids. Syringe to keep the former in check and fumigate frequently for aphids. (J. J. M. Farrell.)

A. *Plant climbing.*

B. *Seeds tubercled, wingless: calyx-segms. narrow: lvs. hastate, not serrate.* (*Subgenus Eumaurandia.*)

C. *Calyx distinctly glandular-pilose; segms. long-attenuate*

Barclaiàna, Lindl. Usually, but not originally, written *Barclayana*. Climber, somewhat woody: lvs. angular, cordate, acuminate, the petioles longer than the blades and twining: fls. about 3 in. long, downy outside, deep purple, personate; upper lip of corolla with 2 transverse rounded lobes, the lower lip with 3 roundish ovate lobes. Mex. B.R. 1108. L.B.C. 14:1381. V. 5:353.—The following trade names advertised like species-names are presumably all color-varieties of this species: *M. alba*, *M. albiflora*, *M. Emeryana*, *M. rosea*, *M. Luceyana*, *M. purpurea grandiflora*, *M. varius*. The last is a trade name for mixed varieties.

CC. *Calyx glabrous, shorter.*

scándens, Pers. (*Ustèria scándens*, Cav. *M. semperflòrens*, Ort.). Shrubby below: lvs. halberd-shaped, long-acuminate, the margins not toothed: fls lavender-colored; throat white. Mex. B.M. 460.—Cult. in S. Calif.

BB. *Seeds with a lacerated or irregular wing: calyx-segms. leafy and broad: lvs. triangular-ovate, serrate.*

C. *Corolla-lobes obtuse or even notched.*

erubéscens, Gray (*Lophospérmum erubéscens*, Don). Woody climber, glandular-hairy: lvs. somewhat triangular in outline, serrate; petiole as well as peduncle twining: fls. 3 in. long, rosy pink. Mex. B.M. 3037, 3038 (as *L. scandens*). B.R. 1381. G.C. II. 20:501.—Cult. in S. Calif.

cc. *Corolla-lobes more acute.*

Lophospérmum, Bailey, nom. nov. (*M. scándens,* Gray, not Pers. *Lophospérmum scándens,* D. Don). Fig. 2335. Perhaps a botanical variety of the preceding. Branches long and slender, glandular-pubescent: lvs. opposite below and alternate above, cordate, subacute, unequally toothed, the petiole twining: corolla twice as long as calyx, rose-purple, obscurely dotted outside, the tube white; lobes triangular ovate, acute or the lower ones nearly obtuse. B.M. 3650.—A handsome plant. A hybrid with the preceding is shown in B. 5: 242. The plants passing in gardens as *M. scandens* need to be worked over botanically.

AA. *Plant not climbing, although with pendulous or lopping growth.*

Púrpusii, Brandegee. Ascending, pendulous or prostrate, 12–16 in., leafy, with tuberous rootstock: lvs. long-stalked, more or less triangular-ovate: fls. axillary, long-peduncled, purple-carmine, beautiful. S. W. Mex. —A showy tender perennial, blooming the first year from seed, of bushy growth; tubers may be stored in winter. Differs from *M. erubescens* in being more glabrous and bearing smaller fls.; lvs. often entire-margined.

M. Conzáttii, Hort., that has been listed in S. Calif.=M. scandens, Pers.

L. H. B.†

MAURÍTIA (after Prince Moritz, of Nassau, 1567–1665, patron of Piso and Marcgraf; by his aid a Natural History of Brazil was published). *Palmàceæ,* tribe *Corỳphinæ.* Very graceful fan palms, very little grown in America except in botanic gardens.

Stems very slender, obscurely ringed, almost spineless: lvs. pinnately flabelliform, semi-circular, orbicular or wedge-shaped, the lobes lanceolate, acuminate; rachis long or short; petiole cylindrical: ovary perfectly 3-celled.—There are 6 or 7 species, all Trop. American. Mauritia must be grown in rich soil in a very hot moist house with a day temperature of 80–85°. The pots of small plants are often partly submerged in water. G.C. II. 26:491.

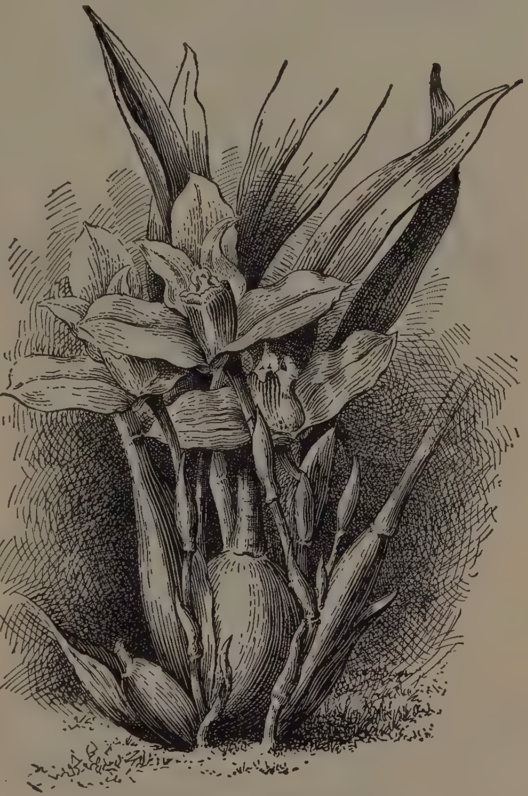
flexuòsa, Linn. f. Moriche Palm. Ita Palm. Sts. without stolons, in nature often 90 ft. tall: lvs. 20–30, erect-spreading, 9–16 ft. long; blade 2½–4 ft. long, yellowish beneath; lobes ⅔–1½ in. wide; petiole stout, rigid, semi-cylindrical, equaling the blade: fr. nearly 2 in. long, depressed-globose; seed 1⅓ in. long. Trop. Brazil.—Offered in 1889 by Reasoner Bros. In the Amazon delta this palm grows to 150 ft. or more in height, with a trunk often 30 in. diam. at base. "The fr. is spherical, the size of a small apple, and covered with rather small, smooth, brown, reticulated scales, beneath which is a thin coating of pulp. A spadix loaded with fr. is of immense weight, often more than two men could carry between them."—Wallace, "Palms of the Amazon." It forms extensive forests, and provides material for subsistence and arts of the Indians.

N. Taylor.†

MAUROCÈNIA (J. F. Mauroceni, Venetian senator and horticulturist). *Celastràceæ.* One shrub in S. Afr., producing a drupe as large as a cherry and called "Hottentot cherry," *M. frangulària,* Mill. (*M. capénsis,* Sond. *Cassìne Maurocènia,* Linn.). Glabrous, 4–6 ft., with 4-angled twigs: lvs. coriaceous, opposite, entire, suborbicular to elliptical or obovate: fls. small, greenish to white, in axillary clusters; calyx very small, 5-parted; petals 5, exceeding the calyx; disk ring-like; stamens 5, exceeding the petals: drupe somewhat juicy, with a hard stone. Cape of Good Hope region.—Apparently not in the trade.

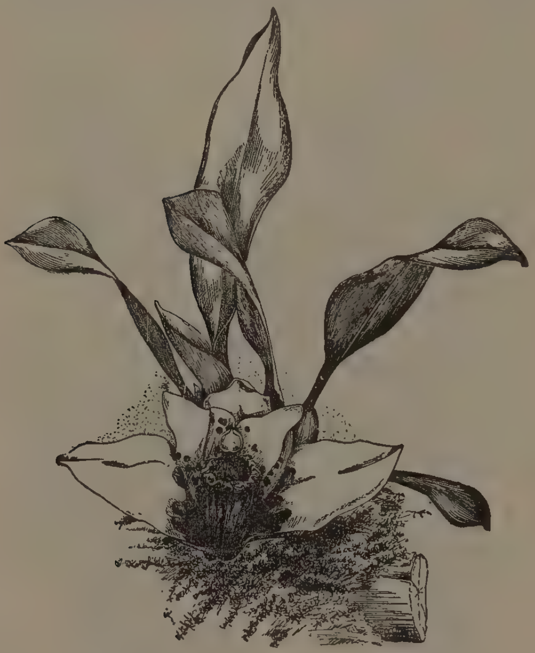
MAXILLÀRIA (Latin, *maxilla,* jaw; referring to the mentum). *Orchidàceæ.* Mostly pseudobulbous epiphytic orchids, resembling lycaste in general appearance.

Rhizomes short or long, creeping or erect, and clothed with distichous lvs.: pseudobulbs clustered or scattered on the rhizome, 1–2-lvd. or densely distichophyllous at the apex of the rhizome: lvs. leathery or subfleshy, plicate or plane and keeled, distichous: sepals subequal, free from each other but united with the foot of the column and forming a projecting mentum; petals similar or smaller; labellum 3-lobed, movably articulated to the foot of the column; lateral lobes erect; middle lobe with longitudinal callosities; the scape arises apparently from the base of the pseudobulb, on the very young leafy axis, but lower down than the corresponding new growth; pollinia 4, seated on a broad, scale-like stipe.—Over 100 species, dispersed at various altitudes in Mex., Brazil and the W. Indies. About 15 species are offered by dealers in Amer. Many of these have small fls. and are of value only in collections. They are, however, easily grown, and blossom profusely. Among those given below, the large white-fld. *M. grandiflora* and *M. venusta,* and the white and purple *M. Sanderiana* are probably the best species. The distichous arrangement of the lvs. distinguishes this genus from Lycaste. For *M. Harrisoniæ* and *M. tetragona,* see *Lycaste.*



2336. Maxillaria grandiflòra. (× nearly ½)

Maxillarias are of easy culture, and can be grown under various methods of treatment with fair success. The best compost consists of clean peat fiber taken from the several species of Osmunda, and live sphagnum, both chopped rather fine and well mixed together. After the receptacle is half filled with clean drainage and the plant properly placed, the compost should be pressed firmly in around the roots, interspersing it with nodules of charcoal. In their native habitats, many of the fine-rooted species grow on rocks and trees with very little compost attached. The base of the pseudobulbs or rhizome should rest on a convex surface raised a little above the rim of the pot when finished. Maxillarias delight in a cool, moist, shaded location at all seasons; the winter temperature should not exceed 58° F. by night and not over 60° or 65° by day. During summer they must be grown as cool as possible with ventilation at all seasons when admissible, especially in wet heavy weather. Water should be given in abundance while the plants are growing and not too sparingly when at rest, as the plants are subject to spot if kept too dry. Weak liquid cow-manure is beneficial occasionally during root-action.—Maxillaria has two recognized horticultural groups or sections; viz., caulescent and stemless. The caulescent section embraces *M. tenuifolia*, *M. variabilis* and kindred species, having scandent rhizomes and often obscure flowers. These should all be grown under pot culture and afforded supports to climb on, such as small cylinders or rafts of open woodwork with a little compost worked in the openings, or osmunda rhizomes supported obliquely in the pots to which the plants can attach themselves as they grow upward, and thus be supplied with moisture for the young roots. To the stemless section belong those with clustered pseudobulbs, as *M. grandiflora*, *M. luteo-alba*, *M. picta*, *M. Sanderiana* and *M. venusta*. Some of the these have very showy flowers. Nearly all do best under pot culture. *M. Sanderiana* and others are exceptions, however, and grow best under basket culture, not too much compost and an airy position. Demand for maxillarias not being great, the market usually relies on new importations, but stock may also be increased by division between the pseudobulbs as the plants start new action. (Robt. M. Grey.)



2337. Maxillaria Sanderiana. (×½)

INDEX.

angustifolia, 12.
elegantula, 8.
fuscata, 6, 7.
grandiflora, 2.
Houtteana, 11.
Lehmannii, 3.
Lindeniæ, 5.
Lindeniana, 5.
luteo-alba, 9.
picta, 6.
rufescens, 7.
Sanderiana, 4.
striata, 10.
tenuifolia, 13.
variabilis, 12.
venusta, 1.

KEY TO THE SPECIES.

A. *Pseudobulbs clustered on the creeping rhizome.*
  B. *Fls. mostly white, large and showy.*
    C. *Sepals long-lanceolate*.......... 1. **venusta**
    CC. *Sepals broad, ovate, triangular or oblong.*
      D. *Middle lobe of the labellum tongue-like*................ 2. **grandiflora**
        3. **Lehmannii**
      DD. *Middle lobe of the labellum rounded*.................. 4. **Sanderiana**
        5. **Lindeniæ**
  BB. *Fls. yellow and brown.*
    C. *Sepals and petals nearly alike, oblong*...................... 6. **picta**
      7. **rufescens**
    CC. *Sepals and petals dissimilar, the latter smaller*................ 8. **elegantula**
      9. **luteo-alba**
      10. **striata**
AA. *Pseudobulbs more or less distant, on an ascending rhizome: lvs. grass-like: fls. small and numerous*.......... 11. **Houtteana**
  12. **variabilis**
  13. **tenuifolia**

1. **venùsta,** Lind. & Reichb. f. Pseudobulbs oblong, compressed, 2-lvd.: lvs. oblong-lanceolate, acuminate, plane, 1 ft. long: scapes 6 in. long, bearing a single glistening white fl. 6 in. across; sepals and petals long-lanceolate, acuminate, spreading; the lateral sepals wider, labellum much smaller; middle lobe triangular recurved, obtuse, yellow; lateral lobes very obtuse, bordered with red; disk with a rounded, hairy callus. Winter and spring. Colombia. B.M. 5296. G.C. III. 12:367 (abnormal).—A large-fld., showy species.

2. **grandiflòra,** Lindl. Fig. 2336. Pseudobulbs clustered, oval: lvs. erect, plane, keeled, ovate-oblong, 1 ft. long: scapes erect, 3–6 in. long, bearing solitary, large white fls. 3–4 in. across; sepals broadly ovate to oblong; petals ovate-acute, suberect, with recurved tips; labellum saccate, white, much-striped with purple on the sides; middle lobe tongue-like, white, bordered with yellow. Aug. Peru and Colombia. I.H. 17:14.—A very showy and beautiful plant.

3. **Léhmannii,** Reichb. f. Fl.-stalks nearly 1 ft. long, bearing white fls. nearly as large as those of *Lycaste Skinneri;* side lobes of the labellum light ocher outside and light reddish brown with chestnut veins inside; middle lobe triangular, wavy, sulfur-color. Ecuador.—Resembles *M. grandiflora,* but distinguished by the character of the lip.

4. **Sanderiàna,** Reichb. f. Fig. 2337. Pseudobulbs orbicular to broadly oblong, 1–1½ in. long: lvs. few, 6–10 in. long, oblanceolate, plane, keeled: scapes 2–3 in. long; fls. 4 in. across, pure white, with the bases of the segms. purplish red, broken upward into blotches; dorsal sepals oblong-obtuse, concave; lateral sepals triangular-ovate, forming a broad mentum at base; lateral lobes of the labellum almost obsolete, middle lobe rounded, crisp, bright yellow, throat dark purple, with a club-shaped callus. Ecuador. B.M. 7518. R.H. 1894:526. J.H. III. 26:495. G.M. 52:414. O. 1909; 26. A.G. 9:13 (adapted in Fig. 2337).—The finest known species.

5. **Líndeniæ,** Hort. (*M. Lindeniàna,* Rich. & Gal.?). Plants resembling *M. Sanderiana,* but the fls. larger and more open: sepals triangular-lanceolate, spreading, 3 in. long, pure white; petals shorter and wider, erect, white; labellum fleshy, obovate, somewhat crisp, recurved, pale yellow, with 5–6 red lines on the lateral lobes. S.H. 1:219.

6. **pícta,** Hook. (*M. fuscàta,* Klotzsch). Pseudobulbs 1½ in. high, ovate, furrowed, bearing 1–2 plane, strap-shaped lvs. 1 ft. long: scape 5–6 in. high; fls. nodding; sepals and petals oblong-linear, acute, incurved, deep

orange spotted with purple within, white with deep purple spots outside; labellum oblong, whitish, spotted; side lobes small, rounded; midlobe recurved, apiculate. Winter. Brazil, Colombia. B.M. 3154. B.R. 1802.—Handsome.

7. **rufèscens,** Lindl. (*M. fuscàta*, Reichb. f.). Pseudobulbs ovate, subtetragonal, 1-lvd.: lvs. lanceolate, acuminate: scape short, with 1 small fl.; sepals and petals oblong-obtuse, yellow-tinged and spotted with reddish orange; side lobes of labellum small, sharp; middle lobe elongate, sub-quadrate, emarginate; all yellow, spotted with crimson. Trinidad. B.R. 1848.—Not valuable.

8. **elegántula,** Rolfe. The bases of the segms. white, the outer halves pale yellow, marked with chocolate-color. Nov. G.C. III. 22:420.—From the illustration, the sepals are ovate-lanceolate, wavy and recurved, the lower pair broader; petals smaller, pointing forward, concave, wavy, with reflexed tips: lvs. lanceolate-acute.

9. **lùteo-álba,** Lindl. Pseudobulbs long-ovate, 1-lvd., 2½ in. high: lvs. broad, obtuse, narrowed at the base, 1 ft. long: scapes 6 in. long; sepals 3 in. long, ½in. wide, tawny yellow fading to white at the base, brown on the back, the lower pair drooping; petals erect, pointing forward, one-half as long, white to brown and yellow above; side lobes of the labellum yellow with purple streaks; middle lobe recurved, hairy, yellow, with white margins. Colombia. G.C. III. 43:165.—A robust species, which soon fills large-sized pans, making very ornamental plants.

10. **striàta,** Rolfe. Scapes 6–8 in. long, bearing solitary fls. 4–5 in. across the sepals; dorsal sepals ovate-oblong; lateral sepals ovate-attenuate, forming a broad mentum at the base, often twisted and recurved; petals narrower, wavy; both sepals and petals are yellow, striped with red-brown; lobes of the labellum crenate-wavy, white with purple veins, the lateral ones recurved. Aug. Peru. G.C. III. 20:631. G.M. 41:705.

11. **Houtteàna,** Reichb. f. Fig. 2338. Rhizome erect or ascending, clothed with brown sheaths: pseudobulbs 2–2½ in. long, linear-oblong, compressed: lvs. solitary, 6 in. long, linear, obtuse, keeled: scape 1½–2 in. long; fls. nearly 2 in. across; sepals ovate-lanceolate, dirty yellow outside, red-purple within, with a yellow margin and spotted below; petals smaller, colored like the sepals; labellum without lateral lobes, oblong-obtuse, yellow with red-brown spots, and an ill-defined callus on the base. April. Guatemala and Venezuela. B.M. 7533.—Fls. last about a month in the coolhouse.

12. **variábilis,** Batem. (*M. angustifòlia*, Hook.). Pseudobulbs oval, compressed: lvs. solitary, plane, linear-oblong, obtuse or emarginate: fls. solitary, small, deep purple; sepals linear-oblong, acute, the lateral ones produced at the base; petals subsimilar; labellum oblong, retuse, fleshy, membranous at the base; disk with a small callus. Midwinter. Mex. B.M. 3614 (as *M. Henchmanni*).—A small plant, of interest only to collectors.

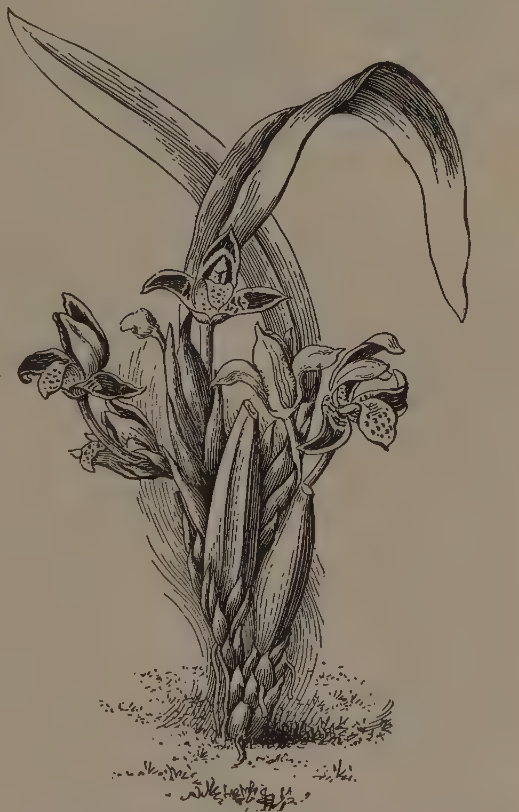
13. **tenuifòlia,** Lindl. Rhizomes erect, bearing ovate-compressed pseudobulbs at irregular intervals: lvs. linear-lanceolate, acute, recurved, grass-like, plane: fls small, spotted and shaded with purple and yellow; sepals ovate-lanceolate, margins revolute, reflexed; petals ovate, acute, erect; labellum oblong, reflexed, with an entire, oblong callus. Spring. Mex. B.R. 25:8.—Not valuable.

M. abbreviàta, Reichb. f. Fls. solitary, on long bracted peduncles, copper-colored. O. 1911:106.—*M. Binòtii*, De Wild. Peduncles solitary or geminate: fls. yellow; lip densely purple-dotted toward the middle. Brazil.—*M. dichròma*, Rolfe. Related to M. venusta, but the petals suffused on the lower half with light pinkish purple, the lip margined, with same color; sepals white.—*M. Fletcheriàna*, Rolfe. A new species intermediate between M. Sanderiana and M. grandiflora in the form and size of fl.: fls. large, cream-white, with purple lines; lip yellow. Peru.—*M. fractifléxa*, Reichb. f. Sepals yellow, bronzy-tinged, twisted; petals cream-colored, twisted and coiled, warty-margined; lip white, purple-marked. Ecuador. G.C. III. 31:359.—*M. funèrea*, Lindl. "Fls. with broad purple-brown sepals and petals, and a darker shining lip, having a broad crest." Brazil.—*M. Fuerstenbergiàna*, Schlecht. Fls. large, snow-white, front part of sepals orange-yellow; middle lobe of lip bordered with red. Peru. O. 1912:116, desc.—*M. Henniseàna*, Schlecht. Fls. yellowish white, fragrant. Colombia. O. 1912:117, desc.—*M. incarnàta*, offered by Lager & Hurrell, a trade name only.—*M. iridifòlia*, Reichb. f. Lvs. distichous, equitant, lanceolate, acuminate; sepals triangular; lip ligulate-pandurate. Colombia.—*M. Johniàna*, Kränzl. Scape 1-fld.; fls. widely expanded, white; sepals and petals deep lilac in upper half; lip yellowish, edged with lilac. Peru.—*M. phœnicánthera*, Rodrig. Fls. white or pale yellow, dotted with purple. Brazil.—*M. púlla*, Lind. & Reichb. f. Plant small: fls. straw-yellow, striped with red-brown. Colombia.—*M. pusílla*, Rolfe. Scapes solitary, short; sepals and petals brownish green; lip dark purple, shiny.—*M. scúrrilis*, Rolfe. Sepals and petals elongated, narrow, curved, dark-spotted, 5–6 in. long. G.C. III. 28:65; 32:243, 245.

Heinrich Hasselbring.
George V. Nash.†

MAXIMILIÀNA (after Maximilian Joseph, first king of Bavaria, 1756–1825, not Prince Maximilian Alexander Philipp, as said by some). *Palmàceæ*, tribe *Attáleæ*. Tall pinnate-leaved palms, spineless, with ringed trunks. Known also as *Englerophœnix;* see *Maximilianea*, below.

Leaves with linear pinnæ in groups, the midveins and transverse nerves prominent; rachis bifacial, strongly compressed; petiole plano-convex. This genus is distinguished from Attalea as follows: petals of the male fls. minute, much shorter than the 6 exserted stamens: fr. 1-seeded: pinnæ in groups instead of equidistant. From Cocos and Scheelia it differs in the above floral characters and in the plano-convex instead of concavo-convex petioles. Fr. yellow or brown, ovoid, with fibrous or fleshy pericarp and bony endocarp, the latter 3-pored at the base, acuminate at the apex.—Species 3, St. Kitts, Trinidad and S. Amer. For cult., see *Palms*.



2338. Maxillaria Houtteana. (×⅓)

A. *Pinnæ verticillate at least on some part of the rachis.*

Marìpa, Drude (*Attalèa Marìpa,* Mart. *Englerophœnix Marìpa,* Kuntze). St. thick, very tall: lvs. 15 ft. long; segms. sword-shaped, acute, divaricate, the lower 3 ft. long, 2 in. wide, gradually diminishing upward: spadix and spathe very woody, the fls. very large for a palm, frequently ¾in. long. Brazil.

2339. Maximiliana regia.

AA. *Pinnæ in opposite clusters.*

règia, Mart. (*Attalèa amygdálina,* HBK. *Englerophœnix règia,* Kuntze). Fig. 2339. St. 15–20 ft. high, 12–16 in. thick at the base, 3 times as thick above because of the persistent petiole bases: lvs. 15 ft. long; segms. more slender, papery, disposed in opposite clusters, the upper as broad as the lower: spadix about 12 in. long, the stalk stout: fls. showy and the fibrous fr. about 2 in. long. Brazil. G.C. III. 1: suppl. Feb. 12.

N. Taylor.†

MAXIMILIÀNEA. *Bixàceæ.* An unfortunate confusion has arisen in the application of this name. As *Maximiliana* (1824), it is accepted for a genus of palms (see above); under the slight variation *Maximilianea* (1819), it is adopted by Warburg in Engler & Prantl, III. 6:312, for the bixaceous genus usually known as Cochlospermum (Kunth, 1822). Different ways out of the difficulty have been suggested. One is to supplant the palm Maximiliana with a new name (Englerophœnix), and to hold Maximilianea in place of Cochlospermum. Another is to allow the palm name to stand, being well established, and for the bixaceous plants to fall back on Cochlospermum; this conforms better to usage and is the more practicable. (See Engler & Prantl, Nachtr. I. 56; O. Kuntze, Rev. Gen. Pl. I. 44.) Still another is to allow both the Maximilian genera to stand, seeing that they are differently spelled; but they are so near alike that conflict would result. Another alternative is to revise the name Wittelsbachia (1824) for Cochlospermum, seeing that the latter is antedated by the Cochlospermum of Lagasca (1818); but this way of escape need not concern us here. Cochlospermum is retained in the "nomina conservanda" of the Vienna Code. Recent authorities make the genus the type of the family *Cochlospermaceæ.*

Maximilianea, or Cochlospermum, comprises about 12–15 trees, shrubs and subshrubs in tropical and subtropical regions of both hemispheres, little known as horticultural subjects: lvs. alternate, digitate or palmately parted: fls. large and showy, yellow, pedicelled, in fascicles, racemes or panicles from the upper axils or terminal, perfect; sepals 5, unequal, imbricate; petals 5, large; stamens very many, free, with long anthers; ovary 1-celled, with 3–5 placentæ, the style undivided and slender: caps. 3–5-valved, with numerous seeds.

M. hibiscòdes, Kuntze, **Cochlospérmum hibiscoìdes,** HBK. (*C. serratifòlium,* DC.). Shrub: lvs. palmatifid into 7 long-acuminate sharply serrate lobes lighter colored on the under side, the basal lobes small: fls. very large and showy, yellow, with oval or obovate deeply notched petals; the numerous stamens incurved into a ball-like body in the center. S. Mex. to Colombia, W. Indies.—Offered in S. Calif. Hemsley's plate (Biol. Cent.-Amer.) shows a brilliant fl. 6 in. across.

M. Gossýpium, Kuntze, or **Cochlospérmum Gossýpium,** DC. (*Bómbax Gossýpium,* Linn.), is apparently not in the trade, although recorded in horticultural literature. India: a small unarmed tree: lvs. palmately 3–5-lobed, with slender petiole, acute lobes, tomentose beneath: fls. 4–5 in. diam., golden yellow, in few-fld. terminal panicles; petals obovate, notched: caps. 2–3 in. long.

L. H. B.

MAXIMOWÍCZIA: *Schizandra.*

MAY APPLE: *Podophyllum;* also *Passiflora.*

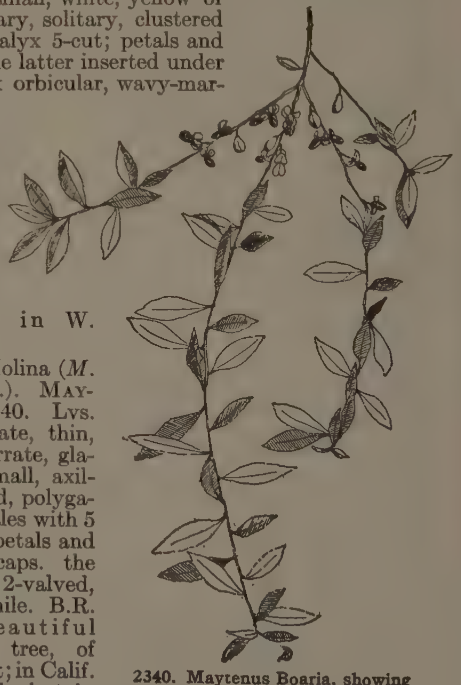
MAYBERRY, JAPANESE GOLDEN: *Rubus palmatus.*

MAYFLOWER of English literature is the same as the hawthorn, *Cratægus Oxyacantha;* of New England is *Epigæa repens;* of the more western states, *Hepatica.*

MAYTÈNUS (from a Chilean name). *Celastràceæ.* Trees and shrubs in tropical and temperate America, one of which is cultivated.

Botanically they are near the common bittersweet, *Celastrus scandens.* Aside from habit, Maytenus differs from Celastrus in having the ovary confluent with the disk instead of free, and the cells are mostly 1-ovuled instead of 2-ovuled. It consists of evergreen, unarmed plants: lvs. alternate, often 2-ranked, stalked, leathery, serrate: fls. small, white, yellow or reddish, axillary, solitary, clustered or cymose; calyx 5-cut; petals and stamens 5, the latter inserted under the disk; disk orbicular, wavy-margined; style none or columnar: caps. leathery, loculicidally 2–3-valved.—Species 70 or more, S. Amer., tropical and temperate, and in W. Indies.

Boària, Molina (*M. chilénsis,* DC.). Mayten. Fig. 2340. Lvs. ovate-lanceolate, thin, glandular-serrate, glabrous: fls. small, axillary, clustered, polygamous, the males with 5 calyx-teeth, petals and stamens: caps. the size of a pea, 2-valved, 2-seeded. Chile. B.R. 1702.—A beautiful evergreen tree, of graceful habit; in Calif. 15–25 ft. high, but in



2340. Maytenus Boaria, showing the dehiscing fruit.

Chile said to attain 100 ft.: branchlets pendulous: lvs. small: fls. minute, greenish, inconspicuous; aril scarlet. Perfectly hardy in Calif. as far north as San Francisco, and highly valued for ornamental planting; recommended as a street and avenue tree: timber extremely hard. Prop. readily from seeds, which are produced in abundance, or from suckers. J. Burtt Davy.

MAY-WEED: *Anthemis Cotula.*

MÀZUS (from the *teats* or tubercles in the mouth of the corolla). *Scrophulariàceæ.* A half-dozen low annuals or perennials, seldom grown in rock-gardens and similar places in mild climates. Allied to Mimulus, from which it differs in usually having the fls. in subsecund racemes rather than axillary or ordinarily racemed, trailing habit and technical floral characters: lvs. opposite or rosulate, or alternate above, variously toothed or cut: fls. small, bluish or white; corolla-tube short, the upper lip erect and 2-lobed, the throat with 2 projecting protuberances; stamens 4, didynamous; style slender, with 2-lamellate stigma.—Mostly prostrate, creeping or runner-bearing herbs in India, Malay Archipelago, China, Austral., New Zeal.

M. pumílio, R. Br. Small perennial, creeping underground and sending up short close-leafy branches: lvs. tufted, obovate-spatulate, obtuse, entire or somewhat sinuate-toothed: peduncles 1–6 fld., usually exceeding lvs., the fls. bluish or white with yellow center. Austral., New Zeal. Listed as an "alpine."—*M. radìcans*, Cheesem. (Mimulus radicans, Hook. f.). Very low, the erect leafy branches rising 1–3 in. from creeping or subterranean sts.: lvs. close, 2 in. or less long, obovate to linear-obovate, obtuse, entire or obscurely sinuate: fls. 1–3 on terminal peduncles, ½–¾in. long, white with yellow center, the tube much exceeding the calyx. New Zeal.—*M. réptans*, N.E. Br. Tufted perennial, 1–2 in. high, the sts. slender, prostrate and rooting at the nodes: lvs. opposite, lanceolate to elliptic, few-toothed: racemes 2–5-fld., erect; fls. purplish blue with lower lip blotched white, yellow and red-purple: plant somewhat resembling some of the small lobelias. Himalaya. B. M. 8554. G.C. III. 53:210 (as M. rugosus).—*M. rugòsus*, Lour. Annual, without runners: radical lvs. obovate-spatulate, crenate-dentate: peduncles many from the root, 2–10 in. long; fls. blue. India.

MEADOW BEAUTY: *Rhexia.* **M. Foxtail:** *Alopecurus pratensis* (a meadow grass). **M. Pink:** *Dianthus deltoides.* **M. Rue:** *Thalictrum.* **M. Saffron:** *Colchicum.* **M. Sweet:** *Filipendula.* **M. Tulip:** *Calochortus.*

MECONÓPSIS (Greek, *poppy-like*). *Papaveràceæ.* Poppy-like herbs, annual and perennial, useful as garden flower plants.

Simple or rarely much-branched plants with yellow juice, annual or biennial (monocarpic: seeding but once) or perennial, with showy large yellow, reddish or blue fls. in cymose racemes or panicles or borne singly: lvs. stalked when radical, short-stalked or sessile when cauline, entire, lobed, or dissected: sepals 2, usually deciduous; petals 4, varying to 5–10; stamens many; stigmas forming a globular mass or body on the several- to many-carpelled ovary: caps. oblong to clavate or even cylindrical, 1-celled with 4 or more projecting placentæ, opening by short teeth or valves at the summit.—Species 28 as defined by Fedde (Das Pflanzenreich, hft. 40. 1909), in the northern extra-tropical regions, mostly in Asia, 2 in W. N. Amer.; other species have been described subsequently. In 1906, Prain admitted 27 species (Ann. Bot. XX, pp. 323–365).

The species of Meconopsis have recently come into much prominence, mostly as herbaceous perennial subjects for borders and rock-gardens. Heretofore these plants have been known mostly by *M. cambrica* and *M. heterophylla*, but within ten or twelve years many attractive species have been introduced from the high elevations in the China-Thibet region. It is probable that the genus will have a great extension of popularity among gardeners. Hybrids already have appeared. Coming from high altitudes, they may be treated as hardy plants. They propagate readily from seed sown directly in the open in spring, or they may be started under glass and transplanted. The annual-biennial species may be carried as seedlings in pots the first summer and planted out in autumn if it is desired to bloom them the second year. They require partial shade. The Chinese and Himalayan species are essentially alpines, and it is probable that they would not withstand the American summers without very special treatment. Their availability here is yet to be determined.

INDEX.

aculeata, 5.
bella, 13.
cambrica, 1.
chelidonifolia, 2.
crassifolia, 3.
Delavayi, 14.
flore-pleno, 1.
grandis, 16.
Henrici, 15.
heterophylla, 3.
integrifolia, 9.
latifolia, 6.
pseudointegrifolia, 10.
punicea, 11.
racemosa, 8.
rudis, 7.
simplicifolia, 12.
sinuata, 6.
Wallichiana, 4.
Wallichii, 4.

A. *Sts. branching: st.-lvs. pinnate or pinnately parted*

B. *Fls. yellow.*

1. **cámbrica**, Vig. (*Papàver cámbricum*, Linn.). Welsh Poppy. Perennial, forming large tufts with thick roots: sts. slender, about 1 ft. high: lvs. long-stalked, pale green, slightly hairy, pinnate, dentate, with 5–7 segms. which are ovate or lanceolate and toothed or pinnately lobed: fls. rather large, long-peduncled, pale yellow: caps. oblong or ovate, glabrous, containing reniform-oval blackish seeds: fls. standing well above the mass of attractive foliage. Rocky woods and shady places. W. Eu. G.C. III. 19:671; 54:52. Var. **flòre-plèno**, Hort., is a double-fld. form. It is described as a very showy and worthy plant, with the very double yellow fls. striped scarlet. G.M. 46:373.

2. **chelidonifòlia**, Dur. & Franch. Perennial, rhizomatous, glaucous, 2 ft., the st. branching and leafy and glabrous above, at first erect but becoming prostrate: lvs. mostly basal, glaucous beneath, setulose, ovate-deltoid or ovate-oblong, pinnately parted, the segms. ovate and cut with the terminal part 3-lobed: fls. on slender axillary wiry peduncles twice exceeding lvs., clear yellow: caps. ovate, glabrous, small. Cent. Asia to W. China.

BB. *Fls. red.*

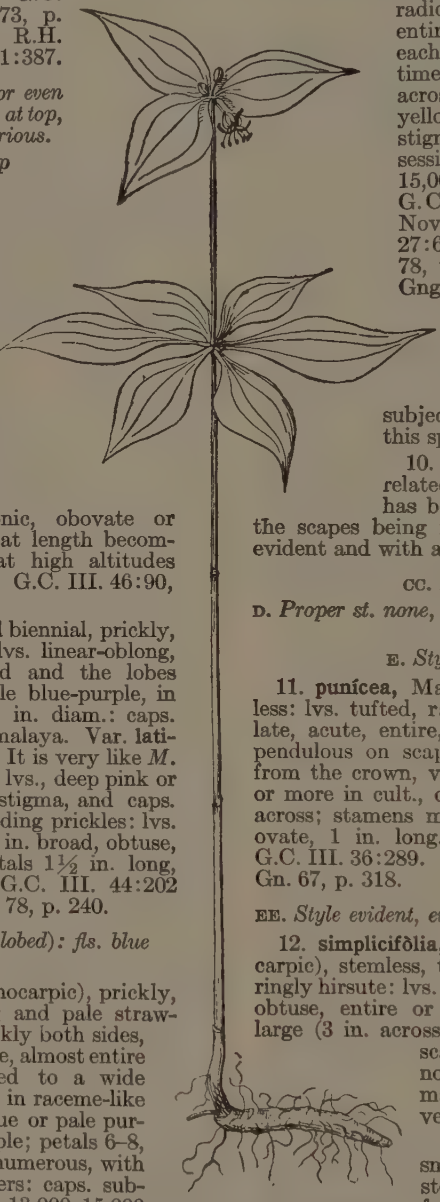
3. **heterophýlla**, Benth. (*Papàver heterophýllum*, Greene). Wind Poppy. Flaming Poppy. Fig. 2341. Annual, glabrous, 1–2 ft.: lvs. pinnate or pinnately cut, the segms. diverse on the same plant and varying from oval and entire or lobed to narrow-linear: fls. brick-red with darker center, satiny texture; petals broadly cuneate-obovate. Calif., Nev., Ore. G.C. III. 29:413; 55:19.—An attractive plant. Var. **crassifòlia**, Jepson (*M. crassifòlia*, Benth.). Blood Drops. Rather smaller and more branching and bearing more fls.: lvs. mostly radical, smaller and thicker. Calif.

2341. Meconopsis heterophylla. (×½)

BBB. *Fls. blue.*

4. **Wállichii**, Hook. (*M. Wallichiàna*, Hort.). Satin Poppy. Tall, 3–6 ft., somewhat glaucous, making a

mound of beautiful cut foliage with rusty hairs, the sts. slender, erect, paniculate: lvs. at base stalked and pinnately parted, the lobes ovate-oblong and sinuate; st.-lvs. sessile, oblong, pinnatifid: fls. satiny, pale blue, with crinkled round-obcordate petals; stamens very many with oblong orange anthers: caps. oblong-elliptic. Mountains (9,000–10,000 ft.), Cent. Asia to W. China. B.M. 4668. F.S. 8:753. G.C. III. 53:147. Gn. 71, p. 626; 73, p. 434; 77, p. 348. G.M. 57:637. R.H. 1912:204. J.F. 3:315. G. 7:449; 31:387.



2342. Medeola virginiana—the Indian cucumber-root. (×½)

AA. *Sts. scape-like and simple (or even none), bearing 1 to many fls. at top, more or less leafy: st.-lvs. various.*

B. *Plant with spines or rigid sharp prickles or hairs.*

C. *Lvs. distinctly lobed: fls. blue or purple.*

5. **aculeàta,** Royle. Probably perennial, somewhat glaucous, sparsely hispid-aculeate (with short scattered prickles), 1–2 ft., leafy: lvs. remotely irregularly pinnatifid, oblong or lanceolate in outline, segms. broad and variously lobed and obtuse or acute, mostly prickly: fls. slender-pedicelled, 2–3 in. across, blue-purple; petals broadly obovate or obcuneate-rotundate: caps. broadly obconic, obovate or oblong, prickly and bristly and at length becoming glabrous. W. Himalaya, at high altitudes (10,000–15,000 ft.). B.M. 5456. G.C. III. 46:90, 91. Gn. 65, p. 384; 75, p. 226.

6. **sinuàta,** Prain. Annual and biennial, prickly, 1–2 ft. or more, the st. leafy: lvs. linear-oblong, obtuse, irregularly sinuate-lobed and the lobes entire, sparsely prickly: fls. pale blue-purple, in few-fld. raceme-like cymes, 2–3 in. diam.: caps. narrow, sparsely prickly. E. Himalaya. Var. **latifòlia,** Prain, is the form in cult. It is very like *M. aculeata*, but differs in less-lobed lvs., deep pink or orange rather than pale green stigma, and caps. longer. plant 1–4 ft., with spreading prickles: lvs. oblong, about 6 in. long and to 2 in. broad, obtuse, irregularly lobed or sinuate: petals 1½ in. long, blue. Himalaya. B.M. 8223. G.C. III. 44:202 (as *M. sinuata*). Gn. 76, p. 316; 78, p. 240.

CC. *Lvs. nearly entire (or not lobed): fls. blue or purple.*

7. **rùdis,** Prain. Annual (monocarpic), prickly, 1½–3 ft., the spines spreading and pale straw-color, rhizome fusiform: lvs. prickly both sides, oblong-lanceolate, obtuse or acute, almost entire or sparingly toothed, narrowed to a wide petiole, glaucescent beneath: fls. in raceme-like cymes, 2½ in. across, bright blue or pale purple, sometimes flushed with purple; petals 6–8, ovate-oblong, obtuse; stamens numerous, with blue filaments and yellow anthers: caps. subglobose or oblong. S. W. China, 13,000–15,000 ft. B.M. 8568.

8. **racemòsa,** Maxim. Very like *M. aculeata*, but with entire lvs.: perennial or biennial with thick elongated root, with yellow prickles, sts. erect or ascending, leafy below, 1–2½ ft.: lvs. glaucous, more or less prickly, the basal ones linear-lanceolate or lanceolate, entire or obscurely sinuate, the st.-lvs. contracted into short winged petiole: fls. deep purple to pale lilac, in long racemose cymes; petals 6 (5–8), obovate, spreading, nearly 1 in. long: caps. with small appressed setæ. Cent. Asia to China, 14,000–15,000 ft. altitude. G.C. III. 42:31; 46:92. G. 34:161. Gn. 68, p. 384; 75, p. 510.—Offered abroad.

BB. *Plant not spiny or prickly, glabrous or only setulose.*

C. *Fls. yellow.*

9. **integrifòlia,** Franch. (*Cathcártia integrifòlia*, Maxim.). YELLOW CHINESE POPPY. Biennial, usually reddish hairy, 1½–3 ft.: lvs. mostly radical, linear-lanceolate, to 8 in. long, entire: fls. on scape-like sts., many on each plant and a half-dozen open at same time, cup-shaped, very large (4–8 in. across), bright sulfur-yellow or primrose-yellow; petals 5–10, broadly obovate; stigmas very many, large and nearly sessile; style wanting. W. China, Thibet, 15,000 and more ft. altitude. B.M. 8027. G.C. III. 36:240; 46:146; 50: suppl. Nov. 11. G.W. 9:534. G.M. 48:287. G. 27:633; 37:8. Gn. 67, p. 286; 73, p. 299; 78, p. 217. G.L. 20:114. F.S.R. 3:80. Gng. 13:279. A.F. 24:781. (Some of these references may apply to No. 10).—A remarkable and showy plant, intro. to cult. something more than 10 years ago from the explorations of E. H. Wilson. A good garden subject. A hybrid is announced between this species and *M. grandis*.

10. **pseudointegrifòlia,** Prain. Closely related to *M. integrifolia*, with which it has been confused in cult.: differs in all the scapes being radical, simple and 1-fld., the style evident and with a narrower stigma. S. W. Thibet.

CC. *Fls. purple or reddish.*

D. *Proper st. none, the fls. borne singly (sometimes twin) on radical scapes.*

E. *Style none; fls. pink-red.*

11. **punícea,** Maxim. Annual (monocarpic), stemless: lvs. tufted, radical, sparsely hairy, ovate-lanceolate, acute, entire, tapering to petiole: fls. large and pendulous on scapes 16–20 in. high, arising directly from the crown, very dark pink and showy; petals 4, or more in cult., ovate-oblong, 4 in. long and 2¼ in. across; stamens many, the filaments flattened: caps. ovate, 1 in. long. W. China, Thibet. B.M. 8119. G.C. III. 36:289. G.M. 48:315. G.W. 10, p. 273. Gn. 67, p. 318.

EE. *Style evident, even though short; fls. blue and purple.*

12. **simplicifòlia,** Don. Annual or biennial (monocarpic), stemless, the foliage radical and tufted, sparingly hirsute: lvs. ovate-lanceolate, acute or somewhat obtuse, entire or toothed, narrowed to petiole: fls. large (3 in. across) and showy, clear blue, on hirsute scapes 12–18 in. high, inclined but not nodding; petals 6–8, ovate; stamens many, with narrow filaments: caps. very narrow. Himalaya. B.M. 8364.

13. **bélla,** Prain. Perennial, very small, the radical lvs. only 2–4 in. long; stemless, the rootstock stout and fusiform: lvs. pinnatisect, the segms, small, ovate-oblong: fls. many, on simple 1-fld. scapes 3 in. or less long, pale blue; petals 4 or 5, broadly ovate, 1¾ in. long and 1½ in. across; stamens numerous, the filaments blue: caps. ¾in. long, pyriform. Himalaya; local. B.M. 8130. G.C. III. 40:197.

14. **Delavàyi,** Franch. Annual (monocarpic), 5–9 in. tall, with long thick and fleshy roots: lvs. all radical, glaucous, lanceolate, attenuate or cordate at base, glabrous above and with sparse colored hairs beneath. fls. solitary on the scapes, half-pendulous, 1½–2 in.

across, deep satiny purple-blue; petals 4 or 5, ovate, obovate or oblong; filaments colored same as petals, anthers orange: caps. 2–3 in. long, on an elongating scape. Yunnan, 11,000–14,000 ft. G.C. III. 50:51. Gn. 77, p. 274.

15. **Hénrici,** Bur. & Franch. Annual or biennial (monocarpic), more or less hairy or sometimes glabrous, low (about 6 in.), the st. very short or practically none, the scapes numerous and 1- or 2-fld.: lvs. linear-oblong or lanceolate, obtuse, entire, attenuate below: fls. large, deep purple-violet, about 3 in. across; petals 6–8; obovate, clawed, spreading; stamens very many, short, the anthers ovate, orange; style slender, exceeding the ovary. W. China.

DD. *Proper st. evident, the flowering branches or peduncles not arising from the base.*

16. **grándis,** Prain. Perennial, 3 ft., pubescent: basal lvs. numerous, somewhat rosulate, ovate-lanceolate, entire or coarsely toothed, the cauline similar and short-stalked or sessile: st. scape-like with fascicled lvs. toward top: fls. 3–5 in. diam., in 3's in umbel-like cymes, brown-purple; petals 6–9; stamens numerous; style short but distinct. Himalaya. G.C. III. 37:369.

M. discígera, Prain. Probably perennial, with golden brown spreading hairs: lvs. in a basal tuft, spatulate, subacute, sparingly toothed, sometimes lobed toward the apex, green above, glaucous beneath: st. scape-like, simple, 1 ft. high: fls. racemose, the petals and sepals not described: caps. bearing a lobed disk. Himalaya.—*M. Fórrestii*, Prain. Allied to M. lancifolia: st. simple: lvs. few, lanceolate or narrow-subspatulate, obtuse or acutish, entire: fls. 3–5, in raceme-like cymes, pale blue; petals oblong. Yunnan.—*M. lancifòlia*, Franch. Annual or biennial, much like M. Henrici, but the deep violet fls. in raceme-like cymes: lvs. narrow-lanceolate or linear-lanceolate, entire or slightly repand; petals broadly obovate: caps. narrow-obconic. China.—*M. nepaulénsis*, Hort. What the cult. plant passing under this name (variously spelled) may be is uncertain. *M. napaulénsis* D.C., is allied to M. Wallichii, but with brownish purple larger fls., and sparsely long-pilose herbage. *M. nipalénsis*, Hook. f., is M. robusta. B.M. 5585. *M. nepalénsis*, Lem., is a form of M. paniculata; and *M. napaulénsis*, Walp., belongs to the same species.—*M. Oliveriàna*, Franch. & Prain. Perennial: st. erect, much branched, 2–3 ft.: lvs. numerous, ovate-oblong, pinnately parted: fls. solitary or twin, probably purple, the petals rounded and nearly 1 in. diam. W. China.—*M. paniculàta*, Prain. Tall perennial, soft-hairy: st. simple or seldom somewhat branched, bearing yellow fls. in lax raceme-like cymes: lvs. linear-lanceolate or oblong, sinuate lobed, coarsely toothed, or rarely pinnatifid: petals entire. Himalaya.—*M. primúlina*, Prain. Annual or biennial, glabrous or sparsely strigose: st. short: lvs. spatulate to linear-oblong, entire: scape nearly radical, 1-fld.; fls. violet-purple, the petals 6–8, the inner ones narrower. Himalaya.—*M. robústa*, Hook. f. & Thoms. Tall annual or biennial, glaucescent, much branched: basal lvs. pinnately parted: fls. racemose or paniculate, sulfur-yellow. Himalaya.—*M. supérba*, King. Annual or biennial, tall and stout: basal lvs. sinuate-lobed: st. simple, bearing white fls. in simple raceme-like cymes. Himalaya.

L. H. B.

MEDÈOLA (named after the sorceress Medea, for supposed medicinal virtues). *Liliàceæ.* Indian Cucumber-Root, from the taste of the edible root. One species, a native perennial herb with 2 whorls of lvs. and small not showy fls. It is offered by some dealers in native plants. Medeola is allied to Trillium, although not suggestive of it in looks. The fls. are umbellate in the upper whorl of lvs., the perianth-segms. all alike, colored and deciduous, stamens 6: fr. a dark, purple few-seeded berry. The *Medeola asparagoides*, Linn., of the older literature, is *Asparagus asparagoides.*

virginiàna, Linn. Fig. 2342. St. slender, 1–3 ft. high, clothed with flocculent deciduous wool, from a short horizontal rootstock: lower whorl of lvs. 5–9, obovate-lanceolate, pointed, netted-veiny, lightly parallel-ribbed; upper whorl of 3–5, smaller, ovate lvs. at top subtending a sessile umbel of small recurved fls. June. Boggy soil, Nova Scotia to Minn., Ind. and southward. B.M. 1316.

L. H. B.

MEDICÀGO (name originally from the country Media). *Leguminòsæ.* Medick. Forage plants, and a few grown for ornament.

Herbs or rarely shrubs, with small pinnately 3-foliolate lvs. and denticulate lfts., and mostly small, purple or yellow fls. in heads or short racemes: stamens 9 and 1, diadelphous: fr. a small spiral or curved, rough or pubescent indehiscent 1- to few-seeded pod: fl. with an obovate or oblong standard and obtuse mostly short keel.—Species probably 50 in Eu., Asia, Afr. Four or 5 species have become weeds in N. Amer. A few are somewhat cult. for ornament. The one important species, from an agricultural point of view, is alfalfa. One species (and perhaps more) is cult. for the odd pods, which are sometimes used by Old World gardeners as surprises or jokes, and are occasionally grown in this country as oddities. See also *Scorpiurus.* Some of the medicagoes simulate clovers in appearance, but the twisted or spiral pods distinguish them. Aside from the following, 2 or 3 species have been used more or less in this country for forage, as *M. hispida*, Willd., and *M. arabica*, Huds., both yellow-fld. annuals. *M. orbicularis*, All., of S. Eu., a very small-fld., yellow annual species with large smooth pods, may be valuable for forage.

2343. Medicago sativa—alfalfa. (×½)

A. *Fls. purple.*

satìva, Linn. Alfalfa. Lucerne. Fig. 2343. Perennial, glabrous, growing erect 1–3 ft. and making a long taproot: lfts. small, linear, oblong to ovate-oblong, prominently toothed toward the top: stipules awl-like, conspicuous, entire: fls. in short, axillary racemes: pods slightly pubescent, with 2 or 3 spirals. Eu.—Now widely cult. as a hay and pasture plant, being to the W. what red clover is to the N. E.; also important eastward. See *Alfalfa*, and books on forage plants.

AA. *Fls. yellow.*

B. *Plant annual and herbaceous.*

lupulìna, Linn. Black or Hop Medick. Nonesuch. Yellow Trefoil. Diffuse, the branches often rooting and becoming 2–3 ft. long, deep-rooted, and difficult to pull up: plant glabrous or slightly pubescent: lfts. oval to orbicular, toothed: stipules broad and toothed: fls. small, light yellow, in pedunculate heads: fr. nearly glabrous, spiral, becoming black. Eu.—Extensively naturalized. It has the appearance of a clover. The yellow clovers with which it is likely to be confounded have larger heads, which soon become dry and papery, and the stipules are entire. It is sometimes used as a forage or hay plant. Of no ornamental value.

prostràta, Jacq. St. prostrate: lfts. linear, dentate at the apex: stipules linear-subulate: pod glabrous, spirally contorted, 2-seeded, black. S. Eu.—Advertised as an ornamental plant. *M. élegans*, a name for a low yellow-fld. plant, may be any one of 4 or 5 species.

scutellàta, Mill. Snails. Erect or spreading, soft-pubescent: lfts. broadly obovate or the upper ones broadly oblong, prominently toothed: stipules falcate, toothed at the base: fls. small, solitary or nearly so: pod large and prominently reticulated, ½in. across, like a snail-shell. Eu.—Grown for the odd snail-like pods, which are used as surprises. See *Caterpillars.* Probably useful also for forage.

BB. *Plant perennial and woody.*

arbòrea, Linn. Tree Alfalfa. Moon Trefoil. Two to 8 ft. tall, with hard black wood: lfts. oval to obovate, light green, toothed at the top: stipules linear-acute, entire: fls. orange-yellow, in rather loose, axillary,

peduncled clusters: pod spiral, 2–3-seeded. S. Eu. L.B. C. 14:1379.—Offered as an ornamental plant in S. Calif.
L. H. B.

MEDINÍLLA (after José de Medinilla y Pineda, governor of the Ladrones). *Melastomàceæ.* Choice warmhouse plants with showy flowers and often with showy bracts and foliage.

Medinilla is distinguished from allied genera (none of which has garden value) chiefly by the curious appendages of the stamens. The stamens are 8, 10 or 12 (twice as many as the petals), the anterior connective 2-lobed or 2-spurred, the posterior one usually setose or 1–2-lobed or 1-spurred: branching shrubs, erect or climbing: lvs. mostly opposite or whorled, entire, often fleshy: fls. white or rose, with or without bracts, in panicles or cymes: fr. a berry crowned by the calyx-limb.—Species 125 and more, in tropical parts of E. Asia, Afr., and the Pacific region, many of them in the Philippines. Those prominently described below have opposite lvs. and mostly 5-merous fls.

Medinillas are amongst the handsomest and most striking of flowering plants, and being of free growth should be given a place in all tropical collections. To succeed with them, a position affording all the light possible should be given them. However, they will not stand strong sunshine, and it is advisable that they be shaded with cheese-cloth the greater part of the year. If they are grown under a heavy shade, they are not inclined to flower well. Cuttings of half-ripened wood, taken in spring, is the best means of propagation. These may be potted singly, in suitable pots, in a mixture of finely sifted peat and sand, with a little powdered charcoal added. Place them in a tight case, and keep fairly moist, care being taken that the air does not become stagnant. The night temperature should not be less than 70°. The cuttings will be rooted in about a month, when they may gradually be given more air and finally transferred to a position in the tropical house. In the earlier stages of growth, the points of the shoots may be stopped by pinching to encourage breaks. Later on they will branch freely of themselves. A good fibrous loam with a third of sharp sand, adding a little charcoal about the size of beans, is the best potting material. Pot moderately firm, as this tends to make a shorter-jointed growth and firmer wood, which is indispensable for success in flowering. Three inches of a shift may be given each time they are potted, as they root freely, but strict attention must be given to drainage, as they require plenty of water during their growing season. A night temperature of not less than 68° is necessary while they are in active growth. Syringe freely on all bright days, especially the under side of the foliage, as red-spider is likely to get a foothold. As autumn approaches, gradually lower the temperature to 60° by night, and gradually withhold water, giving just enough to keep the leaves plump. This ripens the wood for flowering. While the flowers are forming, as dry an atmosphere as possible should be maintained. After flowering, the plants may be pruned into shape, and any repotting done that is necessary. Medinillas may be retained in the same-sized pot for years, after they have attained the desired size, by shaking out a portion of the old soil each year, when repotting, and feeding liberally during the growing period with manure water. *M. magnifica* is the handsomest form, but *M. Teysmannii* (*M. amabilis*) is also a fine variety, the panicles being erect instead of pendulous, which is the habit of the former. *M. Curtisii* is quite distinct from the above. It grows well in a greenhouse temperature of 50° to 55° and begins to flower in the fall, lasting through the winter. The leaves are much smaller than in the above two species. It makes an excellent bush plant and should be better known. Mealy-bug and scale are liable to attack the plants and they must be kept in check as soon as detected. (George F. Stewart.)

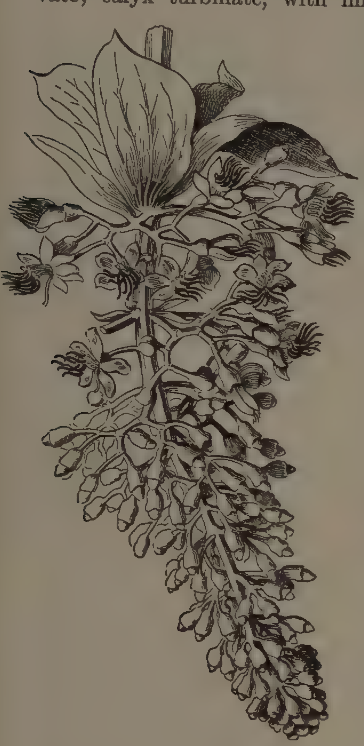
2344. Medinilla magnifica. A young specimen.

A. *Fls. coral-red or rosy pink.*

magnífica, Lindl. Figs. 2344, 2345. Evergreen shrub: lvs. with 9–13 nerves, which run from various points along the midrib to the margin or apex, ovate or ovate-oblong: bracts 1–4 in. long. Philippines. B.M. 4533. F.S. 6:572; 9:968 (splendid). Gn. 51, p 394. G.C. II. 2:421; III. 49:226. R.B. 33, p. 72; 36, p. 54. G. 31:357. J.F. 1:56, 57; 3:298. G.W. 1, p. 6; 10, p. 431. R.H. 1857, pp. 319, 343; 1896, pp. 102, 103. A.F. 7:1047.—Other interesting features are the whorled branches, each one 4-ridged or winged, and the dense ring of short fleshy processes at the joints between the lvs. It can be prop. by seeds or cuttings of young wood in heat. *M. magnifica* is one of the most gorgeous tropical plants in cult. It has handsome broad, shining, leathery foliage and coral-red 5-petaled fls., each about 1 in. across, which are borne in pendulous pyramidal panicles sometimes a foot long, and bearing 100–150 fls. The axis and branches of the panicle are pinkish, and the same color tinges the large showy bracts, which are sometimes 4 in. long. Hooker says: "Its most beautiful state is, perhaps, before the full perfection of the fls., when the large imbricated bracts begin to separate and allow the buds to be partially seen. As the expansion of the blossoms advances, the upper bracts fall off, but the lower ones remain and become reflexed." This remarkable plant flowers copiously when only 2 or 3 ft. high, and a large well-kept specimen in bloom is a worthy ambition of a gardener. The numerous long bent purple anthers, with their yellow filaments, form an additional feature of interest.

Téysmannii, Miq. (*M. amábilis,* Dyer). Exceeds *M. magnifica* in size of fls., but lacks the beautiful colored bracts: glabrous: sts. with 4 crisped or crenulate wings: lvs. very large (12 in. long and 6–8 in. wide), sessile, obovate-oblong or elliptic-oblong, acute and often concave, wavy-margined, 5-nerved: panicle pyramidal, erect, bracts none; fls. rose-colored, 1½–2 in. diam.; calyx truncate or obscurely lobed; stamens 10, upcurved, with pale violet anthers. Celebes, New Guinea. B.M. 6681. G.C. II. 1:373; 17:561.

javanénsis, Blume. Erect shrub or tree with smooth 4-sided branches: lvs. large, sessile, elliptic-ovate, 5-nerved, entire, acute, tinged red beneath: panicle small and compact, lateral and terminal, the bracts small and deciduous; fls. pale rose-color; petals obovate; calyx turbinate, with minute teeth; filaments white and anthers dark purple. Java. B.M. 4569. J.F. 1:96.



2345. Medinilla magnifica. (×⅓)

AA. *Fls. white.*

Cúrtisii, Hook. Shrub with slender drooping branches: lvs. with 2 nerves beside the midrib which run from the base to the apex of the lf., sessile, oblong or ovate-oblong, acuminate: bracts minute, at the base of the spreading branches: fls. ivory-white, with purple anthers, to ⅔in. across; calyx globose and fleshy, with a short limb, petals nearly orbicular. Sumatra. B.M. 6730. G.C. II. 20: 621. G.Z. 28, p. 194.

chionántha, Stapf. Glabrous shrub with terete gray-brown branches: lvs. lance-oblong, acuminate, narrowed into a very short decurrent petiole, 3-nerved: cymes axillary, somewhat umbellate, the bracts minute and acute; fls snow-white; petals broadly elliptic, obtuse, fleshy, ⅔in. long. Malay Peninsula.

There are many beautiful plants in this genus, but only a few of them are in cult. The following may be expected: *M. Sieboldiàna*, Planch. Lvs. oblong, fleshy, opposite, strongly 5-nerved: fls. white, ¾in. across, with purple stamens, in a drooping panicle. Moluccas. B. M. 4650. R. B. 36, p. 38.—*M. speciòsa*, Blume. Dichotomous or trichotomous, the branches 3- or 4-angled: lvs. mostly whorled, nearly sessile, oval or oval-oblong, 5- or 7-nerved: fls. rose in a dense terminal panicle. Java. B. M. 4321. F. S. 5:482.—*M. venòsa*, Blume. Branches terete: lvs. relatively small, short-petioled, oblong-acute, 7-nerved, rusty colored above, opposite: fls. rose-color, in few-fld. cymes; petals oblique-obovate, acute. Malaya. R. B. 36, p. 38.

WILHELM MILLER.
L. H. B.†

MEDLAR: *Mespilus.*

MEGACLÌNIUM (Greek, *large bed*, because of the ample rachis). *Orchidàceæ.* About 50 species of African epiphytic orchids, nearly all tropical, requiring the treatment given Bulbophyllum, which they resemble in habit but from which they are distinguished by having the bracts and fls. attached on either side a flattened rachis and the lateral sepals shorter than the curved free dorsal sepal: herbs with strong creeping rhizome, pseudobulbs usually globose or ovoid and bearing 1 or 2 lvs.: fls. small, yellowish, brownish, purple, variously spotted, on the almost leafy end of the scape that arises from the base of the pseudobulbs; petals smaller and narrower than the sepals; lip jointed to the foot of the column, mobile, entire, denticulate or 3-lobed; column short, winged on both sides: scape usually only a few inches high, sometimes 18 in.

M. bùfo, Lindl. (Bulbophyllum bufo, Reichb. f.). Rachis green, long-linear, 8–9 in. long and ½in. wide, bearing small brownish fls. with darker spots: lip dark purple, flat, the base ovate-orbicular. Sierra Leone. G. C. 1841:348.—*M. Clárkei*, Rolfe. Rachis light green in center and margined and spotted purple-brown, 6–7 in. long, falcate-ensiform, obscurely repand-crenulate: fls. purple-brown specked on green; lip recurved, the base ovate. W. Trop. Afr.—*M. ebúrneum*, Pfitz. Scape as long as lvs., and rachis as long as scape and irregularly dilated: fls. and rachis yellowish white; ends of petals and the dorsal sepal yellow. W. Afr.—*M. falcàtum*, Lindl. (Bulbophyllum falcatum, Reichb. f.). Rachis brown-green, linear-oblong and somewhat falcate, acute, thin-margined, 2–4 in. long: fls. dark brown-red on upper parts and greenish yellow on lower segms.; lip triangular oblong, obtuse. Guinea. B. R. 989.—*M. leucorhàchis*, Rolfe. Rachis white, ⅓in. broad and 3 in. long, falcate-ensiform, obscurely crenulate: fls. velvety yellow; lip recurved, the broad base fimbriate. Upper Guinea. B. M. 7811.—*M. lutéscens*, Rolfe. Scapes less than 2 in. long: rachis very narrow, 1¼ in. or less long: fls. honey-yellow, small and nearly sessile: resembles M. minutum, but the rachis much narrower and the dorsal sepal acuminate. W. Afr.—*M. máximum*, Lindl. Rachis purple, 4–5 in. long and ½in. wide, ensiform, undulate, the scapes 1–1¼ in. long with tubular sheaths: fls. purple; lip oblong, obtuse, the base broad and denticulate. Guinea. B. M. 5936 (as M. purpuratum).—*M. minùtum*, Rolfe. Very small, the scape only 1½ in. long, the rachis purple-brown, oblong, crenulate, bearing about a dozen blooms: fls. dull maroon and greenish yellow, fleshy; lip cordate-ovate, obtuse, reflexed at apex. Upper Guinea. B. M. 7314.—*M. platyrhàchis*, Rolfe. Rachis much dilated, 4–6 in. long and 1 in. broad, crenulate, greenish yellow, spotted white and brown, lengthening in bloom: fls. many, yellow-green; lip fleshy and tongue-shaped, recurved, the lateral lobes small. Cent. Afr. B. M. 7946.—*M. purpuràtum*, Lindl.=M. maximum.—*M. purpureorhàchis*, Wildm. Large, the scapes lateral and stout, 12–14 in. long: rachis broad and flat, undulate and slightly twisted, purple-spotted: fls. brown, velvety outside; lip orbicular-ovate, recurved and obtuse, flattened. Congo. B. M. 8273.—*M. scabérulum*, Rolfe. Rachis dull white, shaded green and marked purple: fls. dull purple, the sepals shaded whitish green at base. S. W. Extra-trop. Afr.—*M. ugándæ*, Rolfe. Scape about 5 in. long: rachis oblong, half length of scape, light green and heavily marked with purple-brown: fls. small, with light green petals and sepals similar in coloring to the rachis. Uganda.

L. H. B.

MEGARRHÌZA: *Echinocystis.*

MEGÁSEA: *Saxifraga.*

MEIBÒMIA: *Desmodium.*

MELALEÙCA (Greek, *melas*, black, and *leukos*, white; from the black trunk and white branches of one of the species). *Myrtàceæ.* Shrubs and trees, often with showy bloom, of high ornamental value for warm temperate regions; especially useful where drought-resistant shrubs are needed.

Leaves alternate, rarely opposite, entire, lanceolate or linear, flat or subterete, with 1–3 or many nerves: fls. in heads or spikes, rarely scattered, each sessile in the axil of a floral lf., their parts in 5's; calyx-tube subglobose; lobes imbricate or open; petals spreading, deciduous; stamens indefinite in number, more or less united at their bases into 5 bundles opposite the petals; anthers versatile, the cells parallel and bursting longitudinally; ovary inferior or half-inferior, inclosed in the calyx-tube, usually with many ovules in each cell; maturing into a persistent caps. Related to Callistemon but distinguished by the united filaments: shares with that genus the name of bottle-brush.—About 100 species of Australian shrubs and trees, some inhabiting salty ground and swamps, others occupying semi-arid slopes of the interior. Grown as specimen and lawn plants, the larger species also for street trees in Calif. and Fla.: *M. Leucadendron* and *M. ericifolia* are recommended for fixing muddy shores and for planting in alkaline soils. The timber is close-grained, hard, and durable. Sixteen species are described and figured in Univ. Calif. Pub. Bot. 4:27–34. For cult. see *Callistemon.*

INDEX.

alba, 8.
armillaris, 8.
Cajuputi, 6.
decussata, 5.
ericifolia, 11.
Huegelii, 10.
hypericifolia, 1.
incana, 14.
lateritia, 2.
latifolia, 6.
Leucadendron, 6.
linariifolia, 4.
minor, 6.
nesophila, 12.
nodosa, 13.
oppositifolia, 1.
parviflora, 9.
Preissiana, 9.
styphelioides, 7.
Wilsonii, 3.

A. *Infl. a cylindric spike (rarely head-like in Nos. 5 and 11), or fls. somewhat scattered.*

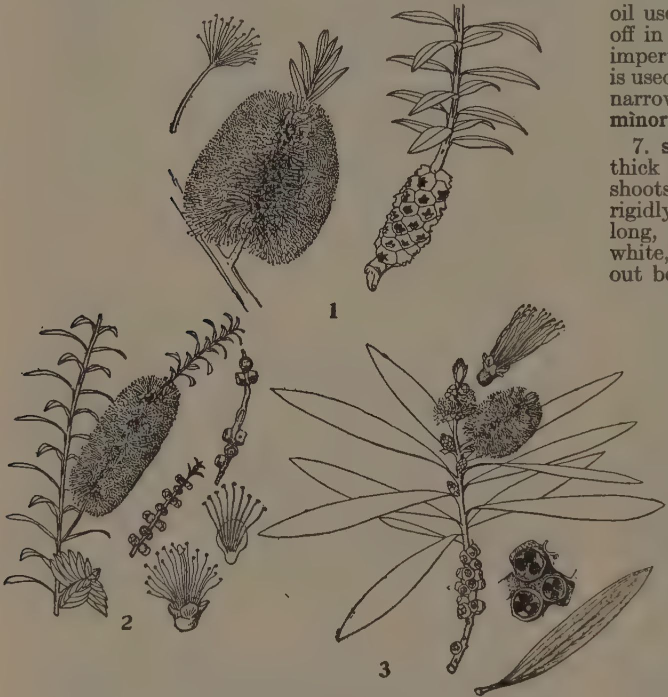
B. *Fls. red or scarlet.*

1. **hypericifòlia**, Smith (*M. oppositifòlia*, Hort.). Fig. 2346. Tall glabrous shrub: lvs. opposite, lanceolate or

oblong, ¾–1¾ in. long, with prominent midrib and dots beneath: fls. rich red, in spikes 2 in. long and about as wide, the axis growing out as a leafy shoot; stamens ¾–1 in. long, including the claw of about ½in.: fr. sessile by a broad base. May–Oct. L.B.C. 2:199.—One of the most popular, with pleasing foliage and gorgeous bloom.

2. **laterítia,** Otto. Graceful shrub with many slender branches, 6–12 ft.: lvs. alternate, linear, acute, ½–¾in. long, quite nerveless: fls. rich scarlet, in cylindric spikes about 2½ in. long and forming the base of leafy branches; stamens ¾in. long, the claw very short: fr. sessile.—Grown for its graceful habit and for the soft color of its fls.

3. **Wìlsonii,** F. Muell. Tall elegant shrub, glabrous or slightly pubescent: lvs. opposite, imbricate on twigs, linear, acute, ¼–½in. long: fls. red, scattered or in loose spikes; stamens ½in. long: fr. sessile. B.M. 6131.



2346. Melaleucas: *1,* M. hypericifolia; *2,* M. decussata; *3,* M. Leucadendron.

BB. *Fls. white, blue, lilac, or pink.*

C. *Lvs. mostly opposite.*

4. **linariifòlia,** Smith. Tall shrub or tree, pubescent only on young parts: lvs. rigid, broad-linear, acuminate, mostly 1–1¼ in. long, the midrib prominent beneath: fls. white, in pairs in spikes 1–1½ in. long, these at first terminal but the shoot soon continuing; stamens ½–¾in. long, the long claws emitting short filaments along their entire length: fr. narrow at base but sessile.

5. **decussàta,** R. Br. Fig. 2346. Spreading shrub, to 20 ft., bright green and glabrous: lvs. lanceolate to oblong, narrowed at base, ¼–½in. long, 1 line wide: fls. lilac, in cylindric spikes 1 in. or less long, the axis growing out as a leafy shoot, or the clusters globose and lateral or terminal when the fls. are sterile; stamens ¼in. long, very shortly united in bundles of 10–15: fr. broad at base, partly embedded in the thickened rachis. B.M. 2268. L.B.C. 13:1208.—Grown in large grounds, where the spreading branches and pendulous twigs may develop to best advantage.

CC. *Lvs. mostly alternate or spiral.*

D. *Length of lvs. mostly over ½in.*

6. **Leucadéndron,** Linn. (*M. Cajupùti,* Roxbg. *M. latifòlia,* Raeusch). Cajuput Tree. Punk Tree. Swamp Tea Tree. Fig. 2346. Large tree with thick spongy bark and pendulous branchlets (branches rigid and erect in small plants), either glabrous or the young shoots silky: lvs. elliptic or oblong, tapering to each end, 2–4 or 8 in. long, ½–¾in. wide, with 3–7 parallel nerves and numerous cross-veinlets: fls. creamy-white (varying to pink and purple in Austral.); the spikes 1½–4 in. long, 1 in. wide, the axis growing out only after flowering; stamens nearly ½in. long. June–Oct. G.M. 40:798. Bot. Cook's First Voy. 112. Maiden, For. Fl. N. S. W. 15.—This tree withstands salt-water, wind, drought, and slight frosts. The lvs. of certain forms yield the well-known green aromatic cajuput oil used in medicine. The bark is pale buff and peels off in many thin layers; it is very durable and almost impervious to water; it is valuable for packing frs. and is used for roofs and boats. A low, pyramidal form with narrow lvs. and silky fls. is sometimes listed as var. **mìnor,** Hort.

7. **styphelioìdes,** Smith. Becoming a tall tree, with thick spongy bark, glabrous except the silky young shoots and infl.: lvs. ovate, sessile by a broad base, rigidly acuminate, often somewhat twisted, ½–¾in. long, nearly ¼in. wide, many-nerved: fls. creamy white, in dense spikes 1 or 2 in. long, the axis growing out before flowering is over; stamens 4 lines long: fr. globose, crowned by the persistent calyx-teeth.—Grown at San Diego; a subject worthy of much wider use.

8. **armillàris,** Smith (*M. álba,* Hort.). Tall graceful shrub with slender leafy twigs, glabrous throughout: lvs. narrowly linear, ½–¾in. long, not 1 line wide, the tip very slender and usually curved: fls. white, in cylindric spikes often 2 in. or more long, the axis protruding and leafy before the buds open; stamens ¼in. long, the ribbon-like claw about equaling the distinct filaments: caps. with broad base partly embedded in the rachis. Bot. Cook's First Voy. 114.—The best of the white-fld. melaleucas, especially because of its slender drooping branchlets and absence of barren twigs. The knotted fr.-clusters, so objectionable in some species, are not evident in this.

DD. *Length of lvs. mostly ½in. or less.*

9. **parviflòra,** Lindl. (*M. Preissiàna,* Schau.). Tree or tall shrub, glabrous or the young parts pubescent: lvs. thick, rigid, lanceolate or broadly linear, very acute, about ½in. long, the nerves obscure: fls. white, in loose spikes 1 in. or less long: fr. globose, narrowed to the base. June–Oct.—*M. armillaris* and *M. ericifolia* are often erroneously labeled *M. Preissiana* in Calif. gardens and nurseries.

10. **Huègelii,** Endl. Erect rigid shrub, 6–15 ft., nearly glabrous: lvs. spirally arranged, appressed, overlapping, sessile, ovate, acute, ¼in. or less long, striate with 3–7 nerves: fls. white (or buds pink), in dense spikes 1–5 in. long by about ¾in. wide, the rachis growing out before the buds open; stamens 4 or 5 lines long, the conspicuous claw ending in 7–11 filaments: frs. globose, with broad base partly embedded in the rachis, crowded into a cylindric spike.—Interesting chiefly because of its oddity.

11. **ericifòlia,** Smith. Small tree, either glabrous or pubescent, the bark thick and soft: lvs. not rigid, usually recurved from the middle, narrowly linear or nearly cylindric, rather obtuse, about ½in. long: fls. yellowish white, the spikes ½–1 in. long and less than ½in. wide, the rachis soon growing out, or the sterile fls. in nearly globular terminal heads; stamens ¼in.

long, each claw bearing about 7 terminal filaments: fr. with broad base partly embedded in the rachis.—Resembles an arboreous heath. Used to a limited extent in Calif. as a lawn tree.

AA. *Infl. a terminal globose head, the rachis seldom growing out until after flowering.*

12. **nesóphila,** F. Muell. Glabrous shrub or tree, to 35 ft., with thick spongy bark exfoliating in broad strips: lvs. alternate, thick, obovate-oblong, obtuse but often mucronate, ½–1 in. long, about ¼in. wide, obscurely 1- or 3-nerved: fls. pink or rose-color, the heads 1 in. or more thick; stamen-claw short: frs. smooth, congested in knot-like masses. May–Sept.—A very rapidly growing species used for large shrubberies and (in S. Calif.) for shade above seats in parks. The persistent caps. are unsightly in small grounds.

13. **nodòsa,** Smith. Tall, nearly glabrous shrub: lvs. nearly awl-like, rigid, straight, ½–1 in. long: fls. pale yellow, in many small heads scarcely ½in. thick: frs. in small inconspicuous heads. Bot. Cook's First Voy. 115.

14. **incàna,** R. Br. Tall shrub, the young twigs, flowering branches, and young lvs. ashy-pubescent: lvs. alternate, rarely opposite, spreading, linear to lanceolate, acute, ¼–½in. long, mostly 1-nerved: fls. yellowish white, in dense ovoid or oblong spikes about ¾in. wide; stamens shortly united in bundles of 3–9: frs. in dense cylindric spikes ¾–1 in. long. B.R. 410.

M. fúlgens, R. Br. Stands next to M. lateritia in botanical characters but lvs. mostly opposite: fls. dark red; stamens 1 in. long, the ribbon-like claw splitting into numerous filaments. B.R. 103. R.H. 1895:232.—*M. genistifòlia*, Smith. Near M. lateritia: lvs. alternate, narrow-lanceolate, rigid, the upper finely striate: stamens about ¼in. long.—*M. micromèria*, Schau. Stands next to M. incana: lvs. minute, scale-like, densely clothing the st. Once grown at Santa Barbara.—*M. tenélla*, Benth. Near M. nodosa: lvs. scattered or in 3's, linear, ¼in. long: stamens about 2 lines long.

HARVEY MONROE HALL.

MELÁNTHIUM (Greek, *black flower;* from the color which the persistent perianth assumes on fading). *Liliàceæ.* Leafy perennial herbs 2–5 ft. high, with thick rootstocks: lvs. linear to oblanceolate, the lower ones sheathing: fls. greenish, white or cream-colored, borne in a large open terminal panicle; segms. of perianth 6, separate, clawed, biglandular; stamens adnate to segms.; styles 3, subulate: fr. a 3-celled caps.—Species 4, E. U. S.

virgínicum, Linn. BUNCH-FLOWER. St. rather stout, to 5 ft., leafy: lvs. linear, 1 ft. or less long: panicles 6–18 in. long; fls. 6–10 lines across, greenish yellow, double gland at top of claw. July. Marshy woodlands and meadows from New England to Fla. and Minn. to Texas. B.M. 985 (as *Helonias virginica*).—A showy and striking plant, good for bog-planting and colonizing. The other species appear not to have been offered in the trade.

L. H. B.

MELASPHÆRULA (a little black sphere; referring to the bulblets or the seeds). *Iridàceæ.* One species from the Cape of Good Hope, a small bulbous plant procurable from Dutch bulb-growers. It belongs to the Ixia tribe, in which the fls. are spicate, not fugitive, and never more than 1 to a spathe. It resembles Ixia in having a regular perianth and simple style-branches, but belongs to a different group of genera in which the stamens are 1-sided and arched. Perianth slit nearly to the ovary, the segms. oblong-lanceolate or lanceolate and very acuminate; stamens short, attached in base of perianth; style short and filiform: caps. 3-lobed, loculicidal. Treated as ixias in cult.

gramínea, Ker (*Gladìolus gramíneus*, Linn. f.). Corm globose, ½in. diam.: st. very slender, 1 ft. or more long: lvs. about 6 in a 2-ranked, basal rosette, linear, ½–1 ft. long: spikes few-fld., panicled; fls. yellowish green, veined with purplish black, ½–¾in. across. Spring. Coast region of S. Afr. B.M. 615.

L. H. B.

MELÁSTOMA (Greek for *black* and *mouth;* said to allude to the color left in the mouth when the berries of some species are eaten). *Melastomàceæ.* Woody greenhouse plants.

This genus, which gives name to the great family Melastomaceæ, with more than 2,000 species, is little known in cult. It is not the most important genus of the family, either horticulturally or in number of species. Cogniaux (DC. Monogr. Phaner. 7) admits 37 species. The larger part of melastomaceous plants are of Trop. Amer., but the true melastomas are natives to Trop. Asia, Austral. and Oceanica. They are shrubs or rarely small trees: lvs. opposite, petiolate, oblong or lanceolate, thick and entire, strongly nerved lengthwise, often handsomely colored: fls. solitary or fascicled on the ends of the branches, purple or rose (rarely white), large and showy; calyx mostly 5-lobed; petals usually 5 and often unequal, ciliate on the back; stamens 10 as a rule, very strongly unequal, part of them being short and small: fr. a leathery or fleshy berry, breaking irregularly, 5–7-loculed, with many small spiral seeds. Nearly all tropical melastomaceous plants require a high temperature, partial shade and considerable moisture.

The melastomas are seldom seen in greenhouses, yet on account of the showy flowers of some of the species all representative collections of plants should have a few of them. The plants known under this name to gardeners are likely to belong in part to other genera (specially to Miconia) but they agree in cultural requirements. They are not difficult to grow, and a little effort bestowed on them will repay the grower when flowering time arrives. Cuttings may be secured from the half-ripened wood in spring. The best way is to place each one in a small pot, in equal parts of peat and sand. Plunge the pots in a bed with 70° to 75° of bottom heat, keeping them shaded from the sun. It is better to inclose them in a tight frame, or case, to avoid draughts. When rooted, place the plants in a greenhouse near to the glass, in a night temperature of 65°. When they become inured to their position, pinch the heart out of them to encourage breaks. Shift them along as they require it. The compost from now on should be equal parts of peat and loam, with about a third of sand, and a little broken charcoal also may be added. See that the receptacles are well drained, as when the plants are growing they require plenty of water, which should have a free outlet to prevent stagnation. If peat cannot be procured, they will do very well in a good fibrous loam to which a third of leaf-mold has been added.—The first season the aim should be to procure a well-shaped plant and this may be done by cutting back the strong shoots, allowing the weaker ones to grow longer to acquire strength. Keep them protected from the sun with a slight shade, such as cheese-cloth, to prevent the foliage from burning. In winter a somewhat lower temperature may be given and a rather dry atmosphere maintained. When the plants are established in their flowering pots, applications of weak liquid manure may be given once a week until they show flower.—In the growing period, occasional syringings with clean water may be made to the under side of the foliage to prevent red-spider. Other insect pests may be kept in check by fumigation with hydrocyanic gas, at the rate of one-half ounce to the 1,000 cubic feet. The atmosphere and plants should be on the dry side, and the temperature around 60° when the operation is performed.—Some of the species flower in winter. *M. decemfidum* is an example. Others flower in summer, among which may be mentioned *M. corymbosum*, *M. denticulatum* (see *Miconia*), and *M. malabathricum.* (George F. Stewart.)

A. *Lvs. strongly 5-nerved.*

decémfidum, Roxbg. (*M. sanguíneum*, D. Don. *M. malabáthricum*, Sims, not Linn.). Three to 4 ft.: branches subterete and hirsute: lvs. lanceolate or lance-oblong, long-acuminate, the nerves (or at least some of them) and the petioles often red: fls. 1–3, large, nearly or quite 2 in. across, the petals rose-colored and retuse. Java to China. B.M. 529; 2241.

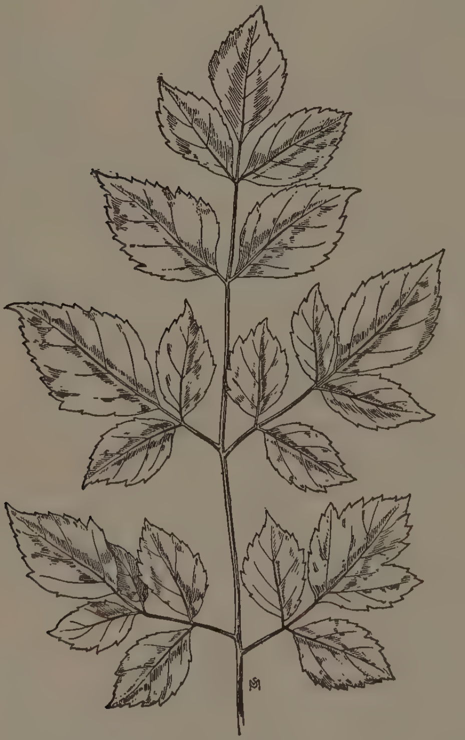
normàle, D. Don. About 5 ft., the hairy young branches brown-gray: lvs. petiolate, ovate-oblong, 5-nerved, yellow-felted beneath: fls. lilac-rose, several together at ends of bractless branches; calyx yellow-pubescent, the lobes linear-subulate; petals ovate, 1 in. long. India to Polynesia. R.H. 1910:332.

AA. *Lvs. strongly 7-nerved or more.*

cándidum, D. Don. Branches 4-angled, hoary, the younger ones pubescent, as also the petioles: lvs. ovate-acute, setulose above, villose beneath: fls. 3–7 in a cyme, rose-colored (sometimes white?), about the size of those of *M. decemfidum;* calyx-lobes shorter than the tube. S. China. *M. malabathricum,* B. R. 672(?).

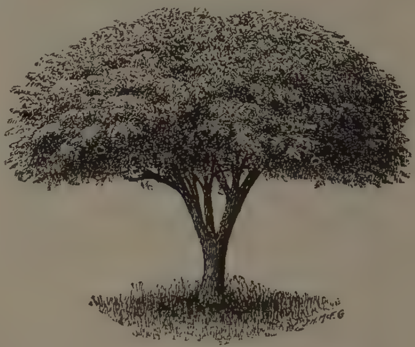
malabáthricum, Linn. (*M. Bánksii,* Cunn.). Differs from the last in having the calyx-lobes about equal to the tube, or sometimes even longer: lvs. oblong or ovate-oblong, acute or short-acuminate, sparsely setulose, above and beneath: fls. corymbose, purple, much smaller than in the last two. E. India to Austral.—Probably the *M. malabathricum* of horticulturists is one of the above species. Not known to be in the American trade.

corymbòsum, Sims (properly **Amphiblémma cymòsum,** Naudin. *Melástoma cymòsum,* Schrad.). Branches terete, glabrous: lvs. large, petioled, the blade 5–6 in. long, cordate-ovate, short-acuminate, glabrous, 5–7–9-nerved, satiny green, sharply serrulate: fls. bright purple, in rather close terminal branching corymbs; petals oval, paler beneath; calyx-lobes ovate-triangular, ciliate; stamens 10. Upper Guinea. B.M. 904; 5473. L.B.C. 10:984.—To the genus Amphiblemma, Cogniaux admits 5 species. They are herbs or shrubs, of the Sonerila group or subfamily, with isomerous fls.: herbs or small shrubs of W. Trop. Afr., with fls. in simple or branched scorpioid cymes: petals 5; stamens 10, very unequal; ovary 5-celled and hollowed at top: caps. turbinate, 5-valved at top, with minute seeds: lvs. membranaceous, long-petioled, ovate-acuminate, 5- or more-nerved, serrulate. L. H. B.



2347. Leaf of Melia Azedarach. (×⅙)

MÈLIA (ancient Greek name). *Meliàceæ.* BEAD-TREE. Trees, from 30 to 40 feet high, some of them much planted South for shade and ornament; sometimes bushes. Leaves deciduous, large, doubly pinnate or once-pinnate, the lfts. acuminate, glabrous: fls. in graceful panicles; sepals 5–6, imbricated; petals 5 or 6; stamens monadelphous, 10–12, of two lengths; ovary with several locules, topped with a single style: fr. a small indehiscent drupe.—Species few, of Asia and Austral.



2348. Umbrella tree—Melia Azedarach var. umbraculiformis.

A. *Lvs. more than once-pinnate.*

Azédarach, Linn. CHINA-TREE. CHINA-BERRY. PRIDE OF INDIA. Fig. 2347. Tree, to 40 ft. and more, making a thick trunk with furrowed bark: lvs. 2-compound, to 3 ft. long, stalked; lfts. many, ovate, oval or elliptic, acute, sharp-toothed or lobed: fls. purplish, in open panicles 4–6 in. long; petals oblanceolate or narrow-oblong, obtuse; sepals acute; ovary 5-celled: drupe nearly globular, yellow and smooth, ½–¾in. diam. Himalayan region, 2,000–3,000 ft. altitude, and probably native elsewhere in Asia; now widely planted. B.M. 1066. S.I.F. 2:35 (as *M. japonica*).—It has become naturalized throughout the S.; the northern limit of its hardiness is about Norfolk, Va., or somewhat southward, on the coastal plain area; it is luxuriant in N. C., except in the Piedmont country. The tree grows with great rapidity, and forms one of the most desirable shade trees, both from the bright green tint of the foliage, which is retained until late in the autumn, and also from the fragrance of the numerous lilac-colored fls. which are produced in April. These are succeeded by an abundant crop of berries, of a yellowish translucent color, which are readily eaten by cattle and birds. In some countries, the seeds are used for the making of rosaries. The wood, although coarse, is very durable. The tree can withstand a low temperature, but a cold of zero will injure or kill it. Several forms have been found, a white-flowering and one with the segms. of the lfts. cut in narrow divisions. These forms are not constant, the seedlings frequently reverting to the typical species. In all forms of *M. Azedarach,* the lvs. are 2- or 3-pinnate, the ultimate lfts. ovate or lanceolate, and varying from serrate to very nearly entire.

Var. **umbraculifórmis,** Berckm. (var. *umbraculífera,* Hort.). TEXAS UMBRELLA TREE. Fig. 2348. Lfts. are less broad than in *M. Azedarach,* and the branches erect, and, in a manner, radiating from the trunk, the drooping foliage giving the tree the appearance of a gigantic umbrella. Mn. 8, p. 73. F.E. 26:187. G.F. 7:95.—The first tree that came to notice is said to have been found near the battlefield of San Jacinto, Texas, but with no record of its intro. there. If the fls. are not cross-pollinated with the common sort, the percentage of seedlings which reproduce the exact umbrella shape seldom varies; hence it is supposed by some to be a distinct species.

sempérvirens, Swartz (*M. Azédarach* var. *sempérvirens,* Linn.). A low-growing tree with lvs. deeply incised, the lfts. the shape of those of *M. Azedarach:* fls. in axillary panicles, small, light lilac, fragrant, in constant succession. A greenhouse species, and a beautiful tree of distinct habit in S. Fla., where it is rapid-growing, holding its lvs. well into winter and blooming at intervals throughout the year. It is there prone to send up suckers and to prop. itself unduly from seeds. *M. sempervirens,* Swartz, is a widespread plant in the W. Indies and elsewhere. B.R. 643.

floribúnda, Carr. (*M. Azédarach* var. *floribúnda,* Morr. *M. japónica* var. *semperflòrens,* Makino). By some considered to be a precocious and very floriferous form of *M. Azedarach,* but the plant grown in this country under this name and as *M. semperflorens* (and which is probably the same as Carriere's *M. floribunda*) is a bushy species, not tree-like, and should receive further study. In S. Fla. it is a "small awkward shrub, never reaching above 10 ft. and seldom branching." In S. Calif. it rarely reaches above 8 ft. and suckers continually; by cutting down to the ground the sts. that have bloomed, it can be had in flower nearly all the year. *M. floribunda* is said to begin to bloom at 1–2 ft., and to flower the second and third years from seed. The lfts. are lanceolate or oblong-lanceolate rather than ovate, very gradually taper-pointed. Perhaps Japanese. R.H. 1872:470. B.H. 30:176.

AA. *Lvs. once-pinnate.*

Azadiráchta, Linn. (*Azadiráchta ìndica,* A. Juss., and by some recent writers kept generically distinct). Large tree, sometimes 50 ft.: lvs. broad, pinnate, with 9–15 lance-acuminate, oblique, more or less serrate lfts.: fls. white, fragrant, very small, 5-merous; petals ciliate: drupe ½–¾in. long, oblong, the seeds yielding oil: foliage crowded near the ends of the branches. India.—Not hardy in the Cent. S.

M. japónica, Don, is by Hemsley (Fl. China) referred to M. Azedarach; *M. japónica,* Hassk., is by some referred to M. Azadirachta, but is perhaps distinct; apparently these plants are not in the trade.

L. H. B.†

MELIÁNTHUS (Greek, *honey-flower*). *Melianthàceæ;* formerly included in *Sapindàceæ.* Evergreen shrubs of South Africa, to be grown out-of-doors in southern California and similar climates.

Leaves alternate, stipulate, odd-pinnate; lfts. unequal-sided: fls. in axillary and terminal racemes, secreting honey plentifully; calyx laterally compressed, with or without a sac-like protuberance at the base, with a nectar-bearing gland within; petals 5, the anterior one abortive; stamens 4, didynamous. *M. himalayanus,* Wall., is *M. major,* which has been intro. into S. Asia.—About a half-dozen species, strong-scented.

A. *Lfts. entire.*

pectinàtus, Harv. (*M. Trimeniànus,* Hook. f.). Rigid shrub, with densely set pectinate-pinnate lvs. on short twigs, the rachis winged: lfts. 8–10 pairs, linear, entire, with revolute margins, white-tomentose beneath: fls. dull red, in more or less whorled racemes, the peduncles purple; petals 4, long-clawed; upper calyx-segm. cuspidate. B.M. 6557. G.W. 4, p. 39.

AA. *Lfts. toothed or serrate.*

B. *Calyx gibbous at base.*

màjor, Linn. St. flexuous, glabrous, sometimes 10 ft. or more in height, with a widely creeping root: lvs. gray, a foot or more long, the upper ones smaller; stipules grown together into one large intra-axillary piece, attached to the lower part of the petiole; lfts. 9–11, 3–4 in. long, 2 in. wide: racemes densely fld., 1 ft. or more in length; bracts ovate, acuminate: fls. red-brown, 1 in. long: caps. papery, 4-lobed at the apex, 1–1¼ in. long; seeds 2 in each cell, black and shining. Cape. G.C. III. 36:142. B.R. 45. R.H. 1867, p. 131; 1913, p. 413. G.W. 4, p. 37.—An excellent foliage plant. *M. intermèdius,* Hort., is a hybrid between this species and *M. comosus.*

BB. *Calyx not conspicuously gibbous at base.*

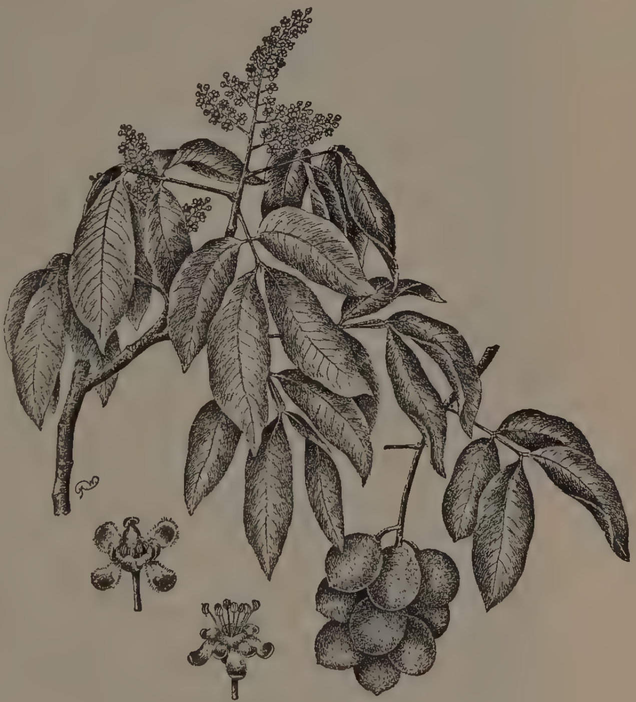
mìnor, Linn. Shrub with branchlets and infl. somewhat canescent: lvs. 5–6 in. long; stipules 2, subulate, lateral free; lfts. 1½–2 in. long, 6–10 lines wide: racemes 6–12 in. long, subterminal; fls. dull red: caps. obtuse at each end, scarcely 4-lobed, 8 lines long.

comòsus, Vahl. Shrub with grayish white branches: lvs. 4–6 in. long; lfts. lanceolate, serrate, pubescent above but becoming glabrate, white-tomentose beneath: fls. orange inside, red-spotted outside and green at base, alternate in nodding racemes; petals oblong or spatulate: caps. oval, 4-winged. B.M. 301 (as *M. minor*).

M. B. Coulston.
L. H. B.†

MÉLICA (old Italian name for Sorghum, from *mel,* honey). *Gramíneæ.* Melic Grass. Slender-stemmed perennials: spikelets 2- to several-fld., rather large, often richly colored or with a pearly luster, in narrow or open panicles.—Species about 35, throughout temperate zones. Several beautiful native species of U. S., but not known in cult. *M. ciliàta,* Linn., of Eu., with a pale spike-like panicle of silky spikelets is sometimes cult. for ornament, and *M. violàcea,* Cav., a Chilean species with graceful panicles of violet-tinged broadly winged spikelets, has been recently intro.

A. S. Hitchcock.



2349. Melicocca bijuga. (Sprays × ¼)

MELICÓCCA (Greek, *honey berry,* referring to the taste of the fruit). *Sapindàceæ.* Two species of tropical fruit trees, natives of America.

Leaves abruptly pinnate: racemes divided; calyx 4-parted; segms. imbricated; petals 4; stamens 8; disk complete; stigma peltate, sub-sessile; ovary 2-celled: berry 1–2-seeded.—S. Amer., perhaps native also in W. Indies.

bíjuga, Linn. Spanish Lime or Genip. Fig. 2349. Lfts. in 2 pairs, elliptical or elliptic-lanceolate, entire, glabrous: fls. whitish, in terminal racemes.—Cult. and naturalized in W. Indies and perhaps native there. The foliage is distinct, the compound lvs. with winged petioles resembling those of *Sapindus saponaria*, the W. Indian soap-berry. The Spanish lime is cult. in S. Fla. and S. Calif. Its frs. are about the size and shape of plums, green or yellow, and have a pleasant grape-like flavor. The large seeds are sometimes roasted like chestnuts. The tree grows slowly, attaining 20–60 ft., and bears freely. It can be fruited in the N. under glass. It withstands several degrees of frost. This fruit is the mamoncillo of Cuba, where it is much prized. It is little known in the U. S. The fr. is usually about an inch long, with thin leathery and green skin and a rather scant acid refreshing pulp that adheres closely to the seeds; it is eaten out of hand, being torn open at one end to allow the translucent white and juicy contents to pass into the mouth. L. H. B.

MELILÒTUS (Greek for *honey lotus*). *Leguminòsæ.* Sweet Clover. Melilot. Perhaps twenty species of annual or biennial tall-growing sweet-smelling herbs, widely distributed in temperate and subtropical regions as weeds, some of them of value for forage and green manure.

Leaves pinnately 3-foliolate, the lfts. toothed and mostly narrow: fls. small, white or yellow, in slender, long-stalked, axillary racemes; calyx-teeth short and nearly equal; corolla papilionaceous, the standard oblong or oblong-obovate, keel obtuse: fr. a small, few-seeded, not twisted but more or less reticulated flattish indehiscent or tardily dehiscent pod.—The species are native in temperate and subtropical regions in the northern hemisphere. Two species, *M. officinàlis*, Lam. (yellow-fld.), and *M. álba*, Desr. (white-fld.), have become weeds along roadsides and in waste places. *M. índica*, All., a common weed in Calif., has very small yellow fls. A recent species.

The prevailing sweet clover, the country over, is *M. alba.* It is an erect biennial herb, often higher than a man, flowering abundantly in spring and early summer. It is said to prefer soils rich in lime, and it thrives on poor and dry soils. Under the name of Bokhara clover and sweet clover, it is grown somewhat as a forage plant. Cattle come to like it for grazing, particularly if turned on it early in the season, before other herbage is attractive. It may also be cut for hay, particularly the second year. About twenty pounds of seed is required to the acre. It is an excellent bee-plant. L. H. B.

MELÌNIS (Greek, *meline*, millet). *Gramíneæ.* A glutinous grass with branched decumbent stems, flat blades and terminal panicles of very small spikelets, of value as a forage plant in the tropics.

Spikelets 1 line long, with a perfect terminal floret and a sterile floret below; first glume very small; second glume and sterile lemma about as long as the spikelet, notched, the latter awned; perfect floret awnless.—Species one.

minutiflòra, Beauv. (*Pánicum Melìnis,* Trin.). Molasses Grass. Two to 4 ft., the base branched, decumbent, tangled and rooting: sheaths and blades viscid-pubescent: panicles purplish, 3–6 in. Brazil and S. Afr. Mart. Fl. Bras. 22:33.—A good forage grass. Has been tested in the W. Indies and in S. Fla.
A. S. Hitchcock.

MELIÓSMA (Greek *meli,* honey, and *osma,* odor; alluding to the fragrant flowers). *Sabiàceæ.* Trees or shrubs grown for their handsome foliage and the large panicles of white or whitish flowers.

Deciduous or evergreen trees or shrubs: lvs. alternate, without stipules, simple or odd-pinnate, with opposite lfts. serrate or entire: fls. in terminal or axillary panicles, perfect, rarely polygamous; sepals 5, rarely 4; petals 5, unequal, the outer 3 roundish, imbricate; the inner 2 much smaller, usually lanceolate, often bifid; stamens 5, usually connate with the petals, the outer 3 sterile; reduced to irregularly cup-shaped staminodes, the inner 2 fertile, the anthers surrounded at the base by the cup-shaped apex of the filaments; ovary superior, often surrounded by a disk, 2-celled, rarely 3-celled, each cell with 2 ovules; style simple: fr. a subglobose or oblong small drupe, usually 1-seeded.—About 50 species in E. and S. Asia and in Cent. and S. Amer.

The meliosmas in cultivation are handsome deciduous trees or shrubs with large pinnate or simple generally oblong leaves with numerous closely set lateral veins, with large often drooping panicles of small white or yellowish usually fragrant flowers followed by pea-sized black or red fruits. Except *M. myriantha,* they are of recent introduction and little is known of their hardiness and their cultural requirements, but they certainly possess promising ornamental qualities, the handsomest being apparently *M. Beaniana* and *M. Veitchiorum.* The latter and *M. cuneifolia* have proved hardy in southern England, and in this country they will probably be hardy as far north as New York or even New England, while the other species are tenderer. Propagation is by seeds sown as soon as they are ripe; also by layers and probably by cuttings of half-ripened wood under glass.

A. *Lvs. simple.*

myriántha, Sieb. & Zucc. Tree, to 30 ft.: lvs. obovate-elliptic to oblong or oblong-obovate, short-acuminate, broadly cuneate or sometimes rounded at the base, toothed, glabrous above, sparingly pubescent beneath, more densely so on the veins, without tufts of hairs in the axils of the veins, 4–8 in. long, with 24–30 pairs of veins: fls. greenish yellow, ⅙in. across, in upright panicles 6–8 in. long, with ascending branches: fr. red, ¼in. across. July. Japan. S.I.F. 2:46. G.C. III. 31:30.

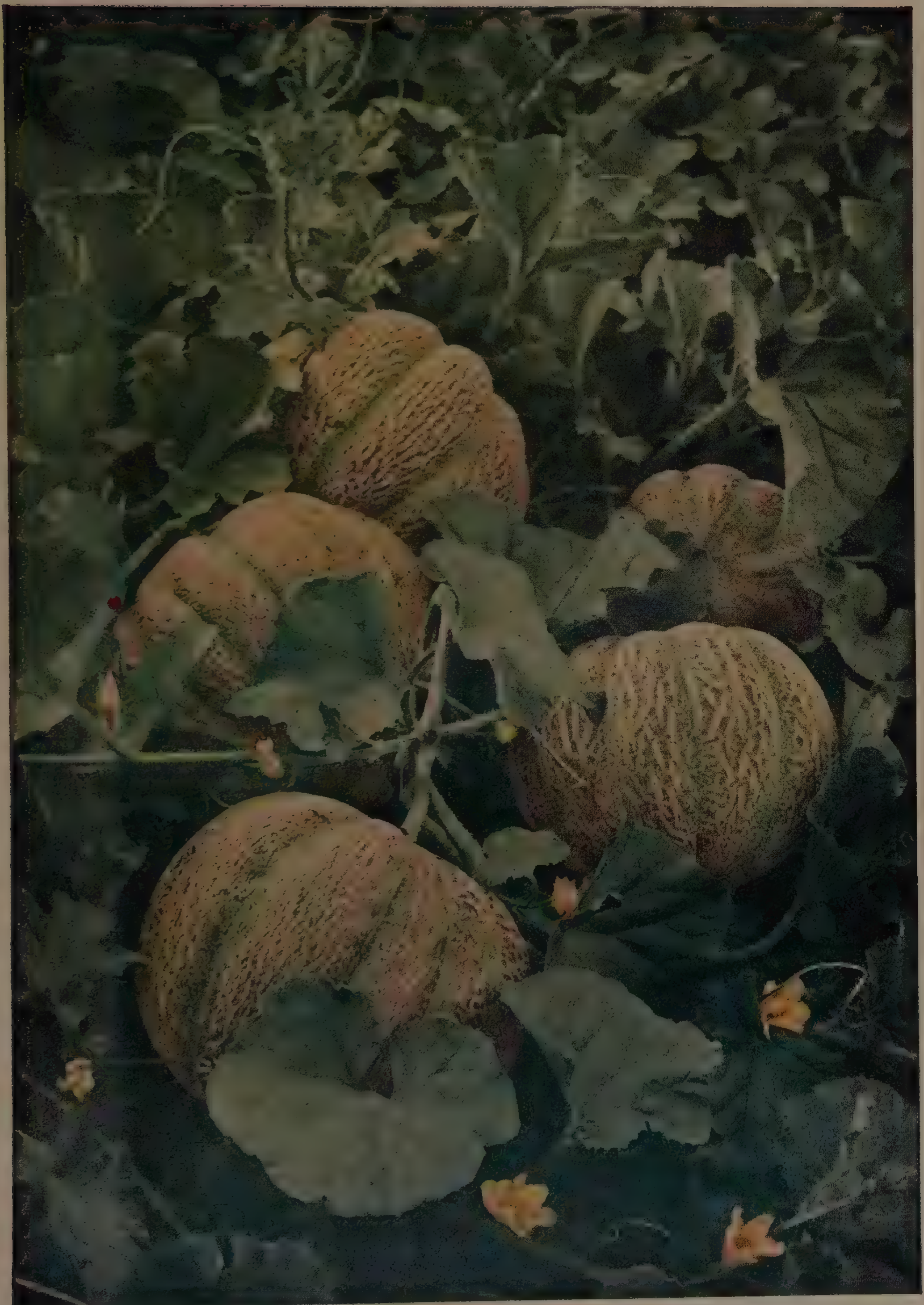
cuneifòlia, Franch. Shrub or tree, to 20 ft.: lvs. obovate, acute or abruptly acuminate, narrowly cuneate at the base, sinuately toothed, glabrous above, pubescent on the veins beneath and with tufts of hairs in their axils, 3–7 in. long, with 20–25 pairs of veins: fls. yellowish white, ¼in. across, in upright panicles with spreading branches, about 8 in. across: fr. black, ¼in. across. July. W. China. B.M. 8357.

AA. *Lvs. odd-pinnate.*

Veitchiòrum, Hemsl. Tree, to 50 ft.: young branchlets with brown shaggy hairs, soon glabrous, marked with conspicuous lenticels and the older ones with large lf.-scars: lvs. 1–3 ft. long; lfts. 9–11, ovate to ovate-oblong or oblong, obtusish or short-acuminate, rounded or broadly cuneate at the base, entire, rarely remotely crenate-serrate, glabrous or nearly so, 3–7 in. long: panicles terminal and axillary, drooping, 8–15 in. long, with or after the lvs.; fls. yellow, ⅕in. across: fr. black, subglobose or pyriform, ¼–⅓in. across, sparingly produced. May: fr. in Sept. Cent. China. —A handsome tree with its large pinnate foliage and the long drooping panicles of very fragrant yellowish fls. A recent species.

Beaniàna, Rehd. & Wilson. Tree, to 50 ft.: young branchlets brownish tomentose: lvs. 6–12 in. long; lfts. 5–13, ovate to elliptic-lanceolate, acuminate, cuneate or sometimes rounded at the base, remotely serrulate or nearly entire, glabrous above and nearly glabrous beneath except tufts of hairs in the axils of the veins, 2–6 in. long: panicles very numerous, before the lvs., 4–8 in. long; fls. creamy white, ⅕in. across: fr. globose, black, ¼in. across. May; fr. in Sept. Cent. China.—A striking plant when covered in spring with a mass of creamy white fls.

M. Oldhamii, Miq. Tree, to 60 ft.: lvs. odd-pinnate; lfts. 9–13, ovate to oblong, serrate, nearly glabrous, 2–4 in. long: fls. white, in broad panicles, 8–12 in. across. Cent. China to Korea.—*M. péndens,* Rehd. & Wilson. Allied to M. myriantha. Shrub, 8–15



LXIX. Muskmelon of the Hackensack type.

ft.: lvs. obovate-elliptic to obovate-oblong, sparingly pubescent beneath, particularly on the veins, 2–5 in. long: panicles slender, drooping, with spreading or reflexed branches; fls. white. Cent. China.

Alfred Rehder.

MELÍSSA (Greek, *bee;* because the bees are fond of balm). *Labiàtæ.* Hardy perennial herbs from Europe and western Asia, one of which is Balm (see Vol. I, p. 442).

Plants erect, leafy and branching, with broad opposite lvs.: fls. white or yellowish, in axillary clusters, somewhat secund; corolla exserted from the long-campanulate calyx, curved, enlarged above and naked within, 2-lipped, the upper lip erect and notched and the lower one spreading and 3-lobed; stamens 4, didynamous, ascending and approximate under the upper lip; style cleft at top: nutlets smooth.—Species 3 or 4, in Medit. region and Cent. Asia.

officinàlis, Linn. Balm. Probably the only species cult., is one of the sweet herbs: pubescent odorous perennial, from S. Eu., N. Afr. and east, sometimes escaped from gardens in this country: lvs. ovate, crenate-dentate: fls. several in each cluster, nearly white or yellowish. Var. **variegàta,** Hort., sometimes used for edgings.

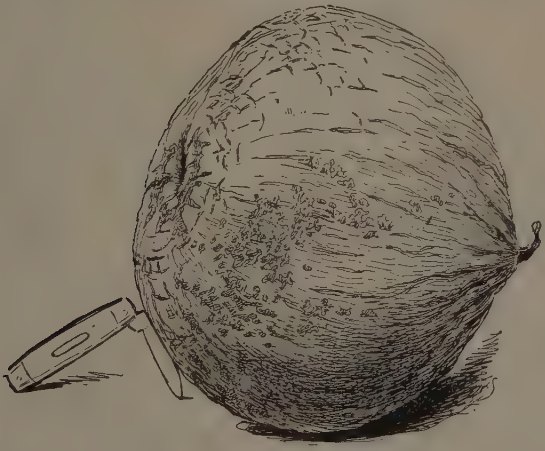
L. H. B.

MELÍTTIS (from Greek *melitta, melissa,* a bee). *Labiàtæ.* One perennial herb in Cent. and S. Eu. and W. Asia, useful for hardy borders. Technically it differs from the long-fld. species of Stachys by its large usually 3-lobed calyx and axillary fls. *M. Melissophýllum,* Linn. (*M. grandiflòra,* Smith), has nearly simple sts. 12–18 in. high, erect, slightly hairy: lvs. cordate-ovate, dentate: fls. large, 2–6 together in axillary whorls, shorter than the lvs., pink and variously variegated; corolla 1–2 in. long, the tube broad, the upper lip erect or reflexed, the lower lip spreading and 3-lobed; stamens 4, in pairs.

L. H. B.

MELOCÁCTUS: *Cactus.*

MELON. A name applied to two very different fruits of the Cucurbitaceæ. Unqualified, the word refers to fruits of the different botanical varieties of *Cucumis Melo* (which see, Vol. II, p. 907). The word muskmelon usually refers to the same fruits, although some forms of *Cucumis Melo* are not musk-scented. The word watermelon refers to the fruits of *Citrullus vulgaris* (Vol. II, p. 780). Inasmuch as the cultural requirements for all melons are very much alike, the whole subject is considered here together.



2350. The Cassaba melon. (×¼)

The cultivated forms of *Cucumis Melo* are very many, and they are difficult of clear classification. The musk-scented forms might be assembled into one group, including the nutmeg or netted melons and the cantaloupe or hard-rinded melons, although the name cantaloupe has become generic in this country for all musk-scented melons. The non-odorous, or at least relatively non-moschatous, melons might comprise another group; and to this would be referred the winter melons, *Cucumis Melo* var. *inodorus.* The winter melons, as a whole, have not been popular in North America, and are, in fact, not generally known. They require a long season in which to mature (see Cornell Bull. No. 96, pp. 364–366, 1895). Very likely the so-called winter or late-keeping melons may not all represent the botanical var. *inodorus.*—Some of the forms of the species are used in the making of preserves and condiments, or even grown for ornament, rather than for eating out of hand. Of such are the Chito (Fig. 2351) and Dudaim types, which are described on page 908.

To the winter melons probably belongs the Cassaba (Fig. 2350), which has lately become popular in California, whence it is shipped east late in the season. The name, variously spelled Kassaba, Cassaba, Casaba, Cassabah, Casba, is derived from the town Kassaba near Smyrna, Asia Minor, whence it was introduced. The seed has been more or less in commerce for many years. According to G.P. Rixford, the seed of the late Kassaba was sent from Smyrna to California late in 1878 by Dr. J. D. B. Stillman and James L. Flood, who found the melons in the hotels of that city. A crop was grown in California in 1879, and appeared on the markets that autumn in limited quantity. M. Rixford, then connected with the "Evening Bulletin," secured a good part of the stock and the next summer had a large quantity raised; and in the winter of 1880–81 seeds were distributed to 3,000 country subscribers of the "Bulletin." The melons did not then become popular, however, because they were usually marketed too green; for these melons must be thoroughly ripe to disclose their excellent flavor. In the original edition of "California Vegetables" (1897), Wickson describes the Cassaba or Pineapple melon as "fine, large, late variety, rich, cream-colored flesh; keeps well into winter."

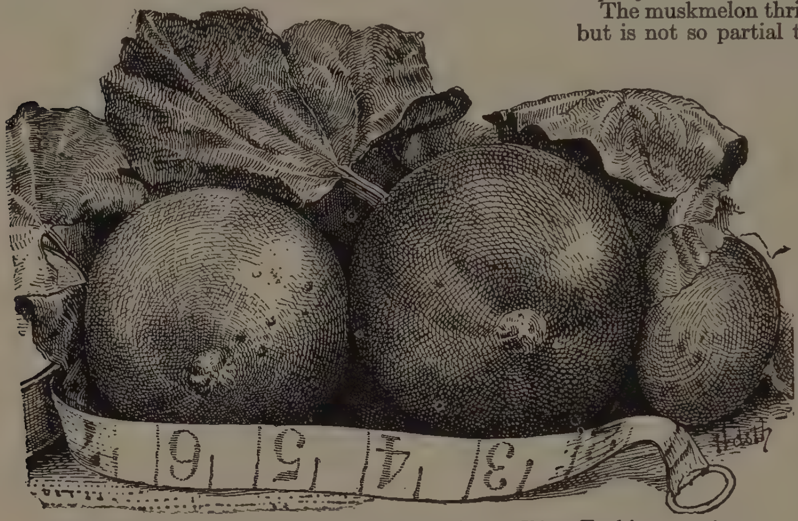
Another Cassaba melon was sent out long before this by the Patent Office, before the organization of the Department of Agriculture. This received special attention from General Bidwell of Chico, California, and became known as the Bidwell Cassaba. This is a large summer melon, said to grow to 1 foot in diameter. This is said to be known only locally, although it was grown at Cornell twenty-five years ago.

On the introduction of Cassabas in this country, W. W. Tracy writes as follows: "The name Cassaba was used in this country as early as 1871, when Bridgman offered the 'Persian,' or 'Ordessa,' or 'Cassaba.' The 'Green Persian,' which seems to have been very much like that stock, if not identical with it, was offered by Ross, of Boston, in 1827. In 1872, Henry A. Dreer offered 'Cassaba' and published a good illustration of it; this seems to be very much like the Bay View of more recent years except that it is more pointed at the stem-end. None of these melons, as they are remembered, was like the Cassaba of California trade today, but were very much like the Cassaba as grown at Chico, California, under the name of Bidwell Cassaba. It seems that the term 'Cassaba' has been used indiscriminately for several different varieties of melons, some of them quite distinct from the others."

L. H. B.

Muskmelon.

The modern cultivated varieties of muskmelon are supposed to have been derived from the wild types native to Asia and Africa. There is some question as to whether the melon was known to the ancient Egyptians as a cultivated plant. It was probably introduced into the Mediterranean countries of Europe about the beginning of the Christian era. Pliny refers to a "new form of cucumber. . . . called *melopepo*, which grows on the ground in a round form, and . . . . although not suspended, yet the fruit separates from the stem at maturity." Nonnius, in the sixth century, speaks of "cucumbers" which are highly odorous. It seems probable that these authors refer to the muskmelon. By the sixteenth century, many varieties of muskmelon were known to European writers.



2351. The Orange or Chito melon.—Cucumis Melo var. Chito. Used in preserving.

The melon reached America among the earliest importations of plants from the Old World, for in 1494 it was recorded as grown by the companions of Columbus. In 1535, "musk melons" were mentioned by a traveler on the St. Lawrence. Melons were reported in New Mexico in 1540, and were abundant in Hayti in 1565. In 1584 they were found in Virginia by Captains Amidos and Barlow. In 1609 they were seen on the Hudson River, and were described as abundant in New England in 1629. In 1806, thirteen kinds were mentioned by M'Mahon as being under culture in America. At the present time, over 400 different variety names are given in American seed catalogues, although the number of important varieties is very much less.

There are two principal classes of muskmelons, the soft-rinded or netted melons, often called nutmeg melons (Fig. 2352), and the hard-rinded or warty melons, known technically as rock melons or cantaloupes. The latter class is grown principally in Europe, often under glass, and is little known in America. The term cantaloupe as used in America is primarily a trade name employed to designate nutmeg melons in general, or, more often, the small type of melon that is shipped in baskets or crates.

The class of muskmelons commonly grown in America may be arbitrarily divided into two groups: large-fruited and small-fruited. This classification is important from a marketing standpoint, since the large-fruited melons are grown principally by market-gardeners, and hauled in bulk to their respective markets, where they are sold by count, though sometimes they are grown as a truck crop and packed in crates to be shipped to the general market. The small-fruited melons are usually packed in crates or baskets, and are very much more extensively handled on the general market than the large-fruited type. The typical small-fruited or "crate" melons weigh about one and one-fourth to one and one-half pounds each; the large-fruited melons weigh anywhere from two to fifteen pounds each.

The flesh of the muskmelon may be either salmon-colored or greenish. The green-fleshed sorts are the more delicately flavored, while the salmon-fleshed varieties are likely to have a more pronounced musky flavor. Formerly, the green-fleshed sorts were preferred on most markets; but in the last few years the demand for salmon-fleshed sorts has been increasing rapidly.

The muskmelon thrives best in a fairly warm climate, but is not so partial to intense summer heat as is the watermelon. It can be grown wherever the summers are sufficiently long to enable it to develop and mature its crop between the frosts of spring and fall. From four to five months are required from the planting of the seed to the end of the harvest. It is considered an exacting crop, and is therefore often omitted from home gardens even in regions where it might readily be grown.

Development of the industry.

Up to 1870, muskmelons were grown principally in private gardens, and it was unusual to see them on the markets. A little later, however, the growing of muskmelons for the New York and other eastern markets was started in Maryland, Delaware, and New Jersey. These melons were principally the Hackensack and Anne Arundel varieties (large-fruited), and the Jenny Lind, a small oblate melon. These melons supplied the market principally from the middle of July till the middle of August. Shipments increased from year to year until in the nineties the New York market sometimes handled from two to three carloads a day at the height of the season.

In 1881 the Netted Gem melon, a small, oval, heavily netted green-fleshed fruit, was first introduced to the public. This variety was destined to revolutionize the melon industry of America. It was tested for a few years, and in 1885 was grown for market in a small way by Wm. S. Ross at Alma, Illinois, and by J. W. Eastwood at Rocky Ford, Colorado. Each planted about one-half acre that year. So far as known, these plantings marked the real beginning of the melon industry in Illinois and in Colorado. Having more melons than his local market could consume, Ross shipped two barrels to Chicago in August, 1885. These were the first melons of this type ever seen on the Chicago market, and were the occasion of considerable amusement on South Water Street when the barrels were opened; the melons seemed ridiculously small as compared with the Hackensack and other melons then on the market. However, after the flavor had been tested, the melons were readily sold and an order received for all that could be furnished. The next year, Ross planted 20 acres, and a few years later, 90 acres. Soon a number of his neighbors began planting, and the industry grew at Alma, until the shipments reached ten to fifteen carloads a day. In 1900, from Alma alone 253 carloads were shipped. In the meantime the industry had spread to other Illinois points, including Anna and Balcom in the extreme southern part of the state. Most of the Illinois melons were shipped in one-third-bushel Climax baskets.

Meanwhile the industry had been developing at Rocky Ford, Colorado, though up to 1894 the shipments had been made entirely by local express, and to

Colorado markets only. That year some of the growers joined together and loaded ventilator cars which were shipped by freight. Up to this time the melons had been shipped in boxes, barrels, and home-made crates,—principally crates made from 12-inch boards and common laths sawed in two. In 1896 the growers were supplied for the first time with regular crates made at a lumber mill. These crates were 12 by 12 by 22¼ inches, inside measure,—practically the same as the home-made crates,—and have ever since been the standard package for Rocky Ford melons. In this year a few cars of melons were shipped as far east as Kansas City and St. Louis.

The Rocky Ford Melon Growers' Association was organized in the fall of 1896 for the purpose of coöperative marketing of Rocky Ford melons; and in 1897, 121 carloads were handled in eastern markets, including Pittsburgh and New York. The melons met with favor and sold at good prices. The next year the membership of the Melon Growers' Association was increased to over 800, and more than 5,000 acres of melons were planted. The yield was heavy, and the markets became glutted with unsalable melons, due partly to poor refrigeration. The outlook was discouraging, and many farmers turned their attention to sugar-beets the next year. However, the melon industry continued, and from 1897 to 1905 inclusive, 5,999 carloads were shipped from the Rocky Ford district, the largest number being in 1904, when 1,182 cars were shipped. Refrigeration was improved, so that the melons carried safely even to Boston, a run of 150 hours.

The success of the Rocky Ford melons on the various markets stimulated the planting of melons of the same type in many other parts of the country, especially in the southern states, and Rocky Ford was looked to as the source of seed. Today the production of melon seed, as well as market melons, is an important industry at Rocky Ford. A number of distinct strains of the Netted Gem type of melon have been developed at Rocky Ford, and the seed is sold under various names, such as Watters' Solid Net, Eden Gem, Netted Rock, Rust-Resistant Rocky Ford, and so on.

The growth of the melon industry of the United States from 1897 to 1905 is indicated by the fact that in 1897 only about 400 carloads of muskmelons were marketed, while in 1905 the shipments amounted to 6,920 carloads.

In 1905, the Imperial Valley of southern California sprang into prominence as a melon-producing region. This valley lies mostly below sea-level, and is situated where the climate is extremely hot. Until 1900 it was known only as a desert. That year work was commenced on a canal system for conducting irrigation water to the valley from the Colorado River, a distance of about 60 miles. In 1905, expert growers from Rocky Ford were secured to organize the melon industry and supervise the growing and packing of the product. One thousand acres were planted that year, and 297 carloads of melons were marketed. Production has increased from year to year, until the Imperial Valley has far outstripped Rocky Ford in the production of melons, and is now recognized as the foremost melon-producing region in the world. The shipments from the Imperial Valley for each year from 1905 to 1914 inclusive were as follows:

Year	Carloads	Year	Carloads
1905	297	1910	1,630
1906	577	1911	2,551
1907	644	1912	2,750
1908	1,911	1913	3,502
1909	1,411	1914	4,446

The hot climate of the Imperial Valley makes early planting possible, and carlot shipments usually begin in May, and continue through June and often a large part of July. These melons, due to pre-cooling and otherwise perfect refrigeration, are shipped safely even to the Atlantic seaboard; and thus all the large markets are fully supplied with melons of uniform grade and quality from four to six weeks earlier than was formerly the case.

Beginning with the California product in May, the markets of the United States are supplied with melons of the Netted Gem or Rocky Ford type continuously until late in October. The states producing these melons in sufficiently large quantities to be mentioned in the general market reports in 1914 were as follows, the states being named in approximately the order in which their products first appeared upon the markets: California, Texas, Florida, Georgia, Illinois, Arizona, Arkansas, Oklahoma, South Carolina, North Carolina, Indiana, Nevada, Maryland, Delaware, Utah, New Mexico, Colorado, Tennessee, Michigan.

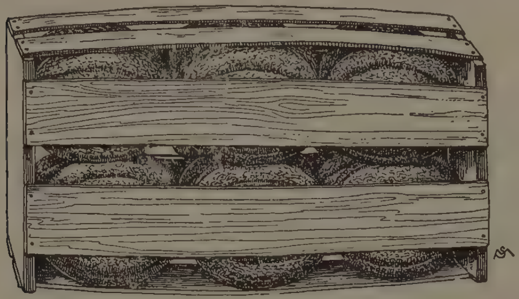
Cultivation of the muskmelon.

Statements that muskmelons demand a particular type of soil are misleading, for the muskmelon can be grown successfully on almost any kind of land from light sandy loam to heavy clay loam, provided the land is properly drained, adequately fertilized, and thoroughly cultivated. Natural drainage is considered best, and melons are usually planted on slopes and knolls rather than on low or flat lands. The soil should be well supplied with humus, either as a result of plowing under a sod or catch-crop or an application of manure. Unless the soil is naturally rich, special fertilizer treatment should be given to the particular spot where each melon hill is to stand. In the home garden, holes are sometimes dug with a spade and partially filled with rotted manure, which is then covered with soil, in which the seed is to be planted. In field culture, the land is furrowed out both ways with a plow, and from a quart to a half-peck of fine, rotted manure or compost is placed at each intersection. The manure is then covered with fine moist soil, and from ten to twelve seeds are planted in each hill. In humid climates, the

2352. A nutmeg melon.

seed is covered about ½ inch deep; in irrigated regions it is covered about 1½ inches.

Attempts to substitute commercial fertilizer for manure in enriching muskmelon hills have usually resulted unsatisfactorily; and attempts to grow melons without special treatment of the individual hills have resulted in failure except on land already very rich, such as market-garden soil or alfalfa sod plowed under.



2353. Crate-or box-packing of melons.

Since muskmelons demand a relatively high temperature and are easily injured by frost, it is useless to plant the seed in the open ground until the weather has become warm and settled. Planting in Colorado, Illinois, Indiana, and similar latitudes usually takes place from May 10 to 20. Attempts to increase the earliness of melons by protection of the plants in the field by means of hand-boxes or forcing-hills are applicable only to amateur areas. Starting the plants in hotbeds and transplanting them to the field when about four weeks old is more practicable on a commercial scale. Since a melon plant is likely to die if the root system is disturbed in transplanting, the seeds must be sown in pots or dirt-bands, or on inverted sods, and the plants very carefully handled during transplanting.

Muskmelon hills are placed from 4 to 6 feet apart, and the plants are thinned to two or three in each hill. Tillage is begun as soon as the plants are visible, and is repeated at frequent intervals until the vines cover the ground, or until the crop is harvested. In the latter case, the vines are kept in windrows, thus allowing space for the pickers as well as permitting late tillage.

In irrigated regions and in rich garden soil, muskmelons are often planted in drills instead of hills. The rows are made 6 or 7 feet apart, and the plants thinned to 2 feet apart in the row. If the crop is to be irrigated, the seed is sown close to the irrigation furrows, and the water turned in immediately after planting, to insure germination. Irrigation is repeated according to the demands of the crop, until the melons are well developed; then the water is withheld to a large extent, and little if any irrigation is given during the picking season. Comparative dryness of the soil when the melons ripen favors the development of high quality in the fruits.

In addition to tillage (and irrigation, in an arid climate), the care of muskmelons consists principally in protecting them from their enemies. Striped cucumber beetles are likely to attack the plants as soon as they appear above ground. They may be controlled by the application of a repellant, such as turpentine mixed with land plaster and dusted on the plants, or bordeaux mixture applied as a spray. The melon louse or aphis is often a serious enemy, especially in dry seasons. It is readily controlled by spraying with nicotine sulfate, if precaution is taken to reach the undersides of the leaves with the spray. The leaf-spot or "rust" is a fungous disease that attacks the foliage of muskmelons, and in some localities has interfered seriously with the production of a marketable crop. In the case of a severe attack it so weakens the vines that the melons do not develop properly and are of poor flavor. This disease has been controlled successfully by repeated spraying with bordeaux mixture, the turning of the vines into windrows making late spraying possible. Also, rust-resistant strains of melons have been developed; so that the disease is no longer a serious menace to the melon industry.

Harvesting and marketing.

Muskmelons must be picked while still firm in order to reach the market in an acceptable condition, yet if they are removed from the vines too early they lack flavor. Unless the market is too distant, melons of the Netted Gem type should not be picked until they will part readily from the stem, and the color of the skin changes slightly from green to gray as seen through the netting. To get the melons picked uniformly at this stage, it is necessary to go over the plantation every day, and in hot weather twice a day.

In order that melons may be kept as cool as possible after they are picked, they are taken immediately to the shade of a packing-shed, where they are graded and packed in crates or baskets. The standard crate for Colorado melons (already mentioned) has been adopted in several other states. It contains forty-five standard-size melons, or twenty-seven to thirty-six "Jumbo" melons. "Pony" crates are slightly smaller (11 by 11 by 22¼ inches), and are packed with fifty-four smaller melons. The melons in the standard crate are arranged in three tiers of fifteen melons each, and each tier is three melons wide and five melons long. Since the crate is made of slats, forty-two of the forty-five melons can be seen from the outside. This permits thorough inspection of the contents of every crate, both at the shipping-point and on the market. Rigid inspection before shipment has helped materially in establishing the reputation of Rocky Ford melons on the markets. California melons and some of the Colorado melons are wrapped in tissue paper to insure better keeping in long-distance shipments. When so handled, the packing is more rigidly supervised, and less dependence is placed on inspection at the loading-platform.

If melons are to be more than twenty-four hours en route, they are usually shipped under refrigeration. The crates are loaded three tiers high, and ample space is left for circulation of cold air. A minimum carload consists of 364 crates, averaging sixty-six pounds each, and the melons seem to reach market in better condition if the cars are not more heavily loaded.

2354. Basket-packing of melons.

The handling of muskmelons or "cantaloupes" in carload lots is an important branch of the produce business, and certain firms known as "general distributors" make a specialty of this product.

Montreal muskmelons; frames.

In addition to the small-fruited "crate" or "basket" melons that are shipped by the carload across the continent, and the ordinary varieties of large-fruited melons that are very generally grown by market-gardeners in outdoor culture, there is a large-fruited variety known as the Montreal Market, which is grown principally near Montreal, Canada, by special methods, and commands very high prices in some of the eastern markets. The seed is sown in greenhouses or hotbeds, usually in pots, early in March, and the plants are later set in sash-covered frames, which afford protection until the crop is nearly grown. Before the frames are placed, the soil is thrown up in ridges about 12 feet wide, and a trench 2 feet wide and 15 to 18 inches deep is dug along the center of the ridge. This trench is filled nearly level with fermenting manure, and then covered with fine moist soil. When the soil over the manure has attained the right temperature, the plants are set. Usually one hill (two plants) of melons are grown under each sash; so that a 6 by 12 frame will accommodate four hills if 3- by 6-foot sash are employed. Great attention is given to watering, syringing, and ventilation. As the fruits develop, they are kept from contact with the soil by means of shingles, pieces of board, flat stones, or slate. Each fruit is turned every few days to insure uniformity in ripening and in development of netting. When the area within the frames becomes fully occupied by vines, the frame is raised a few inches above the ground so that the growing tips of the vines may push out. More ventilation is given as the season advances, and finally the sash and even the frames are removed entirely. The melons thus finish their ripening under outdoor conditions.

Montreal melons are shipped in large wicker baskets, holding one dozen melons each. The melons are packed in fine hay, and the baskets are shipped without covers.

Cassaba melons.

The melons commonly grown in the United States are perishable after reaching maturity, and their market season ends in October. Certain types of muskmelons known as winter melons will keep for several weeks after being picked, if they are properly handled. Melons of this type were formerly little known in America, but are now grown commercially in the San Fernando Valley in southern California, and are shipped by the carload to the larger eastern markets, principally during November and December. The seed was brought from the Mediterranean countries over thirty years ago, and tried in California. The first attempts at growing these melons were not commercially successful, but a few districts were found to be especially adapted to their culture. In the valley above mentioned, hundreds of acres are planted every year. These melons are large, firm, smooth-skinned, and very thick-fleshed. On the market, they are known as Cassaba melons. They are packed in excelsior in half-cases holding six melons, or in full cases holding twelve melons.

Literature.

Books: "How to Grow Melons for Market," W. Atlee Burpee; "Melon Culture," James Troop; "Cantaloupe Culture," P. K. Blinn. *Experiment Station bulletins:* Arkansas, No. 69; Colorado, Nos. 62, 85, 95, 104, 108, 121, 126; Georgia, No. 57; Illinois, Nos. 124, 155, 174; Indiana, Nos. 123, 135; New Hampshire, Nos. 52, 70, 172; also N. H. Technical Bull. No. 2 (classification, by F. Wm. Rane); New Mexico, No. 63; New York (Cornell), Nos. 96, 200, 231; Rhode Island, No. 68; Vermont, No. 169.

JOHN W. LLOYD.

Watermelon.

The watermelon, *Citrullus vulgaris* (Figs. 2355, 2356), is a native of Africa, and is normally a dry-country plant. David Livingstone, writing in 1857, describes it as being very abundant in favorable years in the Kalahari Desert. He says that the species is very variable, some fruits being bitter and some sweet. All the animals of the region from elephants to mice, including the carnivora, seem to enjoy the fruits.

The watermelon was early taken to India, since it has a Sanskrit name. It reached China about the tenth century A. D. It has no name in the ancient Greek and Latin languages, and was probably not known to these people much before the Christian Era.

There are three fairly well-marked types of the cultivated watermelon: the round preserving "citron" (Fig. 2355), the stock (live-stock) melon, and the ordinary watermelon. The two former groups are usually more hardy, more disease-resistant, stronger growers, and more productive. It seems probable that the forms of melon found on our southwestern prairies, and in the cotton fields of the South have returned to approximately their original wild condition. There is apparently little data on the original introduction of the watermelon into the United States. Judging from the varieties at present extant, it does not seem likely that it reached us from Mediterranean lands.

2355. The preserving watermelon, commonly known as "citron."

Commercial importance.

The watermelon is the most valuable vine crop grown in the United States. As a garden plant it has a wide distribution, but as a commercial product its culture is confined chiefly to the region to which the long-leaf pine is indigenous. This region includes the states bordering the Atlantic from Virginia southward as well as those bordering the gulf. The only states outside this territory which grow watermelons on a commercial scale are New Jersey, Indiana, Illinois, Oklahoma, Kansas, and California. The six states producing the bulk of the commercial crop in the order of their importance are Texas, Georgia, Florida, Indiana, Mississippi, and California.

The value of the commercial crop of watermelons in the United States, as stated by the census of 1910, was nearly $4,500,000, grown on 137,000 acres.

In comparison with other vegetable crops, the watermelon stands seventh. The crops having a greater value are Irish potatoes, sweet potatoes, tomatoes, cabbage, onions, and sweet corn, in the order named.

Cultivation.

The watermelon thrives best on light, warm, sandy soils well supplied with organic matter. The plants require a liberal moisture supply during their early life, but are able to produce abundantly in regions with relatively spare rainfall. In order to develop superior quality, the temperature during the fruit-bearing period should be high.

The preparatory treatment of the soil for watermelons preferred by most growers is to turn under a crop of cowpeas the previous autumn. An area which has not been under cultivation for several seasons and upon which there is a good stand of broom-sedge or grass is the second choice. While watermelon seed does not require to be planted early, the land should be prepared in time to allow weed seeds to germinate so that at least the early weed crop can be destroyed by harrowing before the melon seed is planted. This is important as the crop can be given thorough culture only previous to the vining of the plants. The object should be to do most of the cultivation before the crop is planted.

The watermelon, like all other vine plants, is a gross feeder and requires an abundant supply of available plant-food over a comparatively short growing season. For this reason, the fertilizing should be liberal and the materials used of a nature to be quickly available. When stable manure can be secured, this is to be preferred, but when it is not to be had crops planted on lands which have had a crop of cowpeas turned under respond reasonably well when a fertilizer carrying 3 to 4 per cent of nitrogen in the form of nitrate or sulfate of ammonia, 8 per cent of potash, either sulfate or muriate, and 8 per cent of phosphoric acid, either superphosphate or high-grade acid phosphate, is used at the rate of 400 to 500 pounds to the acre in the drill.

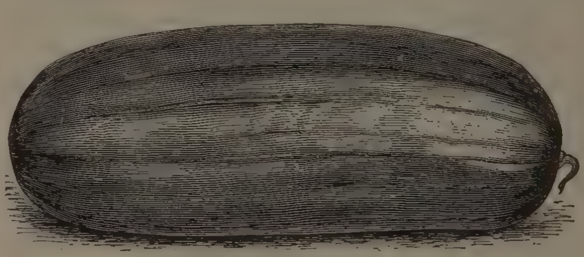
There is no advantage to be gained from planting the seed for the commercial crop of watermelons before the soil is in thorough tilth and well warmed up. Planting should be delayed until both the soil and the season are warm enough to insure quick germination of the seed and rapid growth of the plants. As a rule, the period for planting watermelons follows within a fortnight that for corn.

The watermelon is a more robust plant than either the cucumber or the muskmelon and requires more liberal spaces between both rows and hills in the row. Two general systems of planting are followed: planting in rows and planting in hills. Row-planting is very generally practised in some localities; the method followed is to open a furrow in which the fertilizer or manure is scattered and incorporated with the soil by the use of a suitable implement such as a scooter or sweep. Two furrows are then turned together over the fertilizer to form the bed on which to plant the seed. In humid sections this is somewhat above the general level of the surface, but in dry regions the seed is either planted on the level or slightly below. An abundance of seed is used so as to insure a dense stand of plants in order to fortify the plantation against the ravages of insect pests. After the plants are well established and the danger of loss of stand from insect depredations is over, the rows are thinned so that individual plants stand at intervals of 2 or 3 feet, or they may be thinned so that groups of three or four plants are as far as 6 or 8 feet apart. The rows are usually 8 feet apart. In the hill system of planting, the fertilizer is put either down the length of the row as above described, or the land may be laid off in check-rows 8 by 8 feet apart and a shovelful of well-rotted stable compost placed under each hill located at the intersection of the 8-foot marks. Fertilizer may be used instead of the manure. A stand of plants is insured by placing a dozen or more seeds in a hill, the seeds being scattered over an area of about 1 square foot and the seeds covered with not more than 1 inch of earth.

As has been observed, the main cultivation of the watermelon crop should be made before the seed is planted. No opportunity, however, should be lost to keep the land free from weeds and in a fine state of tilth from the time the plants appear above ground until the vines are too large to continue the use of horse-power implements. Even after implements are excluded, all large weeds should be pulled by hand. In many sections of the South, it is a common practice to sow a light seeding of cowpeas in the watermelon fields at the time of the last cultivation to act as a partial shade to the fruits and to prevent the whipping of the vines in the wind. The cowpeas also contribute to the upkeep of the land, an important factor with the light soils used for melon-culture.

Melons should not follow closely after melons on the same land, as areas used too frequently for melon-culture are almost certain to become contaminated with the wilt disease fungus. As this fungus is capable of perpetuating itself for considerable periods when once the soil is infested, a rotation period of five to seven years is desirable in order to avoid losses on lands which have been previously used for the crop.

As has been suggested, the watermelon is not immune to the ravages of insect pests and fungous diseases. The striped cucumber beetle is one of the most annoying and destructive insect pests attacking this crop. In the garden it can be controlled most satisfactorily by the use of screens or by a square of mosquito netting dropped over a tiny stake in the center of the hill in such a manner as to form a tent over the young plant; then by drawing earth over the edges of the netting it will be held in place and the insects excluded. The use of tobacco dust or tobacco fertilizer as a mulch for the young plants serves as a fairly effective repellant and is at the same time a valuable fertilizer.



2356. A market watermelon.

The wilt disease has caused great loss in years past and while no effective remedy is known, satisfactory crops can be secured by careful attention to crop-rotation in which wilt-resistant crops form a large factor and in which the interval between melon crops is sufficiently long, five to seven years being none too much.

Harvesting and marketing.

An important consideration in harvesting melons for carload shipment is to avoid mixing sizes in the car. If two sizes are to be shipped in the same car, they should be loaded in separate ends. Buyers establish the price for a load of melons by the minimum size of the melons in the load. Melon markets have strong likes and dislikes. Some prefer melons of a definite size only, others prefer melons with particular markings, while still others require either a long or globular melon. These peculiarities of the market should be carefully studied and the plantings be so planned as to meet the preferences of the market to the fullest possible extent. At shipping-time these features should be kept in mind and the distribution of the melons made accordingly.

Varieties of watermelon.

Melons of the highest quality have brittle flesh, few fibers, and a thin rind. Such melons are not well adapted for shipment but are ideal for home use. The commercial melon is one that has good shipping quality, a firm not too thin rind, of a variety in which the melons run uniform in size, and of a weight ranging from twenty to thirty pounds. The variety must also be productive, of fair quality, and medium early. A few sorts worthy of a place in the garden for home use are McIver, Florida Favorite, Kleckley Sweets, Bradford, Long White Icing, and Sugar Loaf. Those most popular as shipping melons are Kolb Gem, Duke Jones, Pride of Georgia, or Jones, Mammoth Ironclad, and Dixie.

Seed-production.

The production of seed has been largely confined to the new prairie breakings of western Kansas and Oklahoma, where a crop can be grown very cheaply. It is interesting to note that the wild animals, notably coyotes, often destroy a planting, so that few fruits are left for seed. The melons grown for seed are pulped in machines devised for the purpose. These machines separate the rind and pulp from the seeds and juice. The mass of seeds and juice is allowed to ferment for one or a few days, when the seed is washed and spread on wire screens for drying. When the seed is thoroughly dry it should be run through a fanning-mill to drive off melon fragments and light seed, when it is ready for market. A crop of seed is rarely planted by a farmer without a contract with a seedsman, who agrees to take all or part of the crop at a stipulated price.

In practically all sections of the Unites States where field corn can be successfully grown, the watermelon can be depended upon to mature a crop sufficient to justify including it in the home-garden. While it can be grown on a wide variety of soils by giving them special preparation, it nevertheless grows best on rich sandy, or loamy soils. The prairie soils of the corn-belt as well as the glacial-drift soils of New York can be successfully used for the garden culture of the crop.

The watermelon is tender to frost, and as it makes its most rapid growth during the warm season, it should not be planted in cold soil or before the danger of frosts has passed. A safe rule for most sections is to plant ten days to two weeks later than corn.

The few hills of watermelons necessary to supply the needs of the average family should be prepared with special care. The seed-bed should be deep and the hills fertilized with manure or compost which will tend to accelerate the growth of the plants. No better use of hog- or chicken-manure can be made than in the preparation of a compost for watermelons. The hills should be given ample distance—7 or 8 feet each way—and the seeds should be scattered ten or twelve over an area about 1 foot square, and covered with about 1 inch of soil.

The young plants will require protection from insects; the use of mosquito-netting, before noted, will prove as inexpensive and as effective as any method yet devised.

After all danger of losing the stand of plants, either by frost or pests, has passed, the population of each hill should be reduced to three or four of the most vigorous plants. From this period on, care to prevent weed-growth should give satisfactory results providing a sort adapted to the region and to home use has been chosen.

L. C. CORBETT.

MELON, Papaw: *Carica Papaya.* **M. Shrub:** *Solanum muricatum.* **Chinese Preserving M.:** *Benincasa.*

MELÒTHRIA (probably a name for a bryony-like plant; *melon* is Greek for apple, which may refer to the shape of the fruit). *Cucurbitàceæ.* Slender herbaceous vines, climbing or trailing, annual or perennial, with small yellow or white flowers and sometimes attractive little fruits, found in warmer parts of the world.

Plants with simple tendrils at the axils and very small monœcious, diœcious or polygamous fls., the sterile usually in corymbs or racemes, the fertile solitary and often slender-stalked: lvs. entire, lobed or divided: fls. white or yellow; sepals 5; corolla 5-lobed, campanulate; stamens in sterile fls. 3 or 5, more or less connate by the anthers, in the fertile fls. reduced to rudiments: fr. a small pulpy pendulous berry, with usually many flat horizontal seeds.—Species perhaps 70, widely distributed, a few of them native from Pa. and Fla. to Texas.

Four kinds appear to be in the trade, *M. scabra, M. japonica, M. maderaspatana* and *M. punctata,* the last being perhaps the best. These are slender but rapid-growing half-hardy annual climbers, which may be grown indoors in winter, but preferably outdoors in summer for covering unsightly objects. They are attractive in fruit.

Cogniaux (in DC. Mon. Phan., Vol. 3, 1881) makes three sections of the genus. *M. scabra, M. pendula,* and *M. japonica,* belong to the first, *M. punctata* to the second, and *M. maderaspatana* to the third. *M. punctata* has sensitive tendrils.

Section I. EUMELOTHRIA. Fls. usually monœcious, males mostly racemose and females solitary; anthers subsessile: fr. mostly with long and slender peduncles; seeds usually not margined and smooth.

Section II. SOLENA. Fls. mostly diœcious, males corymbose; anthers borne on rather long filaments, the connective not produced: fr. mostly short-peduncled; seeds mostly margined and smooth.

Section III. MUKIA. Fls. monœcious, males clustered and females solitary; anthers subsessile, the connective apiculate: fr. subsessile; seeds margined, usually pitted.

scàbra, Naudin. Sts. more or less hairy: lvs. rigid, ovate-oblong or somewhat triangular-hastate, acute or short-acuminate, scabrous: tendrils filiform, short: fls. small, the masculine racemes 5–7-fld. and equaling the petiole; anthers roundish, with a wide connective, the cells straight, not plicate: fr. ovoid or ovoid-oblong, obtuse, 3-celled, rather large (1 in. long, ½in. thick), with broad parallel stripes of white and green. Mex. R.H. 1901, p. 43.

péndula, Linn. Creeping or scandent, much-branched root-perennial, the st. glabrous and shining: lvs. suborbicular-cordate, acute or obtuse, hirsute becoming scabrous, often deeply 5-lobed, the lobes obtuse: male racemes 3–7-fld., usually shorter than the petioles; corolla yellow, the segms. obovate: fr. ellipsoid, to ½in. long, the seeds obovate and whitish. Pa. to Fla. and La. and Mex.—*M. pendula, M. scabra* and *M. punctata* may be confused in horticultural literature.

japónica, Maxim. Lvs. ovate-triangular, emarginate at base, scabrous above, nearly smooth beneath, entire or shallowly 3-lobed: male fls. solitary; anthers suborbicular, not appendaged at apex: fr. ovoid-subglobose, the seeds usually marginless. Japan.

punctàta, Cogn. (*Bryònia punctàta,* Thunb. *Zehnèria scàbra,* Sond. *Pilógyne suàvis,* Schrad.). Sts. glabrous at maturity, angled: lvs. membranous, cordate, angled or slightly 3–5-lobed, white-spotted and somewhat scabrous above, pilose, short-hairy or scabrous below, margin remotely denticulate: fr. brown, lightly pitted, about 3 lines thick; seeds small, about 2 lines long, strongly compressed. S. Afr. R.H. 1900, p. 661.—Intro. 1890 by Henderson & Co. as the oak-leaved climber. *Melothria punctata* is a beautiful climbing herbaceous perennial, better known as *Pilogyne suavis,* and sometimes called *Zehneria suavis.* Even when protected, it is too tender to stand the northern winters. It blooms in clusters; fls. small, white and star-shaped, with a strong musk fragrance: lvs. green, small and glossy. Being a very rapid grower, it is desirable for covering verandas or for house cult. It will do well in any part of a living-room where it has light. It will grow as much as 16 ft. high in one summer by having a liberal supply of water every day and liquid manure once a week. After growing outdoors it can be cut down to 6 in., potted and taken into the house for the winter. In the spring it can be cut back, again planted out and it will do well. The roots may almost be called tuberous, and can be kept dormant in winter, the same as dahlias, buried in sand in a cool, dry place, free from frost. Increased by cuttings. (James Vick.)

maderaspatàna, Cogn. (*Cùcumis maderaspatànus*, Linn. *Bryònia scabrélla*, Linn. f. *Mùkia scabrélla*, Arn.). Annual: lvs. ovate or somewhat deltoid, entire, angled or 3–5-lobed, very scabrous above and scabrous or short-hairy beneath: male fls. fascicled, the female solitary or only partially fascicled: fr. small, globose, smooth or sparsely echinulate, at first green and longitudinally variegated with brown-yellow, becoming red; seeds pitted. Trop. Asia and Afr.

M. fluminénsis, Gardn., produces a fr. said to be pickled when green, in Porto Rico, and eaten, and also good when fully ripe: a climber 5 or 6 ft. long: lvs. cordate-ovate, usually acute or short-acuminate, 5-angled or lightly 3–5-lobed, scabrous above: fr. small, not variegated or otherwise marked and in this differing from M. scabra. Trop. Amer: variable.

WILHELM MILLER.
L. H. B.†

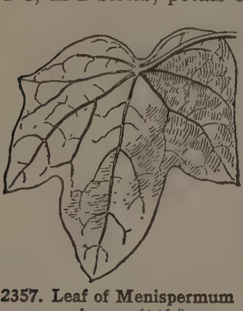
MENÍSCIUM (Greek, *a crescent;* referring to the shape of the sori). *Polypodiàceæ.* A genus of about 10 tropical species allied to Dryopteris, usually with pinnate lvs. and with the main veins united by successive transverse arches, on which the naked sori are borne. They are warmhouse and greenhouse species. See p. 1215.

reticulàtum, Swartz. Stalks 1–3 ft. long, stout: lvs. 2–4 ft. long, 1 ft. or more wide, pinnate; pinnæ 1–4 in. wide, with an acuminate apex, naked or slightly pubescent; main veins 1–1½ lines apart, with 8–12 transverse arches. Mex. and W. Indies to Brazil.

L. M. UNDERWOOD.

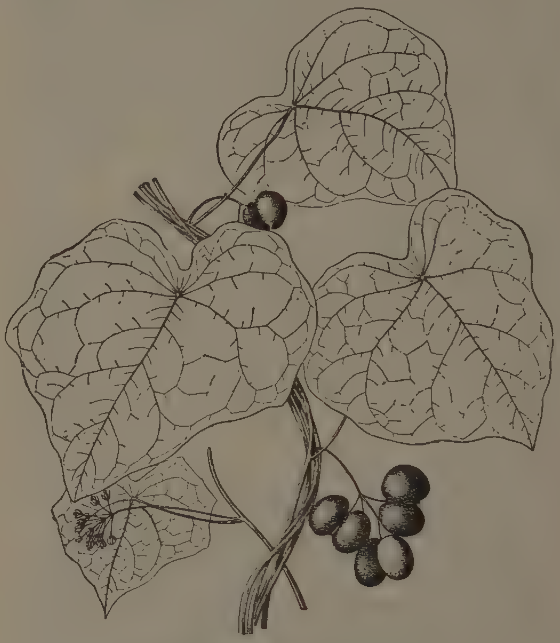
MENISPÉRMUM (Greek, *moonseed*). *Menispermàceæ.* MOONSEED. Hardy and attractive semi-woody climbers.

Twining glabrous or slightly pubescent vines, with alternate long-petioled lvs., which are peltate near the margin, and axillary or super-axillary panicles or cymes of small diœcious not showy fls.: fr. a berry-like drupe, containing a flattened crescent-shaped or curved stone (whence the name moonseed): stamens 9–24, with 4-loculed anthers in the staminate fls., 6 and sterile in the pistillate fls.; pistils 2–4, with broad stigmas; sepals 4–8, in 2 series; petals 6–8, shorter than the sepals.—As conceived by the early botanists, Menispermum contained many species which are now referred to Cocculus, Abuta, Cissampelos, Tinospora, Anamirta and other genera. The genus is now considered to be bitypic, one species in N. Amer. and the other in Siberia, China and Japan. (Diels, in Engler's Pflanzenreich, hft. 46, 1910.) Both the moonseeds are neat and interesting vines, and are hardy in the northern states and Ont. Prop. readily by seeds; or plants of *M. canadense* may be dug from the wild. Cuttings of ripened wood may also be used.



2357. Leaf of Menispermum canadense. (×⅓)

canadénse, Linn. COMMON MOONSEED. Fig. 2357. Sts. slender and terete, woody below, flocculent-pubescent when young, but becoming glabrous, twining 10 ft. or more high: lvs. variable in shape, round-ovate to ovate-cordate, sometimes entire, but usually angulate-lobed, the long petiole attached just inside the margin: fls. greenish white, in loose straggling panicles, the sepals and petals usually 6, the stamens in the male fls. 10–20: fr. bluish black, ¼in. diam., resembling small grapes. Rich soils in thickets and lowlands, Que. to Manitoba and south to Ga. and Ark. B.M. 1910. G.M. 57:153. G.W. 1, p. 63, F.E. 22:493; 28:261.



2358. Menispermum dauricum. (×½)

daùricum, DC. Fig. 2358. In habit much like the above but more vigorous: glabrous: lvs. smaller, distinctly peltate, deeper green, cordate and angular: fls. in cymes, yellowish, the terminal ones with 6 sepals, 9 or 10 petals and about 20 stamens, the lateral ones with 4 sepals, 6 petals and about 12 stamens. S. E. Siberia, Korea, China, Japan. G.F. 5:233 (adapted in Fig. 2358).—Variable. Rarely planted in this country.

L. H. B.

MÉNTHA (from the Greek name of the nymph Minthe). *Labiàtæ.* MINT. Strong-scented perennial herbs; grown mostly for their essential oils but sometimes for ornament.

The term mint, often applied to various species of Labiatæ, is most frequently used to designate plants of the genus Mentha. This genus is characterized by its square sts. and opposite simple lvs. in common with others of the family, and especially by its aromatic fragrance, its small purple, pink or white fls., with mostly regular 10-nerved calyx, slightly irregular 4-cleft corolla and 4 anther-bearing stamens, crowded in axillary whorls and the whorls often in terminal spikes; ovary 4-parted, style 2-cleft: nutlets ovoid and smooth.—Many forms have been described, and the synonymy is extensive. About 30 species are now recognized, all native in the North Temperate Zone, about half of them being native or naturalized in N. Amer. Six species are cult. more or less for the production of aromatic essential oil, which is found in all parts of the herb, and especially in minute globules on the surface of the lvs. and calyx. Some of the species hybridize freely, producing innumerable intergrading forms which make the limitation of certain species difficult.

The mints are scarcely horticultural subjects, although *M. rotundifolia* and *M. Pulegium,* as well as the little *M. Requienii,* may be used as border plants or ground-covers and for the ornamental foliage of some of the forms. They propagate readily by cuttings and division; some of them produce stolons.

INDEX.

arvensis, 8.
canadensis, 6.
citrata, 3.
gibraltarica, 7.
officinalis, 2.
piperascens, 8.
piperita, 2.
Pulegium, 7.
Requienii, 1.
rotundifolia, 5.
spicata, 4.
variegata, 5.
viridis, 4.
vulgaris, 2.

A. *Plant a miniature creeper.*

1. **Requiènii,** Benth. A minute creeping herb from Corsica, used as a carpeter: sts. filiform, ascending: lvs. small, stalked, orbicular: fls. mauve or pale purple in loose few-fld. whorls: plant peppermint-scented.

AA. *Plant larger, erect or tall, or in forms of some species perhaps compact.*

B. *Whorls of fls. in terminal spikes or some in the upper axils.*

C. *Spikes thick: lvs. petioled.*

D. *Lvs. lanceolate, acute.*

2. **piperìta,** Linn. Peppermint. Perennial by runners and rootstocks: sts. erect or ascending, 1–3 ft. high, branched, glabrous: lvs. lanceolate, acute, sharply serrate, 1–3 in. long, glabrous or pubescent on the veins beneath, punctate, with minute oil globules: fls. in thick, terminal spikes, 1–3 in. long in fr., the central spike finally exceeded by the lateral ones; calyx glabrous below, its sharp teeth usually ciliate; corolla purple, rarely white, glabrous. Eu.—Intro. into cult. from England and sometimes naturalized in moist ground. Known as "American mint" or "state mint" in N. Y.

Var. **officinàlis,** Sole. White Mint. Slender, 1–2 ft. high: lvs. 1–2 in. long: sts. and foliage light-colored. Not known in wild state; long cult. in England and sparingly intro. into cult. in Amer.

Var. **vulgàris,** Sole. Black Mint. Rather stout, 2–3 ft. high: lvs. 2–3½ in. long: sts. usually purple and foliage dark-colored. Native in England.—Cult. in recent years in England, Saxony and Amer.

DD. *Lvs. ovate or subcordate.*

3. **citràta,** Ehrh. Bergamot Mint. Perennial by leafy stolons, glabrous throughout: st. decumbent, 1–2 ft. long, branched: lvs. thin, broadly ovate and obtuse or the uppermost lanceolate and acute: fls. in the uppermost axils and in short, dense, terminal spikes; calyx glabrous, with subulate teeth; corolla glabrous. Sparingly naturalized from Eu. in N. Y., N. J., Fla. and Ohio.—The fragrant lemon-scented oil is distilled for use in making perfumes.

CC. *Spikes slender, interrupted: lvs. sessile or nearly so.*

D. *Plant glabrous: lvs. lanceolate.*

4. **spicàta,** Linn. (*M. viridis,* Linn.). Spearmint. Fig. 2359. Perennial by leafy stolons: st. erect, with ascending branches 1–2 ft. high: lvs. lanceolate, sharply serrate, 2½ in. or less in length: whorls of fls. in narrow, interrupted spikes 2–4 in. long, the central spike exceeding the lateral ones; calyx-teeth hirsute or glabrate. Widely naturalized about old gardens throughout the older settled parts of the U. S.; native in Eu. and Asia.

DD. *Plant pubescent: lvs. elliptic or ovate-oblong.*

5. **rotundifòlia,** Huds. Round-leaved Mint. Perennial by leafy stolons, pubescent throughout, somewhat viscid: sts. slender, erect or ascending, simple or branched, 20–30 in. high: lvs. subcordate at base, mostly obtuse, crenate-serrate, 1–2 in. long and about two-thirds as wide, reticulated beneath: fls. in dense or interrupted spikes 2–4 in. long; calyx pubescent; corolla puberulent. Naturalized from Eu., in moist waste places from Maine to New Mex.—Sometimes used as a substitute for peppermint or spearmint. Var. **variegàta,** Hort., with variegated lvs., is used in low borders.

BB. *Whorls of fls. all axillary.*

C. *Plants usually decumbent or prostrate at base: fls. nearly sessile.*

6. **canadénsis,** Linn. American Wild Mint. Perennial by runners and rootstocks: st. usually pubescent, with spreading hairs, erect or ascending, simple or branched, 6–30 in. high: lvs. ovate-oblong or lanceolate, glabrous or nearly so, 2–3 in. long, slender-petioled, the petioles often exceeding the nearly sessile whorls of light purple fls.: calyx pubescent. In wet soil or in water at the margins of streams. New Bruns. to Brit. Col. and southward to Va. and New Mex.—Often called peppermint, for which it is frequently mistaken and for which it is sometimes used as a substitute. It is variable in habit and also in the character of its oil.

7. **Pulègium,** Linn. Pennyroyal. Prostrate, much branched: lvs. small, about ½in. or less long, round-oval, entire or slightly crenate, hairy: fls. in dense axillary whorls, small, bluish lilac; mouth of calyx closed by hairs; upper lobe of corolla notched. In wet places, Eu. and W. Asia, and intro. elsewhere. Var. **gibraltárica,** Hort., is a dwarf compact form with deep green foliage which is sometimes variegated, used in rock-gardens and also in geometrical designs.—*M. Pulegium* has a strong and agreeable odor; lvs. sometimes used for seasoning. It is sometimes grown in kitchen-gardens, preferring a moist rather stiff soil. Prop. by division. The American pennyroyal is *Hedeoma pulegioides.* The oil of the two is similar.

2359. Mentha spicata—Spearmint. (×⅓)

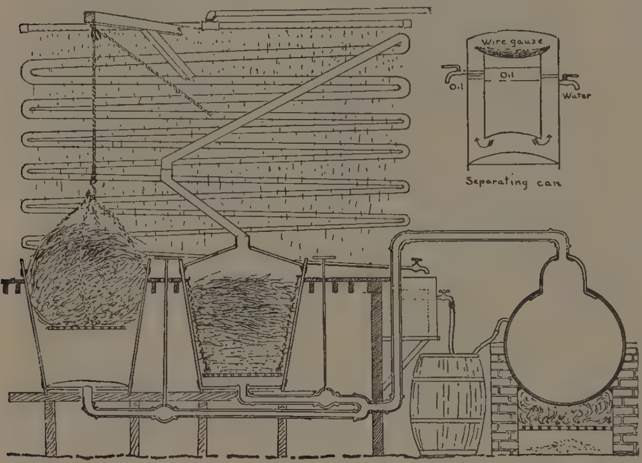
CC. *Plants somewhat rigidly erect: fls. distinctly pedicelled.*

8. **arvénsis** var. **piperáscens,** Malinvaud. Japanese Mint. Perennial by running rootstocks, puberulent or finely pubescent throughout: sts. erect, with numerous branches, 2–3 ft. high: lvs. lanceolate and acute to broadly oblong and obtuse, narrowed at the base, 1½–3½ in. long, sharply serrate, with low teeth: fls. in rather loose, axillary whorls, in distinctly pedicellate umbels, usually shorter than the slender petioles; calyx pubescent, its subulate teeth about half as long as the tube; corolla puberulent. This cult. variety is larger than *M. arvensis* itself, with larger lvs., and yields more oil. The species, *M. arvénsis,* Linn., is naturalized widely from Eu.

Culture of mints for oil.

Peppermint, the most prominent economic species of mint, ranks as one of the most important of all plants in the production of essential oils. It was originally native in Great Britain and possibly in continental Europe, but is now widely naturalized, growing in many places on both continents like a native plant. There is no record of it in America previous to its introduction to Connecticut in the early part of the eighteenth century. From there it was taken to western New York and to the Western Reserve in Ohio, and in 1835 "roots" were taken from Ohio to Pigeon Prairie, in Michigan, where the industry has grown to larger proportions than anywhere else. Peppermint is now cultivated commercially in southwestern Michigan and adjacent parts of northern Indiana, Wayne county, New York, and in Mitcham, Surrey and Lincolnshire, England, and in Saxony.

Peppermint plants may be grown on any land that will produce good crops of corn, but its cultivation is most profitable on muck soils of reclaimed swamps. It is an exhaustive crop, and on uplands is rarely included in the rotation more often than once in five years. On deep, rich muck soils it is often grown consecutively 6 years or more with no apparent diminution in yield. Peppermint is propagated by pieces of running rootstocks, commonly called "roots." These are planted, as early in spring as the ground can be prepared, in furrows 30 inches apart. On uplands two or three crops are usually grown from one setting of the "roots," but in the swamp lands the runners are plowed under after harvest, continuing the crop indefinitely. Clean cultivation is required between the rows, and often it is necessary to hoe the plants or pull weeds by hand, especially on land that has not been well prepared. Fireweed, horseweed, ragweed and other species with bitter or aromatic properties are very injurious to the oil if cut and distilled with the peppermint.



2360. A mint still.

The crop is cut either with scythe or mowing-machine in August or early September, when the earliest flowers are developed and before the leaves have fallen. In long, favorable seasons a second crop is sometimes harvested early in November. After cutting, the plants are cured like hay, then raked into windrows and taken to the stills, where the oil is extracted by distillation with steam. A "mint still" (Fig. 2360) usually consists of two retorts (used alternately), wooden or galvanized iron tubs about 7 feet deep and 6 feet in diameter at the top, each with a perforated false bottom and a tight-fitting, removable cover, a condenser of nearly 200 feet of block-tin pipe immersed in tanks of cold water, or more frequently arranged in perpendicular tiers over which cold water runs, a boiler to furnish steam and a receiver or tin can with compartments in which the oil separates by gravity. The yield of oil varies from ten to sixty pounds to the acre, averaging about twenty-five pounds for black mint, the variety now generally grown. Three kinds of peppermint are recognized: (1) American mint, "state mint" of New York (*M. piperita*), long cultivated in this country and occasionally naturalized; (2) black mint, or black mitcham (*M. piperita* var. *vulgaris*), a more productive variety introduced from England about 1889, and (3) white mint, or white mitcham (*M. piperita* var. *officinalis*), less productive and too tender for profitable cultivation, but yielding a very superior grade of oil. Peppermint oil is used in confectionery, very extensively in medicines, and for the production of menthol, or more properly pipmenthol. Pipmenthol differs in physical properties from menthol derived from Japanese mint.

Japanese mint, secured from *M. arvensis* var. *piperascens*, is cultivated in northern Japan, chiefly on the island of Hondo; not known in the wild state. It has been introduced experimentally in cultivation in England and the United States, but has not been cultivated commercially in these countries. Its oil is inferior in quality to that of *Mentha piperita*, but it contains a higher percentage of crystallizable menthol, of which it was the original source and for the production of which it is largely used. It is propagated by rootstocks carefully transplanted and cultivated by hand-labor. Two crops, rarely three, are obtained in a season, and by abundant fertilizing and intensive culture large yields are obtained. It is usually continued three years from one planting, and then a rotation of other crops follow for three to six years. Three horticultural varieties are recognized, being distinguished chiefly by form of leaf and color of stem. The variety known as "Akakuki," with reddish purple stem and broad, obtuse leaves, is regarded as best.

Spearmint is cultivated on peppermint farms for the production of oil. The plants are propagated and cultivated similar to peppermint and distilled in the same stills. The oil, for which there is a smaller demand than for peppermint, is used chiefly in medicine and to some extent as a flavoring ingredient in chewing-gum and drinks. Spearmint is cultivated in the vicinity of many large cities to supply saloons, where freshly cut sprigs of the plant are used in making the seductive and intoxicating drink known as "mint julep." The plant is more widely known as an ingredient in "mint sauce," the familiar accompaniment of spring lamb and green peas. To supply this demand it is often cultivated in the kitchen-garden. It is easily propagated by the perennial rootstocks, and persists year after year with little care, thriving in nearly all kinds of soil, providing it does not become too dry.

Lyster H. Dewey.
L. H. B.†

MENTZÈLIA (Christian Mentzel, 1622–1701, German botanist). *Loasàceæ.* Showy-flowered plants, some of the herbaceous kinds grown as flower-garden subjects.

Herbs annual and perennial, shrubs and even small trees, glabrous or setose, the sts. often becoming white and shining: lvs. usually alternate, mostly coarsely toothed or pinnatifid: fls. solitary or in racemes or cymes, white, yellowish, yellow or red; petals 5, regularly spreading, convolute in the bud, deciduous; stamens indefinite, rarely few, inserted with the petals on the throat of the calyx: seeds flat, in a caps. dehiscent at the summit.—Species probably 60–70 in the Americas. A good number are native in the U. S. They thrive in sunny moist or dry situations sheltered from strong winds. *M. Lindleyi*, from Calif., is frequent in eastern gardens, where it is commonly known as *Bartonia aurea;* the other species are offered by western dealers, but are not generally in cult. They flower in summer. Although interesting and showy, these plants have not become popular with gardeners. The seeds should be sown where the plants are to remain, as they do not bear transplanting. *M. bartonioides*, Benth & Hook., is Eucnide (which see); *M. gronoviæfolia*, Fisch. & Mey., is the same. By some authors, part of the species are separated as Nuttallia; also as Hesperaster.

A. *Plant herbaceous.*

B. *Color of fls. white, creamy white or yellowish white.*

decapétala, Urban & Gilg (*Bartònia decapétala,* Pursh. *M. ornàta,* Torr. & Gray. *Nuttállia decapétala,* Greene). Biennial or perennial, 2 ft. and more: lvs. 2–6 in. long, oval, lanceolate or oblong, sinuate-pinnatifid: fls. 5 in. across, opening toward night, fragrant, usually bracted; petals 10; stamens 200–300: caps. oblong, with numerous seeds. Dakota and Mont. to Texas. B.M. 1487. R.H. 1878:430.

nùda, Torr. & Gray (*Nuttállia nùda,* Greene). Biennial or perennial, st. somewhat slender, 1–5 ft. high: lvs. 1–3 in. long, lanceolate or oblong-lanceolate, acute, strongly dentate or pinnatifid: fls. opening toward night, creamy white, 1½–2½ in. across, usually bractless; petals 10. Mont., Kans., and Texas. B.M. 5483 (as *Bartonia nuda*).

BB. *Color of fls. yellow.*

Líndleyi, Torr. & Gray (*M. Bartònia,* Steud. *Bartònia aùrea,* Lindl.). Fig. 2361. Annual: st. 1–4 ft. high, simple or branched and straggling: lvs. 2–3 in. long, narrow-lanceolate to ovate, coarsely toothed or pinnatifid: fls. about 2½ in. across, bright yellow, very fragrant in the evening, bracted, opening in evening and remaining the following morning; petals 5, broadly obovate, nearly as broad as long, rounded at the apex except an abrupt short point. Calif. B.M. 3649. B.R. 1831. Gn.W. 21:504.

lævicaùlis, Torr. & Gray. BLAZING STAR. Biennial: st. stout, 2–3½ ft. high: lvs. 2–8 in. long, narrow-oblong to lanceolate, sinuate-toothed: fls. yellow, 2½–3 in. across, bractless; petals lanceolate or oblanceolate, acuminate. Wyo. to Calif.

AA. *Plant shrubby.*

Conzáttii, Greenm. Woody, 20 ft. and more: st. whitish: lower lvs. nearly opposite and upper alternate, simple, oblong-lanceolate, acuminate, finely dentate, the base entire and narrowed into a short petiole, scabrous above and tomentose beneath: fls. 2 in. across, brilliant yellow and showy, cymose-paniculate; calyx deeply 5-lobed; petals 5, ovate-oblong, short-acuminate. S. Mex. Listed in S. Calif.

L. H. B.†

MENYÁNTHES (Greek, probably meaning *month flower;* perhaps because it flowers for about a month). *Gentianàceæ.* BUCKBEAN. Perennial bog-plants.

As understood by the older botanists, the genus has two species, one of which is widespread in the U. S., and the other in the Pacific N.W. to Japan, but later botanists separate the latter plant as Nephrophyllidium (*N. crista-galli,* Gilg). Menyanthes has creeping rootstocks and small, 5-lobed white or purplish fls. in late spring. It is allied to Nymphoides, but the fls. of the latter are not bearded or crested on the face as they are in Menyanthes. Lvs. all alternate, stalked: corolla somewhat funnel- or bell-shaped; stamens inserted on the tube of the corolla; hypogynous glands 5; style long.

trifoliàta, Linn. BUCKBEAN. About 9–18 in. high: lfts. 3, oval or oblong-obovate, to 3 in. long: raceme 12–20-fld.: caps. small, ovoid. Bogs, temperate regions in N. Amer., Eu., and Asia. G.M. 43:335. G. 35:559. V. 2:198; 3:208.—The lvs. are said to be used in Germany as a substitute for hops in beer-making. A very interesting bog-plant, growing often in shallow water.

L. H. B.

MENZIÈSIA (after Archibald Menzies, surgeon and naturalist). *Ericàceæ.* Low deciduous shrubs, allied to Rhododendron, with small 4-merous fls. appearing with the lvs. in terminal clusters: corolla urceolate or bell-shaped, 4-lobed; stamens 8: fr. a 5-valved caps. with many linear caudate seeds. Seven species in E. Asia and N. Amer. Interesting shrubs for alpine rockeries, but not particularly ornamental. **M. pilòsa,** Juss. (*M. globulàris,* Salisb.), is sometimes offered by dealers in native plants. Shrub, 2–6 ft.: lvs. oval to oblong-obovate, glandular-mucronate, entire, strigose, ciliate, 1–2 in. long: fls. few, drooping, on slender glandular pedicels; corolla yellowish, often tinged reddish, ¼in. long; anthers included. May, June. Pa. to Ga. in the mountains. B.M. 1571. For cult., see *Andromeda* and *Rhododendron.*

M. cærùlea, Swartz=Phyllodoce cærulea.—*M. empetrifórmis,* Smith=Phyllodoce empetriformis.—*M. pentándra,* Maxim. Shrub, to 4 ft.: lvs. elliptic: fls. subglobose, greenish white; anthers exserted. Japan.—*M. polifòlia,* Juss.=Dabœcia polifolia.

ALFRED REHDER.

MERÀTIA (after François Victor Mérat, French physician and botanist, 1780–1851). Syn., *Chimonánthus. Calycanthàceæ.* Ornamental shrubs, grown chiefly for their early sweet-scented flowers; grown out-of-doors.

Deciduous or evergreen, with scaly winter-buds: lvs. opposite, without stipules, short-petioled, entire: fls. long before the lvs., on scaly branchlets axillary on branches of the previous year, with numerous imbricate sepals and without petals; stamens 5 or 6, short, with innate anthers; pistils many, inclosed in a hollow receptacle which develops into a caps.-like fr. with numerous achenes.—Two species in China. Often united with Calycanthus, which is easily distinguished by its naked winter-buds and the numerous stamens of the fls. which appear at the end of leafy shoots.

The species in cultivation is a deciduous shrub, in milder climates nearly evergreen, with generally oblong lustrous leaves and with fragrant yellow flowers with purple center appearing before the leaves in early spring. It is hardy about as far north as Philadelphia and likes a warm and sheltered position. See *Calycanthus* for cultivation and propagation.

præcox, Rehd. & Wilson (*Calycánthus præcox,* Linn. *Chimonánthus fràgrans,* Lindl.). Lvs. elliptic-ovate or oblong-lanceolate, acuminate, bright green, lustrous above, glabrous beneath, 3–5 in. long: fls. very fragrant, 1–1½ in. broad, outer sepals yellow, inner ones striped purplish brown. Feb., March. China, Japan. B.M. 466. L.B.C. 7:617. L.D. 3:173. G.C. III. 11:213. Gn.M. 5:141. Var. **grandiflòra,** Rehd. & Wilson (*Chimonánthus fràgrans* var. *grandiflòra,* Lindl.). Fls. much larger and brighter-colored. B.R. 451.—The evergreen *M. nìtens,* Rehd. & Wilson (*Chimonánthus nìtens,* Oliver), with long-acuminate lvs. and smaller and paler fls. (H.I. 16:1600) is not yet introduced.

ALFRED REHDER.

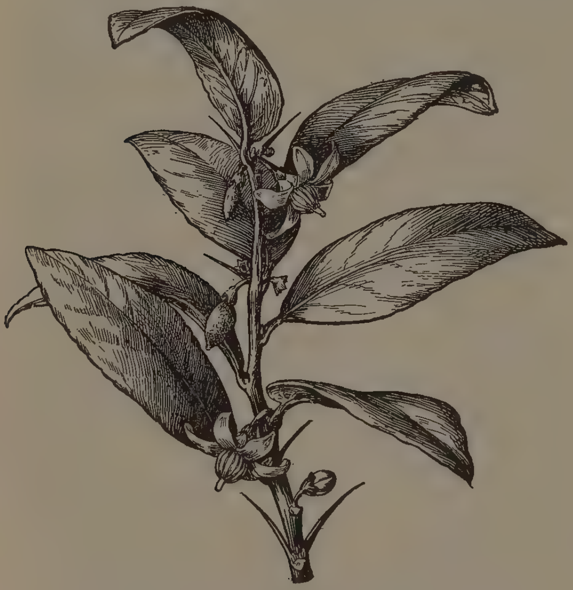
2361. Mentzelia Lindleyi. (×⅓)

MERCURIÀLIS (from Mercury, who is supposed to have discovered some virtue in the plant). *Euphorbiàceæ.* Mercury. Herbaceous plants of temperate regions, of little importance horticulturally. Lvs. opposite, simple: fls. apetalous, very small, in axillary clusters; calyx valvate; stamens 8–20, anther-cells spherical, attached by the apex and hanging; styles undivided; ovary 2–3-celled, 1 ovule in each cell. About 7 species, mostly in the Medit. region. Related to Mallotus and Acalypha. *M. ánnua,* Linn., is a weed in Eu. *M. perénnis,* Linn., is a European poisonous plant, the foliage yielding an unstable blue dye.

J. B. S. Norton.

MERENDÈRA (from *quita meriendas,* Spanish name of *Colchicum autumnale;* some of these plants formerly considered to belong to Colchicum). *Liliàceæ.* Small spring-blooming plants, classed as "bulbs;" little grown.

About 12 species of bulbous plants, mostly natives of the Medit. region and Asia, one in Abyssinia. They belong to the same tribe with Colchicum and Bulbocodium, but Colchicum has a real corolla-tube, while the other two genera have 6 very long-clawed segms. which are merely connivent, forming a loose tube at first and afterward separating. In Merendera there are 3 styles which are distinct from the base, while in Bulbocodium the style is 3-cut only at the apex. Merenderas are low stemless plants with tunicated corms: lvs. linear, appearing with the fls.: fls. 1–3, appearing in spring or fall, mostly lilac-colored. The genus is divided by Baker into two groups, based on the anthers. The 2 species described below belong to the group with small, oblong, versatile anthers, which are fastened at the middle rather than the base. They are hardy spring-blooming plants with about 3 lvs., and fls. 1–1½ in. across. These plants are procurable from Dutch bulb-growers. They are pretty, small-fld., hardy, fragile plants which persist well under good garden cultivation. The garden names are confused. *M. ruthenica* is probably *Bulbocodium ruthenicum,* which is a form of *B. vernum.*



2362. Flowering branch of Merope angulata. (Natural size)

A. *Blade of petals oblanceolate, obtuse.*

caucásica, Bieb. Lvs. 3–4, with the fls.: the 3 outer corolla-segms. appendaged on each side at the junction of blade and claw: new corms sessile. Caucasus, Persia. B.M. 3690.

AA. *Blade of petals lanceolate, acute.*

sobolífera, Fisch. & Mey. Lvs. 3, appearing with the fls.: segms. not appendaged: a very small new corm produced at the apex of a shoot. Asia Minor, Persia.—The plant cult. under this name is *Colchicum procurrens,* Baker, which differs from the Merendera in having a long perianth-tube, autumnal fls., and lvs. appearing in spring. The true *M. sobolifera* may not be in cult.

Wilhelm Miller.
L. H. B.†

MÉROPE (named for Merope, one of the Pleiades). *Rutàceæ.* Kigerukkan. A curious and as yet little-known salt-resistant plant related to Citrus, of interest for trial as a stock.

Small spiny tree: lvs. simple, thick and leathery; spines in pairs in the axils of the lvs.: fls. white, 5-merous with 10 free stamens: frs. triangular, having large flattened seeds imbedded in the sticky mucilaginous pulp.—Only one species is known.

angulàta, Swingle (*Cítrus angulàta,* Willd. *Scleróstylis spinòsa,* Blume. *Paramígnya angulàta,* Kurz.). Fig. 2362. A small spiny tree bearing curious angular frs. and growing in the tidal swamps in S. Java: lvs. coriaceous, thick, 3–5 x 1–1½ in., borne on simple petioles: fls. white, 5-parted with 10 free stamens, pistil projecting beyond the stamens: frs. triangular, 1–2 in. long, in cross section approximately an equilateral triangle ¾–1 in. on a side. Illus. Kurz., Journ. As. Soc. Bengal, 42 pl. 18 (1874). Valeton, Icon. Bogor, 4: pl. 348 (1912). Swingle, Journ. Wash. Acad. Sci. 5:420, figs. 1, 2 (1915).—This peculiar thick-lvd. plant thrives in saline soils and is being tested as a stock for other citrous frs. by the U. S. Dept. Agric.

Walter T. Swingle.

MERTÉNSIA (after Franz Carl Mertens, a German botanist). *Boraginàceæ.* Attractive herbs for colonizing and for borders.

Perennials, glabrous or pubescent: lvs. alternate, often having pellucid dots: racemes terminal or the cymes loose, few-fld., 1-sided, sometimes panicled; fls. blue or purplish, rarely white, with funnelform or campanulate corolla that is either crested or unappendaged in the throat, the lobes 5 and similar and not much spreading or the margin nearly entire; calyx 5-cut or 5-parted; stamens attached at the middle of the tube or higher; ovary 4-lobed, the style filiform: frs. 4 erect more or less wrinkled nutlets.—Species probably 40, in the cooler parts of the northern hemisphere, a good part in N. Amer. In recent years, the American species have been much redescribed. They are often very smooth plants, of attractive habit and bright colors. The most popular species is *M. virginica,* Virginia cowslip, bluebells, and Virginia lungwort. This grows 1–2 ft. high and bears more or less drooping clusters of blue-belled fls. in March to May. The fls. are about 1 in. long, and 20 or more in a terminal group. They have a purple tube and blue bell of distinct shape, the lobes of the corolla being little pronounced.

The common mertensia (*M. virginica*) is one of the plants that should remain undisturbed for years, and hence is suited to the rockery and to margins and ravines. It is unusually good for colonizing in woods. Its leaves die down soon after flowering-time. The plant should have a sheltered position and rich loamy soil. *M. sibirica* (of gardens) is considered by some even more desirable. The flowers are later, light blue, and not so distinctive in form. The foliage of *M. sibirica* lasts through the summer. Mertensias may be propagated by seed if sown as soon as ripe, but with uncertainty by division. Although of secondary importance, mertensias add variety to the border and are nearly always attractive to plant-lovers.

While *Mertensia virginica* grows well in full sun, it does almost as well in shady situations. It makes its growth early in the spring before the shade under the trees becomes very dense, and the foliage, which disappears after blooming, seems to ripen as readily in the shade as in the open. As large masses of this plant are effective, and as the blank left by the disappearing foliage precludes its being grown in the open border, it is fortunate that it will adapt itself to shady places where its yellowing foliage may be somewhat hidden and its absence during the summer be unnoticed. (W. C. Egan.)

INDEX.

alpina, 7.
chitralensis, 11.
ciliata, 5.
echioides, 9, 12.
elongata, 9.
lanceolata, 10.
maritima, 1.
oblongifolia, 3.
paniculata, 6.
papillosa, 8.
primuloides, 11.
pulmonarioides, 2.
rubra, 2.
sibirica, 4.
virginica, 2.

A. *Plant fleshy, glaucous and very smooth.*

1. **marítima,** S. F. Gray (*Pneumària marítima,* Hill. *Pulmonària marítima,* Linn.). Lungwort. On seacoasts from Mass. northward and in Eu. and Asia, likely to be planted in seaside places but apparently not in the trade: a spreading or ascending plant with branches 1 ft. or so long: lvs. fleshy, ovate to spatulate and oblong, entire, upper surface becoming blistered: fls. ⅓in. or less long, blue or whitish.

AA. *Plant not prominently fleshy, smooth or essentially so. (Nos. 9 and 10 may be sought here).*

B. *Fls. trumpet-shaped, the open part not prominently 5-lobed; filaments much longer than the anthers.*

2. **virgínica,** DC. (*M. pulmonarioìdes,* Roth). Virginian Cowslip. Bluebells. Fig. 2363. Vol. III, pl. LIII. Very smooth and glabrous, 1–2 ft.: lvs. obovate or oblong, or the lowest large, rounded and long-stalked; veins conspicuous: fls. at length more nodding than shown in Fig. 2363. Spring. N. Y. and westward to S. C. and Tenn., usually inhabiting low or moist grounds. B.M. 160 (as Pulmonaria). Gn. 23, p. 463, and 32, p. 173. J.H. III. 43:210. G. 6:115. Gn.M. 15:306. V. 3:181; 7:244; 11:180; 12:140. Mn. 4:33. Var. **rùbra,** Hort., has pink-colored fls.

BB. *Fls. with the upper part more bell-shaped and prominent spreading lobes; filaments shorter than the anthers or only a little longer.*

3. **oblongifòlia,** Don. About 12 in. high, smooth or very nearly so: lvs. mostly oblong or spatulate-lanceolate, somewhat succulent, veins inconspicuous: fls. blue in a rather close cluster, the corolla-tube 2–3 times length of the limb and also of the calyx; calyx-lobes acute. Mont. to Wash.—Not easy to cult.

4. **sibírica,** Don. Glabrous, 1–5 ft. high: lvs. roundish or broadly elliptic, somewhat fleshy, the upper ones very acute or acuminate and ovate: fls. purplish blue, in long racemes; the fls. sometimes vary to white. E. Siberia. Gn. 18:514.—Offered by some American dealers.

5. **ciliàta,** Don. The N. American plants heretofore referred to *M. sibirica* are now separated as *M. ciliata,* being specially marked by a short calyx with oval or oblong obtuse cilate lobes: glabrous, pale and glaucescent, very leafy, 1–3 ft.: lvs. oblong or lance-ovate, ciliate on the margins, mostly acute or acuminate, the basal ones ovate or subcordate: fls. bright blue, the tube 3–5 times as long as the calyx-lobes. Rocky Mts W. and N.; also in the trade. G. 27:661.—A handsome species, with bell-shaped blossoms and pinkish buds.

6. **paniculàta,** Don. Greener than *M. sibirica,* roughish and more or less pubescent: st.-lvs. ovate to oblong-lanceolate: fls. blue, in loosely panicled racemes; calyx-lobes acute, lanceolate or linear. Lake Superior and north, E. Asia. B.M. 2680 and B.R. 146 (as *Pulmonaria paniculata*).

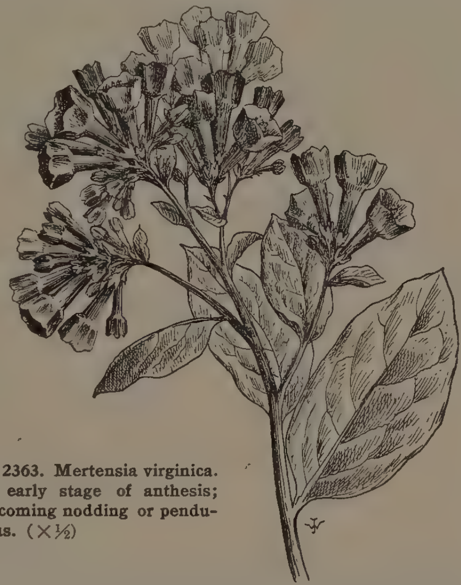
7. **alpìna,** Don. Mostly smooth and somewhat glaucous but sometimes pubescent, only a few inches high: lvs. oblong, spatulate or lanceolate, somewhat obtuse, the cauline sessile: fls. blue, crowded, corolla ⅓–¼ in. long, the tube rarely exceeding the corolla-limb and equally or slightly exceeding the lanceolate calyx-lobes; anthers nearly sessile. Subalpine places in the Rocky Mts.

AAA. *Plant not prominently fleshy, more or less hairy (at least the lvs.).*

B. *Corolla-tube little if any longer than calyx.*

8. **papillòsa,** Greene. Sparingly leafy, 12 in. or less high: lvs. oblong and revolute, densely papillose (with many minute projections) and hairy above, smooth beneath, scabrous on margins: fls. blue, panicled, the corolla small and almost tubular, with a narrow limb and shallow lobes. Mountains of Colo.—Offered in the W.

9. **elongàta,** Benth. (*M. echioìdes* var. *elongàta,* Hort.?). Sts. 8 in., hairy: lvs. somewhat hairy, oblong to spatulate, the cauline sessile: fls. blue, in many-fld. elongating racemes, the corolla-tube little exceeding the calyx, the throat bearing very small scales and the lobes spreading. Kashmir. G.C. III. 47:390 (as *M. echioides* var. *lanceolata*).



2363. Mertensia virginica. In early stage of anthesis; becoming nodding or pendulous. (×½)

BB. *Corolla-tube conspicuously longer than calyx.*

10. **lanceolàta,** DC. Dwarf, 8 in. or less high: lvs. closely or minutely pubescent on upper surface but otherwise glabrous, glaucescent, spatulate to lance-linear, somewhat fleshy: fls. blue (buds pink) in early spring, loosely paniculate; corolla-tube hairy within at the base, usually nearly twice as long as calyx. Plains and hills, Wyo., Colo.—Offered W., as a choice rock-plant, thriving in any light soil.

11. **primuloìdes,** Clarke. Dwarf, the st. about 3–6 in. long and very leafy below, hairy: lvs. small, elliptic or lanceolate, the lower ones very short-petioled: fls. about ½in. across, indigo-blue passing into white and yellow, on very short pedicels in few-fld. dense short racemes, the corolla-tube twice longer than calyx, the throat bearing distinct scales. High Himalayas. Gn. 69, p. 319. F.S.R. 1:246. Var. **chitralénsis,** Hort., has larger and more deeply colored fls. N. W. India.

12. **echioìdes,** Benth. St. 12 in. more or less: plant soft-hairy: lvs. oblong to spatulate, the lower ones long-

petioled, somewhat obtuse: fls. deep blue in dense many-fld. racemes, the corolla-tube one-third longer than calyx, with no scales in the throat, the lobes of corolla erect. Himalaya. WILHELM MILLER.
L. H. B.†

MÉRYTA (from the verb *to roll*, because of the character of the male fls.). *Araliàceæ.* Glabrous small trees of the S. Pacific Isls., perhaps 15 species, with large alternate simple coriaceous lvs.: fls. diœcious, small, in terminal panicles, the sterile with 4 or 5 stamens, the fertile with 4- to many-celled ovary; petals 4 or 5; calyx-limb none or minutely toothed. *M. Sínclairii,* Seem. (*Botryodéndrum Sínclairii,* Hook.), the PUKA, is one of the rarest plants in New Zeal., but is considerably planted in the northern part where it makes a striking round-headed evergreen tree to 25 ft. high, with large oblong or obovate shining lvs. crowded near the ends of the branches and terminal stout panicles of greenish white fls.: fr. small, ½in. or less long, succulent, black. It is intro. in England, and is well worth trying in Calif. G.C. III. 34:422; 45:2. *M. Dénhamii,* Seem., has been cult. for some time at Kew and is used as a stock on which to graft *Aralia* (*Dizygotheca ?*) *Veitchii.* It is a tree growing 30 ft. or more, with variable narrow lvs. a ft. or two long. S. Sea Isls. B.M. 7927. L. H. B.

MESEMBRYÁNTHEMUM (Greek, *midday flower;* the flowers usually open in sunshine and close in shadow). Sometimes spelled *Mesembrianthemum. Aizoàceæ.* FIG-MARIGOLD. Mostly low-growing succulents, grown as pot subjects under glass or in window-gardens and sometimes planted out in summer; some kinds are good bank-covers in mild climates.

Annual or perennial prostrate or erect herbs, and sometimes subshrubs, with thick fleshy usually opposite lvs. which are 3-angled, terete or flat, and with entire or more or less spiny margins: fls. white, red or yellow, mostly terminating the branches, usually opening in full sun but a few expanding in the evening; calyx mostly 5-parted, the lobes usually lf.-like and unequal; petals very many, linear, in 1 to many rows, united at the base; stamens very numerous, also in many rows and united at base; ovary mostly 5-celled (but variable): caps. 5- to many-celled, stellately dehiscing at the summit, becoming baccate, hygroscopic; seeds very numerous.—Mesembryanthemum includes some 300 and more species, nearly all of which are S. African, according to Sonder "abounding throughout the arid plains and sands of the whole country to the south of the Orange River and west of the Great Fish River." Four species are described by Bentham in Flora Australiensis. Two (*M. crystallinum* and *M. equilaterale*) are native in Calif. Others occur in New Zeal., Canaries, Arabia and the Medit. region. They are allied botanically to the cactaceous series, although lacking the spines of those plants and bearing true lvs. Horticulturally, they are fanciers' plants, and are classed with "succulents." Very few are in the general trade, although a number are advertised in Calif. and others are in botanic gardens. As with most succulents, the species are not well understood botanically, owing largely to the difficulty in making herbarium specimens. Many of them are of odd and grotesque form. One species, *M. crystallinum,* is a common house-plant, being known as ice-plant, but it is one of the least showy in fl. It is grown for the thick glistening foliage. It prop. readily by seed or division. The best available account of the mesembryanthemums is Sonder's elaboration of the S. African species (293 numbers) in Flora Capensis, Vol. II (1861–2), from which the following treatment has been largely taken. Sonder writes that "the caps. are tightly closed in dry weather and open naturally after rain. If thrown into water until it becomes thoroughly soaked and then removed, an old caps. will open out its capillary valves, radiating from a center like a star; and will close them again when dry. This experiment may be repeated several times without destroying their remarkable hygrometric property."

In sunny and semi-arid regions the fig-marigolds are very appropriate and attractive, covering the soil with plump foliage and giving a display of brilliant colors. They are also used more or less in bedding-out on south borders and exposures in cooler and moister climates.

2364. Mesembryanthemum felinum. (×⅓)

M. edule has extensively run wild in many parts of the world and is useful in covering banks and holding loose sands. It withstands some frost. Any number of species may be found in the collections of fanciers, and many not described below are mentioned in periodical literature, but they need not be entered here as they are really not horticulturally known. See *Succulents.*

The cultivation of the fig-marigolds should consider their natural conditions. They are found in their native habitats growing most luxuriantly on dry barren rocky places and on dry sandy plains. They are succulent plants with thick fleshy leaves, and are therefore able to stand the severe drought they have to put up with in those arid places. Knowing that these plants delight in dry arid situations gives the key to their cultivation. When grown in pots, care should be taken that the pots are well drained. A light sandy loam, mixed with brick rubbish broken small, makes a good compost for them. In summer they may be placed out-of-doors in a slightly elevated and sunny position, where they will produce an abundance of their showy blossoms. On the approach of cold weather in autumn they may be placed in a cool greenhouse with a dry atmosphere and plenty of air. Very little water is needed during the dull months of winter. Some of the species make good window plants. *M. cordifolium* var. *variegatum* is largely grown for edgings for beds. *M. pomeridianum* and *M. tricolorum* are good showy annuals. Propagation is effected either by cuttings or by seeds. Cuttings should be dried in the sun for two or three days before they are inserted in sand. (Robert Cameron.)

In the following account, the species are all South African unless otherwise specified.

INDEX.

acinaciforme, 15.
acutangulum, 33.
æquilaterale, 17.
albinatum, 4.
angustum, 5.
aurantiacum, 20.
aureum, 21.
barbatum, 44.
bigibberatum, 6.
blandum, 26.
calamiforme, 14.
caulescens, 30.
cordifolium, 39.
crystallinum, 36.
cultratum, 10.
deflexum, 47.
densum, 46.
depressum, 11.
Ecklonis, 51.
edule, 18.
elegans, 47.
falciforme, 8.
felinum, 3.
floribundum, 43.
glabrum, 41.
heteropetalum, 25.
inclaudens, 23.
lacerum, 24.
Lehmannii, 35.
linguæforme, 8.
minimum, 1.
muricatum, 31.
mutabile, 22.
obliquum, 8.
pinnatifidum, 37.
polyanthum, 48.
pomeridianum, 40.
pubescens, 13.
pustulatum, 12.
pyropeum, 38.
roseum, 29.
rubrocinctum, 16.
Salmii, 7.
serrulatum, 19.
spectabile, 27.
stellatum, 45.
stipulaceum, 34.
subcompressum, 42.
subincanum, 50.
tigrinum, 2.
tricolor, 38.
tricolorum, 38.
uncatum, 9.
uncinatum, 32.
variegatum, 39.
violaceum, 49.

A. EPAPULOSA: *Plant not bearing glittering papillæ or projections (species 1–35).*

B. *Plant stemless or nearly so.*

C. *Lvs. 2, minute, united into a globe.*

1. **mínimum,** Haw. Stemless, when cult. often somewhat caulescent, obconical, with confluent rather branched dots: fls. whitish; petals connate at base; ovary exserted. G. 1:437.

CC. *Lvs. distinct.*

D. *Fls. yellow (Nos. 2–12).*

E. *Lvs. 4–6, semi-terete at the base, thickening and triquetrous at the apex.*

2. **tigrìnum,** Haw. TIGER'S JAW. Stemless or essentially so: lvs. cordate-ovate, 2 in. or less long, glacuous green and marbled with white, the upturning edges with long, soft, ciliated teeth, the keel entire: fls. nearly sessile, large, yellow. B.R. 260. Gng. 16:227. G.L. 19:138; 27:226. A.F. 30:376.

3. **felìnum,** Haw. Fig. 2364. Lvs. triquetrous, rhomboid-lanceolate, 2 in. or less long, but narrower than in the last, somewhat glaucous, faintly dotted with white, the edges with 8 ciliate teeth; keel entire: fls. nearly sessile, yellow.

EE. *Lvs. 4–6, triquetrous, thickened from the base to the middle, but tapering to the apex.*

4. **albinàtum,** Haw. Stemless: lvs. curved-triquetrous upward, with a recurved mucro or spine at the apex, bearing elevated whitish dots: fls. sessile, yellow.

EEE. *Lvs. half-cylindrical, of various sizes or forms on the same plant, in alternate pairs.*

5. **angústum,** Haw. Nearly or quite stemless, small: lvs. 2-ranked, linear, tongue-shaped, long, keeled at the apex, somewhat unequal, one of them straight-acute and the other hooked: fls. nearly sessile, yellow.

6. **bigibberàtum,** Haw. Rather caulescent: lvs. small, scarcely tongue-shaped, very smooth, usually with 2 gibbosities, subequal, one attenuated and acute, the other keeled-dilated, obtuse at the apex: petals denticulate.

7. **Sálmii,** Haw. Nearly stemless: lvs. decussate, attenuate, one acute, the other oblique and blunt, 6–8, with a white spot at the inside of base: fls. sessile.

EEEE. *Lvs. tongue-shaped, with one margin thicker than the other, of two or more forms, 2-ranked.*

F. *Peduncle less than 1 in. long.*

8. **linguæfórme,** Haw. Lvs. unequally tongue-shaped, deflexed and somewhat falcate, becoming depressed when old, flattish above, obliquely attenuate: fls. yellow. Index Kewensis makes the *M. linguæforme* of Haworth synonymous with *M. obliquum,* Willd., and uses Linnæus' *M. linguiforme* as a tenable name.

9. **uncàtum,** Salm-Dyck. Nearly stemless: lvs. narrow tongue-shaped, 2½ in. long, thick, incurvate-uncinate at apex: fls. yellow; petals revolute.

FF. *Peduncle 1 in. or more long.*

10. **cultràtum,** Salm-Dyck. Lvs. 2-ranked, thick, tongue-shaped and curved like a pruning-knife, blunt at the apex: fls. yellow, on a somewhat 3-angled peduncle.

11. **depréssum,** Haw. Prostrate: lvs. narrow, tongue-shaped, recurved-depressed, acute: fls. yellow, with petals somewhat recurved.

12. **pustulàtum,** Haw. Lvs. 2-ranked, narrow, tongue-shaped, long and ascending, blunt, bearing pustules near the base: fls. yellow.

DD. *Fls. white or reddish.*

13. **pubéscens,** Haw. Almost stemless: lvs. silky-pubescent, semi-cylindrical, oblique at apex: fls. bright rose-red. Gt. 59:1579 and p. 13.

14. **calamifórme,** Linn. St. 1–2 in. long, woody: lvs. glaucescent, cylindric, with a much-thickened base: fls. in short stout peduncles, solitary, white with pink tips, 2½ in. across. B.M. 7775.

BB. *Plant with an evident erect or prostrate st.*

C. *Foliage-lvs. distinct or essentially so (not truly perfoliate nor connate).*

D. *St. or caudex prostrate.*

E. *Branches angular: lvs. acinaciform with smooth angles.*

F. *Peduncle with 2 bracts.*

15. **acinacifórme,** Linn. St. articulate, 2–3 ft. long, the young growth compressed: lvs. opposite, 2–3 in. long, scimitar-shaped (curved and thicker on one edge), the keel dilated: fls. purple, about 4 in. across, "the largest in the genus," the stigmas 14: fr. size of a gooseberry, and eaten by Hottentots. Gn. 62, p. 362. Gt. 59, p. 15.—Handsome.

16. **rubrocínctum,** Haw., is probably a form of the last, differing in having a red line on the keels of the lvs. B.R. 1732.

17. **æquilateràle,** Haw. Differs from *M. acinaciforme* chiefly in thinner lvs. and smaller fls.: sts. several feet long, often forming large mats: lvs. 3-sided, thicker than broad, to 2 in. long: fls. fragrant, to 2 in. across, bright rose-purple, showy and fragrant. Native to Austral., Tasmania, Chile and Calif. Grows on dunes and banks near the sea.

FF. *Peduncle without bracts.*

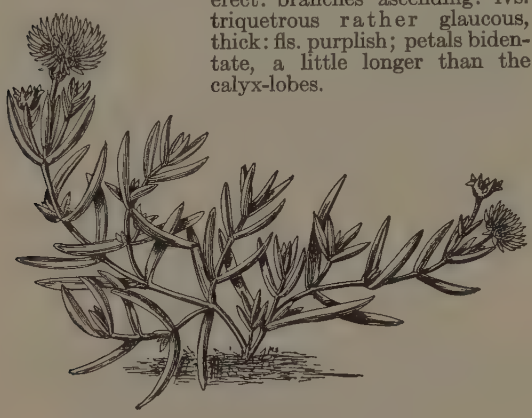
18. **edùle,** Linn. Fig. 2365. St. angular: lvs. opposite, 3–4 in. long, triquetrous, curved, the keel serrate:

2365. Mesembryanthemum edule.—Hottentot fig.

fls. large, yellow or purple, the stamens 8: fr. edible, being one of the Hottentot figs.—Grows well on the sea-cliffs in S. England, making long hanging masses (Gn. 55, p. 235, with picture); also used in Calif. and elsewhere to hold sand and to provide ground-cover. Gn. 71, p. 600.

EE. *Branches angular or terete; lvs. subacinaciform, with serrulated angles.*

19. **serrulàtum,** Haw. St. shrubby, when young erect: branches ascending: lvs. triquetrous rather glaucous, thick: fls. purplish; petals bidentate, a little longer than the calyx-lobes.



2366. Mesembryanthemum aureum. (×⅕)

DD. *St. or at least the branches, erect or prominently ascending.*

E. *Fls. yellow, orange or copper-color.*

20. **aurantìacum,** Haw. St. becoming 1 ft. or more high, much branched, sometimes decumbent at base, the branches somewhat compressed: lvs. 1 in. or less long, smooth and glaucous, bluntly triquetrous: fls. orange, with petals ¾in. long and in about 3 series.

21. **aùreum,** Linn. Fig. 2366. Larger: lvs. 1½–2 in. long, cylindrically triquetrous, smooth and glaucous, mucronate: fls. golden, 2 in. across, the petals in many series. B.M. 262.—In this and the last, the lower lvs. are often nearly connate at the base.

EE. *Fls. rose-color or purplish.*

F. *Lvs. triquetrous, carinal angles drawn out, often lacerate: branches 2-edged.*

22. **mutábile,** Haw. With straw-color or reddish tortuous, erect branches: lvs. about ½in. long, compressed-triquetrous, incurved, the keel entire, apex acute: fls. mostly solitary on an upwardly thickened peduncle, rose-color, the inner short petals pale yellow.

23. **inclaùdens,** Haw. Distinguished from the last by scimitar-shaped lvs. and broader petals: lvs. crowded, green, compressed-triquetrous and scimitar-shaped (thicker on one edge).

24. **lácerum,** Haw. St. erect, branches spreading: lvs. glaucous, 1½–2 in. long: fls. often solitary, large; petals numerous, inner ones short, exterior ones longer than calyx, rose-colored.

25. **heteropétalum,** Haw. St. and branches erect-spreading: lvs. glaucous, subfalcate: fls. small, solitary, rarely geminate; petals pale red or whitish, interior ones very short.

FF. *Lvs. subtriquetrous, elongated, acute, very smooth: branches erect, rigid.*

26. **blándum,** Haw. Two ft., with numerous branches: lvs. distant, 2 in. or less long, compressed-triquetrous, but with equal sides, narrow, minutely dotted, acutish: fls. 2 in. across, pale rose, the petals toothed. B.R. 582. L.B.C. 6:599.

FFF. *Lvs. subconnate, triquetrous, with equal sides, gradually attenuated: branches suberect.*

27. **spectábile,** Haw. St. prostrate, but branches ascending: lvs. 2–3 in. long, crowded, glaucous, incurved and spreading, triquetrous, attenuate and mucronate: fls. purplish; petals 1 in. long, the inner somewhat shorter. B.M. 396. G.W. 14, p. 649.

FFFF. *Lvs. falcate-recurved, with obtuse angles.*

28. **falcifórme,** Haw. One to 2 ft., branches spreading: lvs. much crowded, triquetrous, angles acute: fls. in 3's or solitary, 1½ in. diam., showy; petals in many series, lanceolate; filaments white. J.H. III. 50:493.

29. **ròseum,** Willd. To 2 ft. high, branches spreading, leafy: lvs. attenuate on both ends, incurved: fls. in 3's or solitary, showy; petals pale rose-colored, in two series. Gn. 62, p. 363.—One of the common species in Calif., extensively used in parkings and in terraces where it is difficult to secure a grass sod, and for covering rocks behind retaining-walls. If given water, the foliage has a rather dark green color, but if grown without watering it is grayish green and the fls. are somewhat smaller although not less brilliant.

FFFFF. *Lvs. compressed-triquetrous, with dilated keel near recurved apex, not toothed.*

30. **cauléscens,** Mill. Shrub to 1½ ft.: lvs. incurvate-erect, glaucous, acutish, with the sides obtuse, toothed and the keel entire: fls. in 3's, or often solitary; petals obtuse, emarginate.

31. **muricàtum,** Haw. St. suberect: plant bluish: lvs. less than ½in. long, somewhat incurved, deltoid and toothed, very glaucous: fls. small and fragrant, the petals acute.

CC. *Foliage-lvs. truly connate or perfoliate.*

D. *Lvs. triquetrous.*

32. **uncinàtum,** Linn. St. diffuse, much branched: lvs. sheathing at base, glaucous-green, punctate, short and equal-sided, triquetrous, often furnished with 1 or 2 spines underneath at the apex: fls. on short, thick peduncles, ½in. diam., rose-colored. Hardy in England.

33. **acutángulum,** Haw. St. shrubby, with rigid and erect branches: lvs. sheathing, ½in. long and about as long as the internodes, glaucous green, triquetrous, compressed near the apex, somewhat incurved: fls. white, small, in a panicle.

DD. *Lvs. elongated, subulate or somewhat cylindrical.*

34. **stipulàceum,** Linn. Dwarf, with erect, decussate branches: lvs. 1½–2 in. long, very slender, crowded, spreading and recurved, very glaucous: fls. in the axils, mostly solitary, purplish.

35. **Lèhmannii,** Eckl. & Zeyh. Branches compressed, ascending: lvs. spreading, subconnate, turgidly triquetrous, without dots, very smooth, glaucous: fls. terminal, solitary, on short peduncles, 1–1½ in. diam.; calyx 6-cleft; petals in many rows, interior ones shorter, pale yellow.

AA. PAPULOSA: *Plant usually bearing glittering papillæ, vesicles or projections on sts. and lvs.,—hence the popular name ice-plant (species 36–51).*

B. *Lvs. flat.*

C. *Stigmas 5.*

D. *Root annual or biennial (cult. as annuals).*

36. **crystállinum,** Linn. ICE-PLANT. Fig. 2367. A common plant in window-gardens and hanging-baskets and readily grown from seeds (which are offered by seedsmen), procumbent: lvs. flat, fleshy, ovate or long-spatulate, usually clasping, undulate, covered with glistening dots or elevations: fls. small, whitish or varying to light rose-color. S. Afr., Greece, Canary Isls., S. Calif. G. 2:147.—Grown for its glistening foliage. Fls. open in the sun.

37. **pinnatífidum,** Linn. f. Sts. diffuse: lvs. obovate, 1–2 in. long, lyrate pinnatifid: fls. axillary, solitary, pedunculate; petals as long as calyx, yellow. B.M. 67.

DD. *Root annual.*

38. **pyropèum,** Haw. (*M. trícolor* and *M. tricolòrum,* Hort.). Almost stemless, branched from the base: lvs. connate, radical or rising from the base of the st., linear-elongate, semi-cylindrical: fls. solitary, pedunculate, variable in color from light pink with red eye to self-colored white, pink and red. B.M. 2144. G.C. III. 43:42. G.M. 54:299.

DDD. *Root perennial and the st. becoming somewhat woody.*

39. **cordifòlium,** Linn. Sts. 1–2 ft., diffuse, minutely papillose: lvs. opposite, 1 in. or less long and nearly as wide, cordate-ovate, somewhat papillose: fls. solitary, peduncled, purple, the petals short and linear. A var. **variegàtum** is in cult., and is a good half-hardy trailing plant.

CC. *Stigmas 10–20.*

40. **pomeridiànum,** Linn. St. simple or forking, the branches ascending, hairy on branches, peduncles and calices: lvs. lance-spatulate or spatulate, narrowed into a petiole, ciliate: 2 of the calyx-lobes longer than the petals; petals linear-lanceolate. B.M. 540.

41. **glàbrum,** Ait. Glabrous: lvs. lance-spatulate, petiolate and dilated at base: fls. straw-colored, darker at the eye; lobes of the calyx linear and unequal.

BB. *Lvs. terete or nearly so.*

C. *Branches hispid or bristly.*

42. **subcompréssum,** Haw. Erect, 2 ft.: lvs. not crowded, ¾in. or less long, narrow, very blunt, greenish canescent, flattened-terete: fls. solitary, purplish; calyx-lobes unequal.

43. **floribúndum,** Haw. Tortuous in growth, the branches not over 6 in. long, more or less decumbent: lvs. less than 1 in. long, very narrow, terete, curved, obtuse, a little thicker toward the apex: fls. small, axillary, rose-color, the 5 styles exserted, the petals twice longer than the calyx.

CC. *Branches not hispid.*

D. *The lvs. barbate at the apex.*

44. **barbàtum,** Linn. A foot or more tall, diffuse and decumbent: lvs. not crowded, ½in. long, spreading, green and pellucid, semi-cylindrical, with 5 or 6 hairs at the end: fls. solitary, reddish, the petals entire and 2–3 times longer than the calyx.

2367. Common ice-plant—Mesembryanthemum crystallinum. (×¼)

45. **stellàtum,** Mill. Three or 4 in. high, fleshy and tufted: lvs. crowded, ⅓in. long, glaucous, semi-cylindrical, scabrous, with many hairs at the apex: peduncles hairy: fls. reddish violet, the calyx campanulate, ¼in. long.

46. **dénsum,** Haw. Much like the last: lvs. longer, flattish above and convex beneath, ciliate also at the base: calyx longer: fls. reddish violet. R.H. 1869, p. 356.

DD. *The lvs. punctate-scabrous.*

47. **élegans,** Jacq. (*M. defléxum,* Haw.). Shrubby, 6–12 in. or more tall, branchy, whitish or red: lvs. crowded, ½in. long and very narrow, very glaucous, scabrous: fls. numerous, mostly panicled, pale red (or whitish), the petals ½in. long.

48. **polyánthum,** Haw. Subshrub to 1 ft., much branched: lvs. much crowded, erect-spreading, very narrow, compressed-semiterete, bluish glaucous, prominently dotted: fls. very numerous, ternately panicled; petals rosy violet.

49. **violàceum,** DC. Distinguished from the preceding by the more robust, erect st., less diffuse branches, lvs. longer and a little incrassate: fls. numerous, very long-peduncled, ternately panicled; petals entire, twice longer than calyx, violet.

DDD. *The lvs. minutely papulose.*

50. **subincànum,** Haw. Root woody, branched, fibrous: st. erect, branched: lvs. connate, spreading, without dots or papulæ, recurved and mucronulate at the apex: fls. trichotomous, subcorymbose, fragrant, white.

51. **Ecklònis,** Salm-Dyck. Root woody, branched: st. and branches pubescent, at length glabrate: lvs. depressed triquetrous, minutely papillate and hairy: fls. in 2's or 3's, subtrichotomous, ½in. diam., white.

L. H. B.

MESOSPINÍDIUM (Greek compound; meaning obscure). *Orchidàceæ.* Plants with the habit of a slender odontoglossum, with sheathing leaves at the base of the pseudobulbs.

Flowers in racemes on panicles; sepals and petals sub-similar, expanded; labellum with 2 longitudinal ridges, adnate to the column, with rounded lateral lobes and a narrow middle lobe; column long or short; pollinia 2, seated on a rhomboid pedicel. These plants are evergreen coolhouse orchids, and thrive well in baskets of peat and moss, with plenty of water. The plants cult. as Mesospinidium are referred by some to the genus Cochlioda. Mesospinidium has about 5 species, of which the following is often cult.

sanguíneum, Reichb. f. Pseudobulbs oval, 2-lvd., mottled: lvs. ligulate, sharp-pointed, shorter than the many-fld. drooping panicle: fls. numerous, small, vivid rose; the lower sepals are partially united, oblong; petals cuneate-ovate. Peruvian Andes. B.M. 5627.

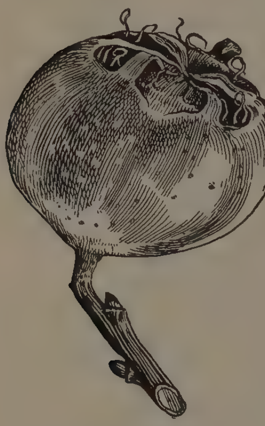
M. vulcánicum, Reichb. f., is described as Cochlioda vulcanica (Vol. II, p. 809), its proper name.

HEINRICH HASSELBRING.

MÉSPILUS (Greek substantive name of doubtful significance). *Rosàceæ.* MESPIL. MEDLAR. Woody plants, grown in Europe for the edible fruit and sometimes planted in this country.

From Pyrus, with which this genus is sometimes united, Mespilus differs in bearing the fls. singly on leafy growths of the season (the frs., like the quince, having no true detachable peduncles as do pears and apples), and in having the top of the ovaries not covered by the over-growing receptacle, and the pyrenes readily separable. There is but one species of true Mespilus, although some authors (e.g., Focke, in Engler & Prantl's "Die Natürlichen Pflanzenfamilien") include some of the Cratægus species in the genus. From Cratægus it differs in its fr. (as from Pyrus), in the large fls. borne singly, and the more leaf-like calyx divisions.

germánica, Linn. MEDLAR. Fig. 2368. The only recognized species: small tree, or sometimes only shrub-like, thorny in the wild but usually unarmed in cult.: lvs. simple and nearly sessile, lance-oblong or elongated-oblong, pubescent, serrate: fls. large and sessile on short leafy shoots, white or pinkish, pubescent outside; styles usually 5, glabrous and distinct; top of the hypanthium pubescent: fr. a pome with open top bearing a more or less hairy disk and from which the pyrenes or stones partially or slightly protrude. Var. **gigantêa,** Kirchn. (var. *macrocárpa,* Hort.), is a large-fruited form. Var. **abortìva,** Kirchn. (var. *apyrèna,* Koch), is a seedless form. Cent. and S. Eu. to the Caucasus, and also wild in England but probably not indigenous there. G. 4:363. It hybridizes with Cratægus (see *Cratægo-Mespilus,* Vol. II, p. 878).



2368. Medlar—Mespilus germanica. (Natural size)

The medlar is grown to a considerable extent in parts of Europe for its acid fruits, but in this country it is very little known. It is perfectly hardy in central New York, and its cultivation requires no special treatment or skill. It makes a twiggy tough-wooded bush or small tree, 10 to 15 feet high, bearing large white blossoms late in May or early in June, after the leaves are full size. The foliage is soft and luxuriant. The fruit (Fig. 2368) remains hard and austere until mellowed by frosts. With the freezing and the incipient decay, the fruit becomes brown and soft. It is usually picked after it is touched by frost and laid away on shelves or in drawers in a cool dry room; the ripening process which follows is known as bletting. When finally softened, it is agreeable for eating from the hand, particularly for those who enjoy fruit-acids. It also makes good preserves. Medlars are easily raised from seeds, although seeds (like those of Cratægus) may not germinate the first year. On these stocks the named varieties may be grafted or budded. Medlars may also be worked on pear, thorn (Cratægus) or quince. The Dutch or Hollandish and the Nottingham are the leading varieties. The fruit of the former is often 2½ inches in diameter. The latter is much smaller, but is better in quality. There is also a seedless variety, and two variegated forms.

M. arbutifòlia, Linn.=Aronia arbutifolia.—*M. grandiflòra,* Smith=Cratægus grandiflora (see Vol. II, p. 888).—*M. japónica,* Thunb.=Eriobotrya japonica.—*M. Pyracántha,* Linn.=Pyracantha coccinea.—*M. Smíthii,* DC.=Cratægus grandiflora.

L. H. B.

MESQUIT of Mexico is *Prosopis juliflora* (Leguminosæ). A picture of a mesquit forest is shown in G. F. 1:116.

METAPLÉXIS (Greek, referring to relationships of the corona parts and stamens). *Asclepiadàceæ.* Three twining shrubs of Japan, N. China and Siberia, little grown: lvs. opposite, cordate: fls. medium or small, in pedunculate clusters. *M. Staùntonii,* Roem. & Schult. (*M. chinénsis,* Decne. not Turcz.), has acuminate undulate lvs.: racemes extra-axillary, peduncled, the fls. pale rose or greenish white, small: likely to kill to the ground and to send up long herbaceous blooming shoots. China. G. 32:661.

METHÓNICA: *Gloriosa.*

METROSIDÈROS (Greek, *heart of iron;* this and other genera of the myrtle family are called ironwoods). *Myrtàceæ.* BOTTLE-BRUSH. Trees and shrubs, sometimes climbers, more or less planted for the showy red or white long-stamened flowers.

Leaves coriaceous, mostly opposite, sometimes distichous: fls. red, crimson, or white, mostly in terminal cymes or racemes; petals 5, spreading; stamens very numerous, 1 in. or more long, much longer than the petals; ovary 3-celled, with filiform style: fr. a coriaceous caps., inclosed in the persistent calyx-tube or protruding, the seeds numerous, linear.—The species described below are coolhouse shrubs, and are rarely grown outdoors in the S. The genus has about 20 species, half in New Zeal., and others in Pacific Isls. and Austral., 1 in S. Afr. Some of the species are brilliant when in bloom, although they have been only sparingly intro. to cult. *M. robusta* is the remarkable "rata" of New Zeal., of which Cheeseman writes: "A magnificent tree, sometimes reaching a gigantic size, specimens having been measured with trunks over 20 ft. diam. It usually (but not invariably) commences life as an ephiphyte in the upper branches of some tall forest-tree, sending to the ground aërial roots, which coalesce and form a trunk after the death of the supporting plant. Terestrial specimens are frequently seen, but these either have no trunk at all, keeping during life the habit of a much-branched bushy shrub, or produce a short, hard, and durable wood, which is much employed for wheelwrights' work, framework for machinery, wagons, etc., and for shipbuilding."

The plants belong to the class of Australasian shrubs whose chief beauty lies in their long red stamens. They are somewhat grown for a fancy Easter trade by florists, largely from imported stock. They are allied to Callistemon, and at least some of the *M. floribunda* of the trade is *C. lanceolatus.* In Metrosideros the flowers are borne in dense two- or three-forked cymes, while in Callistemon they are borne in spikes. In Fig. 745 (page 630) the plant is shown with apparently terminal inflorescence, but the branch is really terminated by the leaf-buds, which develop later. *M. semperflorens,* Lodd.=Callistemon lanceolatus.—*M. speciosa,* Sims=Callistemon speciosus.

The plant known to the trade as *Metrosideros robusta,* Fig. 2369, and which is probably *Callistemon lanceolatus,* has been grown for many years as a cool greenhouse plant, but it is only within recent time that Europeans have been sending American florists the compact little bushes that arrive with the azaleas. The city florist can perhaps dispose of one of these bottle-brushes for every ten plants of *Azalea indica.* Plants in 6-inch pots, well flowered, fixed with a red ribbon and placed in a modern basket, certainly look novel and attractive. The Belgians grow the young plants in peat, as they do most hard-wooded plants, but they do very well in good turfy loam with a fourth of leaf-mold. Cuttings of the young growth may be struck in early spring and planted out in good soil by the end of May, but it is cheaper to import stock. When the plants arrive, soak the ball of roots, pot firmly and place them in a house of about 45°. Freshly imported plants cannot be forced in much heat, like azaleas, or they will shed their flowers. Watch them carefully, give them more heat gradually and they will bloom for Easter. Plants unsold the first spring will be much more satisfactory the second year. By the end of April cut them

2369. Metrosideros floribunda of the trade, but Callistemon lanceolatus of the botanists.

back to within 1 or 2 inches of the old growth, put them in a good heat and keep them syringed. They will make a bushy growth, with a good number of shoots. Early in June plunge them in a sunny spot outdoors, with the rim of the pot well covered, and be careful that they do not suffer for water in hot weather. In July, or earlier, mulch the pots with an inch of half-decomposed cow-manure. Before frost, remove the plants to a temperature of 45° or warmer if bloom is desired before Easter. (William Scott.)

A. *Fls. red.*

robústa, A. Cunn. Large forest tree, to 100 ft., with an irregular trunk: lvs. opposite, elliptic-ovate to elliptic-lanceolate, 1–1½ in. long, glabrous, very coriaceous, obtuse, veiny, with an extra nerve near each margin and parallel: fls. dark scarlet, many in broad and dense terminal cymes; calyx top-shaped. New Zeal. B.M. 4471 (erroneously as *M. florida*). R.B. 24:269.—Probably not in the trade, the plant sometimes known by this name being *Callistemon lanceolatus*. There appears to be a white-fld. form of the trade plant.

tomentòsa, A. Rich. Christmas-Tree of New Zeal., because of its season of bloom, intro. into S. Calif. many years ago and now offered by nurserymen: much-branched tree to 70 ft., the short trunk becoming 5 ft. in diam.: lvs. very variable, 1–4 in. long, lanceolate to broad-oblong, acute or obtuse, very thick, usually tomentose beneath: fls. large, dark crimson, in many-fld. terminal cymes, the pedicels and calyces tomentose; stamens numerous, to 1½ in. long. J.F. 2:146.—Cheeseman reports it as a "noble and picturesque tree," abundant in the N. Island of New Zeal.

AA. *Fls. yellowish red; stamens red.*

flórida, Smith. "Usually a tall woody climber," writes Cheeseman in the New Zeal. Flora, "reaching the tops of lofty trees:" lvs. opposite, elliptic-oblong, obtuse, veiny, glabrous: fls. yellowish red or orange-red in few-fld. or many-fld. simple or branched cymes; petals orbicular; stamens scarlet, very numerous, to 1 in. long.—The typical form is not advertised, but only var. **variegàta**, Hort.

M. floribúnda, Hort.=Callistemon lanceolatus.—*M. lùcida*, A. Rich., Mountain Rata, is slightly in cult. in England in an amateur way; usually a tall erect tree in New Zeal., but often a bush in subalpine or exposed places: lvs. elliptic-lanceolate or lanceolate, acuminate, very coriaceous: fls. bright crimson, in broad cymes; calyx-lobes 5, ovate and obtuse; petals oblong, surpassing the calyx-lobes; stamens numerous, 1 in. long. G. C. III. 55:450. G. 36:607.—*M. scándens*, Soland. (M. buxifolia, A. Cunn.), Aka, is a tall woody climber of New Zeal., with distichous, sessile, small, broadly ovate or orbicular, obtuse very coriaceous lvs. and small white fls. in 3-fld. cymes; stamens slender, ⅛in. long. J. F. 1:24.

Wilhelm Miller.
L. H. B.†

METRÓXYLON (*heart wood*, in allusion to the large pith). *Palmàceæ*. Sago Palm. A half-dozen or more species of erect monocarpic (fruiting but once) palms of the Malayan Archipelago, New Guinea and Fiji, mostly or often unarmed, ringed below, with pinnatisect lvs., allied to Raphia. Lvs. terminal, suberect, equally pinnatisect, the segms. opposite and linear-lanceolate-acuminate: spadix large, loosely paniculate: fls. polygamous-monœcious or perfect; corolla 3-parted, the lobes oblong; stamens 6, the filaments connate at base; ovary imperfectly 3-celled, the ovules 3: fr. subglobose or ellipsoid, 1-celled and 1-seeded.—The species and synonymy are confused. None, apparently, is in cult. within our territory. The sago of commerce is derived from the trunks of *M. læve* and *M. Rumphii*. The trunks are cut into lengths, split, and the starch washed out and subsequently heated. These grow in the Malay Isls.

METTERNÍCHIA (Prince Metternich, 1772–1859, Austria). *Solanàceæ*. Probably less than a half-dozen glabrous showy-fld. trees or shrubs of the American tropics, little known in cult. and none of which appears to be in the trade: lvs. entire, shining: fls. solitary or clustered at the ends of the branches, white or rose-red to yellowish; corolla funnelform, tube enlarging above, the limb with 5 or 6 broad lobes; stamens 5, affixed in the base of the corolla, included or somewhat exserted; ovary sessile, 2-celled, the style filiform: caps. narrow, 4-valved. *M. Wércklei*, Schum., Costa Rica, is recently recorded in horticultural literature: sarmentose evergreen shrub, with edible tuberous rootstock, sometimes epiphytic: lvs. ovate: fls. in terminal corymbs, like gloxinia in form, corolla 3 in. long and 2 in. across, fragrant, white changing to sulfur-yellow.

L. H. B.

MÈUM (an old Greek name). *Umbelliferæ*. Spignel. One perennial herb, differing botanically from Ligusticum mostly in technical characters of fr., sometimes cult. for the ornamental delicate foliage. **M. athamánticum**, Jacq. (*Athamánta Mèum*, Linn.), of mountains in Eu., a glabrous tufted aromatic plant with sts. 1–2 ft.: lvs. mostly radical (cauline lvs. very few, small and less divided), pinnately decompound, the segms. multifid and wide-spreading: fls. white, whitish yellow, or pink, in many-rayed terminal compound umbels of medium size; petals acute, narrowed at base, entire but usually with an incurved point; bracts of involucre few and narrow: fr. ⅓in. long, not beaked, the carpels with 5 prominent ribs. The rootstock is said sometimes to be eaten. Prop. by seeds and division.

L. H. B.

MEXICAN TEA: *Chenopodium.*

MEYÈNIA: *Thunbergia.*

MEZERÈUM: *Daphne Mezereum.*

MEZONEÙRUM (Greek *meizos*, stronger, and *neuron*, nerve; referring to the strongly developed, winged upper suture of the pod). *Leguminòsæ*. A group of about 10 species of large usually armed and often climbing shrubs or rarely trees from S. Asia, Afr. and Australasia, closely related to Cæsalpinia, from which it differs chiefly in its compressed indehiscent pod winged at the upper suture and the short very oblique calyx-tube with the lowest lobe enlarged and concave or all lobes connate into a tube. They can be grown only in tropical or subtropical regions. Only the following species is in cult. **M. kauaiénse**, Hillebrand (*Cæsalpínia kavaiénsis*, Mann. *C. kauahiénsis*, Hort.). Tall shrub, to 12 ft., with spreading unarmed branches pubescent while young: lvs. bipinnate, with 2–10 pinnæ, each with 9–17 oblong, obtuse and retuse lfts. about 1 in. long: fls. pinkish purple, in terminal dense racemes; calyx pinkish, glabrous, with the lowest lobe large and concave; stamens exserted, with hairy filaments: pod oblong-obovate, 3–3½ in. long, with 2–4 seeds. Hawaiian Isls.—Intro. into Calif. in 1907. Called "uhuihi" in Hawaii. For cult. and prop. see *Cæsalpinia.*

Alfred Rehder.

MICHAÙXIA (André Michaux, 1746–1802, French botanist, who lived for ten years in America and wrote much on American plants). *Campanulàceæ*. A half-dozen species of rather coarse-habited biennial (perhaps perennial) herbs from the Levant. Useful for borders.

Michauxia belongs, with Campanula and other genera of garden importance, to a group characterized by having the caps. closed at the top and opening laterally by little holes between the ribs or by small solitary valves. It is distinguished from the other genera of this group by the 8–10-parted corolla with narrow, spreading, finally reflexed lobes and an 8–10-celled ovary. Michauxias are erect plants, hispid or glabrous: lvs. irregularly toothed or lobed, the st.-lvs. few: fls. terminal or growing along the branches, the top ones opening first, peduncled or nearly sessile, white or pale rose.—Only 2 species are known to any extent as cult. plants.

campanuloìdes, L'Her. Lvs. lanceolate in outline; upper ones sessile, acute, almost clasping: calyx with reflexed appendages shorter than the lobes; stamens 8. Asia Minor. B.M. 219. G.C. III. 40:111. G.W. 11, p. 199; 15, p. 595.—It grows 4–5 ft. high, has irregularly toothed, bristly-hairy foliage and large curious drooping fls., white, tinged with purple, wheel-shaped at first, later the parts reflexed. The fl. is parted nearly to the base into 8–10 oblong segms. 1½–2 in. long. This plant is a striking subject for the back of a hardy border. It is easily prop. by seeds (which should be fresh), and likes a well-enriched soil of a light character.

Tchihátcheffii, Fisch. & Heldr. A stately plant, 6–7 ft., stout and erect, simple below: lvs. 6–8 in. long, spreading and deflexed, narrow-oblong, toothed or serrate and sometimes lyrate: fls. white, in an erect cylindric very densely fld. terminal spike; corolla-lobes 8, ovate-lanceolate, the margins fimbriate. Asia Minor. B.M. 7742. Gn. 71, p. 625; 77, p. 486. G.M. 57:594. G. 36:22. G.W. 11, p. 198.—Described as biennial, and also as perennial if well cared for.

Wilhelm Miller.
L. H. B.†

MICHÈLIA (P. A. Micheli, 1679–1737, Florentine botanist). *Magnoliàceæ.* Temperate and tropical trees and shrubs, two of which (*M. fuscata* and *M. Champaca*) are cultivated in the southern states for their handsome magnolia-like foliage and red or pale yellow fragrant flowers.

Differs technically from Magnolia in the fls. mostly axillary rather than terminal, the gynophore (stipe of ovary) long and the ovules usually more than 2 in each carpel: fls. mostly axillary, solitary; sepals and petals similar, 9–15 or more, in 3 or more series; stamens as in Magnolia; carpels in a loose spike; stigma decurrent; ovules 2 or more: fr. a long, loose or crowded spike of leathery carpels, which split down the back; seeds like Magnolia.—Species about a dozen, in Asia.

Only one michelia has attained any prominence in this country. This is *M. fuscata,* one of the most popular garden shrubs in the southern states. It is known as the brown-flowered or banana shrub; also *Magnolia fuscata.* It is shrubby in habit, attains a height of 10 to 15 feet and is perfectly hardy in the middle and lower South. The shining young twigs and petioles are covered with brown tomentum. The flowers are 1 to 1½ inches across, brownish yellow, edged with light carmine, exhaling a strong banana fragrance. The flowering period extends from the end of April until June. Propagate by seeds as stated for *Magnolia grandiflora* (p. 1965), but as seed is somewhat scarce, the better method is from ripened wood cuttings, under glass and with bottom heat. The cuttings should have one or two leaves left, and be cut before very cold weather. It is a very desirable conservatory shrub in northern sections. (P. J. Berckmans.)

A. *Fls. pale yellow.*

Champàca, Linn. A tall tree native of the Himalayas, with pubescent branchlets: lvs. ovate-lanceolate, tapering to a long point, 8–10 in. long, 2½–4 in. broad, shining above, pale and glabrous or puberulous beneath; petiole 1½ in. long: fls. 2 in. across; sepals oblong, acute; petals linear: fr. 3–4 in. long.

compréssa, Sarg. (*Magnòlia compréssa,* Maxim.). Tree, to 40 ft., with smooth dark bark: lvs. oblong or narrow-obovate, narrowing into long petioles, obtuse or short-pointed, entire, coriaceous, lustrous above, 3–4 in. long: fls. fragrant, yellow, about 1 in. across; sepals and petals narrow-obovate; anthers nearly sessile; head of pistils stipitate: fr.-cone 2 in. long. Japan, a northern species. G.F. 6:77.

AA. *Fls. brownish.*

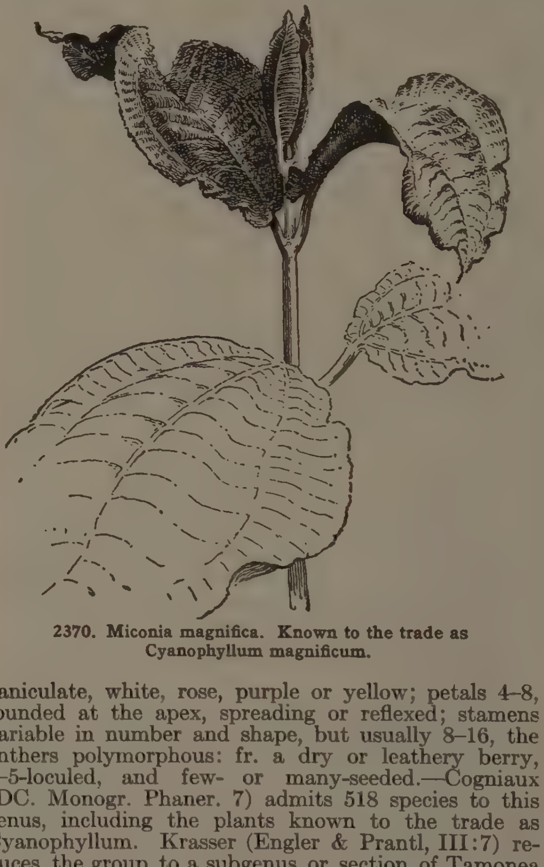
fuscàta, Blume (*Magnòlia fuscàta,* Andr.). Young growths brown-pubescent: lvs. elliptic-lanceolate or elliptic-oblong, smooth at maturity: fls. small, erect, brown-purple, very fragrant; none of the sepals or petals linear. China. B.M. 1008.

L. H. B.†

MICHOLÍTZIA ("sent home by Micholitz when collecting in India and Burma"). *Asclepiadàceæ.* A genus founded in 1909 by N. E. Brown, allied to Marsdenia but differing in the calyx-lobes being valvate and the corona-lobes tubercle-formed and spreading. The single species, *M. obcordàta,* N. E. Br., from India, is said to possess no horticultural value. It is a small undershrub with milky juice, rather small obcordate or obovate lvs. and small fls. with olive-green tube and reddish lobes.

MICÒNIA (D. Micon, Spanish physician). *Melastomàceæ.* Glasshouse subjects, notable for the handsome foliage.

A Trop. American genus of trees and shrubs, with large and showy opposite or verticillate strongly veined lvs.: fls. relatively small, usually corymbose or paniculate, white, rose, purple or yellow; petals 4–8, rounded at the apex, spreading or reflexed; stamens variable in number and shape, but usually 8–16, the anthers polymorphous: fr. a dry or leathery berry, 2–5-loculed, and few- or many-seeded.—Cogniaux (DC. Monogr. Phaner. 7) admits 518 species to this genus, including the plants known to the trade as Cyanophyllum. Krasser (Engler & Prantl, III:7) reduces the group to a subgenus or section of Tamonea (but subsequently restored), the latter genus comprising at that time (1898) about 550 species in Trop. Amer. Many species have been described recently. The most popular of the greenhouse plants, *Cyanophyllum magnificum,* is placed by Cogniaux among the species that are imperfectly known and is not described in the monograph, although it was illustrated and described as long ago as 1859. See *Tamonea.*


2370. Miconia magnifica. Known to the trade as Cyanophyllum magnificum.

The miconias of gardeners are conservatory or warmhouse subjects, grown for their large and striking foliage. They belong to the old genus Cyanophyllum, in which the anthers are subulate and incurved and with a single pore, the flowers large and the calyx oblong or campanulate and truncate or dentate. They propagate by cuttings of the firm wood over bottom heat. The plants should be screened from the direct glare of the sun, and be given abundance of water. Use a fibrous soil. Since the plants are known to gardeners mostly for their foliage, it is probable that some of the trade species are referred to wrong genera. Flowers are not always known when the plants are named. Some of the names have no standing in botanical literature. For culture, see *Melastoma* and *Medinilla.*

magnífica, Triana (*Cyanophýllum magníficum,* Hort.). Fig. 2370. Reaching several feet in height as grown under glass (probably a tree in its native place), robust: lvs. very large (becoming 2–2½ ft. long), broad-ovate and wavy-edged, arched, rugose, upper surface lustrous green, lower surface red, the very prominent veins white or light-colored: fls. small, panicled. Mex. R.H. 1859, p. 359.—Discovered by Ghiesbrecht and first shown by Linden in 1857. One of the best and most striking of all conservatory foliage subjects. Voss (Blumengärtnerei) refers this species to the genus Tamonea and calls it *T. magnifica,* Voss. **M. velùtina,** Lind. & Rod. (I.H. 41:21), of Brazil, is perhaps a form of it; the lvs. are not arched and colors are more bronzy.

spectánda, Rod. (*Cyanophýllum spectándum,* Nichols.). Lvs. oval, 1½ ft. or less long, 6–7 in. broad in the middle, the upper surface dark lustrous green, under side greenish red, the midrib prominent and gray. Brazil.

denticulàta, Naudin (*Melástoma denticulàtum,* Bonpl., not Hort.?). Branches obtusely 4-angled; the young branches, lvs. and calyx furfuraceous: lvs. narrow-ovate, somewhat obtuse, 3-nerved, base rounded, minutely serrulate: fls. pedicillate, aggregated in panicles; petals subrotund, small; calyx somewhat hemispherical. Ecuador. L. H. B.

MICRÁNTHUS (*small flower*). *Acanthàceæ.* Two genera, one iridaceous and one acanthaceous, bear the name Micranthus. The acanthaceous genus now becomes Phaulopsis (or Phaylopsis), which see. The iridaceous genus Micranthus comprises two species from the Cape, allied to Watsonia but differing in the very short tube of the small straight perianth, the fls. in long dense distichous spikes. They appear to be not in regular cult. The species are *M. spicàtus,* Pers., rose-colored, and *M. plantagineus,* Eckl., blue.

MICROCÍTRUS (from the Greek for *small* and *Citrus*). *Rutàceæ,* tribe *Cítreæ.* Small spiny trees or shrubs, closely related to Citrus, but differing in having dimorphic foliage, very small fls., free stamens, very short pistil, few-celled ovary and in the presence of cataphylls in the seedling.

Four species of this new Australian genus (see Swingle in Journ. Wash. Acad. Sci. 5:570) are at present known.

australàsica, Swingle (*Cítrus australàsica,* F. Muell.). Finger-Lime. Spiny shrub or small tree, 15–30 or even 40 ft. in height, native to the mountain scrubs of N. New S. Wales and Queensland: juvenile lvs. very small, oval or ovate, on stiff spreading branchlets; mature lvs. small, obovate, cuneate or rhomboidal, ½–1½ x ½–¾ in.: frs. finger-shaped, 2½–4 x ¾–1 in., smooth-skinned. Ill. Wash. Acad. Sci. 5:572, figs. 1–4.—Young plants of the finger-lime are very ornamental, having successive tiers of horizontal spiny branchlets with juvenile foliage somewhat like a young araucaria. They flower and fruit when but a few years old. The finger-shaped frs. contain a rather disagreeably pungent acid juice. This species is promising for breeding purposes because of its hardiness. It is also promising for use as a hedge plant in warm climates because of its dense spiny branches, dwarf habit, and ability to grow from cuttings. A variety of this species (*M. australàsica* var. *sangúinea*), the red-fruited finger-lime, has blood-red frs. with a pinkish pulp.

Gárrowayi, Swingle (*Cítrus Gárrowayi,* F. M. Bailey.) Garroway's Finger-Lime. Small spiny tree from N. Queensland: juvenile lvs. very small, on stiff spreading branchlets: frs. oval, 2–2½ x 1–1¼ in., rough-skinned, 5-celled.—This species, recently introduced into this country, is very closely related to *M. australasica.*

austràlis, Swingle (*Cítrus austràlis,* Planch.). Dooja. Round-fruited Australian lime, native to the subtropical coastal forests of New S. Wales and Queensland: juvenile lvs. linear, on flexuose branches; mature lvs. ovate or elongate-rhomboidal, 1–2 x ½–¾in.; frs. round, rough-skinned, 1–2½ or even 3 in. diam., 5- (rarely 6- or 7-) celled. Ill. Penzig, Studi s. Agrumi, pl. 21, figs. 8–12.—The dooja is one of the most interesting Australian citrous frs. It reaches a height of 30 to 60 ft. and bears frs. said to reach 2½ or even 3 in. diam. The growing shoots and immature lvs. on plants cult. in the open are of a deep wine-red color. Because of its vigor this species is of interest for use as a stock. It shows considerable resistance to winter cold in Calif.

inodòra, Swingle (*Cítrus inodòra,* F. M. Bailey). The Russell River Lime. A spiny tree, bearing ribbed frs., native to Queensland: lvs. large, 3–7 x 1½–2½ in., lanceolate, not articulated with the petiole which is very short; fls. inodorous: frs. ribbed, 2–2½ x 1¼ in., oval, 8-celled. Ill. Bail. Fl. Queensland, 1, pl. 10, 1899.—The Russell River lime in the wild state bears edible frs. said to equal in flavor the West India lime. This has not yet been intro. into culture. Walter T. Swingle.

MICROCÝCAS (*small cycas*). *Cycadàceæ.* One species in Cuba, differing from Zamia in the character of the floral scales (masculine scales plane and obtuse, the feminine thickened at the apex and truncate); caudex cylindrical, covered with bases of the petioles. *M. calócoma,* A. DC. (*Zàmia calócoma,* Miq.), has a dwarf trunk and lvs. 3 ft. long: lfts. about 80 pairs, long-linear, acuminate, revolute, parallel-nerved: foliage pubescent. Probably not offered.

MICROGLÓSSA (*small tongue,* because the ligules are short). *Compósitæ.* Nine or 10 Asiatic and African shrubs, sometimes climbing, allied to Erigeron and Aster, very little grown: lvs. mostly entire and alternate: fls. in small corymbose or panicled heads with very small white or bluish rays; ray-fls. in 1 to many series, pistillate and fertile; disk-fls. perfect and fertile, with 3–4-toothed dilated limb; involucre of many-rowed narrow bracts, the outer shorter; receptacle flat, nearly or quite naked: achene angled, bearing copious slender pappus-hairs. *M. albéscens,* Clarke (*Áster albéscens,* Wall.), occurs in horticultural literature: erect, with faintly grooved branches: lvs. lanceolate, entire or slightly serrate, hoary beneath: heads ⅓in. diam., with bluish or whitish ligules. Temperate Himalaya. R.H. 1907, p. 523.

MICROKÉNTIA (*small* or *minute Kentia*). *Palmàceæ.* Here may belong the plant known to the trade as *Kentia gracilis.* Microkentia is a genus of 6 species of palms from New Caledonia. They are unarmed, with slender bamboo-like ringed trunks. The lvs. are terminal, pinnatisect, and the lf.-segms. are long-sword-shaped and distinct, or the upper ones grown together into a broad 2-cut blade. The frs. in this genus are amongst the smallest in the palm family. The fls. also are minute. The true kentias, of which perhaps none is cult., have larger fls. and frs., the former white, the latter vermilion. The anthers are fixed at the base in Kentia, but dorsifixed and versatile in Microkentia. Microkentia is nearer Clinostigma and Cyphosperma, but in these the lf.-segms. are irregularly cut off at the apex. *Kentia gracilis,* Brongn. & Gris. =*Microkentia gracilis,* Benth. & Hook. It is possible that the *Kentia gracilis* of the trade is *Kentiopsis divaricata.* None of the other species is known in cult. N. Taylor.†

MICROLÉPIA (Greek, *a small scale;* alluding to the indusium). *Polypodiàceæ.* A genus of graceful greenhouse ferns, allied to Davallia, but having the shallow, half-cup-shaped, membranous indusium attached to the sides as well as the base; the stalks are also continuous with the rootstock, and not joined to them, as in the true davallias.—Twenty or more species are known. For cult., see *Davallia.*

A. *Lvs. once-pinnate.*

marginàta, C. Chr. (*M. marginàlis,* Baker. *M. scàbra,* Hort.). Rootstock creeping: lvs. 18–24 in. long, 9–15 in. wide, with linear pinnæ, which are cut about half-way to the rachis into bluntish, oblong lobes. Ceylon to China.

AA. *Lvs. tri-quadripinnatifid.*

platyphýlla, J. Smith. Rootstock stout, scaly: lvs. 3–4 ft. long, on stout stalks, tripinnatifid; ultimate divisions broad, bluntish, toothed, oblong, deltoid; sori 2–12 to a segm., 1 in each tooth. India to Japan.

hírta, Presl. Lvs. 3–6 ft. long, on stout stalks, tri-quadripinnatifid; ultimate divisions oblong, broadly toothed; rachises hairy or pubescent; sori 2–20 to a segm., 1 or more together at the base of each tooth. India and Polynesia. Var. **cristàta** is also offered by the trade. F. 1878, p. 59. Gn. 31, p. 428. F.R. 1:769.

L. M. Underwood.

MICROLÒMA (*small fringe,* referring to the hairs in the corolla-tube). *Asclepiadàceæ.* Slender-stemmed twining perennials, or sometimes dwarf little shrubs, little known in cult.: lvs. small, opposite: fls. mostly pink or red, in small subaxillary umbel-form cymes: 10 species in S. Afr. *M. tenuifòlium,* Schum., has a cluster of stout fleshy roots, partially herbaceous, glabrous st., linear revolute lvs., urn-shaped somewhat fleshy carmine-red corollas with tube 2½ in. long. B.M. 8248.

MICROMÈLES: *Sorbus.*

MICROMÈLUM (from the Greek for *small* and *apple*). *Rutàceæ.* Small spineless trees or shrubs distantly related to Citrus, of interest for breeding experiments and trial as stocks.

Leaves odd-pinnate; lfts. 3–9, alternate, ovate or obtusely acuminate: infl. a many-fld. terminal cyme or corymb; fls. 4–5-parted: fr. small, like a large pea, 5-celled with 1–2 ovules in each cell. The genus ranges from Indo-China throughout India and the Malay Archipelago, and includes several species. They should be intro. into the U. S. for trial in breeding experiments.

Walter T. Swingle.

MICROMÉRIA (*small part;* small-flowered). *Labiàtæ.* Small more or less trailing or decumbent perennial herbs and subshrubs, sometimes planted in borders and rock-gardens.

Leaves usually small, entire or toothed: whorls axillary or in terminal spikes; fls. small; calyx tubular and mostly 13-nerved, 5-toothed, somewhat 2-lipped; corolla 2-lipped, upper lip erect, flattish, entire or notched, lower spreading, 3-lobed; stamens 4, didynamous; style 2-parted at apex: nutlets smooth, ovoid or oblong.—Species 60 or more in northern extra-tropical countries, particularly in the Medit. region. By some authorities, the genus is included in Satureia. Of simple cultural requirements. Prop. by division as well as by seeds.

A. *Fls. few in the axils.*

Chamissònis, Greene (*M. Doúglasii,* Benth. *Thýmus Chamissònis,* Benth.). Yerba Buena. Perennial: sts. long, slender, trailing and creeping, with sweet-scented round or oval lvs., 1 in. or less across: fls. purplish, mostly solitary in the axils, on long 2-bracted pedicels. Woodlands, from Vancouver Isl. to S. Calif.—Sandy soil. Roots by stolons.

Piperélla, Benth. (*Thýmus Piperélla,* All.). Fig. 2371. A few inches high, with slender arching branches: lvs. ovate, more or less cordate, sessile: fls. purple-and-white in few-fld. lax peduncled secund fascicles; corolla lightly pubescent. S. Eu.—A partially shrubby rock-garden plant; prop. by cuttings.

AA. *Fls. numerous in the axils.*

2371. Micromeria Piperella. (Flower ×½)

rupéstris, Benth. A dense, low-growing perennial, woody at the base, with prostrate sts., which turn up at the extremities, giving a heath-like effect when in bloom: lvs. with the odor and taste of pennyroyal: fls. abundant, small, white, with lavender spots on the inner side of corolla-lobes, borne for several inches along the sts. S. Eu.—Prop. from cuttings and seeds. It blooms from July until heavy frosts, and proves very satisfactory for rockery and informal border.

L. H. B.†

MICROPHŒNIX (*small Phœnix*). *Palmàceæ.* A name applied to two hybrid palms that were described some thirty years ago. *M. decípiens,* Naudin, is a hybrid between *Phœnix dactylifera* and *Chamærops humilis;* and *M. Sahùtii,* Carr., between the foregoing (*M. decipiens*) and *Trachycarpus excelsus,* with the violet-colored petioles and fruit of the latter parent. R.H. 1885. p. 513.

MICROSPÉRMA: *Eucnide.*

MICRÓSTYLIS (Greek, *small style*). Syn., *Achroánthus. Orchidàceæ.* Mostly terrestrial orchids, sometimes grown under glass, and the hardy kinds perhaps transplanted to the bog-garden; some of the exotic species have colored foliage.

Deciduous, low plants, with fleshy roots, solid bulbs, or some of the kinds with pseudobulbs: lvs. plicate or membranaceous (in some species only 1): fls. mostly small, usually greenish or yellowish but often oddly shaped, in a terminal raceme, spike or umbel, with small and narrow bracts; sepals free, spreading and nearly equal; petals about the length of the sepals but very narrow or even filiform; lip sessile and erect or spreading, shorter than petals but often very broad, entire or fimbriate or 2–3-lobed, cordate or ovate or auricled at base; pollinia 4, in pairs: fr. a small ovoid beakless caps.—Species more than 100, in many parts of the world, largely in the North Temperate Zone and some of them tropical; a few species occur in the U. S. and Canada. None of the species seems to be regularly in the American trade, but a few are offered abroad by orchid specialists.

The species of microstylis are deciduous orchids. They grow well in the warm end of the cattleya department, or better still treated like thunias or calanthes,—a rather warm moist atmosphere when growing in spring, reducing the same toward late summer as they begin to lose their foliage, and eventually resting them quite dry in a temperature of about 60° F. during winter. They will probably suffer in a Wardian case or bell-glass. They certainly will after growth is completed, if not at all times. (Robert M. Grey.)

M. calophýlla, Reichb. f. 9 in.: fls. yellowish: lvs. ovate, undulate, spotted green, greenish brown in center and the margin gray-green: pseudobulb conical. Malaya.—*M. congésta,* Reichb. f. (M. Bernaysii, F. Muell. M. fusca, Reichb. f.). One foot: fls. greenish yellow, in a dense cylindrical raceme or spike: lvs. green.

Trop. Asia.—*M. díscolor*, Lindl. 9 in.: fls. handsome but very small, yellow, shading to orange, on upright stalks: lvs. red-purple, bordered green. Ceylon. B.M. 5403.—*M. Josephiàna*, Reichb. f. 1 ft.: fls. yellow, rather large, in a raceme: lvs. broad-ovate, bronze, light green below: pseudobulbs oblong. India. B.M. 6325.—*M. macrochìla*, Rolfe. 15 in.: fls. rather large, the sepals and petals yellow and lip red-purple and veined: lvs. mottled with light brown and cream. Farther India.—*M. metállica*, Reichb. f. 9 in.: fls. rose-purple, with sepals marked yellow: lvs. oblong, acute, dark glossy purple with metallic sheen, light rose underneath: pseudobulbs cylindrical. Borneo.—*M. philippinénsis*, Kränzl. Fls. yellow or purplish, sometimes as many as 100 in a spike 8 in. or more long; lip orbicular, deeply cordate at base: lvs. broad-oblong, somewhat undulate, bright green. Philippines.—*M. purpùrea*, Lindl. 9 in: fls. yellow-purple: lvs. dark metallic crimson above and red-gray beneath. Ceylon.—*M. Scóttii*, Hook. f. 6 in.: fls. yellow: lvs. light green and cream-colored, on the margin and along the rib mottled light brown. Farther India. B.M. 7268.—*M. Wállichii*, Lindl. (M. biloba, Lindl.). 9 in.: fls. green-yellow to purplish: lvs. green, more or less shaded purple. Burma.

L. H. B.

MIGNONETTE (*Reseda odorata*) is a branching, annual herb from northern Africa, which at first grows upright, but later becomes more or less decumbent and wide-spreading. The leaves are simple. The fragrant small yellow-and-white flowers are borne on spicate racemes which vary in size with different strains of seed. (Fig. 2372.)

Although mignonette has been grown under glass for many years, it is only recently that growers have specialized with this crop for winter forcing. Careful selection of seed has resulted in greatly improved strains. Formerly the mignonette spikes were scattered and comparatively small; now large spikes of dense flowers are being produced. The sprays are very pleasing when arranged with carnations or other flowers having scanty foliage. The fragrance of the flowers adds to their popularity. The demand for mignonette has so increased the importance of the crop commercially that many florists are specializing in its cultivation.

Mignonette will grow in almost any soil, but the large growers prefer a medium light turfy loam. Pasture sod is excellent, and sod from a field which has been in grass for a considerable time is also good. William Nicholson of Framingham, Massachusetts, has been exceptionally successful in growing mignonette, and from his cultural notes have been compiled the following directions:

In growing good mignonette, a well-prepared soil is of prime importance. The same kind of soil is used as for carnations, and is prepared by first plowing the sod-land after the grass has been cut, usually about the first of August. After plowing, the wheel-harrow is used, and then rye and Canadian white field peas are sown. The last of October or the first of November, a heavy top-dressing of cow- or horse-manure is applied. Cow-manure is preferable. This is plowed under and left until spring. As soon as it is possible to work the ground, the land is wheel-harrowed several times, and an application of manure is made. The soil is plowed again, well disked, and bone-meal applied, about one ton to the acre; the land is then ridged, and is ready for the benches. This method of preparation eliminates much hand work, and there is little danger of the soil becoming sour, as it frequently does if the compost method is practised.

Most growers prefer to grow mignonette in raised benches about 5 inches deep. An inch of well-rotted stable-manure is placed on the bottom of the bench, and the remainder is filled with the composted loam.

The surface of the soil is leveled carefully, and marked off in rows 6 by 8 inches apart. From six to ten seeds are dropped at the intersection of each row, and covered very lightly. A light watering with a fine sprinkler is then given the soil, to settle it around the seeds.

Three sowings of seed are made each year,—in the first weeks of July, August, and September. Plants of the last sowing flower until the next July. After the seeds have germinated, and the seedlings have developed the third leaf, three strong plants are selected and the others removed. Seed for next season's crop is selected from the plants started in September. The plants which produce good foliage and compact flower-spikes, with large individual flowers, are selected as the seed-bearing parents.

Great care should be taken that the seedlings started in July receive sufficient air. The ventilators should be kept open day and night to keep the plants stocky and short-jointed. During bright weather, temporary shading is necessary in the middle of the day, until the seedlings get their second leaf, then full sunlight should be given. After the flower-spikes begin to appear, all side shoots should be removed from around the top of the stem. Three or four strong bottom side shoots are left for a second crop. In this way a succession of blooms may be obtained throughout the winter. As soon as the plants are well developed, a wire ring is placed about each plant. Later, wires with cross strings are used for supports, the same as are used for carnations.

Mignonette is injured by over-watering, and great care should be taken that the soil be not too wet, especially when the plants are just started. As they develop, watering should be done only on bright mornings, for if water remains long on the foliage, the leaves become spotted.

2372. Mignonette, Allen's Defiance.

A night temperature of 45° to 48° best suits mignonette. On cloudy days the temperature should be kept at 55°, and on bright days it should never be allowed to go above 65°.

When the plants have developed sufficiently so that flower-spikes are forming, they will require additional food. It is composed of one part sheep-manure and two parts of loam The two are thoroughly mixed and three large handfuls of the mixture are scattered about the plants in a row across a 3-foot bench. Instead of this top-dressing, they may be given a weak solution of liquid manure. A bushel of sheep-manure is put into a bag and suspended in a barrel of water for two or three days. The bag is then removed, and the plants watered with the liquid.

Mignonette is grown in pots to a limited extent. There is some demand for it at Christmas and Easter, and some florists always have pot-plants in stock. It is more difficult to grow in pots than in beds, as it is necessary to have compact, stocky plants. This requires a great deal of care. The best method of culture is to fill 2½-inch pots with finely sifted soil, which has been prepared the same as described for bench culture, and to sow the seed in this soil. It should be remembered that the mignonette will not transplant; therefore, the seeds should be sown exactly where the plants are to grow. Several seeds should be sown in each pot to insure a perfect germination, and after this has taken place and the plants are well developed, all but one plant should be removed. The young plants should be kept as near the glass as possible to foster a stocky growth. Great care should be taken not to let the plants dry out, neither should they be over-watered.

As soon as the soil is filled with the feeding-roots, the plants should be re-potted, and this re-potting should be done frequently, the plants never being allowed to become pot-bound. When the plants are from 4 to 5 inches tall, they should be pinched, and the side shoots allowed to develop. When they have grown to a height of 6 or 7 inches, they should be staked and tied, and again pinched back to encourage branching. The large flower-spikes are not desired in pot-grown plants, but a larger number of smaller spikes. Pinching makes the plants much more symmetrical. When the plants are in flower, they should be in 7- or 8-inch pots.

As a garden flower, the mignonette is by no means showy, but its delicate fragrance makes it popular. It requires a cool well-drained soil, and one which is moderately rich in decayed organic matter. It does not like the full sunlight, so should be given a spot which is shaded a part of the day. The seed should be sown late in April, in the North, and a second sowing may be made early in July, so that the season of bloom be extended until the time of severe frosts.

E. A. White.

MIKÀNIA (Prof. J. G. Mikan, of Prague, or his son and successor, J. C. Mikan, who collected in Brazil). Syn., *Willugbæya. Compósitæ.* Shrubs or herbs, the latter twining, rarely erect.

Leaves opposite, usually stalked: heads spicate, racemose, corymbose or panicled; fls. mostly white or pinkish.—About 150 species, mostly found in the warmer parts of Amer. Nearest to Eupatorium, but the latter has an indefinite number of involucral bracts instead of 4, and contains erect plants. This includes *M. scandens*, the climbing hempweed, a common native weed, but a pretty one.

scándens, Willd. Climbing Hempweed. Foliage distinct, the lvs. being somewhat heart-shaped or halberd-shaped, and long-acuminate: fls. very small, numerous, pinkish, and borne in dense clusters 1–2 in. across; these clusters, as in all the species, are composed of many small heads, each containing 4 fls., surrounded by an involucre of 4 bracts. Moist ground, New England to Fla. and Texas.—Very rarely offered by dealers in native plants.

Sánderi, Hort. Hothouse climber, with variegated foliage. Intro. 1899 by Sander & Co., who say the lvs. are richly embellished with dark velvet-purple patches; veins of mature lvs. white. The lvs. are about 6 in. long, 5 in. wide, boldly toothed. The botanical affinities of this plant are uncertain.

N. Taylor.†

MILDEW is the name given to a group of fungous diseases which attack leaves, shoots, flowers and fruits. The true or powdery mildews (Erysiphaceæ) appear as a thin white powdery coating on the surface of the plants. The disease is usually accompanied by distortion and dwarfing, and often death of the affected parts. In some cases, however, as in the maple mildew, the affected areas of the leaves retain their chlorophyll and remain green in the autumn long after the remainder of the leaf is dead and yellow. The mycelium is always superficial, forming spots or more or less extended areas on the affected organs. The injury is done by numerous haustoria, which penetrate the cells of the host and absorb nutriment for the mycelium, and also serve as organs of attachment. During the summer mildews are propagated by 1-celled spores, many of which are cut off in succession from erect simple branches all over the diseased surface. Other spores, by means of which the fungus passes through the winter, are produced in sacs inclosed within hollow spherical receptacles, called perithecia. These appear as minute black or dark brown specks over the diseased area. They are produced in the autumn, and remain on the fallen leaves; but the spores within them do not ripen until the following spring, when they are liberated by the decay of the perithecia.

In the United States, considerable injury is caused by the following species: The rose mildew, *Sphærotheca pannosa*, on roses under glass; *Erysiphe graminis* on wheat and other grasses; the vine mildew, *Uncinula spiralis*, producing the powdery mildew of grapes; *Podosphæra Oxycanthæ* on apples and pears; and *Sphærotheca Castagnei*, the hop mildew. The most successful mode of combating the mildews is by dusting with sulfur or spraying with bordeaux mixture. Either of these fungicides kills the mycelium and spores of the fungus

The downy mildews or false mildews belong to the Peronosporaceæ, a group of fungi widely separated from the true mildews. The mycelium is parasitic within the tissues of the host, only the fruiting branches appearing at the surface. The fruiting branches have a characteristic form and method of ramification for each genus of the group. The spores, when they lodge on new host-plants, either produce an infecting thread directly, or, in most cases, the content of the spore is discharged in the form of swarm-spores, which swim about for a time and finally come to rest and produce the infecting mycelium. Resting-spores are produced sexually in this group within the tissues of the host.

This family contains about ten genera, of which the following are most commonly known: *Phytophthora infestans*, the potato blight; *Plasmopara viticola*, the downy mildew of grapes; *Bremia lactucæ*, often causing great damage to lettuce in forcing-houses; *Pythium Debaryanum*, causing damping-off of seedling cucumbers and various other seedling plants; and *Cystopus candidus*, the common white rust of crucifers. Modes of combating these diseases are set forth for each specific case in the experiment station literature of the various states. See, also, *Diseases and Insects*.

Heinrich Hasselbring.

MÍLIUM (ancient Latin name of broom-corn millet which, however, belongs to a different genus). *Gramíneæ.* Millet-Grass. Spikelets 1-fld., in diffuse panicles: glumes awnless, the lemma and palea coriaceous, as in Panicum.—Contains 5 or 6 species distributed through Temp. Eu. and Asia, one of which, *M. effusum*, also found in N. Amer., is occasionally cult. for ornament.

effùsum, Linn. A smooth woodland perennial, 3–6 ft. high: lvs. broad and thin: panicle 6–9 in. long, with slender drooping branches. Dept. Agric., Div. Agrost. 7:104.

A. S. Hitchcock.

MILK PEA: *Galactia.*

MILK VETCH: *Astragalus.*

MILKWEED: *Asclepias.*

MILKWORT: *Polygala.*

MÍLLA (J. Milla was head gardener at the Court of Madrid). *Liliàceæ.* An attractive spring-flowering bulb.

Leaves few, very narrow, grass-like, radical: scape low, simple and leafless, bearing 1 to several fls. in a terminal umbel; perianth salverform with 3-nerved segms. which are separate nearly to the base; stamens 6, nearly sessile in one row: caps. sessile, oblong-obovate. Bentham & Hooker, as well as Engler, restrict the genus

Milla (as Cavanilles, its author, intended) to one Mexican species. From Brodiæa the genus differs in the fact that the pedicels are not jointed and the perianth-segms. are always 3-nerved. Milla and Brodiæa are native to the northern half of the western hemisphere. In S. Amer. is the genus Triteleia, which is by some referred to Milla, by others to Brodiæa, and by still others kept distinct. There is one Triteleia (*T. uniflora*) in common cult. In his monograph (Journ. Linn. Soc. 11, p. 378), Baker refers the triteleias to Milla, and this disposition is followed by Index Kewensis, but in a later account (G.C. III. 20, p. 459) he refers them to Brodiæa. Watson (Proc. Amer. Acad. Arts & Sci. 9, p. 240) restricts Milla to one species. The N. American plants which have been referred to Triteleia are perhaps best treated as brodiæas, and they are so considered in the account of that genus in Vol. I of this work (p. 576). The S. American triteleias are described under that genus in Vol. VI.

biflòra, Cav. Scape 6–18 in. high from a small coated bulb, bearing 1–5 (usually 2) star-like, waxy white, fragrant fls. 2–2½ in. across, with oblong-lanceolate segms.: lvs. rough, nearly terete. S. Ariz. and New Mex. to Cent. Mex. B.R. 1555. F.S. 14:1459. Gn. 24, p. 155. J.H. III. 55:133. G. 6:271.—One of the best of the small bulbs. It is known as Mexican star, Mexican star of Bethlehem, frost flower, and floating star. The fls. are of a charming waxy consistence, and are borne on long sts. They are excellent for cutting, and last several days. Planted in the border early in spring, they soon throw up their fls. and lvs. They should be allowed to remain until Sept. or Oct., when they may be taken up and stored for the winter. Our gardeners know milla mostly as a pot bulb for flowering under glass late in winter or early in spring. It blooms readily in the conditions given to freesias. Several bulbs should be placed in a pot, although a number of stalks will spring from one bulb. The plant is little offered by dealers. L. H. B.

MILLER, DUSTY: *Lychnis Coronaria;* also *Senecio* and *Artemisia.*

MILLETS are important agricultural grasses. The true millet or **Broom-corn millet** of Europe is *Panicum miliaceum.* The common millets of the United States, the **Foxtail millets,** are forms of *Setaria italica.* **African millet,** also called Black, Chinese, Indian, and improperly Pearl millet, is *Holcus Sorghum.* The name African millet is sometimes applied to *Eleusine Coracana.* **Barnyard** or **Japanese millet** is *Echinochloa frumentacea.* **Pearl millet** is *Pennisetum americanum.* Dept. Agric., Farmer's Bull. No. 101 is devoted to foxtail millets. A. S. Hitchcock.

MILLÉTTIA (named in honor of Dr. J. A. Millett, botanist, and who wrote on China in 1726). *Leguminòsæ.* About 100 or so species of Old World tropical trees and large shrubs, usually climbers; differs from the Japanese and N. American genus Wistaria in the hard usually flat and thick pod not opening so readily: lvs. large, odd-pinnate; lfts. opposite, stipellate: fls. showy, in axillary racemes often fascicled, simple or paniculate and terminal, white, purple or reddish.—Although an abundant genus in Trop. Afr. and the far E., it has yielded little for American horticulture.

A. *Fls. purple.*

cáffra, Meissn. Ironwood. A S. African tree, 20–30 ft. high, with very hard close-grained brown wood and dark, rough, rugulose bark: lvs. on channeled petioles 6–8 in. long; lfts. lanceolate-oblong, acute, in 5–6 pairs, 2–2½ in. long, 1 in. apart; slender stipules 2–3 lines long: panicle 6–8 in. long: fr. leathery, velvety, used as a medicine by the Kafirs. Intro. into Fla. in 1891.

AA. *Fls. white.*

japónica, Gray. A Japanese woody climber: lvs. light green, odd-pinnate; lfts. narrowly ovate, 4–6 pairs, 1½ in. long, 1 in. apart: racemes simple, nodding, 5–8 in. long. Probably not hardy in the N. Has been offered by dealers in Japanese plants. S.Z. 1:43 (*Wistaria japonica*).—At the Arnold Arboretum (Boston) it kills to ground but comes up in spring, not blooming; on Long Island, it blooms and even fruits. L. H. B.

MILTÒNIA (named for Lord Fitzwilliam, Viscount Milton, a patron of horticulture). *Orchidàceæ.* Some of the most beautiful orchids in cultivation, with pseudobulbs closely clustered and sheathed with long graceful dark green leaves, forming plants over 1 foot in diameter, bearing numerous large flowers.

Herbs, with short pseudobulbs, bearing 1–2 lvs. at the summit and few or many sheathing lvs. at the base: the infl. arises from the base of the pseudobulbs, and consists of a single-fld. peduncle or of a loose raceme of long-pedicelled fls.; sepals sub-equal, spreading, free or the lateral ones slightly united; petals similar or a little wider; labellum not distinctly clawed, large, expanded, not 3-lobed, but often bifid at the apex; both the segms. and the labellum are expanded, forming a flat fl.; column short.—About 20 species, mostly from Brazil. *M. Roezlii, M. vexillaria,* and some closely related kinds were until recently known in gardens as odontoglossums. In the group containing the "true" miltonias, the pseudobulbs are separated from each other on the rhizome, and bear 1–2 yellowish green lvs. at the summit and few sheathing lvs. of the same color at the base. The fls. of nearly all miltonias remain on the plants in a fresh condition for a month or more. The leading species run into many horticultural forms listed under Latin names.

INDEX.

alba, 1, 4.
bicolor, 5.
candida, 8.
Clowesii, 7.
Cobbiana, 2.
cuneata, 9.
Endresii, 3.
flavescens, 12.
gigantea, 2.
grandiflora, 2, 12.
leucochila, 10.
Moreliana, 5.
Phalænopsis, 4.
picta, 2.
purpurea, 6.
Regnellii, 6.
Roezlii, 1.
rosea, 2.
rosefieldiensis, 7.
Russelliana, 11.
spectabilis, 5.
superba, 8.
vexillaria, 2.
Warscewiczii, 10.
Weltonii, 10.

KEY TO THE SPECIES.

A. *Pseudobulbs crowded, with numerous dark or gray-green sheathing lvs. at the base.*
  B. *Labellum sagittate at the base* .... 1. **Roezlii**
    2. **vexillaria**
  BB. *Labellum not sagittate, constricted in middle, (broadly panduriform)* ... 3. **Endresii**
    4. **Phalænopsis**
AA. *Pseudobulbs situated at intervals on the rhizome, with few yellowish green lvs.*
  B. *Segms. of perianth broad, ovate to oblong.*
    C. *Perianth uniformly colored white, rose or purple* .... 5. **spectabilis**
      6. **Regnellii**
    CC. *Perianth variegated, yellow and brown or brown and green.*
      D. *Labellum fiddle-shaped* .... 7. **Clowesii**
      DD. *Labellum broadly obovate* ...... 8. **candida**
        9. **cuneata**
      DDD. *Labellum oblong* ....10. **Warscewiczii**
        11. **Russelliana**
  BB. *Segms. of perianth linear-lanceolate*..12. **flavescens**

1. **Roèzlii,** Nichols. (*Odontoglóssum Roèzlii,* Reichb. f.). Pseudobulbs narrowly ovate, 1–2 in. long: lvs. numerous, slender, 8–12 in. long, narrowly linear-lanceolate: scapes about half as long as the lvs., bearing 2–3 large fls.; fls. flat, 3–3½ in. across, pure white, with a purple band at the base of the petals and a yellow stain, more or less marked with reddish brown

at the base of the labellum; sepals and petals ovate-oblong, acute; labellum large, broadly obcordate, with a tooth in the sinus, and a spur-like horn projecting backward on each side of the column. Closely allied to *M. vexillaria*, from which it differs in color and by the more slender, nerved lvs. Flowers twice a year in winter and spring. Colombia. B.M. 6085. I.H. 23:228. R.H. 1875:450. Gn. 4, p. 251; 10:106; 26:232. G.C. III. 32:135. Var. **álba,** Hort. (*Odontoglóssum Roézlii* var. *álbum*). Fls. large, lacking the purple band on the petals. Gn. 26: 232. F.M. 1875:164. A.F. 13:1453. Gng. 6:327.

2. **vexillària,** Nichols. (*Odontoglóssum vexillàrium,* Reichb. f.). Fig. 2373. Pseudobulbs 1½–2 in. long: lvs. 6–12 in. long, narrowly elliptic-lanceolate: scapes sometimes 6 from a single pseudobulb, slender, and longer than the lvs., 3–4-fld.; fls. the largest of the genus, flat, about 4 in. long; sepals and petals ovate-oblong or obovate, pale or dark rose, sometimes with white margins; labellum large, rounded, deeply emarginate, narrowed to a sagittate claw, deep rose, whitish at the base, streaked with yellow and red. The fls. are extremely variable in shape and color. Spring and early summer. Western slope of the Andes, Colombia. B.M. 6037. I.H. 20:113. F.S. 20:2058. R.H. 1876:390. Gn. 9, p. 577; 10, p. 108; 17:474; 35, p. 268; 45, p. 536. G.C. II. 26:145; III. 18:743; 19:755; 27: suppl. May 26; 42:406; 44: 184. J.H. III. 31:301. G.F. 8:195. G. M. 39:386. G.Z. 21, p. 241. V. 5:138. A.F. 13:121.—One of the most popular of all orchids. Var. **Cobbiàna,** Hort. Sepals and petals light rose, passing into white margin; lip white with 3 basal small yellow lines. Vars. **gigantèa, grandiflòra, pícta, ròsea,** have been advertised under Odontoglossum. Many forms are mentioned and described in horticultural literature; for these, the reader should consult the lists of orchid specialists.

2373. Miltonia vexillaria.

3. **Éndresii,** Nichols. (*Odontoglóssum Warscewíczii,* Reichb. f.). Pseudobulbs small, tufted: lvs. numerous, distichous, elliptic-lanceolate, about 1 ft. long: scape as long as the lvs., inclined or drooping, 6–8-fld.; fls. 2–2½ in. diam., flat, white, with a yellow crest on the labellum and a rose-colored blotch at the base of each segm.; sepals broadly ovate; petals elliptic; labellum very broadly fiddle-shaped and 2-lobed. Feb. Costa Rica. B.M. 6163.

4. **Phalænópsis,** Nichols. (*Odontoglóssum Phalænópsis,* Lind. & Reichb. f.). Pseudobulbs ovate, with grass-like lvs. 8–10 in. long at the base and apex: stalks 1–3-fld., shorter than the lvs.: fls. large, flat, white, with the labellum variegated and streaked with crimson; sepals 1 in. long, oblong, pointed; petals broader and rounded; labellum large, broadened and 2-lobed in front, constricted near the middle and expanded above into 2 rounded lobes. The pseudobulbs are clustered, forming clumps 1 ft. or more across, with numerous fls. mingled with the long, grass-like lvs. Spring and summer. Colombia. I.H. 3:109. Gn. 18, p. 447; 26, p. 232; 35, p. 269; 36, p. 315. G.C. II. 25:364. I.H. 28: 417 (var. *luxurians,* more vivid). Var. **álba,** Hort. Fls. pure white except yellow markings on lip.

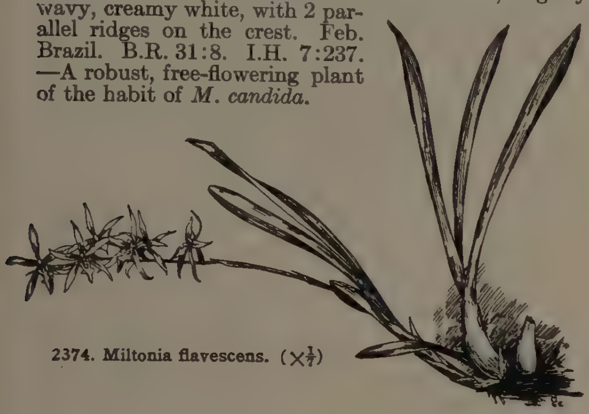
5. **spectábilis,** Lindl. Rhizome creeping, with the pseudobulbs placed about 1 in. apart, with 2 lvs. at the apex and few sheathing lvs. at the base: lvs. linear-oblong, 4–12 in. long: scapes erect, sheathed, 6–8 in. long, bearing a single fl. about 4 in. diam.; sepals and petals oblong, obtuse, slightly waved, white or cream-colored; labellum 2 in. long, very broad in front, pendent, somewhat undulate, rose-purple, with darker veins. Brazil. B.M. 4204. B.R. 1992. I.H. 6:216; 12:446 (var. *cereola*); 14:524 (var. *rosea*); 15:573 (var. *virginalis*). P.M. 7:97. F.C. 1:45 (*Macrochilus Fryanus*). R.B. 15:25. G.M. 38:642. A.F. 6:631.—The first miltonia intro. into cult. It blossoms in autumn, large plants bearing from 20–50 fls., all opening at once and lasting about a month. Var. **bícolor,** Hort. Fls. white, with a violet spot on the labellum. Large-fld. and vigorous. Aug. Var. **Moreliàna,** Hort. (*M. Moreliàna,* Hort.). This variety is very distinct in color. Sepals and petals deep purple; labellum of the same color, veined and shaded with rose. In habit the plant is like the type in every detail. B.M. 4425 (as var. *purpureo-violacea,* Hook.). F.S. 10:1008. I.H. 2:71. Gn. 31:374 (habit poor). F.M. 1874: 143. G.M. 40:37. F. 1850, p. 123 (outline). A.F. 6:633.

6. **Régnellii,** Reichb. f. Like *M. candida* in habit and foliage: lvs. 1 in. broad: scapes erect, bearing several large fls. over 2 in. diam.; sepals and petals spreading, recurved at the apex, oblong, acute, white; labellum subpandurate, obtuse or emarginate, rose-purple, with deeper veins and 3 yellow keels at the base. Sept. Brazil. B.M. 5436. Var. **purpùrea,** Pynaert. Sepals and petals tinted with rose, with white margins; labellum crimson, with a white crest. R.B. 17:253.

7. **Clówesii,** Lindl. Pseudobulbs ovate-oblong, leafy at the base and bearing 2 narrow ensiform lvs. at the apex: scape erect, 1 ft. long, many-fld.; fls. 3 in. across, orange-yellow, mottled with brown, the lip white with a violet base; sepals and petals spreading, lanceolate, acuminate; labellum fiddle-shaped, with a cordate base and a broadly rotund, acute terminal portion. Resembles *M. candida.* Sept., Oct. Brazil. B.M. 4109. P.M. 9:241. Gt. 5:160. Var. **rosefieldiénsis,** Hort., has very large fls.

8. **cándida,** Lindl. Pseudobulbs ovate-oblong, 2-lvd., with few lvs. at base: lvs. oblong-linear, 1 ft. long, 1½ in. broad: raceme erect, 1 ft. long, 6–8-fld.; sepals and petals spreading, oblong, acute, somewhat wavy, bright yellow, with large red-brown blotches; labellum large, broadly obovate, convolute, crenate and wavy on the margin, white, changing to yellow, with a faint purple blotch. Brazil. B.M. 3793 (var. *flavescens*). P.M. 6:241. Gn. 20, p. 463.—A strange species producing 5–6 racemes, each with 6–10 fls. about 2½ in. across. Autumn. Var. **supérba,** Hort. Lip white, with a purple blotch.

9. **cuneàta,** Lindl. Pseudobulbs ovate, clustered, 4 in. long, sheathed with lvs. at the base and 2-lvd. at the apex: lvs. dark green, strap-shaped, 1 ft. long: scape erect, 5–8-fld., as long as the lvs.; fls. 3–4 in. across; sepals and petals lanceolate, spreading, mostly chocolate-brown, greenish yellow at the tips, and few spots of the same color; labellum obovate-rotund, slightly wavy, creamy white, with 2 parallel ridges on the crest. Feb. Brazil. B.R. 31:8. I.H. 7:237. —A robust, free-flowering plant of the habit of *M. candida.*


2374. Miltonia flavescens. (×⅕)

10. **Warscewíczii,** Reichb. f. (*Odontoglóssum Wéltonii,* Hort. *Oncídium fuscàtum,* Reichb. f. *Oncídium Wéltonii,* Hort. *M. Wéltonii,* Hort.). Pseudobulbs 3–5 in. long, much flattened: lvs. linear-oblong, obtuse, 5–6 in. long: fls. 2 in. long from the tips of the lip to that of the upper sepal, numerous, borne in a branched nodding panicle; sepals and petals cuneate-obovate, waved and crisped, pale reddish brown, with whitish tips; labellum oblong, fan-shaped, bifid, white, with a large rose-purple disk on the center of which is a large, brownish yellow blotch. March. Peru. B.M. 5843. F. S. 18:1831. Var. **leucochìla,** Hort. Fls. pale purple; lower half of lip ruby-purple.

11. **Russelliàna,** Lindl. (*Oncídium Russelliànum,* Lindl.). Pseudobulbs ovate, ribbed, 2-lvd.: lvs. narrowly lanceolate: fl.-sts. dark purple, few-fld.: sepals and petals ovate-oblong, somewhat undulate, brownish purple with green margins; labellum oblong-cuneate, retuse, apiculate, violet, the crests or lamellæ on the disk margined with white. Dec. Brazil. B.R. 1830. P.M. 7:217.—Fls. rather small and dull in color.

12. **flavéscens,** Lindl. Fig. 2374. Pseudobulbs narrow: lvs. linear-ensiform: raceme many-fld., the stalk sheathed with bracts; fls. stellate, yellow, with the labellum somewhat spotted with purple; sepals and petals linear-lanceolate, acuminate; labellum pandurate, undulate-acuminate. June. Brazil. B.R. 1627 (as *Cyrtochilum flavescens*). Var. **grandiflòra,** Regel. Fls. larger, white at first, becoming whitish yellow; labellum obtuse. Gt. 39:1328.

M. Bértii=M. Bleuana × M. vexillaria.—*M. Bleuàna,* Hort. (Miltoniopsis Bleui, Bleu)=M. vexillaria × M. Roezlii. In habit like M. vexillaria: fls. 3–4 in. across; sepals and petals white, the latter purple-stained at base; lip nearly orbicular, notched at apex, white veined with pink in front of the yellow disk. Intermediate between the parents. A.F. 6:631; 9:1087. G. F. 5:198, 199. J.H. III. 68:277. O. 1913:104.—*M. Bleuàna grandiflòra,* a large-fld. form. G.M. 57:267.—*M. Bleuàna Peètersiæ,* Hort.=M. Bleuana Peetersii M. Roezlii × M. vexillaria Leopoldii) × M. Bleuana. Sepals and petals rose-purple below, the color on the sepals lighter; lip with the yellow crest crimson-bordered, with a rose band in front. G.C. III. 49:274.—*M. Bleuàna Stèvensii,* a dwarf variety with white fls. and lip crimson-striped.—*M. Blúntii Lubbersiàna,* Reichb. f. Fls. about 4 in. across; sepals and petals light yellow, blotched and barred with brown; lip purple at base, lined red-brown, the nearly orbicular front lobe lighter. Supposed to be a natural hybrid between M. spectabilis × M. Clowesii. G. 29:563. —*M. Chárlesworthii*=M. vexillaria "G. D. Owen" × M. Hyeana.—*M. festìva* =M. spectabilis × M. flavescens, probably.—*M. Hyeàna*=M. Bleuana × M. vexillaria var. Leopoldii.—*M. radiòla,* Hort. "Fls. larger, white, shaded purple, and heavily blotched with purple and yellow."—*M. Róbsonæ* =M. Roezlii × M. vexillaria "Queen Alexandra."—*M. Rógersonii,* Hort. "Like a large pale M. vexillaria."—*M. Sánderæ,* Hort. Fls. pale with a dark maroon eye. Hybrid between M. St. Andre × M. vexillaria "G. D. Owen." Gn. 77, p. 352.—*M. Schroederiàna,* Hort. Raceme 7–9-fld.; fls. 2½ in. long, fragrant; sepals and petals brown, yellow-marked; petals falcate, turned toward dorsal sepal; lip pandurate, rose-purple at base, the apex white. Cent. Amer. R. 2:96.—*M. travassosiàna,* Hort. Apparently a form of M. Regnellii with yellow sepals and petals.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

MILTONIÒDA. *Orchidàceæ.* Bigeneric hybrids of Miltonia and Cochlioda. *M. Coòperi* is a garden hybrid between *Miltonia Warscewiczii* and *Cochlioda Noetzliana;* fls. brick-red with lighter tip to labellum, in slender branched spikes. *M. Hárwoodii* is a garden hybrid between *Miltonia vexillaria* and *Cochlioda Noetzliana.* Fl. about 2 in. long, the sepals and broader petals bright cerise-rose; lip miltonia-like, cream-white freckled with rose. *M. Líndenii* is a garden hybrid probably of *Cochlioda vulcanica* and *Miltonia Phalænopsis.*

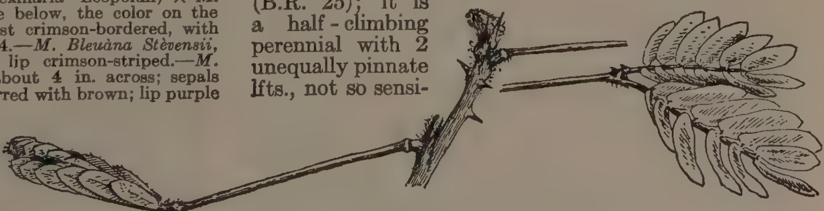
MILTONIÓPSIS. Garden hybrid, *M. Pauwelsiàna,* between *Miltonia Roezlii* and *M. vexillaria* var. *Leopoldii,* recorded as distinct from other kinds.

MIMÒSA (Greek, *a mimic,* alluding to the fact that the leaves of some species are sensitive). *Leguminòsæ.* Woody or herbaceous plants, mostly tropical, grown for the showy flowers or feathery foliage; of some species the leaves are sensitive. What the florists know as mimosas are acacias (chiefly *A. armata*).

Trees, shrubs or herbs of varying habit (sometimes woody climbers), mostly thorny or prickly, with bipinnate often sensitive lvs. (sometimes the lvs. reduced to phyllodia): fls. not papilionaceous, in close heads or head-like spikes, usually with 4 or 5 united petals, and a minute or obsolete calyx; stamens 4–10, exserted; pollen granular: pod flat, oblong or linear, breaking up into 1-seeded joints when ripe. Mimosa has stamens 10 or less (once or twice as many as the petals); Acacia has numerous stamens.—Of Mimosas there are probably 300 species, chiefly of Trop. Amer. A number of the bushy species, and the small trees, are planted more or less in warm countries for ornament. They require the treatment given the woody acacias.

A. *Plant herbaceous or practically so in cult.*

pùdica, Linn. SENSITIVE PLANT. HUMBLE PLANT. Fig. 2375. Cult. as an annual, but probably perennial in the tropics, and somewhat shrubby, erect, branching, hairy and spiny: lvs. long-petioled, with 2 or 4 subdigitate pinnate linear-oblong lfts.: fls. many, in globular-oblong heads on elongating axillary peduncles, purplish: pods comprising 3 or 4 spiny joints. Brazil, but widely naturalized in warm countries; run wild in the Gulf States. G.W. 2, p. 18.—Easily grown from seeds, which are sold by seedsmen. The plant grows readily in any place in which garden beans will thrive. It is grown for its sensitive foliage. The movements are usually quickest in young plants. When the lvs. are touched, the petiole falls and the lfts. close. The utility and the origin of these movements are not well understood. *M. sensitìva,* Linn., is a distinct plant (B.R. 25); it is a half-climbing perennial with 2 unequally pinnate lfts., not so sensi-


2375. Mimosa pudica.—Sensitive plant. Normal position of the leaf is shown on the right, and the collapsed position on the left. (×⅓)

tive as *M. pudica.* The word *pudica* is Latin for *modest* or *bashful.*

AA. *Plant distinctly woody: trees or bushes.*

B. *Primary pinnæ 1 pair.*

Spegazzínii, Pirotta. Bush, scandent and much branched, with recurved spines at base of petiole: lvs. sensitive, bipinnate; pinnæ 2, from 2–3 in. long; lfts. or pinnules very numerous, sessile and close together, oblong or linear-oblong and acute, 3-nerved: fls. rose-purple, in globular peduncled heads 1¼ in. diam., the heads axillary or in a terminal raceme; corolla 4-lobed; filaments rose-red and anthers yellow: pod 1 in. long, linear. Argentina. B.M. 7899. G.W. 2, p. 19. —A good greenhouse shrub; intro. in S. Calif. Var. **glaùca,** Hort., has glaucous foliage and whitish fls.

BB. *Primary pinnæ 2 pairs.*

guayaquilénsis, Steud. (*Acàcia guayaquilénsis,* Desf.). Pinnæ 4, with 3–5 pairs of ovate-obtuse glaucous lfts., of which the lower ones are smaller; opposite stipular spines at the base of the lf. Ecuador.

álbida, Humb. & Bonpl. Scandent, shrubby. branches cano-pubescent, spiny: pinnæ 2, each with 4 lfts., the inner ones of the lower pair very small, the others oblong and very unequal at base and acute at apex; petioles unarmed: fl.-heads twin, pinkish: pod about 1 in. long, grayish pubescent. Mex. to Peru. L.B.C. 3:249 (as *M. sensitiva*).—Intro. in S. Calif.

BBB. *Primary pinnæ 3–5 pairs.*

Ceratònia, Linn. (*Acàcia Ceratònia,* Willd.). Scandent glabrous shrub, with recurved prickles on branches and petioles: pinnæ about 5 pairs; lfts. obovate to roundish: pods glabrous, somewhat articulate and spiny, broadly oblong. W. Indies.

BBBB. *Primary pinnæ mostly 6–8 pairs or more.*

acanthocárpa, Poir. (*Acàcia acanthocárpa,* Willd. *A. brachyacántha,* Humb. & Bonpl.). Bush or small tree: pinnæ 12–14, with 6–15 pairs of oblong-pubescent lfts.: stipular spines 2: fls. in heads on twin axillary peduncles: pod falcate, spiny. Mex.

Dénhardtii, Hort. Ornamental shrub, the lvs. said to be almost as sensitive as those of *M. pudica:* branches glabrous or minutely hairy, striate, usually bent at each thorn: lvs. hairy, the pinnæ 12–14, the ultimate lfts. small (⅙in. long) and crowded and falcate-oblong-acute: fls. in club-shaped, axillary clusters: thorns 1–3 in. long. S. Amer.—Intro. in S. Calif.

rubicaùlis, Lam. Low tree, with many small hooked spines: pinnæ 8–20, the rachis prickly; lfts. 12–24, thin, ½in. or less long: heads reddish but becoming lighter colored, about ½in. long, on short simple peduncles; corolla very small: pod strap-shaped and somewhat falcate, 3–4 in. long. India, Afghanistan.—Intro. in S. Calif.

M. argéntea, Hort. Of climbing habit, suitable for warmhouse, said to be of the same section of the genus as M. pudica, slender, the sts. and branches hairy: pinnæ 2 or 3 pairs; lfts. about 40, oblong pinkish on the under side (as are the young shoots), green at the tips and silver-gray on lower half. Brazil.

L. H. B.

MÍMULUS (Latin, a *little mimic,* from the grinning fls.). *Scrophulariàceæ.* Mostly herbs (annual or perennial) with interesting irregular flowers in many colors, some of them border subjects and others flower-garden plants.

Low plants (sometimes shrubby), decumbent, ascending or erect, glabrous or pilose and often clammy: lvs. opposite, entire or toothed: fls. axillary, solitary or becoming racemose by the reduction of the upper lvs.; calyx 5-angled, with 5 short or long teeth; corolla-tube cylindrical, sometimes swollen at the throat; stamens 4, didynamous: caps. oblong or linear, loculicidally dehiscent.—Species probably 60 or 70, if Diplacus, Eunanus and Mimulastrum are included, mostly in extra-Trop. Amer., but some in Asia, Austral. and Afr. The genus is specially rich in W. N. Amer. This genus includes the monkey-flower, *M. luteus,* and the musk-plant, *M. moschatus.* Monkey-flowers are something like snapdragons, although they do not have a closed throat. They are 2-lipped fls., with 2 upper and 3 lower lobes, which are all rounded and usually irregularly splashed and dotted with brown on a yellow ground. Though perennial, they are commonly treated as annuals and are considerably used for pot cult. in winter, as well as for summer bloom outdoors. The musk-plant is grown for its scented foliage and pale yellow fls. It is sometimes used in hanging-baskets, but the foliage is so sticky that it gathers too much dust. The kinds described below are all perennial at least by underground parts (except *M. brevipes*), and most of them are natives of wet and shady places in N. W. Amer. They mostly grow 1–3 ft. high and bloom all summer. Diplacus is here included in Mimulus.

Mimulus plants (*M. luteus*) can be increased by sowing seed from January to April in pans of light sandy soil. They like a mixture of loam, leaf-mold and sand in equal parts. They may be kept in a temperature of 60° until they show signs of coming up, when they should be placed in a house that stands at about 50° during the night. As soon as the seedlings can be handled, they should be potted off into small pots and grown along in as cool a house as possible. The early-sown plants can be planted out in May in a cool shady situation, where, if they can have enough water to keep the roots moist, they will bloom fairly well. Those that are sown late can be grown on by shifting into 2-, 3-, 4- and 5-inch pots, using a compost of fibrous loam three parts, well-decayed cow-manure one part, and enough sand to keep the compost open. In the summer these may be grown outside in frames covered by lath shading. Late in autumn they may be brought into a coolhouse with 45° to 50° night temperature. Give them a place near the glass, and with care as to watering and ventilating they will bloom satisfactorily. They can also be increased from cuttings taken in the early spring.—*M. moschatus* can be grown from seed and cuttings. They may be planted out in a partly shaded situation, where they will grow all summer. In the autumn, lift some of the clumps and pot them. These may be grown in a coolhouse of about 45° at night. In the spring, when it is desired to increase the stock, take pieces of the new growth and place them around the side of a 3-inch pot, using the compost mentioned above; by keeping moist and shaded for a short time, they will soon root into the mixture and be ready to grow on. These may be shifted into 4-inch pots and soon will make fine little plants by their rapidly creeping growth. (J. J. M. Farrell.)

INDEX.

alatus, 2.
alpinus, 5.
brevipes, 3.
Burnetii, 5.
cardinalis, 6.
cupreus, 4.
duplex, 5.
gloriosus, 5.
glutinosus, 9.
grandiflorus, 5.
Harrisonii, 8.
hybridus, 5.
Lewisii, 7.
luteus, 4, 5.
maculosus, 5.
maximus, 5.
moschatus, 8.
pardinus, 5.
quinquevulnerus, 5.
ringens, 1.
rivularis, 5.
Roezlii, 5.
Smithii, 5.
tigridioides, 5.
tigrinus, 5.
variegatus, 5.
Youngeana, 5.

A. *Fls. violet, purple or lilac.*

1. **ríngens,** Linn. Herb with perennial rootstocks, branching, 1–3 ft. high, the sts. square: lvs. oblong or lanceolate, acute, serrate, clasping at base: fls. violet (varying to white), about 1 in. long, the throat very narrow; peduncle exceeding the calyx; calyx-teeth long and awl-shaped. Wet places, Nova Scotia to Man. and far S. B.M. 283.—A common and rather attractive native, useful for establishing and colonizing in wet places.

2. **alàtus,** Soland. St. somewhat winged or angled: lvs. ovate to oblong, acute, dentate-serrate, petioled:

fls. violet; peduncle shorter than calyx; calyx-teeth short and broad, abruptly sharp-pointed. Wet places, W. New England to Kans., south to Texas. L.B.C. 5:410.

AA. *Fls. yellow, brown or brick-red, often spotted.*

B. *Plant annual.*

3. **brévipes,** Benth. Viscid-pubescent, 1–2 ft.: lvs. bright green, to 4 in. long, lanceolate to linear: fls. large (to 1½ in. long) clear canary-yellow, the limb broad and with rounded lobes; calyx-teeth acuminate, very unequal. Calif.—Seeds are now offered.

BB. *Plant perennial, herbaceous.*

C. *Foliage not sticky or clammy.*

4. **cùpreus,** Regel (*M. lùteus* var. *cùpreus*, Hook. By Gray included in his var. *alpinus* of *M. luteus*). A Chilean species, differing from *M. luteus* in its tufted habit and the fls. yellow at first, finally becoming copper-colored, and the lobes possibly rounder and more nearly equal, the throat yellow, spotted brown. B.M. 5478. Gn. 24, p. 177. R.H. 1883, p. 284.—Perhaps not specifically distinct from the next.

5. **lùteus,** Linn. MONKEY-FLOWER. Fig. 2376. Glabrous, the larger forms 2–4 ft. high: lvs. parallel-veined, ovate to roundish to subcordate, sharply toothed, upper ones smaller, the lower sometimes laciniate: fls. deep yellow and commonly with dark spots within, the corolla 1–2 in. long; calyx ½in. or less long, somewhat ventricose. Alaska to Chile. B.M. 1501.—Monkey-flowers nearly always have yellow throats with brown dots. The lobes are sometimes clear yellow. In var. **rivulàris,** Lindl., only 1 lobe has a large brown patch. B.R. 1030. L.B.C. 16:1575. In var. **Youngeàna,** Hook., every lobe has such a patch. B.M. 3363. B.R. 1674 (as *M. Smithii*). In the common strains these patches are more or less broken up and the fls. mottled and dotted. F. 1863:73 (as *M. maculosus*). V. 10:289 (as *M. hybridus*). A very distinct set of colors is represented by var. **variegàtus,** Hook., the throat chiefly white, but with 2 yellow longitudinal lines dotted with brown on the middle lobe of the lower lip; all the lobes bright crimson-purple, with a violet reverse. B.R. 1796. B.M. 3336. L.B.C. 19:1872. G. 29:335. Modified as described under var. *Youngeana*. R.H. 1851:261. F. 1850:137. The pictures cited above bear various legends. The varietal names given above do not appear in the trade, the leading current names being *duplex* (hose-in-hose), *gloriosus*, *hybridus*, *hybridus tigrinus*, *hybridus tigrinus grandiflorus*, *quinquevulnerus maximus*, *pardinus*, *tigridioides* and *tigrinus*. Some of these names are advertised as varieties, but all of them frequently appear as if they were species. For *M. hybridus cupreus*, Hort., see *M. cupreus*, No. 4. *M. Búrnetii*, Hort., is a garden hybrid between *M. luteus* and *M. cupreus*. G.C. III. 30:107.

2376. Forms of Mimulus luteus. (×½)

Var. **alpìnus,** Gray (*M. Roèzlii*, Hort.). About 2–12 in. high, leafy to top: st. 1–4-fld.: corolla ¾–1¼ in. long.

CC. *Foliage sticky or viscous.*

6. **cardinàlis,** Douglas. Villous, 2–4 ft. high: lvs. sharply toothed: fls. red and yellow, the upper lobes much grown together and reflexed, the whole limb remarkably oblique. Water-courses, Ore. and Calif. to Ariz. B.M. 3560. R.H. 1857, p. 137 (as Diplacus). Mn. 8:161. F. 1843:193.—Hardy in Mass., with slight winter covering. Blooms first year from seed.

7. **Lèwisii,** Pursh. A more slender plant than No. 6, greener, and merely pubescent: lvs. minutely toothed: fls. rose-red or paler, the lobes all spreading. Shady, moist ground. Brit. Col. to Calif. and Utah. B.M. 3353 and B.R. 1591 (both as *M. roseus*).

8. **moschàtus,** Douglas. MUSK-PLANT. Perennial, by creeping sts. 1–3 ft. long, villous and sticky, with a musky odor: lvs. oblong-ovate: fls. pale yellow, lightly dotted and splashed with brown, the corolla about ⅔in. long. Brit. Col. to Calif. and Utah. B.R. 1118.—This and *M. luteus* have a broad throat. The fls. are normally about ¾in. across, but in F.M. 1877:248 (var. *Harrisonii*) they are 1½ in. across. Hardy, evergreen trailer for damp shady spots; good for planting under cool greenhouse benches.

BBB. *Plant perennial, woody or shrubby* (*at least at base*).

9. **glutinòsus,** Wendl. (*Diplacus glutinòsus*, Nutt.). Shrubby, 2–6 ft. high, nearly glabrous but sticky: lvs. narrow-oblong to linear, entire or denticulate, to 4 in. long, the margins at length revolute: fls. to 2 in. long, short-pedicelled, orange or salmon to pale buff, rather obscurely 2-lipped, the lobes toothed or notched. Rocky banks; common from San Francisco south. B.M. 354 (*M. aurantiacus*). G.W. 15, p. 649. A.G. 12:737. A.F. 12:1107.—A very variable species.

M. capénsis, Hort., is listed abroad as fit for cool greenhouse or pot-plant, or for warm border: 3–4 in. high: fls. bright orange, Apr.–July. Said to resemble M. cardinalis in habit and infl.—*M. radicans* of the lists is probably Mazus radicans (Mimulus radicans, Hook. f.).

WILHELM MILLER.
L. H. B.†

MÍMUSOPS

MÍMUSOPS (Greek, *ape-like*, but application not obvious). Including *Imbricària*. *Sapotàceæ*. Tropical trees, with milky juice, some of them producing edible fruit, planted far South mostly for ornament.

Leaves thick and shining, simple and entire, alternate, with inconspicuous transverse veins: fls. perfect, gamopetalous, the corolla of 6 or more lobes, but bearing twice as many appendages in the sinuses, the calyx of 6 or 8 sepals in 2 rows; stamens usually 6–8, inserted on the base of the corolla; staminodia present: fr. a globose or ovoid, 1–6-seeded berry, sometimes edible.—Probably 60 species in the tropics of both hemispheres. The species are confused and the names in the trade may not represent the species as now accepted by botanists. For a recent account of the W. Indian species, consult Pierre & Urban in Symbolæ Antillanæ, V (1904). The mimusops are fine evergreen trees, good for ornament in frostless countries, and yielding perfumery, oil, rubber and other products. The fls. are small, white, and usually borne in axillary fascicles. Some of the species become more than 100 ft.

high, and several of them yield hard and durable timber. A few species have been somewhat advertised in S. Calif. and S. Fla., but their cult. in this country is of small account. The sapodillo (which see) is a closely allied tree.

Kaùki, Linn. (*M. dissécta,* Hook. *M. Hoòkeri,* A. DC. *M. Bòjeri,* A. DC. *Kaukénia Kaùki,* Kuntze). Tree, 20–35 ft., the young branches gummy, lightly pubescent: lvs. crowded at ends of branches, obovate-elliptic, or ovate, 4 in. long, long-petioled, obscurely nerved, silky-white beneath: fls. clustered on tomentose twin or solitary pedicels not exceeding the petiole; corolla ⅓in. long, with 18 narrow acute lobes or petals, the exterior narrower; calyx-lobes 6; staminodes 6–8, lobed or serrate; stamens 6–8; ovary 6–7-celled: berry about 4-seeded, to 1 in. diam., obovoid and smooth. Birma to Malaya. B.M. 3157. Cultivated in West Indies.

Balàta, Miq. (*Áchras Balàta,* Aubl. *M. bidentàta,* A. DC. *M. Pierreàna,* Baill.). Tall tree, to 100 ft.: lvs. petioled, oblong-lanceolate, elliptic or oblong-obovate, acuminate or obtuse, about 4 in. long, grayish velutinous or nearly glabrous beneath, lightly very many-nerved: pedicels 10 or more, somewhat shorter than the petioles: calyx-lobes or sepals 6, grayish velutinous on the back; corolla-lobes 6 or 8 and more, the exterior ones 2-lobed or -parted and denticulate; stamens 6 or 8; staminodes lobed or denticulate; ovary 8-10-celled: berry ovoid, about 1 in. long. W. Indies and S.—It is a variable species, with a number of named botanical varieties in the W. Indies. The *M. globosa* of lists probably belongs here.

2377. Four-O'clock.—Mirabilis Jalapa.

Cómmersonii, Engler (*M. coriàcea,* Miq. *Imbricària coriàcea,* A. DC.). Tree: lvs. oval-obovate, retuse, short-petioled, entire, shining above and slightly pilose beneath, coriaceous: pedicels solitary, or twin, axillary, much shorter than lvs.: outer calyx-lobes reddish pubescent outside but nearly glabrous inside, the inner ones narrower and white-velvety. Madagascar.—Said to be intro. in S. Calif.

parvifòlia, Radlk. (*M. Sièberi,* Chapm., Gray, et al. *M. floridàna,* Engler. *M. bahaménsis,* Pierre. The *M. Sièberi,* A. DC., is a form of *M. Balata.*). Wild Dilly. Becoming 35 ft. tall: lvs. elliptic to obovate, retuse, green, 2–4 in. long, slightly revolute, slender-petioled: corolla-segms. 6, oblong and exceeding the narrow appendages; fertile stamens 6; staminodia short-triangular, nearly entire: fr. nearly 1 in. diam., brownish or yellowish, maturing in autumn, said to be edible. Fla. Keys to Trinidad.

Eléngi, Linn. Tall tree (becoming 50 ft.): lvs. elliptic and short-acuminate (3–3½ in. long), rhomboid at the base, petiole ¾in. long: corolla-lobes about 6, narrow-lanceolate; fertile stamens 8; staminodia pilose, acute, entire or nearly so: fr. 1 in. or less, ovoid, 1- or 2-seeded, yellow, edible. E. Indies.

díspar, N. E. Br. Smaller tree than *M. Elengi:* lvs. small, cuneate-oblanceolate, obtuse, rusty-tomentose when young, but become glabrous-green, the petiole ⅓in. or less long, and the blade ¾–2 in. long: fls. 12–16, in umbels on the tips of the branches; sepals 6–8, in two series; petals 18–24, in three series, linear-lanceolate, yellow; stamens 6–8; staminodia lanceolate-acuminate channelled: fr. size of an olive, yellow. Natal.—Intro in S. Calif. L. H. B.

MÌNA: *Quamoclit.*

MINKELÉRSIA (Dr. Minkelers, professor of physics in the University of Louvain). *Leguminòsæ.* Creeping or twining herbs of very few species, in Mex. Hooker writes that "the genus is considered by Bentham to be little more than a section of Phaseolus, distinguished by its longer calyx-lobes, and the elongate petals." None of the species seems to be regularly in cult. The following has been recently described. *M. biflòra,* Hemsl., has a tuberous root and long very slender twining sparsely hairy st.: lfts. 3, nearly equal, orbicular-ovate, obtuse: fls 1½ in. long, pale red-purple, 2 on each axillary peduncle: pod linear and straight, containing very small seeds. Mex. B.M. 7819.

MINT: *Mentha.*

MINT GERANIUM: *Chrysanthemum Balsamita.*

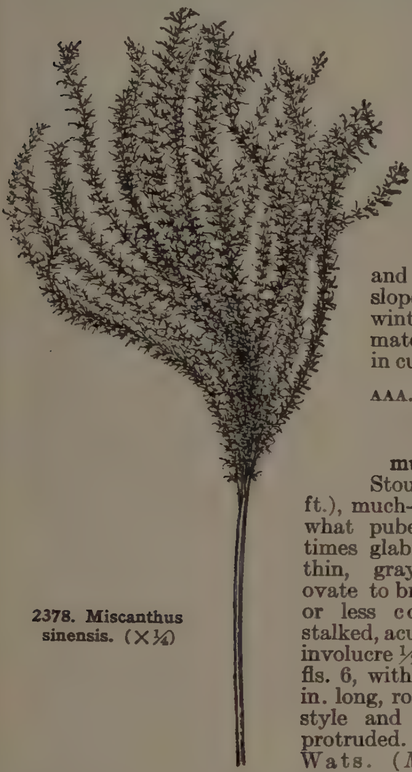
MIRÁBILIS (The old name was *Admirabilis,* meaning wonderful, strange; shortened by Linnæus to Mirabilis). *Nyctaginàceæ.* Interesting flower-garden herbs.

The fls. have no corolla, but the calyx is colored and tubular and exactly like a corolla in appearance. The fls. are surrounded by a leafy involucre, and sometimes (as in *M. Jalapa*) only 1 fl. is borne in an involucre, simulating a corolla in a 5-cleft calyx; stamens 5 or 6, as long as the perianth, their filaments united at the base; style 1, with a capitate stigma: fr. hardened, caps.-like and indehiscent.—About a dozen species in the warmer parts of Amer.; or twice that number if Oxybaphus is included. The species of Mirabilis are perennial herbs, although grown as annuals from seeds, with lvs. petioled and opposite, and fls. solitary or paniculate and nearly or quite sessile in the involucres.

A. *Involucre containing only 1 fl.: plant glabrous or very nearly so.*

Jalàpa, Linn. Four-O'clock. Marvel of Peru. Fig. 2377. Erect-bushy quick-growing herb, germinating readily from the large conical-oblong frs., 2–3 ft. high, bearing profusely in late summer and fall long-tubed funnelform fls. in white and shades of red and yellow, and striped, opening in cloudy weather or late in the afternoon (whence the common name four-o'clock), and closing in the morning: lvs. ovate-lanceolate, short-petioled, acuminate, entire: fls. in clusters amongst the lvs.; stamens not exserted. Trop. Amer. B.M. 371. G. 2:499.—Cult. from early times, and always a favorite. In the tropics it has tuberous roots, and these were once supposed to be the source of jalap, whence the name *Jalapa.* There are dwarf and compact varieties; also forms with variegated foliage. The four o'clock is an "old-fashioned" fl. It is treated as a tender annual, thriving in any garden soil. It is a useful plant for growing in a hedge (plants 1 ft. apart) at the rear of the fl.-garden. Sometimes it comes up in the spring from self-sown seeds. Even as far north as New York, it often produces tuberous roots large enough to be lifted and stored like dahlias.

AA. *Involucre containing 1–3 fls.: plant viscid-pubescent.*



2378. Miscanthus sinensis. (×¼)

califórnica, Gray. Plant 1–3 ft. tall, the many sts. ascending from a somewhat woody base: lvs. thick or almost fleshy, ovate-oblong to round-ovate, short-stalked: involucres 5-cleft, short-peduncled, containing 1–3 rose-purple fls. ½in. long, with stamens sometimes protruded. S. Calif. to Utah and S., on sunny slopes, blooming all winter in milder climates.—Little known in cult.

AAA. *Involucre containing 3 or more long-tubed fls.*

multiflòra, Gray. Stout and tall (2–3 ft.), much-branched, somewhat pubescent or sometimes glabrous: lvs. rather thin, gray-green, lance-ovate to broad-ovate, more or less cordate, short-stalked, acute or acuminate: involucre ½in. long, stalked; fls. 6, with a tube often 2 in. long, rose to purple, the style and the 5 stamens protruded. Var. **pubéscens,** Wats. (*M. Froèbelii,* Greene), is very pubescent throughout. The *M. multiflora* of B.M. 6266 is probably this variety. The species ranges from Colo. and Texas to S. Calif. and south. Little known in cult.

longiflòra, Linn. Plant 2–3 ft., glandular-pubescent above: lvs. cordate and usually acuminate, short-stalked, pubescent: fls. pubescent, with a very narrow tube 5–6 in. long, and a small, flaring white, rose or violet limb, very fragrant at evening. Mex.—An old garden plant, but less frequent than *M. Jalapa;* easily grown from seeds. It has been hybridized with *M. Jalapa.*

L. H. B.

MIRASÒLIA: *Tithonia.*

MISCÁNTHUS (Greek, *miskos,* a stem, and *anthos,* a flower). *Gramíneæ.* EULALIA. Tall perennial grasses with ample terminal feathery fan-shaped panicles, allied to the sugar-cane and Erianthus; often planted for bold lawn specimens and in borders.

Spikelets 1-fld., in pairs at the joints of the rachis, one nearly sessile, the other pedicellate, usually awned; clusters of silky hairs arising from the bases of the spikelets give the panicle its beautiful feathery appearance.—Comprises about 6 species in S. and E. Asia, several of which are cult. for ornament. Includes the eulalias of the trade but not Eulalia, Kunth, which is referred to Pollinia, by Hackel.

Although many progressive nurserymen now advertise these favorite grasses as Miscanthus, the name eulalia will probably remain in the English language as a thoroughly naturalized word, like geranium and chrysanthemum. Eulalias probably rank among the first half-dozen most popular grasses cultivated for ornament. They are remarkably hardy and are universal favorites for bedding. One of the commonest and best designs for a bed of ornamental grasses employs *Arundo Donax* as a tall centerpiece, surrounded by eulalias. Propagated by seed or division of roots.

sacchárifer, Benth. (sometimes written *sacchariflòrus. Imperàta sacchriflòra,* Maxim.). Distinguished by its nearly or quite awnless spikelets. China. Gt. 1862:357.—Procurable of dealers in Japanese plants.

nepalénsis, Hack. HIMALAYA FAIRY-GRASS. Spikelets one-fourth as long as the brown involucral hairs: lvs. smooth on the margin. Himalayas.—Occasionally cult.

sinénsis, Anders. (*Eulàlia japónica,* Trin.). Figs. 2378, 2379. Spikelets about equaling the white or subviolet involucral hairs: culm 4–9 ft.: lvs. 2–3 ft., margins scabrous: panicle 6–12 in., formed late in the season.—Established plants form clumps as much as 18 ft. in circum. Sometimes found escaped from cult. The forms in cult. are mostly the following varieties: Var. **variegàtus,** with lvs. striped; var. **zebrìnus,** lvs. banded. These two varieties are not quite so hardy as the type, and are usually prop. by division, as the seeds are not so sure to come true. Gn. 61, p. 74. Gng. 4: 375; 6:107. B.M. 7304. G.W. 3:423. Var. **gracíllimus** (*Eulàlia gracíllima univittàta, E. japónica gracíllima,* etc.). Lvs. much narrower than the type. Gn. 50, p. 108. Gng. 5:273. R.B. 21, p. 179.

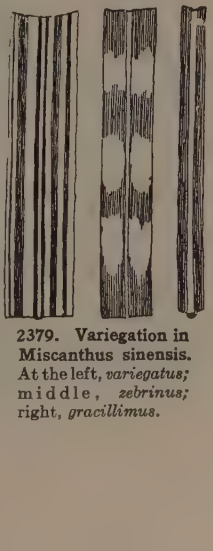
A. S. HITCHCOCK.

MISCHOPHLŒUS (*stem* and *bark,* of no evident application). *Palmàceæ.* One unarmed palm of medium height with pinnatisect lvs., from the island of Ternate in the Malay Archipelago, listed abroad. It is allied to Areca, from which it differs in having more stamens (9), in having the inferior fls. on the spadix branches in 3's rather than in 2's or solitary, and in other technical characters. The species is **M. paniculàta,** Scheff. Lvs. terminal, unequally pinnatisect, the segms. lanceolate and double-toothed and mostly many-nerved: fls. small, in double-branched spadices: fr. ovoid, with terminal stigma, the pericarp fleshy or fibrous.

MISTLETOE of the Old World is *Viscum album;* of America, *Phoradendron flavescens.* See, also, *Loranthus.*

MITCHÉLLA (Dr. John Mitchell, of Virginia, one of the first American botanists, correspondent of Linnæus). *Rubiàceæ.* PARTRIDGE-BERRY. TWIN-BERRY. SQUAW-BERRY. A very attractive native trailer.

There are two species of Mitchella, one of which (*M. undulata,* Sieb. & Zucc.) grows in Japan. The native partridge-berry has small shining evergreen roundish lvs., sometimes marked with white lines, and bright scarlet berries, often borne in pairs, which remain all winter. This plant can be easily collected, and is also procurable from dealers in hardy plants. It thrives under evergreen trees, forming mats. Little pans with fruiting plants are often sold by florists in midwinter, particularly about Christmas time. The fls., which are borne in spring, are small, white, with pinkish throats, and are fragrant. The berries are edible, but nearly tasteless. Fls. twin, the ovaries united into one; calyx 4-toothed; corolla funnel-shaped, 4-lobed; lobes spreading, densely bearded inside, valvate in the bud: fr. a 2-eyed berry or double berry, red (rarely white), persisting through the winter.



2379. Variegation in Miscanthus sinensis. At the left, *variegatus;* middle, *zebrinus;* right, *gracillimus.*

rèpens, Linn. Partridge-Berry. Squaw-Berry. Fig. 2380. Lvs. opposite, round-ovate, petioled, with minute stipules, often whitish veined: fls. in pairs, on the apex of a peduncle. Nova Scotia to Minn., south to Fla. and Mex. Mn. 3:49. L.B.C. 10:979. Gn.M. 2:19.—Attractive in half-shaded spots in the wild garden and rockeries. Prop. by division. L. H. B.†

2380. Mitchella repens.—Partridge-berry. (×½)

MITÉLLA (diminutive of *mitra*, a cap; applied to the form of the young pod). *Saxifragàceæ*. Mitrewort. Bishop's-Cap. Low slender perennials, with somewhat creeping rootstocks and racemes of small and greenish or white flowers, sometimes planted in shady places.

Closely related to Tiarella, but the petals of the latter are entire, while in Mitella they are pinnatifid: lvs. round, heart-shaped, mostly alternate, on rootstock or runners, with slender petioles; those on flowering sts. opposite, if any; calyx short, 5-lobed, the lobes valvate in the bud, spreading; petals 5, inserted on throat of calyx, very slender; stamens 10 or 5, very short: fr. soon widely dehiscent. A few natives of N. Amer., 2 species in E. Asia.—Offered by some dealers in native plants.

A. *Scapes usually leafless.*

B. *Fls. numerous.*

trífida, Graham (*Ozomèlis trífida*, Rydb.). Lvs. round-reniform or cordate, crenately toothed and sometimes incised or lobed, 1–3 in. across: scape 9–12 in. long; fls. somewhat scattered on one side of spike; petals 3–5-parted, small; stamens 5, opposite the calyx-lobes. Canadian Rockies.

BB. *Fls. few (about 5).*

nùda, Linn. Lvs. rounded or kidney-shaped, deeply and doubly crenate: raceme 4–6 in. long. Does well in moist shady situations. May–July. Labrador to Brit. Col. and south to Pa., in bogs and cold woods. A.G. 13:518.

AA. *Scapes bearing lvs.*

B. *Lvs. on scape alternate.*

cauléscens, Nutt. (*Mitellástra cauléscens*, Howell). Raceme loose; stamens alternate with the pinnatifid petals. Mont. to Brit. Col. and N. Calif.

BB. *Lvs. on scape opposite.*

diphýlla, Linn. Lvs. acutely heart-shaped, somewhat 3–5-lobed, toothed: raceme 6–8 in. long. May. Que. to N. C. and Mo. V. 12:189.—A good plant for the rockery. M. B. Coulston. L. H. B.†

MITRÀRIA (from the mitre-shaped pods). *Gesneriàceæ*. One Chilean scandent shrub, prized for its bright scarlet flowers.

Leaves opposite, usually small, few-toothed: fls. stalked, solitary in the axils; calyx relatively small, free, 4–5-parted, with 2-lobed large bracts; corolla-tube much exceeding the calyx, ventricose and contracted near the top, the 5 lobes nearly equal; stamens 4, attached near the bottom of the corolla. *M. coccínea* Cav., is the only species: lvs. ovate and acute: fls. about 1½ in. long, pendent on peduncles much exceeding the lvs. Chile. B.M. 4462. F.S. 4:385. J.H. III. 48:471. G. 5:464; 36:817.—It is a dense-growing subscandent evergreen greenhouse plant (standing out-of-doors in parts of England), of easy cult., blooming in summer and autumn.

MITREWORT: *Mitella*. False M., *Tiarella*.

MITRIOSTÍGMA (Greek, *mitre-shaped stigma*, from the conspicuous stigma, which is club-shaped, the 2-cut summit suggesting a cap). *Rubiàceæ*. This genus includes the charming evergreen tender shrub known to the trade as *Gardenia citriodora*. It makes a low or medium-sized bush of compact and branching habit and bears a great profusion of fls. that resemble those of the orange in odor, size, color and general appearance. The fls. are white, salver-shaped, 5-lobed, tipped with pink in the bud, and borne in dense axillary clusters. This plant is a favorite in the S., together with the Cape jessamine, but is little known in northern conservatories. The genus contains 2 species in Afr., very like Gardenia and distinguished by technical characters as the 2-celled rather than 1-celled ovary.

axillàre, Hochst. (*Gardènia citriodòra*, Hook.). Lvs. opposite, petiolate, elliptic-lanceolate, subacuminate, glabrous; stipules awl-shaped from a broad base: calyx not ribbed, lobes lanceolate, acuminate, equal; corolla salver-shaped, the tube twice as long as the calyx, lobes obovate, obtuse: fr. oval. S. Afr. B.M. 4987. R.H. 1859, p. 175; 1886:348. F.S. 12:1254. J.H. III. 48:449. Gn.W. 4:53. Wilhelm Miller.

MOCCASIN FLOWER: North American name for species of *Cypripedium*.

MOCK ORANGE: *Philadelphus*.

MODÉCCA (an E. Indian name). *Passifloràceæ*. Thirty or more species of erect or twining and tendril-climbing plants in the tropics of Afr., Asia, Austral., little known in cult. Herbs or undershrubs: lvs. alternate, entire or palmately 3–5-lobed, gland-bearing at base of blade: fl.-stalks axillary, terminating in a tendril, bearing greenish or whitish unisexual fls., the hypanthium or calyx-tube not elongated; male fls. with 5 very narrow laciniate petals included within the fl.-tube, 4–5 stamens and 5 staminodes or disk-glands; female fls. with 10 staminodes or disk-glands in 2 series, and a stipitate 1-celled ovary; both kinds of fls. with a corona of interesting structure: fr. a coriaceous or fleshy 3-valved or indehiscent caps. *M senénsis*, Mast. (*Clemánthus senénsis*, Klotzsch. *Adènia senénsis*, Engler), is a tall-climbing shrub from Senna, Zambesi and other places in Trop. Afr.: glabrous and rather glaucous: lvs. 5-parted, pale green, glaucous beneath, the segms. narrow and obtuse. calyx corolla-like, pale yellow, narrow campanulate, about 1 in. long; petals very small and contained within the calyx. B.M. 7763. L. H. B.

MOEHRÍNGIA: *Arenaria*.

MÒHRIA (from Daniel Mohr, a German botanist; died 1808). *Schizæàceæ*. A genus of S. African ferns, having the habit of Cheilanthes, but the sporangia of

the Schizæaceæ. *M. caffròrum*, Desv. Lvs. in tufts, 9–22 in. long, 2–4 in. broad, tripinnatifid, the pinnæ close, the pinnulæ oblong, deeply cut or pinnatifid. The lvs. have a pleasant odor when bruised. Interesting as a rarity but not of commercial value. *M. achilleæfòlia*, Hort., is nearly quadripinnatifid, and is said to have a different odor.
R. C. Benedict.

MOLÌNIA (J. Molina, a writer upon Chilean plants). *Gramineæ.* A cespitose perennial allied to Eragrostis. Panicle contracted; spikelets sub-cylindrical, 2–4-fld., purplish; glumes short, somewhat unequal; lemma 3-nerved, rounded on back, pointed but awnless.—Species 1, native of Cent. Eu. and Temp. Asia, sparingly intro. in the U. S.

cærùlea, Moench (*Aìra cærùlea,* Linn.). Culms tufted, 1–3 ft. high: lvs. rather rigid, slender pointed. The usual form in cult. is var. **variegàta,** with striped lvs., used for bedding. Dept. Agric., Div. Agrost. 20:133.
A. S. Hitchcock.

MOLOPOSPÉRMUM (*striped seed,* a Greek compound). *Umbellíferæ.* One species, **M. cicutàrium,** DC. (*Ligùsticum peloponnesìacum,* Linn.), a large perennial of the mountains of S. Eu., grown sometimes for its handsome dense foliage; prop. by division or by seeds: 3–5 ft. with large hollow sts.: lvs. ternately decompound, the lfts. lanceolate, with pinnatifid segms.: fls. small, in umbels, the terminal umbels larger, yellowish white, the flowering sts. standing well above the clump of foliage. G.W. 12, p. 411.—Hardy in England; thrives in good garden soils.

MÓLTKIA (Count Joachim Gadske Moltke, Denmark, died 1818). *Boraginàceæ.* About a half-dozen perennial cano-pubescent mostly cespitose herbs allied to Lithospermum, but having stamens exserted and different nutlets; S. Eu. and Asia. Fls. blue or yellow, racemose or in terminal cymes; corolla-tube more or less funnel-shaped, the broad throat naked or hairy, the 5 lobes obtuse, erect or nearly so (spreading in Lithospermum); stamens 5. Two or 3 of the species are used more or less in rock-gardens and as alpines.

petræ̀a, Boiss. (*Lithospérmum petræ̀um,* A. DC. *Échium peræ̀tum,* Tratt.), from southeastern Eu., is a good rock-plant, 6–8 in., more or less woody, hoary: lvs. to 1½ in. long, narrow-linear to linear-oblong, the margins recurved: fls. deep violet-blue, in simple forked or branching revolute cymes; corolla-tube twice as long as calyx; lobes erect, short and rounded; style slender, exserted. B.M. 5942. B.R. 29:26.

cærùlea, Lehm. Suffruticose, the sts. erect, rigid and thickish, with crowded lvs., canescent: lvs. oblong-spatulate and obtuse, those on the st. linear-lanceolate and somewhat acute: fls. blue, in scorpioid racemes, the corolla-tube slender and exceeding the calyx; filaments exserted; calyx-lobes linear-lanceolate. Asia Minor.

graminifòlia, Benth. & Hook. (*L. graminifòlium,* Viv.). By some kept in Lithospermum: st. somewhat woody below, but ascending, appressed-hairy: lvs. linear, revolute: fls. purple-blue, about ½in. long, the corolla glabrous and with erect lobes; stamens somewhat exserted. Italy. G.C. III. 47:213. Gn. 65, p. 147. Gn.W. 21:668.—A dwarf shrub with grayish lvs., said to prefer a dry and sunny place on limestone.
L. H. B.

MOLUCCÉLLA (diminutive, made from Molucca). Also written *Mollucella. Labiàtæ.* Half-hardy annuals, flowering in midsummer, interesting because of the cup-shaped calyx.

Annual: corolla-tube included, with an oblique hairy ring within, the upper lip erect, the lower trilobed, the middle lobe broader, notched; stamens ascending under the hood, the anthers attached by lateral pedicels to the tip of the filament, cells divergent; style bifid: nutlets 4, convex on one side, angular on the other, broader upward, truncate.—Of 25 described names only 2 now remain in this genus as accepted species. Bentham & Hooker place this genus near Lamium. Other genera of garden value in which the upper lip of the corolla is concave or vaulted and often villous within are Stachys, Leonurus and Phlomis. From these Moluccella is easily distinguished by its calyx. The fls. are white, tipped pink, scarcely if at all thrust out of the calyx, and borne in whorls of 6–10.

To this genus belongs the shell-flower, a quaint old annual plant, that self-sows in old-fashioned gardens, but is now rarely advertised for sale. Start the seed in frames in February and March; the seedlings may be transplanted to the rockery or border in May. They seem to like a sandy loam.

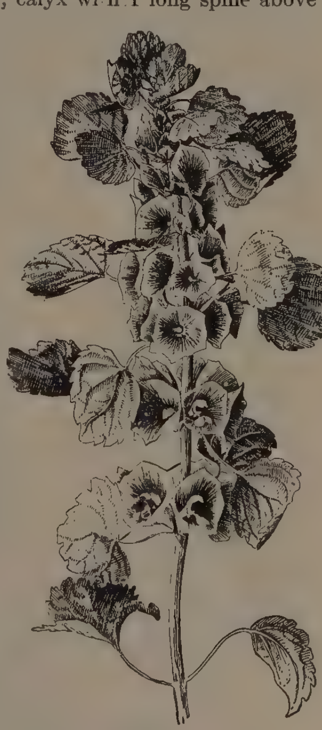
A. *Calyx not prickly.*

læ̀vis, Linn. Shell-Flower (so called because of the shell-like calyx in which the seeds nestle like eggs). Molucca Balm. Fig. 2381. Height 2–3 ft.: st. simple or branching below, fl.-bearing almost from the base: lvs. long-petioled, rounded-subcordate, teeth coarse, round: fls. in whorls, 6-fld.; bracts shorter than calyx-tube; corolla white, shorter than calyx; calyx bears 5 small thorns. W. Asia. B.M. 1852.—Fls. odorous.

AA. *Calyx beset with long prickles.*

spinòsa, Linn. Height 6–8 ft.: lvs. ovate, deeply and sharply cut: fls. in whorls, 6–10-fld.; bracts subulate, spiny, shorter than calyx-tube; corolla white, limb longer than calyx-tube; calyx with 1 long spine above and 7 others below. S. Eu., Syria. B.R. 1244 (as *Chasmonia incisa*).—Annual or biennial, with brownish red square sts., bristling calyx and gaping corolla. Said to have been cult. in England since 1596.

Wilhelm Miller.
A. C. Hottes.†


2381. Moluccella lævis. (×⅓)

MOMÓRDICA (*momordi,* from *mordeo,* to bite, since the seeds appear to have been bitten). *Cucurbitàceæ.* Annual or perennial tendril-climbing herbs of tropical countries, some of which are cultivated for ornament and also for the edible fruits.

Annual or perennial: fls. monœcious or diœcious, the staminate solitary or panicled, the pistillate solitary; corolla and calyx similar in sterile and fertile fls.; corolla-segms. 5, often extending nearly to the base, making a rotate or broadly campanulate fl.; stamens usually 3, the short filaments free, one of the anthers 1-loculed and the others 2-loculed; style single and long, with 3 stigmas: fr. oblong or nearly spherical, small, often rough, usually many-seeded, sometimes splitting into 3 valves, but usually indehiscent; seeds usually flattened, often oddly marked or sculptured: tendrils simple, in this distinguished from Luffa.—Species about 35, chiefly in Trop. Afr. also Trop. Asia. Two momordicas (*M. Charantia* and *M. Balsamina*) are known to American gardens as ornamental vines, but the frs. of *M. Charantia* are eaten by the American Chinese. They are tender annuals and thrive where cucumbers and gourds will grow. They are excellent in the S. for covering porches and arbors. *M. Elaterium* of the catalogues is Ecballium, which see.

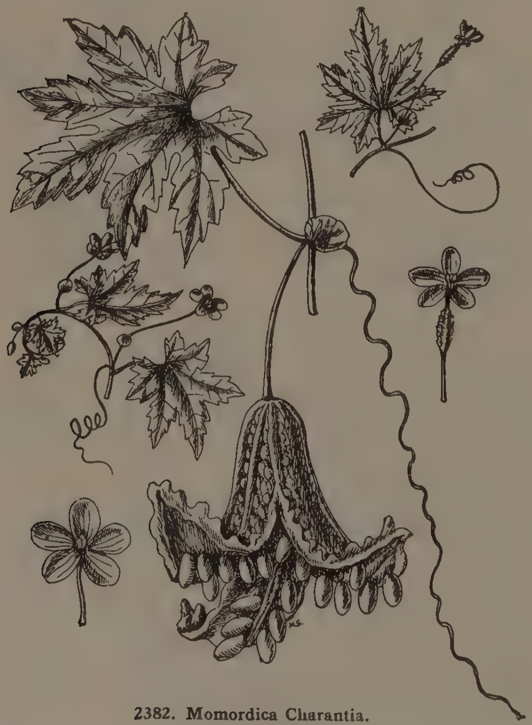
A. *Bract usually about midway (or at base) on the peduncle, entire: all peduncles bracted.*

Charántia, Linn. Balsam Pear. Fig. 2382. Running 10 ft. or more, the st. slightly pubescent and furrowed: lvs. roundish, dull green, pubescent beneath (at least on the ribs), 5–7 lobes with rounded sinuses, the lobes sharp-toothed and notched: fls. yellow, 1 in. across, both the sterile and fertile solitary: fr. yellowish, oblong, pointed, furrowed lengthwise and tuberculate, 6 or 7 in. long, at maturity splitting into 3 divisions and disclosing the bright scarlet arils of the white or brown carved seeds. Trop. Asia and Afr., and naturalized in W. Indies. B.M. 2455. G.C. III. 52:473. A.G. 13:525.—The Chinese gardeners about the American cities grow this plant under the name of la-kwa, for the edible pulpy arils surrounding the seeds, and also for the edible fr. itself (which is prepared, usually by boiling, before it is ripe). The rind is sometimes dried and used in medicinal preparations (see Bailey, Bull. No. 67, Cornell Exp. Sta., with illustrations). The odd seeds cause it to be called the "art pumpkin" by some persons.

Var **abbreviàta,** Ser. (*M. zeylánica,* Mill.). Plant smaller: lobes of lvs. narrower: fr. shorter, ovate-mucronate, with rows of sharp spines; seeds small, commonly smooth. In the tropics.—Perhaps specifically distinct; but *M. Charantia* runs into many forms.

AA. *Bract of sterile peduncle near the top, toothed: peduncle of fertile fl. bracted at base or not at all.*

Balsámina, Linn. Balsam Apple. Slenderer and more graceful, bright green throughout, glabrous, the foliage smaller and neater: lvs. cordate-orbicular in outline, 3 in. or less across, 3–5-lobed, with rounded sinuses, the lobes and the few notches or teeth acute: fls. solitary, nearly or quite 1 in. across, yellow, often with blackish center: fr. orange, 2–3 in. long, ovoid and more or less narrowed each way, smooth or tuberculate; seeds compressed, nearly smooth. Widely distributed in Afr. and Asia, and naturalized in the W. Indies. G.C. 1848:271. R.H. 1857, p. 182. G.M. 48:3.—A neat vine, growing 4–6 ft.



2382. Momordica Charantia. (Main spray × ¼)

AAA. *Bract near the top of the sterile peduncle, entire.*

involucràta, E. Meyer. Much like *M. Balsamina,* but teeth of lvs. blunt, with a short mucro, fls. larger, bract much larger: fls. white or cream-white, often dotted with black: fr. sulfur-yellow, changing to scarlet, bursting, 2 in. long. S. Afr. R.H. 1865:350 (as *M. Balsamina* var. *leucantha*). B.M. 6932.—A very slender and graceful climber, with the peduncle bract against the calyx, like an involucre. Intro. to American trade about 1890.

M. cochinchinénsis, Spreng. (M. mixta, Roxbg.), is a large species with 3-lobed lvs., pale yellow, purple-eyed fls., 4 in. across, and an oblong, bright red fr. 4–7 in. long. Farther India. B.M. 5145. F.S. 14:1478. G.C. III. 16:531. G.M. 37:777.

L. H. B.

MONÁNTHES (named for the often solitary flower). *Crassulàceæ.* About 10 little fleshy herbs of the Canary Isls. and Morocco. Perennial, tufted, mostly glandular-hairy: lvs. fleshy, clavate or cylindrical, opposite or alternate, part or all of them rosulate: fls. reddish or orange, on slender peduncles, solitary or in cymes or racemes; sepals connate at base; petals 6–12, small, lanceolate; scales broad and petal-like. Closely allied to Cotyledon and Sempervivum, and presumably requiring similar treatment. From Sempervivum it differs in the much more developed scales in the fl., opposite the carpels. Fanciers are likely to grow a number of species; the following description will indicate what the plants are like.

atlántica, Ball. Branches prostrate, 1–3 in. long, cylindric, bearing toward the end a dense imbricated rosette of 20 or more lvs., the latter about ⅙in. long: fls. golden yellow, speckled red on back, on peduncles from the ends of the branches; petals 6, elliptic-ovate, acuminate. Canaries, Morocco. B.M. 5988 (as *M. muralis*).

L. H. B.

MONÁRDA (after Nicolas Monardes, a Spanish physician and botanist, who published in 1571 a book containing accounts of American products. See Fig. 1850). *Labiàtæ.* Horse-Mint. Annual and perennial, erect, aromatic herbs.

Leaves dentate or serrate: calyx tubular, narrow, 15-nerved, nearly 5-toothed, mostly villous in the throat; fls. rather large, white, red, purplish, yellowish or mottled, in dense capitate clusters, mostly bracteate, terminal and sometimes axillary, the bracts often highly colored; corolla glabrous within, tube slightly dilated above; upper lip erect or arched; lower lip spreading, 3-lobed, the middle lobe larger or longer than the others; anther-bearing stamens 2, usually exserted, the posterior pair rudimentary or wanting; anthers linear; ovary 4-parted.—About 12 species, natives of N. Amer., including Mex.

This includes the Oswego tea (*M. didyma*), one of the most brilliant of our native wild flowers, being surpassed in the intensity of its red only by the cardinal-flower. It is a rather coarse herb, with large heads of gaping, wide-mouthed flowers, which have none of the refinement of the cardinal-flower. For mass effects, however, these plants are very striking. They grow wild along the banks of streams, lighting up the dark corners of the woods. This suggests their proper place in landscape gardening. They should be grown in masses, in wild spots against a dark background. However, they can, if desired, be grown in an ordinary sunny border without more moisture than usual. As a bedding plant they would be inferior to *Salvia coccinea*, the flowers being shorter-lived. The white- and rose-colored varieties are less desirable. *M. fistulosa* is the same type of plant, and is procurable in colors ranging from white, flesh-color and lilac, through rose and crimson to deep purple, but not scarlet. This species is very variable in height. The lighter-colored varieties are usually less robust.

Monardas are easy of culture, thriving in any good soil. They spread quickly, and therefore need frequent separation, which operation is best done in the spring, as plants disturbed in autumn will often winter-kill.

2383. Monarda didyma. (×⅓)

A. *Calyx slightly hairy at the throat.*

dídyma, Linn. (*M. Kalmiàna*, Pursh. *M. coccínea*, Hort.). Oswego Tea. Bee-Balm. Fragrant Balm. Fig. 2383. St. acutely 4-angled: lvs. thin, ovate-lanceolate, acuminate. B.M. 145 (erroneously as *M. fistulosa* var.), and 546. R.B. 26:49. G.W. 14, p. 618. Vars. **álba** and **ròsea,** Hort., are offered, but the latter should be compared with the next species. In 1893 John Saul advertised *M. Kalmiana* as if horticulturally distinct, calling it the finest of monardas. Var. **salmònea,** Perry. Large heads of delicate shade of salmon-pink.—Suited to moister positions than the others.

AA. *Calyx densely bearded at the throat.*

B. *Lvs. petioled.*

fistulòsa, Linn. Wild Bergamot. Sometimes called bergamot in nursery catalogues, but the bergamot of the Old World is *Mentha odorata*. St. mostly obtusely angled: lvs. firmer: fls. purple, usually not so numerous as *M. didyma*. July, later than *M. didyma*. Var. **rùbra,** Gray. Fls. crimson or rosy red. Var. **mèdia,** Gray (var. *purpùrea*, Hort.). Fls. deep purple. Var. **purpùrea,** Pursh. The deep purplish crimson fls. are smaller. L.B.C. 14:1396. Var. **móllis,** Benth. (*M. móllis*, Linn.). Fls. flesh-color to lilac. B.M. 2958 (as *M. menthæfolia*).—Will grow in dry positions.

Ramàleyi, A. Nelson. Similar to *M. fistulosa* but softly and lanately white-pubescent, densely so at the nodes: lvs. lanceolate or narrowly ovate; petioles short, lanately pubescent as are also the midribs of the lvs.: involucral lvs. scarcely purple-tinged: corolla lavender. Cent. Colo.—This species is catalogued as being dwarf, 1–2 ft., bearing bright clover-red fls.

BB. *Lvs. nearly sessile, at least below.*

Bradburiàna, Beck. Fls. light purple, spotted darker on the middle lobe of the lower lip, which is much larger than the lateral ones. June. Ind. to Tenn. and Kans. B.M. 3310 (erroneously as *M. fistulosa floremaculata*).—Will grow in dry positions.

Wilhelm Miller.
A. C. Hottes.†

MONARDÉLLA (diminutive of Monarda, having its aspect, inflorescence and calyx). *Labiàtæ.* Annual or perennial sweet-smelling herbs, natives of California. Leaves entire or obscurely toothed: fls. rose, red, purple, or rarely, white, compacted in terminal heads with an involucre; calyx tubular, narrow or long, 10–13-nerved, 5-toothed; the teeth short, straight and nearly equal; the throat naked within; stamens 4, exserted.—About 15 species closely allied to Pycnanthemum and Origanum. The plants are best prop. by division in the spring. They prefer a sandy soil. The following have been advertised, and can be secured through western collectors.

A. *Fls. large, few, rather loosely glomerate.*

macrántha, Gray. Perennial, tufted, about 9 in. high: bracts of the 10–25-fld. head sometimes whitish or purplish tinged: corolla about 1½ in. long, glabrous, orange-red, its tube fully twice the length of the calyx; the lobes lanceolate. S. Calif.

nàna, Gray. Pubescent: 9 in. high: bracts whitish or rose-color: fls. smaller than *M. macrantha;* corolla less than an inch long, white tinged with rose, the slender tube pubescent. S. Calif., in mountains near San Diego.

AA. *Fls. smaller, more numerous, densely capitate.*

B. *Plants perennial.*

villòsa, Benth. Soft-pubescent, or the heads and lower face of lvs. villous, or sometimes the whole herbage glabrate, 9–12 in. high: lvs. ovate, all petioled; veins conspicuous, widely spreading. Woods and banks. W. Calif., especially along coast. Farther inland is a form (var. *interior*, Jeps.) with coarsely toothed lvs. and large heads.

odoratíssima, Benth. Cinereous-puberulent, or nearly glabrous: 9–12 in. tall: lvs. narrowly oblong to broadly lanceolate, entire or nearly so, short-petioled, or the upper subsessile, firm in texture; veins inconspicuous: bracts thin-membranaceous and colored (whitish or purple). Dry hills, Wash., Ore., and through higher mountains of Calif., Nev., Utah.—Odor of pennyroyal.

BB. *Plants annual.*

C. *Corolla rose-red or purple.*

lanceolàta, Gray. Lvs. oblong-lanceolate or narrower, tapering into a slender petiole: corolla rose-color or purple: bracts leafy. Calif.

CC. *Corolla white or nearly so, small and short.*

cándicans, Benth. Lvs. lanceolate or narrowly oblong, tapering into a slender petiole: bracts minutely pubescent outside, greenish along numerous nerves. Calif.

A. C. Hottes.†

MONÉLLA: *Cyrtanthus.*

MONÈSES (Greek, *single delight;* from the pretty solitary fl.). *Pyrolàceæ.* One-flowered Pyrola. One species, a low perennial herb: st. decumbent: lvs. roundish, clustered at base: fls. single, drooping, from top of slender scape 2–6 in. long, white or rose-colored, 6 lines across; petals 5, widely spreading, orbicular; filaments awl-shaped, naked; anthers as in Pyrola, but conspicuously 2-horned. **M. uniflòra,** Gray (*M. grandiflòra*, S. F. Gray. *Pýrola uniflòra*, Linn.), grows in moist cold woodlands from Labrador to Alaska, in middle states and westward along the mountains. It has been offered among native plants.

MONEYWORT, or **CREEPING CHARLIE,** is *Lysimachia Nummularia.*

MONKEY-FLOWER: *Mimulus luteus.*

MONKEY-PUZZLE: *Araucaria imbricata.*

MONKSHOOD: *Aconitum.*

MONOCHÆTUM (*one bristle*, referring to the connective). *Melastomàceæ.* Shrubs and subshrubs of tropical America, suitable for glasshouse culture, little grown.

Allied to Rhexia, but differing in the clavate-appendaged connective and other minor characters: mostly erect, pilose: lvs. 5–7-nerved, ovate or lanceolate: fls. paniculate, medium size, purple or rose; calyx-lobes 4, narrow, deciduous or persistent; petals 4; stamens 8, unlike, with glabrous filaments: fr. a 4-valved caps.—Species 30–40, Mex. to Peru. They are said to be of easy cult.; see *Melastoma* and *Medinilla* for similar plants. Prop. by cuttings.

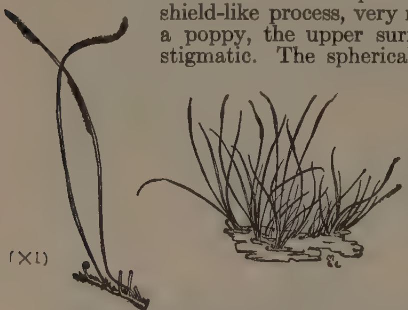
A number of species may be found in the collections of fanciers. Probably the one most likely to be cult., and which is now offered abroad, is **M. seríceum,** Hort. (probably *M. sericeum,* Naudin=properly *M. Bonplandii,* Naudin). There is also a garden var. *multiflorum* of it, with handsome mauve fls. produced in abundance in spring. *M. Bonplandii* is shrubby, the branches somewhat hirsute: lvs. ovate, 5-nerved, entire, short-petioled, villous, and pubescent beneath: fls. axillary or terminal, violet. S. Amer., in the Amazon region.

L. H. B.

MONOCHÒRIA (name refers to the *one separate* stamen). Sometimes misspelled *Monocharia. Pontederiàceæ.* A very few species of rhizomatous herbs allied to Pontederia but differing in the absence of perianth-tube, in erect rather than versatile anthers, and the ovary 3-celled and many-ovuled rather than 1-celled and 1-ovuled. The species are aquatic herbs in the tropics or subtropics of E. Asia, Afr., and Austral., with long radical and short cauline lvs., the blade cordate-ovate or lanceolate: raceme appearing to arise from the petiole of a scape-lf., bearing many blue or violet fls. Probably none is in the trade. *M. vaginàlis,* Presl, of India, bears long-petioled oblong-lanceolate cordate acute lvs. with hollow petioles and is eaten when young as a pot-herb: 2 ft. high: fls. blue. G.W. 11, p. 388.

MONODÒRA (Greek, *single gift,* in allusion to the solitary flowers). *Annonàceæ.* Trees, or shrubs, often with more or less climbing habit.

Flowers extra-axillary or opposite the lvs. or sometimes terminal, borne on a long bracteolate usually pendulous peduncle. This genus forms a distinct tribe distinguished from all other Annonaceæ by a 1-celled compound ovary with numerous ovules attached to the inner walls. The fls. are composed of 3 valvate sepals, a corolla of 6 petals united at the base, many short stamens crowded on a spheroid receptacle bearing 2 elongated parallel pollen-sacs capped by the dilated apex of the connective. The ovary borne on the summit of the receptacle expands into a shield-like process, very much like that of a poppy, the upper surface of which is stigmatic. The spherical gourd-like fr. is closely packed with seeds having the small embryo and wrinkled endosperm which is characteristic of all Annonaceæ. This genus though of African origin was first established from a plant growing in Jamaica, certainly intro. from Afr. with negro slaves. Of the 11 species described by Engler & Diels, all African, 2 are of economic importance. They are little known as horticultural subjects.



2384. Monogramma trichoidea.

Myrística, Dunal. CALABASH NUTMEG. Lvs. short-petioled, the blade firmly membranaceous or paper-like, glabrous, obovate or oblong-elliptical, cuneately narrowed toward the base, which is obscurely cordate; apex more or less acuminate, primary lateral nerves 10–20, prominent beneath, curving upward, connected by secondary nerves almost at right angles to them: fls. fragrant, solitary, long-pedunculate, the peduncle bearing at or above the middle an ovate-lanceolate or suborbicular bracteole often more or less acuminate at the apex; outer petals more or less ovate-lanceolate, gradually narrowing toward the apex, undulate-crispate, white or yellowish, and variegated with purple or brown spots; interior petals shortly clawed, ovate-cordate obtuse, auriculate and pilose at the base; stigma with the circular margin scalloped or entire: fr. globose, more or less longitudinally striate or obscurely ribbed, with the pericarp thick, woody and gourd-like, often 4–6 in. diam., and hanging on a peduncle 24 in. long. An African tree endemic in the forests of Sierra Leone, Upper Guinea, Kamerun, Gabun, the Lower Congo, and Angola. In its native habitat it often reaches a height of 60 ft. or more; but in cult. it is usually much smaller.—The aromatic seeds, with the endosperm ruminate like that of a nutmeg, are highly prized by the native Africans. They are used medicinally and as a spice for seasoning food, and are offered for sale in local markets, strung together like rosaries.

angolénsis, Welw. ANGOLA CALABASH NUTMEG. A shrub or tree sometimes reaching the height of 12 ft.: fls. very fragrant; outer petals undulate-crispate, variegated with purple, broadly ovate, erect and curving inward above the essential parts; inner petals rose-tinted or whitish in color, borne on a long narrow claw, dilated into a transversely elliptical or subrhomboid pilose limb: fr. is ovoid-ellipsoid, longitudinally striate and abruptly apiculate.—The aromatic seeds are used in the same way as those of the preceding species.

W. E. SAFFORD.

MONOGRÁMMA (Greek, a *single line;* alluding either to the grass-like lvs. or to the elongated linear sorus). *Polypodiàceæ.* A tropical Old World genus of several small species of grass-like ferns, rarely seen in cult. *M. trichoídea,* J. Smith (Fig. 2384), is a tiny bark-inhabiting plant with thread-like lvs., 1–2 in. long, native in the Philippines. It is of exceptional interest from the collector's standpoint because it is without exception, so far as known, the simplest and most delicate fern in existence. Its habitat is like that of most filmies and the cultural conditions required are also similar.

R. C. BENEDICT.

MONOLÈNA (Greek words referring to the single spur-like appendage on the anterior side of the anther-connective). *Melastomàceæ.* About 5 species of stemless somewhat fleshy herbs from Cent. Amer., Colombia and Peru, one of which is a small hothouse foliage plant, cult. like bertolonia, and known to the trade as *Bertolonia primulæflora.* All the species have a characteristic rootstock, composed of clusters of short thick rhizomes, prominently scarred by the falling of the lvs., and the fls. are numerous, and resemble a primrose about 1 in. across, 5-petaled, pink, and borne on slender scapes: lvs. long-petioled, oblong to orbicular, entire or dentate. See *Bertolonia.*

primulæflòra, Hook. f. (*Bertolònia primulæflòra,* Hort.). Glabrous: lvs. leathery, broadly elliptical, the margins dentate and ciliate: calyx-lobes broadly ovate-rounded. B.M. 5818. F.S. 18, p. 162. G.C. 1870:309. —It has metallic green lvs. 4–6 in. long, with 3–5-parallel veins, the under surface of the lvs. being a showy rosy purple.

MONOLÒPIA (Greek, *one garment* or *husk;* referring to the involucre, the scales of which are united at base or into a cup). *Compósitæ.* Yellow-fld. woolly annuals from Calif., with 8–10 pistillate rays which are 2–4-toothed or lobed: lvs. alternate (or lower ones opposite), sessile, entire or pinnately parted: peduncles terminal, solitary, 1-fld.; heads large, many-fld.; some of the disk-rays sterile; lobes of disk-corollas somewhat bearded and ray-fls. with appendage at base of ligule; pappus none.—Species perhaps a half-dozen; of minor importance horticulturally.

màjor, DC. (*Helènium Doúglasii*, Hort.). Small and woolly in the wild, green and 2–3 ft. high in cult.: lvs. entire or somewhat toothed, sessile, linear to broadly lanceolate: fls. 2 in. across, yellow; rays dilated, coarsely 3–4-toothed, appendaged at the base. B.M. 3839.—Said to bloom most of the summer. Lvs. 3–5 in. long, reflexed: rays 8–9, fertile, short, broad and coarsely toothed, bright golden yellow.
L. H. B.

MONOMÉRIA (*one part*, referring to the single anther). *Orchidàceæ*. Two epiphytic orchids from India, allied to Bulbophyllum, little cult. Pseudobulbs 1-lvd., on a stout rhizome, the lf. long, thick and flat: scape arising from the rhizome and bearing a loose raceme; petals minute, fimbriate; dorsal sepal broad and erect, the lateral much longer; lip small, jointed on the column-base, subcordate; column very short, 3-toothed; anther 1-celled; pollinia 4. *M. barbàta*, Lindl., has scape about 1 ft. long, and fls. about 1¼ in. long, greenish marked red-brown. Sikkim.

MONÓPANAX: *Oreopanax*.

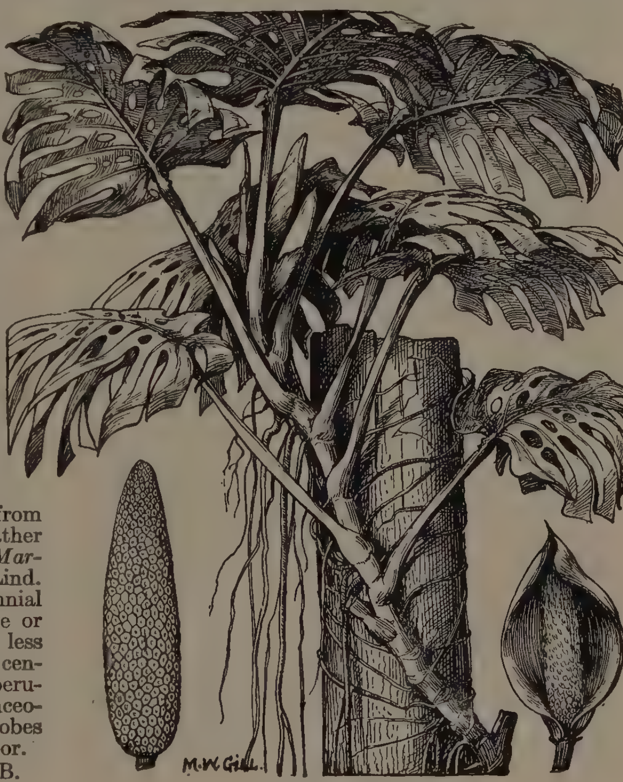
MONOTÁGMA (*single row* or *series*, from the Greek). *Marantàceæ*. Maranta-like plants, about 10 species, in S. Amer., one of which is in cult. It belongs to the 1-loculed section of the family, with a single staminodium; differs from Ischnosiphon, among other things, in its solitary rather than geminate fls. **M. smarágdinum**, Schum. (*Marànta smarágdina*, Lind. *Calathèa smarágdina*, Lind. *Ischnosìphon smarágdinum*, Eichl.). Erect perennial showy herb, 1–1½ ft.: lvs. long-petioled, lanceolate or oblong-lanceolate, acuminate, the base more or less rounded, emerald-green above with a dark green central stripe, beneath pale green and minutely puberulent: fls. 4–8, solitary, disposed in spikes; sepals lanceolate; corolla-tube much exceeding calyx, the lobes lanceolate and obtuse; staminode obovate. Ecuador.
L. H. B.

MONSÒNIA (named for Lady Ann Monson, correspondent of Linnæus). *Geraniàceæ*. Erect or decumbent herbs or shrubs, sometimes grown under glass as are pelargoniums.

Annual or perennial, mostly with slender sts.: lvs. alternate or opposite, crenate-dentate or dissected, stipulate: peduncles axillary or rarely nearly basal, bracteate, 2- to many-fld., or rarely 1-fld. by abortion; fls. white, rose-colored, red, purplish, regular; sepals and petals and glands 5; stamens 15, all fertile, connate at base; ovary 5-lobed and 5-celled, beaked: valves of fr. 1-seeded, revolutely dehiscing.—Species 29 as accepted by Knuth in Engler's Das Pflanzenreich, hft. 53 (1912), African, 2 or 3 extending into Asia. Probably the species most likely to be met with in cult. are *M. lobàta*, Mont., and *M. speciòsa*, Linn. f., suffruticose plants 1 ft. or so high, from S. Afr. The former has lvs. cordate and 5–7-lobed, and fls. greenish and variegated outside and pale bluish inside with darker center. B.M. 385. The latter has lvs. palmately 5-parted and lobes 2-pinnatifid, and fls. rose-colored with darker eye. B.M. 73.
L. H. B.

MONSTÈRA (name unexplained by the author; probably from the Latin for *strange* or *monstrous*). *Aràceæ*. Root-climbing evergreen aroids from tropical America, of which one, *Monstera deliciosa*, is often grown under glass for its odd foliage and in the tropics for its edible fruit.

Woody, the branches rooting, the roots often cord-like, the lvs. more or less distichous: lvs. often very large (small on juvenile shoots and more regular), from lanceolate to oblong and broader, entire, perforated or pinnatifid, the petiole prominent and sheathing: peduncles terminal, solitary or fascicled, bearing ovate or oblong boat-shaped spathe that opens widely after flowering and finally is deciduous: spadix shorter than the spathe, cylindrical or nearly so, densely flowered, bearing the hermaphrodite or perfect fls. above and sterile fls. below; fertile or perfect fls. with no perianth, and 4 stamens, and a 2-celled ovary with 2 ovules in each cell: frs. many small berries, crowded or joined into a multiple fr. or cone-like structure.—Species 27 as monographed by Engler & Krause in Engler's Pflanzenreich, hft. 37 (1908).



2385. Monstera deliciosa.

The species commonly known in horticulture is *Monstera deliciosa*, the ceriman (Fig. 2385). It is a greenhouse climber, with huge perforated leaves. As the plant climbs, the stems emit long aërial roots, many of which never reach the ground. The plant bears an edible fruit, which has a taste between a pineapple and a banana. The fruit grows about 6 to 8 inches long, and looks like a long pine-cone, the rind being composed of hexagonal plates. The monstera is a satisfactory greenhouse subject, even in a young stage, and being a great curiosity, excites much comment from visitors. It is usually kept in a hothouse, but succeeds in a coolhouse also. It is commonly allowed to grow in a spreading rather than climbing fashion. As a conservatory plant it does best when planted out in a bed of rich soil, where it can be kept within bounds by judicious pruning. It is not particular as to soil, as it fills the pots in which it is planted with thick succulent roots in a very short time. It is one of the best plants for enduring the varying conditions of temperature in a dwelling-house, as nothing short of a freeze seems to hurt it.

The propagation of monstera is easily accomplished by division of the growing stems. These can be cut up into lengths so as to include two or three joints placed in a propagating-bed with bottom heat of 75° to 80°. A good method is to place each cutting in a 3-inch pot, filled with a mixture of sand, peat and leaf-mold in equal parts. Plunge the pots up to the rims in a warm propagating-bed and cover with glass so as to insure a humid atmosphere. When they have made new roots they can be taken out of the propagating-bed and placed on a bench in a house, with a night temperature of 65° to 70° with a rise during bright days to 80° or 85°. While they will grow in 8 to 10° cooler temperature, they will never come to their full perfection without plenty of heat. As the pots become filled with roots, they should be shifted until the plants are in 10- or 12-inch pots or tubs. They may also be planted out along some wall or pillar in the greenhouse. Monsteras are tropical climbers, so will need some mode of support to keep them growing in their natural habit. For a compost they like a turfy soil three parts, leaf-mold and well-rotted manure one part each; to this add enough sand to make it porous. Give plenty of ventilation. They should be syringed frequently during the spring, summer and fall months. During the summer, they require plenty of water to keep up their vigorous growth. When monsteras are wanted to ramble over a large area, they should be given much liquid feeding. They will need a little shade during the hottest part of the summer, but no more than is necessary to hold the foliage in good color, as it only tends to make them grow soft and flabby. During the winter months, it is always better to lessen the water-supply as they are in a state of dormancy until about the end of January when they will show renewed state of activity. These plants are not troubled with many insects. The texture of their leaves will allow syringing to such an extent as to dislodge any kind of pest. (J. J. M. Farrell.)

In the American tropics *M. deliciosa* requires a very warm moist climate for the production of fruit. Although it naturally grows by attaching itself to trees and creeping up, it appears to be more fruitful if compelled to grow on the ground without climbing. The fruit is green in color until it ripens, when there is just a tinge of yellow, and the outer rind comes off in bits at a touch.

The plant known to the trade as *Marcgravia paradoxa* is *Monstera dubia*. The adult leaves are something like those of *M. deliciosa*, being now and then perforated, but usually pinnately cut. The young leaves are very different, being much smaller, entire and heart-shaped. In its young stage, *M. dubia* is a very handsome hothouse climber, with thick roundish waxy leaves, which grow in two ranks and overlap one another. When the plant was introduced by Bull, it was shown growing on a board apparently in parasitic fashion, and emitting aërial roots. It seemed most like a Marcgravia, but when it flowered and fruited the first name was found to be incorrect. Marcgravia is a dicotyledon and Monstera a monocotyledon. The monstera-like leaves are likely to be developed when the plant reaches 15 feet. In the young stage the plant is generally allowed to clamber over a dead log or tree-fern trunk, in the manner of Philodendron, which see for culture.

deliciòsa, Liebm. (*M. Lénnea*, Koch. *Philodéndron pertùsum*, Kunth & Bouché). CERIMAN. Fig. 2385. Sts. strong, terete, climbing high: lf.-blades 1–2 ft. and more long, leathery, pinnately cut, perforated, the petiole very long. Mex., Guatemala. A.F. 7:253. G.M. 41:329. Gn. 21, p. 39.

dùbia, Engler & Krause (*M. ténuis*, C. Koch. *Marcgràvia dùbia*, Kunth. *M. paradóxa*, Bull). SHINGLE PLANT. Young lvs. a few inches long, waxy, entire; mature lvs. pinnatifid, the segms. narrow-linear and acute. Mex. Gn. 29, p. 290 (both kinds of lvs.). G.C. II. 8:13.

latevaginàta, Engler & Krause (*Pòthos celatocaùlis*, N. E. Br.). Sts. flat on under side, lying close to support: early lvs. distichous and overlapping, broad-elliptic, sessile, dark velvety green, appressed to support; older lvs. larger, lobed, free. Trop. Amer. F.S. 23:2419, 2420. I.H. 30:496. L. H. B.†

MONTANÒA (Montano, a Mexican statesman). Sometimes spelled *Montágnæa*. *Compósitæ*. Shrubs or even small trees, pot-plants being used sometimes for subtropical bedding and for winter bloom; somewhat allied botanically to Rudbeckia.

Strong mostly robust plants, mostly pubescent or tomentose: lvs. opposite, entire, dentate or even pinnatifid: heads small or medium, corymbose-paniculate, heterogamous, radiate; ray-florets neutral, in 1 series; disk-florets perfect but the innermost sterile; receptacle convex or conical, with carinate scales about the fls.; corolla white or rose-colored.—About 20 species, Mex. to Colombia. They are of easy cult.; the seeds are started indoors and the plants may be transferred to the open for foliage effects, as are melianthus, the large solanums and others; prop. also by cuttings. Several of the species are likely to appear in collections in subtropical gardens.

bipinnatífida, Koch (*Polýmnia grándis*, Hort.). Erect and strong, half-shrubby, to 8 ft.: lvs. pinnatifid or 2-pinnatifid, more or less hairy, the segms. serrate or notched: heads 3 in. diam., with showy pure white rays. Mex. G.C. III. 39:123; 42:419. Gn. 72:308. G. 30:277. G.M. 50:903. R.H. 1910, p. 175.—A striking subject either for winter bloom indoors or for bedding out with bold planting.

mollíssima, Brongn. Branching shrub, more branching and stiffer than *M. bipinnatifida*, 6 ft., the branches pubescent but becoming almost glabrous: lvs. lanceolate or ovate-lanceolate, about 6 in. long, sessile, dentate, white-tomentose beneath, veiny, soft to the touch: heads 1½ in. diam. on long peduncles, the rays about 9 and white, the disk yellow. Mex. B.M. 8143.—This and *M. grandiflora*, DC., are confused, but the latter (which may be in cult.) has very rough and scabrous lvs. that are brown-hairy beneath; what is known in cult. as *M. grandiflora* is probably diverse. Mex. G.C. III. 43:40. Gn. 74, p. 623.

Wércklei, Berger. A recent species from Costa Rica: shrub, to 20 ft., the branches white-tomentose: lvs. petioled, 5–7-lobed or trifoliolate or unequally pinnate, soft-pubescent, 8–10 in. long, the lfts. small: heads about 2 in. across, probably white, in broad corymbs. L. H. B.

MONTBRÈTIA: *Tritonia.*

MONTEREY CYPRESS: *Cupressus macrocarpa.*

MONTEREY PINE: *Pinus radiata.*

MÓNTIA (Guiseppe Monti, professor of botany at Bologna in the first half of the eighteenth century). *Portulacàceæ*. Small glabrous herbs, grown for ornament and one as a salad or pot-herb; annual and perennial.

Leaves opposite, fleshy: fls. minute, nodding solitary or loosely racemed, white, or pale rose-color; sepals 2 (rarely 3), broadly ovate, persistent; petals 3, more or less united; stamens 3 (rarely 5), inserted on the corolla; ovary 3-ovuled; style short, 3-parted: caps. 3-valved, 3-seeded; seeds nearly orbicular, compressed, minutely tuberculate.—About 18 species of American herbs, including the winter purslane, a salad or pot-herb known to the European trade as *Claytonia perfoliata*. This odd plant is perhaps cult. in Amer. by a few fanciers of rarer kinds of vegetables. In hot countries it may be more desirable. The most remarkable feature is a sort of cup an inch or more in diam., from which arise the racemes of small white or rose-colored fls. One of these cups crowns each of the sts., which are numerous, slender, leafless, and about twice as long as the lvs. The name "perfoliata" is suggested by the resemblance of the cup to a perfoliate lf. In *M. perfoliata* the cup is usually 2-lobed; and the species runs into *M. parviflora*, which rarely has the cup transformed into 2 almost disjoined lvs. *M. fontana* is the aquatic or semi-aquatic species found in most of the temperate regions of the world. The winter purslane is now a weed in many parts of the world. The seed may be sown all through spring and summer where the plants are to stand. Montia cannot be distinguished from Claytonia by any one character, but the cult. plants of both genera have been sufficiently discriminated here and under Claytonia.

A. *Sts. without true lvs.*

perfoliàta, Howell (*Claytònia perfoliàta,* Don). Winter Purslane. Rather coarse, green, often reddening with age: radical lvs. from subreniform to spatulate-obovate, often 1–3 in. broad; cauline lvs. merely flattened disks: pedicels not longer than the fruiting calyx; petals white, little surpassing the calyx. Banks of streams, Calif. to Ariz. and Mex., north to Brit. Col.; common near Pacific coast. It grows wild in Cuba but is not native there, as often stated. B.M. 1336. R.H. 1897, p. 159. Annual.

parviflòra, Howell (*Claytònia parviflòra,* Douglas). More slender, green or slightly glaucous: radical lvs. spatulate to filiform-linear: pedicels slender, much longer than calyx; petals white or pale rose-color hardly double length of calyx. Calif. to Brit. Col., east to Idaho and Utah. Annual.

AA. *Sts. leafy.*

B. *Lvs. alternate, numerous, small.*

parvifòlia, Greene (*Claytònia parvifòlia,* Moc.). Sts. a span to a foot long, ascending or some procumbent, sometimes reduced to naked runners: radical and lower cauline lvs. rhomboid-obovate, about ½in. long, contracted at base into a slender petiole; upper narrower and small: fls. few and racemose, rose-color varying to white. The plant has bulb-like offshoots in the axils of the cauline lvs. Moist rocks, Brit. Col. to Rockies in Mont. and Alaska.—Of very little ornamental value. Apparently perennial.

BB. *Lvs. opposite.*

fontàna, Linn. Water or Blinking Chickweed. Blinks. Water-Blinks. Densely tufted, very green, weak, diffuse or ascending, 1–6 in. long, freely branching: lvs. spatulate or obovate, mainly obtuse, ⅛in. broad or less: fls. nodding, solitary and terminal or in a small, loose, leafy-bracted raceme; sepals obtuse, slightly shorter than the petals: caps. globose, nearly ⅛in. diam.—Wet places, Que., Maine, Nova Scotia, Newfoundland, mountains of Calif. Summer. Annual, or perennial by rooting at the nodes. A. C. Hottes.†

MOON DAISY: name used in England for *Chrysanthemum Leucanthemum* and other species. See page 754.

MOONFLOWER in America always means *Calonyction aculeatum* and related species; in England it rarely, if ever, means this, but *Chrysanthemum Leucanthemum.* Moonflower in England also means sometimes *Anemone nemorosa* and *Stellaria Holostea.*

MOONSEED: *Menispermum canadense.*

MOONWORT: *Botrychium;* also *Lunaria.*

MOÒREA (named in 1890 for F. W. Moore, curator of the Glasnevin Botanic Garden, Ireland). *Orchidàceæ.* One handsome warmhouse orchid, something like Houlletia, from which it differs in the lip having no claw and being articulated with the foot of the column and the midlobe or epichile not articulated with the hypochile.

irroràta, Rolfe. Pseudobulbs ovoid, to 3 in. high: lvs. 2, plicate, to 2 or 3 ft. tall and 8 in. broad: scapes much shorter than or equaling the lvs., several- to many-fld.; fls. about 2 in. diam., the sepals and petals red-brown and whitish at base; lip smaller, 3-lobed, straw-yellow with dark purple lines, the crest bright yellow; column stout and incurved; pollinia of 2 unequal pairs. Probably Colombia. B.M. 7262. G.C. III. 11:489; 29:248. J.H. III. 42:277. G.W. 15, p. 431.—The cult. is similar to that for houlletia; to be potted in a mixture of peat, sphagnum and a little fibrous loam; should be rested after growth. It is easily grown and free-flowering, doing well in a cattleya house. L. H. B.

MOOSEWOOD: *Dirca palustris* and *Acer pennsylvanicum.*

MORÆA (from a personal name). *Iridàceæ.* Morea. Charming bulb plants much like irises, but they are not so hardy as the common irises and the individual flowers last only a day or so; of interest to amateurs.

Mostly having corms except in subgenus Dietes which has a short rhizome: perianth-tube obsolete; outer segms. obovate-cuneate, with a reflexing limb; inner similar, smaller; stamens with anthers like those of Iris, but filaments more or less connate; ovary, style, caps., and seed as in Iris: lvs. few, linear or ensiform: fls. 2 or more, clustered, various in color, usually fugitive.—About 60 species, 45 of which are S. African, while the others are chiefly from Trop. Afr., one species being found in Austral. Moræa is the African representative of Iris. No one character will separate the two genera. Moreas have no perianth-tube, while irises usually have one. The filaments are usually monadelphous in Moræa and free in Iris. Irises grow either from rhizomes or bulbs, while moreas mostly grow from corms, except the subgenus Dietes, which grows from a rhizome. Most of the showiest moreas belong to the subgenus known as Moræa proper. There is another subgenus which differs from it in having the ovary extended into a long beak which looks like a perianth-tube, but none of this group is cult. The moreas proper are about as tender as other Cape bulbs. The amateur may find some suggestions as to their cult. under *Bulbs, Iris* and *Ixia.*

By far the largest and most remarkable plant of the genus is *Moræa Robinsoniana.* This grows 6 to 8 feet high and has the habit of the New Zealand flax, *Phormium tenax.* A splendid specimen mentioned in B.M. 7212 bore 457 flowers between June 20 and October 1. The individual flowers are 4 inches across, fragrant and last only a day. At Kew this noble plant has been successfully grown in the south end of a house. The stately plant pictured in G.F. 10:255 grew in a Californian garden and was said to be sixteen years old from seed. The finest picture, however, is that in G.F. 4:355.

INDEX.

bicolor, 15.
edulis, 3.
fimbriata, 2.
glaucopis, 11.
iridioides, 14.
Johnsonii, 14.
juncea, 6.
longifolia, 3.
lutea, 10.
Macleaii, 14.
odora, 3.
papilionacea, 1.
Pavonia, 10.
polyanthos, 7.
prolongata, 14.
revoluta, 8.
Robinsoniana, 13.
spathacea, 9.
Thomsonii, 5.
tricuspis, 12.
tristis, 4.
villosa, 10.

A. *Rootstock a corm, tunicated: ovary not beaked.*

B. *Inner segms. conspicuous.*

C. *Plants dwarf, 4–6 in. tall.*

D. *Lvs. hairy all over.*

1. **papilionàcea,** Ker. Very dwarf, 4–6 in. tall: fls. red or lilac, yellow on the claw; style-crests erect: sts.

simple or forked low down, bearing 1–6 clusters on short erect peduncles: lvs. hairy all over, linear, 3–6 in. long: caps. oblong, ⅓in. long. S. Afr. B.M. 750.

DD. *Lvs. hairy only at edges.*

2. **fimbriàta,** Klatt. Very dwarf, 4–6 in. tall: fls. lilac: sts. simple or forked low down, bearing 1–4 clusters on erect peduncles: spathes 2–3-fld.: lvs. 3–10 in a basal tuft, linear, much crisped, hairy at edges: caps. oblong, ⅓in. long. Cape Colony.

CC. *Plants above 6 in. tall.*

D. *St. provided with 1 wiry lf. just below infl.*

3. **edùlis,** Ker. Fls. lilac, spotted yellow: st. naked except for one long wiry lf. from base of infl.: caps. cylindrical. S. Afr. B.M. 613. Var. **odòra** has white fls. Var. **longifòlia** has yellow fls. B.M. 1238.

DD. *Sts. with 1–2 produced lvs. somewhat distant from infl.*

E. *Fls. lilac.*

F. *Lvs. above 8 in. long.*

4. **trístis,** Ker. Lvs. 2–3, produced near the base, 1–2 ft. long: clusters of fls. 4–6; fls. dull lilac, ochre or salmon-colored, with a yellow spot; style-crests lanceolate: caps. oblong. Cape Colony, southwest district. B.M. 577 (*Iris tristis*).

FF. *Lvs. less than 8 in. long.*

5. **Thómsonii,** Baker. A rigid herb of rush-like habit: lvs. terete, 6-furrowed: fls. 1¾ in. diam. in spicately arranged fascicles; perianth lilac, yellow at base, spotted brown, midribs darker lilac inside, reddish brown outside. E. Trop. Afr. B.M. 7976.

6. **júncea,** Linn. Fls. lilac, in 2–3 clusters: lvs. 2–3 in. long, falcate, linear complicate: st. very slender, 6–8 in. long: ovary oblong. Cape Colony.

7. **polyánthos,** Thunb. Lvs. about 3, one from near the base of the st., the others from the lower forks, ½–1 ft. long: clusters of fls. 5–20; fls. lilac: caps. clavate or oblong, ⅓–½in. long. Cape Colony, northward to Transvaal.

EE. *Fls. bright yellow.*

8. **revolùta,** C. H. Wright. Closely allied to *M. spathacea:* sepals revolute; styles crested, crossed like closed tips of wings of some birds; fls. solitary; petals oblanceolate, 2½ in. long, bright yellow. Angola.

9. **spathàcea,** Ker. Lvs. 1 only produced, strongly ribbed, 1½–2 ft. long: st. stout, 2–3 ft. long: spathes 2–4-fld.; perianth bright yellow; crests large, lanceolate. Cape Colony. B.M. 6174 (*Dietes Huttoni*).

BB. *Inner segms. inconspicuous.*

C. *Color of fls. chiefly orange-red.*

10. **Pavònia,** Ker (*Ìris Pavònia,* Linn. f.). Outer segms. without a distinct claw, orange-red, with a blue-black or greenish black spot at the glabrous base: lvs. narrow, linear, usually pilose: spathe-valves scariose at the tip. B.M. 1247. Var. **villòsa,** Ker (*Ìris villòsa,* Ker). Lvs. pilose: outer segms. bright purple, with a blue-black spot and a hairy claw. B.M. 571 (*Iris villosa*). Var. **lùtea,** Baker. Lvs. glabrous: fls. yellow, unspotted. B.M. 772 (*Moræa tricuspis* var. *lutea*). Cape Colony, southwest district.—In *M. Pavonia* and *M. glaucopis* the inner segms. have a large central cusp and 2 lateral lobes, while in *M. tricuspis* the inner segms. have 3 large cusps.

CC. *Color of fls. chiefly white.*

D. *Spotted blue.*

11. **glaucópis,** Drap. Outer segms. white, with a blue spot: produced lf. single, long, narrow, linear: st. 1½–2 ft. long; usually 1–3-branched: caps. clavate: crest large, lanceolate. Cape Colony, southwest district. B.M. 168 (erroneously as *Iris Pavonia*).—In this species the outer segms. have a short, distinct claw, while *M. Pavonia* has none.

DD. *Spotted brown.*

12. **tricúspis,** Ker. Outer segms. whitish or lilac, with a purplish spot: produced lf. single, long, firm, narrow: st. 1–2 ft. long, with 2–3 sheath-lvs., usually with 3–4 erect branches: spathe-valves scariose at tip: caps. clavate. Cape Colony, southwest district to Natal. B.M. 696.

AA. *Rootstock a rhizome, short, creeping.*

B. *Color of fls. chiefly white.*

C. *Height of plant 6–8 ft.*

13. **Robinsoniàna,** Moore & Muell. (*Ìris Robinsoniana,* Muell.). WEDDING IRIS. Rhizome short: lvs. radical, 5–6 ft. long: fl.-st. 5–6 ft. long; fls. laxly corymbose; perianth pure white, outer segms. spotted red and yellow near base; crests short and broad. Lord Howe's Isl., Austral. B.M. 7212. G.F. 4:355; 10:255. J.H. III. 32:569. G.M. 34:569. G.C. 1872:393; III. 9:457.

CC. *Height of plant 1–2 ft.*

14. **iridioìdes,** Linn. St. 1–2 ft. long, with many short, sheathing, lanceolate bracts: lvs. in fan-shaped basal rosettes: fls. over 3 in. across, white, marked yellow on claws of outer segms.; style-crests lanceolate, ⅓–½in. long, marked with blue. In Calif. this species is very satisfactory, blooming once a fortnight from early spring until Nov. S. Afr. B.M. 693. L.B.C. 19:1861 (*Iris crassifolia*). G.C. III. 43:88. G.L. 26:92. Vars. **Mácleaii,** Hort., and **prolongàta** are garden forms. Var. **Jóhnsonii,** Hort. Differs from type in having longer lvs., 2½ ft. long, erect, instead of spreading obliquely: fls. 4 in. across. G.C. III. 41:296.

BB. *Color of fls. chiefly yellow.*

15. **bícolor,** Steud. Habit of *M. iridioides:* fls. 2 in. across, yellow, with beautiful brown spots on the outer segms.; style-crests yellow: lvs. 1½–2 ft. long: sts. 1–2 ft. long: style-crests small. Cape Colony, southeast district. B.R. 1404. L.B.C. 19:1886. P.M. 9:29 (all as *Iris bicolor*). R.B. 33:21.

M. sinénsis, Hort. Fl.-sts. 15 in.; fls. 1½ in. across, golden yellow, spotted and streaked vivid scarlet and orange: seeds abundantly. G.C. III. 51:37. May be the same as Belemcanda chinensis, Leman., the blackberry lily.—*M. Sisyrinchium*=Iris Sisyrinchium.

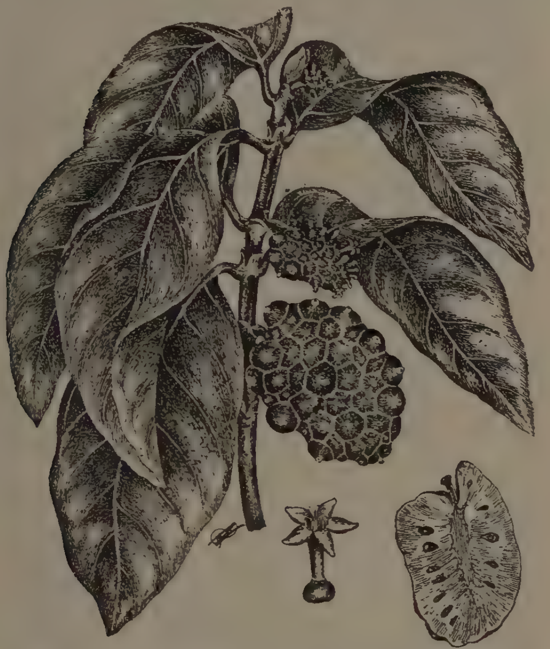
WILHELM MILLER.
A. C. HOTTES.†

MORÈNIA (G. Moreno, physician and naturalist in Lima). *Palmàceæ.* Closely akin to Chamædorea, but distinguished by the 3-toothed rather than disk-like or ring-like calyx in the male fl. Species Andine, about a half-dozen, very little known in collections. *M. corállina,* Karst., has an annular slender erect st. to 20 ft. high: lvs. pinnate, the lanceolate straight lfts. about 24 pairs: fls. white becoming pale yellow, slightly sunk in the spadix; petals 3 and stamens 6: berry ⅔in. diam., bright pink. Colombia. B.M. 8527. *M. fràgrans,* Ruiz & Pav. About 6 ft., graceful: lvs. ovate, the petiole long-sheathing at base; lfts. 1 ft. long, narrow-lanceolate, acuminate, unarmed: spadix nodding, 1 ft. long, the branches white. Peru. B.M. 5492.

MORICÁNDIA (named for Moricand, an Italian botanist). *Cruciferæ.* A few herbs or little shrubs of the Medit. region, seldom cult., allied to Brassica. Erect, very glabrous and glaucous, branching: lvs. entire or pinnatisect: fls. large, purple or rose: pod elongated, on strict pedicels. Only one species is likely to be cult., *M. arvénsis,* DC. This is annual or biennial, 12–18 in. high, with entire lvs., the cauline cordate and clasping, the lower ones oblong: fls. terminal, in spring and summer, violet with darker lines, attractive. S. Eu. B.M. 3007. G. 35:707. Seeds sown in early spring give plants blooming in midsummer.

MORÌNA (Louis Morin, a French botanist, 1636–1715). *Dipsàceæ.* Perennial herbs, suitable for borders and rock-gardens.

Somewhat thistle-like or resembling spiny plants of the Labiatæ, glabrous or pubescent: lvs. opposite or whorled, narrowly oblong or linear, mostly spinous-toothed: fls. whorled in spikes, the whorls with wide lf.-like bracts, and with spinous bracteoles among the fls.; calyx 2-lipped, the lips entire or 2-lobed; corolla 5-lobed and somewhat 2-labiate, the tube curved; stamens 2 or 4, and sometimes a sterile one.—About 10 species, in Asia, allied to Cephalaria and Dipsacus.



2386. Morinda citrifolia branch with leaves, flowers and fruit Also vertical section of fruit (fruit sometimes larger) and enlarged flower below. (×½)

A. *Fls. mostly white.*

Bulleyàna, Forr. & Diels (*M. Beesiàna,* Hort.?). St. 1–2 ft., hairy in stripes: lvs. linear to ovate-lanceolate, spiny-dentate, 5–6 in. long: fls. subcapitate, white or purple; calyx spathaceous, entire, spinose at mouth. China. Recent.

AA. *Fls. yellow.*

Coulteriàna, Royle. St. 2–3 ft., more or less hairy: lvs. 6 in. long and less than 1 in. wide, sessile, glabrous, spinous-toothed: fls. yellow, the corolla-tube to ¾in. long; calyx-lobes nearly equal and bifid, sharp or spiny; fertile stamens 2. India, 9,000–13,000 ft. in the Himalayas.

AAA. *Fls. pink or purple.*

pérsica, Linn. (*M. túrcica,* Hal. *M. græca,* Jaub. & Spach). Thistle-like: st. 3–4 ft., pubescent or hairy: lvs. 6 in. long and 1 in. wide, sessile, doubly spinous-toothed, pubescent or glabrous: spikes long, bearing bright pink fls.; calyx-lobes nearly equal, entire or emarginate; fertile stamens 2, the filaments as long as corolla-lobes; corolla-tube to 1½ in. long. Greece to the Himalayas.

longifòlia, Wall. St. 3–4 ft., pubescent or hairy: foliage thistle-like; lvs. 6 in. long, 1 in. across: fls. showy, deepening from white in the bud to pink and finally crimson, crowded in dense whorls near the top of st.; calyx-lobes unequal, 2-lobed with obtuse not spinous lobes; fertile stamens 2, the filaments much shorter than the corolla-lobes. Himalayas, 9,000–14,000 ft. Hardy. June–Aug. Himalayas. B.M. 4092. B.R. 26:36. R.H. 1857, p. 514. G.W. 7, p. 5. H.U. 1, p. 191. J.H. III. 51:127.—Whorl-flower is a catalogue name. A useful plant.

L. H. B.

MORÍNDA (Latin, *morus,* mulberry, and *indica,* Indian). *Rubiàceæ.* Woody plants, sometimes seen far South; one species has been planted in southern Florida and southern California.

Shrubs, trees and climbers in Trop. Asia, Austral. and the Pacific Isls., and some in Trop. Amer., perhaps 60 species now described: lvs. opposite, rarely in 3's; fls. white or crimson, in axillary or terminal, simple, panicled or umbellate heads; corolla-tube short or long, funnelform or salverform; lobes 4–7, coriaceous, valvate in the bud; stamens 4–7, usually 5, the filaments adnate to throat of corolla; ovary 2–4-celled, the styles united: fr. an aggregate of the ovaries, or berries, in the head.—Some of the species yield dyes. The frs. of some of them are edible. One species, *M. Roioc,* Linn., is native in Fla., extending to the W. Indies; it is a branching shrub with prostrate or somewhat climbing sts.

citrifòlia, Linn. INDIAN MULBERRY. Fig. 2386. A small tree, with smooth bark and obtusely 4-angled branches: lvs. short-petioled, to 10 in. long, broadly elliptic, shining, acute or obtuse: stipules large, broadly oblong or semi-lunar: fl.-head on solitary peduncles 1 in. long usually in the axil of every other pair of lvs. or lf.-opposed; calyx-limb truncate; corolla 5-lobed, tube about ½in. long: fr. yellowish, fleshy, globose or ovoid, about 1 in. diam. Probably India; also Malay Archipelago to Austral. and islands. G.C. II. 11:333.—The fls. contain a red and the roots a yellow coloring principle.

Var. **bracteàta,** Hook. Stipules more acute: calyx-limb often with a lanceolate or spatulate white leafy lobe, sometimes 3 in. long.

M. B. COULSTON.
L. H. B.†

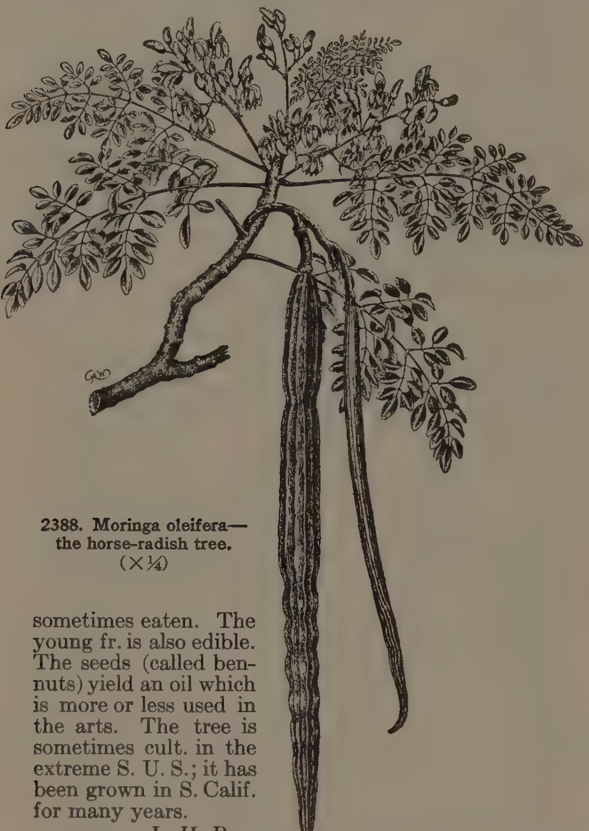
MORÍNGA (altered from the native Malabar name). *Moringàceæ.* Trees of warm countries, one of which is run wild in W. Indies and planted in southernmost parts of the United States.

Flowers perfect, 5-merous; calyx cup-shaped, 5-cleft, the lobes reflexing; petals 5, one of them erect and larger; fertile stamens 5, alternating with 5 or 7 staminodia, the anthers attached on the back, and 1-loculed: fr. a long, 4–9-angled, 1-loculed pod with 3 valves, the seeds immersed in the spongy contents of the valves.—Only three species comprise the family Moringaceæ, all members of the genus Moringa. They are small spineless trees, with alternate deciduous pinnate lvs., axillary panicles of rather large, white or red fls., and long pod-like frs. They are native of N. Afr. and the tropical parts of Asia. The position of the family Moringaceæ is difficult to determine. Bentham & Hooker ally it with Anacardiaceæ. Engler & Prantl place it between Resedaceæ and Sarraceniaceæ. Grisebach joins it to the Capparidaceæ. Others ally it with the Leguminosæ, which it resembles in external appearance.

oleífera, Lam. (*M. pterygospérma,* Gaertn.). HORSE-RADISH TREE. BEN. Figs. 2387, 2388. Small tree (reaching 25 ft.), with soft wood and corky bark, the young parts pubescent: lvs. mostly 3-pinnate, ¾–2 ft. long, all parts stalked: fls. whitish, stalked, fragrant, 1 in.

2387. Moringa oleifera (About natural size) across: pod often 1½ ft. long, 9-ribbed, bearing 3-angled, winged seeds. India, but now spontaneous in parts of the W. Indies.—The horse-radish tree is so named from the pungent taste of the root, which is sometimes eaten. The young fr. is also edible. The seeds (called ben-nuts) yield an oil which is more or less used in the arts. The tree is sometimes cult. in the extreme S. U. S.; it has been grown in S. Calif. for many years.

L. H. B.



2388. Moringa oleifera—the horse-radish tree. (×¼)

MORÍSIA (G. G. Moris, 1796–1869, Italian botanist). *Cruciferæ.* One perennial, excellent in alpine gardening, from Corsica and Sardinia, **M. hypogǽa,** Gay. Fig. 2389. Sts. short or none, the underground part spreading horizontally and sending up many linear, pinnatisect or pinnatifid lvs. 3 in. long: fls. golden yellow, in spring and early summer, solitary but numerous and large (¾in. diam.); sepals erect, linear-oblong and obtuse; petals spatulate: scape decurving and burying the fr., the latter ½in. or more long and ripening under ground. B.M. 7598. G. 34:323.

L. H. B.

MORISÒNIA (Robert Morison, British botanist, 1628–1683). *Capparidàceæ.* Woody plants of very few species, in the West Indies and South America, one of which is listed abroad: a warmhouse subject, grown for its bloom.

Plants unarmed: lvs. simple, petioled, coriaceous: fls. in many-fld. axillary or terminal clusters, large or small; calyx tubular or campanulate, splitting; corolla of 4 obtuse petals; stamens 6–20, shorter or longer than the corolla, with subulate filaments; ovary 4-celled, stalked: fr. a globose berry. **M. americàna,** Linn. Low tree: lvs. oblong, at first with lepidote scales, shining, about 6 in. long: fls. white, petals and the infl. scurfy: berry 1½–2 in. diam. W. Indies, Colombia.

L. H. B.

MORMÒDES (Greek, *a grotesque creature*). *Orchidàceæ.* Rather large plants remarkable for the interesting form of their flowers, which suggested the name given to the genus by Lindley.

Pseudobulbs long, tapering, sheathed by the dry bases of the fallen lvs.: lvs. long, plaited, deciduous in the autumn: raceme from the base of the pseudobulbs, bearing many showy fls.; sepals and petals subequal, mostly narrow; labellum firmly united with the column, with revolute margins, rarely concave, turned to one side; column without appendages, twisted in the opposite direction from the labellum. Distinguished from the closely related genus Catasetum by its perfect fls. and wingless column.—About 20 species in Colombia, Cent. Amer. and Mex.

Mormodes are commonly found in poor condition among the collections, which is the result of neglect rather than difficulty of cultivation. They should be grown in small baskets suspended from the roof, in a compost of equal parts of clean chopped peat fiber, sphagnum and sod, interspersed by nodules of charcoal, and the whole pressed in firmly around the roots. The roots like to work among the charcoal, and this also serves the purpose of dividing the compost, thereby allowing it to dry out more readily. Mormodes do not require an abundance of water at any time, and the compost should be allowed to dry out frequently during the growing season. When at rest, an occasional application will suffice to keep the soil moist and the pseudobulbs from shriveling. Re-basketing should take place at the commencement of new growth in spring. They all require warmhouse temperature; the cattleya or cypripedium department affords them a proper location as to temperature and moisture. (Robert M. Grey.)

Colóssus, Reichb. f. Pseudobulbs 6–12 in. long, clothed with brown sheaths: lvs. elliptic-ovate, 10–15 in. long, plaited: raceme inclined, 2 ft. long, with the stalk; fls. 5–6 in. across; sepals and petals narrow-lanceolate, spreading or reflexed, with recurved margins, pink below, changing to yellow toward the upper portion; labellum ovate, long-acuminate, very revolute, yellow, somewhat sprinkled with pink dots. March. Cent. Amer. B.M. 5840.—A plant of striking appearance.

pardìna, Batem. Pseudobulbs 4–7 in. high, st.-like, sheathed by the bases of the lanceolate, striate lvs., which are 4 times as long: raceme nodding, many-fld., shorter than the lvs.; fls. yellow, spotted with reddish purple, fragrant, crowded on the upper end of the stalk; sepals and petals ovate, pointed, convergent; labellum nearly like the segms. but with 2 lateral acute lobes. July, Aug. Mex. B.M. 3900. F.C. 3:113.—A curious and rather rare plant. Var. **unícolor,** Hook. (*M. citrìna,* Hort.). Fls. of one color, all yellow. B.M. 3879. I.H. 1:25. G.C. III. 14:181. Var. **aurantìaca,** Rolfe. Sepals and petals golden yellow; labellum yellow. I.H. 39:144.

Buccinàtor, Lindl. Plants 1–2 ft. high: lvs. lanceolate, membranous, striate: fls. pale green, with an ivory-white lip; sepals linear-oblong, the lateral ones reflexed; petals erect; labellum subrotund-cuneate, with the sides rolled back, giving it the appearance of a trumpet. April. Mex. B.M. 4455 (*M. lentiginosa*). Var. **aurantiaca,** Rolfe. Differs in its golden fls. B.M. 8041. Var. **Rólfei,** Hort. Sepals and petals

2389. Morisia hypogæa. (×½)

bronzy green; labellum rosy crimson.—This plant is extremely variable in color, ranging from nearly white to chocolate-brown, the various forms being either spotted or plain. Its forms have been described under at least 7 distinct specific names.

luxàta, Lindl. Pseudobulbs 4–6 in. long: sheathing lvs. 1–2 ft. long, narrow-lanceolate, plaited: raceme much shorter; fls. 2 in. diam., rather fleshy and globular, lemon-yellow, with a dark brown streak down the labellum; sepals ovate-lanceolate; petals oblong, concave; labellum hemispherical, concave, obsoletely 3-lobed. July. Mex. B.R. 29:33. R.H. 1889:132.—Very fragrant. The fls. are remarkably distorted. Var. **ebúrnea,** Hort. Fls. creamy white. This is a very effective plant, superior to the type. G.C. II. 18:145. I.H. 34:35.

M. Oberlanderiànum, Lehm &. Kränzl. Sepals and petals lemon-color, rose-spotted; lip apricot, with large spots of same color. N. S. Amer. G.C. III. 28:318.—*M. revolùtum,* Rolfe. Fls. cinnabar, with a yellow lip; sepals and petals lanceolate, acute or acuminate; lip 3-lobed, the midlobe acuminate, reflexed. Peru. B.M. 8390.—*M. Wolteriànum,* Kränzl. Resembling M. Buccinator: racemes up to 10-fld.; fls. orange-brown. Peru.

Heinrich Hasselbring.
George V. Nash.†

MORMÓLYCE (a *bugbear* or *phantom,* probably referring to shape of flowers). *Orchidàceæ.* One Mexican epiphytic orchid, **M. ríngens,** Fenzl (*Trigonídium ríngens,* Lindl.), of the Maxillaria group: rhizome creeping: st. very short, with 1 coriaceous rather long lf. from a globose pseudobulb: scape leafless, slender, with 1 medium-sized yellowish green inodorous fl.; sepals spreading; labellum with erect lateral lobes and short middle lobe; column incurved; pollinia 4, ovoid.

MORNING-GLORY: *Ipomœa.*

MORRÈNIA (Professor Charles Morren, Belgian botanist). *Asclepiadàceæ.* Two pubescent twining shrubs of S. Amer., allied to Cynanchum, but differing in its convex 2-lobed stigma (flat or concave in Cynanchum) and the tubular corona, which is longer than the pistils, villose on the inside, and conniving over the pistils. A few other species have been added more recently. The lvs. are opposite and hastate. **M. odoràta,** Lindl., is more or less in cult., and is listed in S. Calif. It has white very fragrant fls. in dense cymes in the axils; sepals 5, linear; corolla rotate, the lobes wide-spreading and acuminate; corona tubular, 5-lobed. Argentina and Paraguay. Has merit for the agreeable vanilla fragrance of its inconspicuous fls. H.U. 5, p. 129. *M. brachystéphana,* Griseb., is a climber from Argentina with ovate, acuminate, hastate or cordate lvs., and loose axillary cymes of pure white star-shaped vanilla-scented fls.

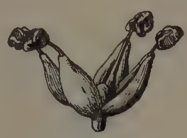
L. H. B.

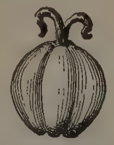
2390. Staminate catkin of Russian mulberry. (Natural size)

2391. Pistillate catkin of Russian mulberry. (Natural size)

MÒRUS (the ancient Latin name). *Moràceæ.* Mulberry. Ornamental and fruit-bearing small trees.

Unarmed, fls. diœcious or monœcious, both sexes in small hanging axillary catkins, the males soon falling (Figs. 2390, 2391); calyx 4-parted; stamens 4, the filaments partially inclosed in the calyx-lobes (Fig. 2392): pistillate fl. with one 2-celled ovary and 2 stigmas, and the 4 calyx-lobes adherent to the ovary (Fig. 2393) becoming fleshy and cohering into a long multiple fr. which suggests a blackberry in external appearance (Fig. 2394): real fr. an ovate compressed little achene, covered in the pulpy mass, 1 for every fertile fl. represented in the aggregate fr.—Temperate regions of the Old and New World. About 100 species of Morus have been described, but Bureau, DC. Prodr. 17:237 (1873) reduces them to 5; probably 10 or a dozen species represent the genus as now known. Two species are native in the U. S. Some of the names are now referred to other genera. Many of the names represent cultural forms of *M. alba.*


2392. Staminate flower of Russian mulberry. (Enlarged)


2393. Pistillate flower of Russian mulberry. (Enlarged)

Mulberries are grown as food for silkworms and for the edible fruits. The silkworm mulberry of history is *M. alba,* and the fruit-bearing mulberry of history is *M. nigra.* Yet, strangely enough, the leading fruit-bearing varieties of North America, are derived from *M. alba* (see Bailey, Bulletin No. 21, Cornell Experiment Station, and "Evolution of Our Native Fruits"). The native *M. rubra* has also given varieties which are grown for their fruits. The silkworm mulberry of the Chinese is *M. multicaulis,* by some considered to be a form of *M. alba.* This was introduced into North America early in last century, and for a time there was the wildest speculation in the selling and planting of the mulberry tree, and in the rearing of silkworms. These efforts have now largely passed away in North America. *M. multicaulis* gave rise to one variety which was prized for its fruits, the Downing. This variety is now little known, but the name has been popularly but erroneously transferred to a good variety of *M. alba* (the New American).

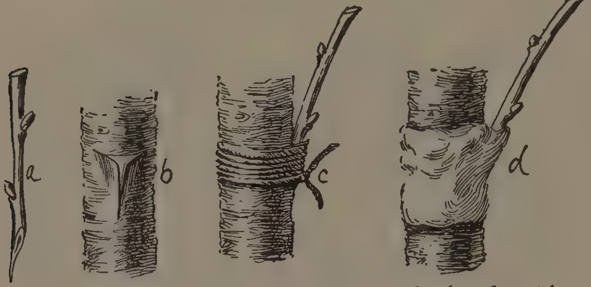
In North America the mulberry is known chiefly as a fruit-bearing tree, although it is never planted extensively and the fruit is scarcely known in the market. Two or three trees about the home grounds are sufficient to supply a family. The fruits are sweet and soft. To many persons they are too sweet. Because of their sweetness they are of little value for culinary uses. They usually drop when ripe. They are harvested by being shaken on sheets or straw. Birds are exceedingly fond of them. In the East and North, varieties of *M. alba* are chiefly grown, as the New American (frequently cultivated as Downing), Thorburn and Trowbridge. On the Pacific coast and in some parts of the South, varieties of *M. nigra* are grown, particularly the Black Persian. In parts of the South forms of the native *M. rubra* are grown, as Hicks and Stubbs. These are popular for planting in hog pastures, as the animals like the fruits. The mulberry thrives in any garden soil. It does well even on thin gravels and rocky slopes. For fruit-bearing purposes, trees may be planted from 20 to 40 feet apart.

The Russian mulberries are offshoots of *M. alba.* Their particular merits are great hardiness to withstand cold, drought and neglect. They are useful for low windbreaks and also for sheared hedges. They have become popular on the Plains. They are readily propagated by seeds, and the resulting plants are variable. Now and then a large-fruited form appears and it may be named and propagated, but for the most part the Russian mulberry

2394. Fruit of Morus alba. (Natural size)

has little merit for its fruits unless one desires to feed the birds.

Varieties of mulberries are now readily worked on seedlings of the Russian. One of the most successful grafts is S. D. Willard's method, shown in Fig. 2395.



2395. A method of grafting the mulberry. *a*, **the cion;** *b*, **matrix to receive cion;** *c*, **the graft tied;** *d*, **the graft waxed.**

The grafting is performed in spring when the bark will slip, using cions which have been kept perfectly dormant or on ice; *a* is the cion, the lower part being cut thin so that it will enter readily between the bark and wood of the stock; *b* is the stock, with an incision made through the bark essentially as for shield-budding; *c* shows the graft bound with cord or raffia; *d* shows the completed operation, the work being covered with wax. *Morus multicaulis* grows from cuttings in the South. These cuttings, with the buds removed to prevent sprouting, are often grafted before they are planted with a long cion of the desired variety (see Fig. 1691). The cutting acts as a nurse, and the cion takes root of itself if set deep enough.

There are many mulberries with ornamental forms. Of these, the most popular in America at present is Teas' weeping, a chance seedling of the Russian mulberry tribe. When grafted several feet high on straight Russian stock, it makes one of the best of small weeping lawn trees (Fig. 2396). It originated on the grounds of John C. Teas, Carthage, Missouri, about 1883. Various cut-leaved forms, mostly of *M. alba*, are seen in fine collections, of which the form known as *M. venosa* (Fig. 2397) is one of the best. The foliage of mulberries is interesting because so variable. Even on the same tree there may be leaves of several forms, while different trees of the same species may show strong individual traits. The most striking variations are in the lobing of the leaves.

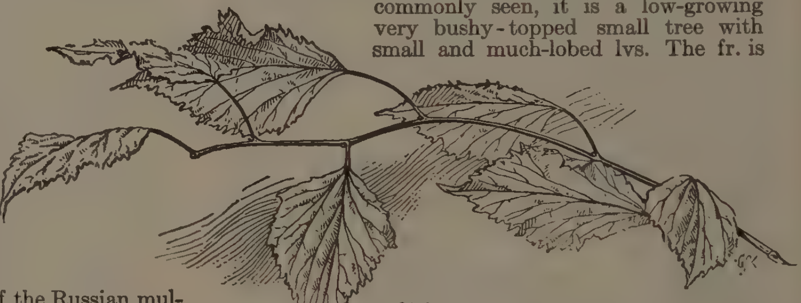
A. *Lvs. mostly bright and glabrous above, and usually glossy.*

B. *Style very short or practically none.*

2396. Teas' weeping mulberry.

álba, Linn. WHITE MULBERRY. Figs. 2398, 2399 B. Lvs. light green, rather small, smooth or very nearly so above and often shining, the veins prominent beneath and whitish, variously lobed or divided, the basal lobes unequal, the teeth large and for the most part rounded or nearly obtuse, the branches gray or grayish yellow: fr. variable, usually narrow, 1–2 in. long, white or violet, very sweet. China.—*Morus alba* has been cult. from the earliest times, chiefly for feeding the silk-worm. It is a frequent tree along roadsides and in the old yards in the eastern states, where the trunk sometimes attains a diam. of 2 ft. This half-wild form usually has rather small rounded shining lvs. with very large rounded teeth, and bears small whitish or violet frs. which are very sweet. Sometimes the frs. are an inch long, but they are oftener only half that length, and one sometimes finds trees on which the frs. are barely ¼in. long. Now and then a tree bears fr. nearly or quite black. Birds, poultry and hogs are fond of these mulberries. The trees are usually very thick-topped and bushy growers, but sometimes one is seen which, when young, has branches as straight and trim as a Northern Spy apple. These half-wild trees are seedlings, and this accounts for their variability. Var. **péndula,** Dipp. Branches slender, drooping. Var. **pyramidàlis,** Ser. (var *fastigiàta*, Schelle). Tree of pyramidal form: lvs. acute, usually lobed. Var. **laciniàta,** Beissn. (var. *skeletoniàna*, Schneid.) SKELETON-LEAVED MULBERRY. Lvs. regularly and deeply divided into narrow lobes, the terminal lobe and usually two of the lateral ones with very long points: a distinct and graceful form.

Var. **tatárica,** Loudon (*M. tatárica*, Linn.). RUSSIAN MULBERRY. Fig. 2400. A hardy type of *M. alba* which was intro. into our western states in 1875–77 by the Russian Mennonites. It differs little from the type of *M. alba* in botanical characters. As commonly seen, it is a low-growing very bushy-topped small tree with small and much-lobed lvs. The fr. is usually very small and insipid, and varies from creamy white to violet, and almost black.



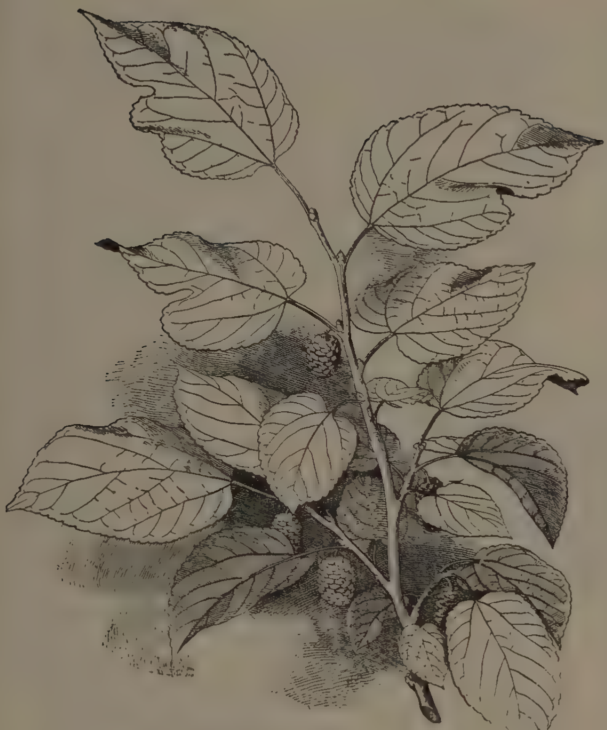
2397. The venosa mulberry.—Morus alba var. venosa.

Var. **venòsa,** Del. (var. *nervòsa*, Lodd. Var. *fibròsa*, Ser. *M. urticæfòlia*, Hort.). Fig. 2397. Lvs. contracted and jagged, and very strongly marked with many white veins. It bears fr. ½in. long. Among the horticultural curiosities this tree should find a place, although it is not grown by our nurserymen. Its ornamental value is considerable, especially when striking effects are desired. Rare in Amer. The history of this mulberry is obscure. Delile described it in a French report as long ago as 1826; of horticultural origin.

The variations of this species allow of many Latin names to be applied. The following names, which one may find in horticultural literature, are referable to *M. alba: byzantina, cedrona(?), colombassa, constantinopolitana, Fegyvernekiana, globosa, intermedia, italica, laciniata* (of some), *lucida, membranacea, macrophylla, Morettii, Morettiana, romana, rosea.*

BB. *Style evident or even prominent.*

japónica, Audib. (*M. álba* var. *stylòsa*, Bureau). Lvs. usually large, dull, rather thin, long-pointed, the rounded teeth very large and deep, or the margin even almost jagged, the lvs. upon the young growth usually deeply lobed. China, Korea, Japan.—This species has been intro. into this country, but apparently is not much known. It is tender in the N. when young. The fr. is described as short-oblong and red.



2398. Morus alba. (×¼)

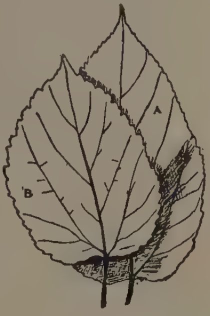
AA. *Lvs. dull green, mostly rough or pubescent.*

B. *Full-grown lvs. more than 4 in. long.*

multicaùlis, Perr. (*M. álba* var. *multicaùlis,* Loud. *M. álba* var. *latifòlia,* Bureau. *M. sinénsis,* Hort. *M. latifòlia,* Poir., which Bureau refers here, is probably *M. índica,* Linn.). Fig. 2399A. A strong-growing small tree or giant shrub, with dull roughish and very large long-pointed lvs., which are seldom or never prominently lobed, and which are often convex above, bearing black sweet fr.: style evident. China, where it is apparently the chief silkworm mulberry.—Once much grown in this country, but not now well known, particularly not in the N.

nìgra, Linn. Black Mulberry. Lvs. dark, dull green, rather large, tapering into a prominent point, commonly very rough above, usually not lobed, the base equal or very nearly so on both sides, the teeth rather small and close, the branches brown: fr. large, comparatively thick and fleshy, mostly dark-colored. The black mulberry is a native of Asia, probably of Persia and adjacent regions.—This is the species which is cult. in the Old World for its fr. In Amer. it is very little grown, although run wild now and then about grounds and along roadsides. It is not hardy, except in protected places, in New England and N. Y. The Black Persian mulberry of the S. and of Calif. is probably of this species.

rùbra, Linn. Native Red Mulberry. Fig. 2401. Lvs. usually large, very various, those on the young shoots deeply lobed with very oblique and rounded sinuses in the base of which there are no teeth, the upper surface rough and the lower one soft or variously pubescent, the teeth medium or comparatively small and either rounded or bluntish: fr. deep red, or when fully ripe almost black, variable in size, often very good, nearly always having an agreeable slight acidity. Mass. to Fla., Kans. and Texas, mostly in rich soils and bottom lands. S.S. 7:320.—This native mulberry has been tried for the feeding of silkworms, but with indifferent success. At least 3 of the named fr.-bearing mulberries belong to it, and a yellow-lvd. mulberry, which is somewhat grown for ornament, also appears to be of this species. The characteristic lobing of lvs. on the young growth is shown in the upper spray of Fig. 2401. The nearest approach to this lobing is in the Japanese (*Morus japonica*), and this affords another of those interesting parallelisms which exist between the Japanese and E. American floras. The red mulberry is the largest tree of the genus. In the S. it often attains a height of 70 ft. and a diam. of 3 or 4 ft. The timber is used for posts and light woodwork. Var. **tomentòsa,** Bureau (*M. tomentòsa,* Raf.). Lvs. very soft-pubescent and whitish beneath, often glossy but rough above. Texas.—A large-fruited form of this was intro. in 1889 by T. V. Munson as the Lampasas mulberry.



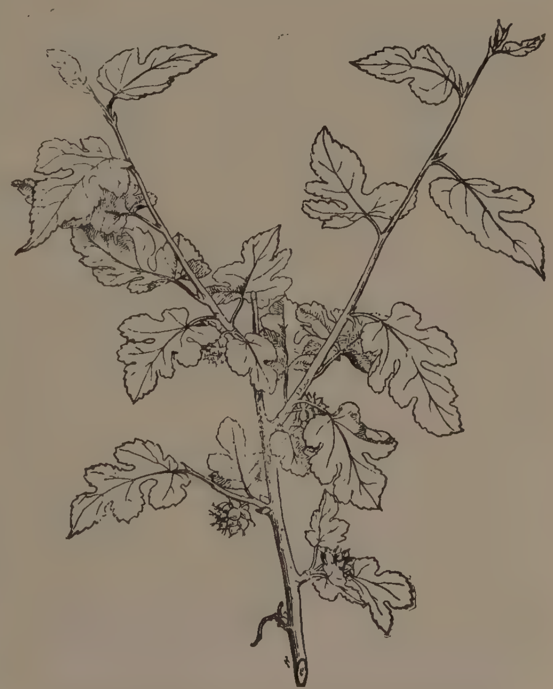
2399. Leaf of Morus alba at *B*; of M. multicaulis at *A*.

BB. *Full-grown lvs. usually 3 in. or less long.*

celtidifòlia, HBK. (*M. mexicàna,* Benth. *M. microphýlla,* Buckl.). Much smaller tree than *M. rubra,* rarely more than 25 ft. tall, and with smaller and smoother lvs. and smaller, sourer black fr., which ripens earlier and is not so good: lvs. cordate-ovate, more or less lobed, mucronate-serrate, nearly smooth on both sides: fr. short-ovate or sometimes nearly globular. Texas and Ariz. to Peru. S.S. 7:321.—Occasionally planted for its frs.

L. H. B.

MOSCHÓSMA (from the musk-like odor). *Labiàtæ.* In recent years there has come into prominence in European gardens a showy-flowered small shrub or tall herb from tropical and southern Africa under the name *Moschosma riparium,* but which N. E. Brown now refers to Iboza. The plants belonging to Iboza,



2400. Russian mulberry.—Morus alba var. tatarica. (×¼)

Brown writes, "have hitherto been referred to Moschosma, but they differ entirely from that genus in habit, calyx and corolla, and in having unisexual flowers, with the sexes on different plants. The small size and form of the corolla and the arrangement and spread of the stamens is somewhat like that of Mentha," next which he considers this genus should be placed.

Iboza (Kafir name of *I. riparia*) has more than a dozen species in S. and Trop. Afr.: fls. very small, diœcious, the males larger and bearing an abortive ovary or style; calyx minute, 3-lobed; corolla very small, with funnelform tube and more or less unequally 4–5-lobed limb; stamens in male fl. 4, free and separate; ovary 4-lobed: nutlets erect, oblong or ovoid, dorsally compressed.

2401. **Morus rubra, a native mulberry** (×⅓)
(See page 2071)

Ibòza ripària, N. E. Br., or **Moschósma ripàrium,** Hochst. Stout, 2–5 ft., perennial, the st. branching and obtusely 4-angled: lvs. broadly ovate, most of them notched at base and otherwise toothed: fls. very numerous, in erect panicles above the foliage and therefore conspicuous although small, creamy white with dark anthers. G.C. III. 31:122; 35:31. Gn. 61, p. 121; 65, p. 37; 69, p. 69. Gn.W. 20:90. G. 24:30.—An excellent bloomer under glass Dec.–Feb. After blooming, the plants may be cut back and good shoots secured for cuttings for the next winter's bloom. It is handled much like salvias and the species of coleus.

L. H. B.

MOSS. A general name for many humble green plants of the cryptogamia (so-called flowerless plants), mostly with distinct stems and foliage leaves. In North America there are about 1,000 species, distributed in various families. They have solitary, or rarely clustered, mostly stalked spore-cases or capsules arising from the apex or side of a leafy stem (Fig. 2402). The capsule is covered with a thin cap or calyptra (*c*) which is shed at maturity. The capsule opens by means of a lid or operculum (*o*), and the orifice is usually guarded by one or two rows of teeth, or peristome. A fuller discussion of the structure and relationships of the mosses will be found in Volume I, on page 6. The mosses are not horticultural plants. Sphagnum moss is much used as a packing material and for holding moisture about pots, and as a medium in which to sow delicate seeds, but it is collected from bogs and not grown for the purpose. Club-mosses are not true mosses but lycopodiums (see *Lycopodium* and *Selaginella*). The "moss" on fruit and other trees is mostly lichen. The Florida or Spanish moss is a flowering plant (see *Tillandsia*).

MOSS PINK: *Phlox subulata.*

MOULDS, MOLD. The term mould is applied to any small fungous growth which appears on decaying organic matter, such as fruits, both fresh and preserved, vegetables, and so on. The moulds are very simple fungi producing immense numbers of spores, a fact which accounts for their presence everywhere, in the air, in dust, and on all exposed bodies. As a rule, these fungi are not directly injurious to plants; they are normally saprophytes and perform a great service in disorganizing organic matter which would otherwise accumulate on the earth. A few of the species may become parasitic. Thus, species of Botrytis often attack lettuce in forcing-houses which are too close and damp. Carnation buds and violet plants are also frequently injured by Botrytis. The mould-like growths occurring on boards in damp cellars or in greenhouse benches are sterile mycelia of higher fungi. These do not attack plants, but sometimes, as in the case of violets, grow over and smother the plants. The so-called sooty moulds constitute the small family of the Perisporiaceæ. They receive their name from the fact that they form dark olive-green or black coatings on the twigs and leaves of plants on which they grow. They are not parasitic but live for the most part on the honey-dew secreted by insects and sometimes on the insects themselves. Apparently little direct damage is caused to plants by these fungi. It has been found in laboratory experiments with isolated leaves that those freed from the fungous coating absorb more carbon-dioxide and liberate more oxygen than leaves coated with the fungus. The extent of injury arising from interference with physiological processes on account of shading and the possible closing of the stomata under natural conditions has not been generally determined, but it is certain that orange and lemon trees sometimes suffer serious injury, in fruit and foliage, brought about in this way. The sooty moulds are mostly confined to tropical and subtropical regions where they are abundant on many kinds of plants. They occur occasionally in greenhouses on coriaceous-leaved coolhouse plants, such as oleander and evonymus, which were formerly more generally grown. With the advent of present-day heating systems and the introduction of the practice of growing rapidly shifting crops, these fungi, never of great significance, have practically disappeared from greenhouses. The following are among the more common forms of sooty moulds: *Dimerosporium mangifera*, on mango; *D. pulchrum*, on privet, lonicera and cornus; *Apiosporium salicinum*, common on leaves of woody plants; *A. Footii*, on greenhouse plants; *Capnodium fœdum*, on oleander; *C. guajavæ* on guava and other tropical shrubs and trees; *Meliola Penzigii* causes considerable injury to citrus trees in Florida by coating the leaves and fruit. The numerous forms occurring in the tropics have not been fully investigated. See, also, *Diseases* and *Fungi*.

Heinrich Hasselbring.

MOUNTAIN-ASH: *Sorbus Aucuparia.* **M.-Ebony:** *Bauhinia.* **M.-Laurel:** *Kalmia*, particularly *K. latifolia.* **M.-Mahoe:** *Hibiscus elatus.* **M.-Mahogany:** *Cercocarpus.* **M.-Mint:** *Pycnanthemum.* **M.-Rose:** *Antigonon.*

MOURNING BRIDE: *Scabiosa.*

MOVING PLANT: *Desmodium gyrans.*

MUCKLAND-GARDENING. In recent years there has been a large development of truck-gardening in swamps, bogs and similar areas that have been drained and improved. These areas have deep black soil, very adaptable to onions, lettuce, celery and certain other crops, and special methods have been developed on them, so much so that muckland-gardening has become almost a special department of horticultural operations.

Location.

One should be careful in selecting muck, as poor muck will not yield paying crops. A patch of muck that can be drained so that the water-table will be 2½ feet from the surface, is most desirable. It should be so located that a running stream of water will flow through or near the muck, which will keep it moist during a dry spell. Never buy any new muckland for gardening purposes if it is not covered with a good crop of timber or weeds. Muck covered with a thrifty growth of elm, black ash, and soft maple, will give good crops when brought under cultivation. Cedar and spruce muck are not so good for all kinds of muckland crops. If a muck tract has been cleared from timber and is not cultivated, it should grow a very thrifty crop of swamp weeds; if it does not show a good growth of weeds it should be avoided.

Endeavor to locate near a railroad or on a good improved highway. Good mucklands yield large and bulky crops and the cost of long hauls to market or the railroad will be very high. In a few years the extra expense of drawing the crops to market will exceed the first cost of the muck itself. It is also advantageous to locate where one can ship on several good railroads. It will give a wider range of markets and a lower freight rate.

It is well to have the muck-garden near a large body of water. Muckland so located has a much longer growing season. The water warms the air during the cold nights in the fall, and many times saves the entire crop from a frost. It also cools the very hot air during the midsummer.

Clearing and preparing for cropping.

If the muckland is covered with a heavy growth of timber, it should be cut down and the stumps removed. There are many ways of clearing and removing the stumps, either dynamite or stump-pullers working very well. The holes should be filled up before plowing, and all the roots that the plow comes in contact with removed. A good disc-plow does better work on newly cleared land, as the small roots will not clog a disc as they do a moldboard plow. Corn is a good crop to which to plant new muckland, as it will grow well and helps greatly to subdue the land. The following year the land may be planted to garden crops providing it has been well cultivated while the corn was growing, and carefully prepared and fitted to receive the muck crops.

2402. Hair-cap moss.—Polytrichum commune.

Drainage.

All mucklands must have good drainage or they will not yield paying crops. The water-table should be 2½ feet from the surface to give best results. In order that the water may be lowered to the same level throughout the tract, it will be necessary to construct main and lateral ditches. The latter should be placed from 5 to 10 rods apart, according to the condition of the muck. If the muck is coarse and fibrous, the lateral ditches may be placed farther apart; if it has reached a more advanced stage of decay so that it is fine and pulverized, the lateral ditches must be placed closer together. If the natural fall in the main ditch is not sufficient to give ample drainage and the water-shed from the uplands is not too great, artificial drainage can be installed and will prove very profitable. The water should be led to the lowest point in the main ditch and a pumping-station installed, with which the water is elevated. When artificial drainage is used, the land should be surrounded by a good dyke and should have a ditch all around the muck on the inside of the dyke leading to the pumping-station. There are many muck-gardens operated by this system of drainage that are producing good crops. They are not affected by a drought as are the higher located muck-gardens. The expense for power is not very high, if one has a good outfit for pumping.

Fertilizers.

All mucklands in the northern states are very rich in organic matter, fairly well supplied with phosphoric acid and low in potash, and very high in nitrogen. Samples of muck taken from various sections show by analysis that they contain materials as follows:

Organic matter	from	82.5	to	88.7	per cent.
Nitrogen	from	1.8	to	2.42	per cent.
Phosphoric acid	from	.27	to	1.9	per cent.
Potash	from	.15	to	.26	per cent.
Calcium-oxide	from	4.2	to	6.3	per cent.

However, the plant-food found in muck is not available to garden crops in large enough quantities to warrant the growing of such crops without the use of commercial fertilizer or stable-manures. When muckland is brought under cultivation, it renders some of the plant-food available to the crops, but it would mean failure to any grower if he did not use fertilizer of some kind each year. A brand of fertilizer containing about 2 per cent nitrogen, 8 per cent available phosphoric acid and 10 per cent potash, is a good mixture with which to start the crop. If the growth is not fast enough after the crop is well started, apply nitrate of soda. By watching the growth of the crop, one will soon learn what to apply.

Many growers apply about 1,000 pounds of 2:8:10 fertilizer to the acre in the spring just before the crop is planted and work it well into the soil and then apply from 400 to 1,000 pounds during the growing season. Some growers prefer to apply all the phosphoric acid and potash in the spring and then feed the crop on nitrogen alone during the growing season, using nitrate of soda, dried blood and tankage. Not more than 400 pounds of nitrate of soda to the acre is used at one time, unless the ground is very cold and wet in early spring. Such crops as onions, lettuce, carrots and beets do not need such large amounts. Spinach will respond greatly to a liberal application of nitrate of soda. One grower has raised sixteen tons of spinach to the acre and harvested the crop by June 8 by applying 800 pounds of 2:8:10 to the acre before sowing the seed and 600 pounds of nitrate of soda to the acre when the crop was well started. Twenty-five carloads of celery were also grown on 8 acres by using 3,000 pounds of commercial fertilizer, 4:7:10 brand, before planting, and side-dressing with fish tankage every two weeks, making three applications during the season after the crop had started and using 1,200 pounds of tankage to the acre in the three applications. However, this celery was grown under irrigation. It is not advisable for anyone to use that amount of fertilizer unless he thoroughly understands the health condition of the celery crop, as he may spoil the entire crop by so doing. Such crops as onion and celery should produce a good yield by applying from 1,000 to 2,000 pounds of 2:8:10 to the acre during the season. Lettuce, carrots, beets and potatoes should do well on 600 to 1,000 pounds to the acre. Spinach will do well on 500 pounds of 2:8:10

and 500 pounds of nitrate of soda to the acre. Never sow spinach on a new muck, as it will not do well.

Vegetable crops adapted to muckland.

The main crops grown on muckland in the northeastern states are onions, celery, and lettuce, but there are many other crops that yield good returns to the grower. Potatoes grown on muckland are, as a rule, not very good for eating purposes but they make the choicest kind of seed stock. A good business could be worked up on muckland-grown seed potatoes.

Sweet corn grows very well on muck and the yield is large, but it must be grown for canning purposes as the season is not long enough fully to mature the crop. Peas for canning purposes do well. Beets for winter use or for canning while small yield large crops. Carrots yield enormous crops of excellent quality. Parsnips do well on well-drained muck but not unless the water-table is low. Horse-radish grows to perfection and the quality is good. Spinach grows better on old muck than on any other kind of soil, and the quality is far superior to upland spinach, as it is entirely free from grit. Asparagus grows to perfection on well-drained muck but the water-level must be kept down below the crowns during the winter months or it will rot them. Cauliflower grows well on muckland. Cabbage does very well on shallow muck, but is likely to head soft on deep muck. Asters and sweet peas for cut-flowers grow to perfection on muck, and there is a good demand for the blossoms in the large cities. Gladioli grown for bulbs do very well on muck.

Tillage and handling of muckland.

There are many different opinions as to how muck should be tilled. Some growers believe in deep plowing so as to get the best of conditions possible for a good root-growth. However, deep plowing should never be practised in the spring. If virgin muck soil is brought to the surface in spring or summer, it will bake and form lumps much like soft coal, and will not hold the moisture and therefore the crops will not do well. The deep plowing should be done in the fall after the frost has worked on the virgin subsoil which when brought to the top becomes pulverized and will be in fine condition for cropping the next spring. When the frost is out of the ground in the spring, break the soil up thoroughly with a cultivator to a depth of 6 inches, and put on the first application of fertilizer. Work this well into the soil by dragging it three or four times and then go over the land with a leveler, after which the seed is sown.

Deep cultivation in the early spring helps to dry out the soil and warms it up, and causes the roots of the crop to work deeply into the ground. As the crops grow and the weather and soil warm up, cultivation must be continued, but of less depth so that the roots are not cut off. If shallow cultivation is practised at first, the root-growth will all be near the surface and when dry weather sets in, roots will have no moisture and the plants stop growing until they can send roots down into the moist soil. A mulch of dry muck for a depth of 1 or 2 inches will carry the crop through a dry spell in good condition. In wet weather the land should be left in ridges after cultivating, as this helps to dry it. In dry weather, however, it should be left as level as possible in order to hold the moisture.

HENRY GREFFRATH.

MUCÙNA (Brazilian name). *Leguminòsæ.* Under this name several annual bean-like vines have been grown in the southern states for forage, green-manuring and ornament. The genus, as accepted by the standard works, has recently been divided, however, and the plants cultivated in this country are separated under Stizolobium (which see).

Mucuna, as thus re-defined (Bort, Bull. No. 141 Bur. Pl. Ind., U.S. Dept. Agric., and Piper & Tracy, Bull. No. 179, same), is a genus of perennials, whereas Stizolobium is annual or essentially so; in Mucuna, the hilum on the seed is much elongated and band-like, extending nearly all the way around the seed; in Stizolobium, the hilum is linear, elevated and oblong-crateriform, extending from one-fifth to nearly one-fourth of the circumference of the seed; there are also marked differences in germination. As thus restricted, Mucuna appears to have no species cult. in this country. L. H. B.

MUEHLENBÉCKIA (after Dr. Muehlenbeck, a Swiss physician). *Polygonàceæ.* A rather small group of climbing or erect, usually slightly shrubby plants, all inhabitants of the South Temperate Zone.

Leaves alternate, with sheathing stipules at the base: fls. unisexual, small, fascicled in the lf.-axils; perianth with 5 nearly equal lobes; stamens 8; ovary 1-celled, 1-ovuled; styles 3: achene obtuse or acute, 3-angled, crustaceous, about equaling the succulent perianth. Ornamental plants, various in appearance. Species about 15.

A. *Stigma fringed.*

B. *Sts. very flat and broad.*

platyclàda, Meissn. (*Coccóloba platyclàda,* F. Muell.). A very interesting, erect, shrubby plant with broad, flat, ribbon-like, glossy, delicately striate branches replacing the lvs., which are scanty or entirely wanting: lvs. membranous, oblong-lanceolate, sometimes hastate: bracts and stipules very short: fls. white, in few-fld. clusters: achenes included in the fleshy perianth, which at maturity is bright red or at length deep purple and quite showy. Solomon Isls. B.M. 5382.—Frequently grown in greenhouses because of the odd flat sts. and showy fr.

BB. *Sts. slender and nearly terete: lvs. fiddle-shaped.*

vàrians, Meissn. Somewhat shrubby at base: sts. smooth, herbaceous, filiform, twining; internodes elongated: sheaths white, narrow, 3 lines long: lvs. 1 in. or less long, petioled, ovate, acuminate, deeply lobed at the middle on each side, fiddle-shaped; sinus broad or narrow-obtuse; otherwise entire: racemes axillary, solitary or in 2's, simple or bifid, forming a terminal leafy panicle 3–4 in. long; fls. subsessile, similar to those of *Polygonum aviculare.* Habitat (?).

AA. *Stigma papillose.*

B. *Sts. low, rarely twining: lvs. 3–5 lines long.*

compléxa, Meissn. WIRE PLANT. A twining or drooping, somewhat shrubby plant: st. slender and much-branched, glabrous except when very young: lvs. very small, 3–5 lines long, light green, about equaling the petiole, mostly fiddle-shaped, rarely hastate; sheaths small, tubular, deciduous: fls. 1–6, in somewhat racemose, pubescent clusters, green and inconspicuous: fr. with a succulent, transparent, whitish, persistent perianth. New Zeal. B.M. 8449.—A graceful basket plant. Fr.-clusters glistening, showy. It is sometimes called Polygonum by florists. A popular high-climbing vine in Calif., on chimneys and elsewhere. Of variable habit.

BB. *Sts. coarser, twining, reddish: lvs. larger.*

chilénsis, Meissn. Somewhat shrubby, glabrous: branches strongly sulcate, loosely twining, angular, "bright red:" lvs. somewhat fleshy or coriaceous, petioled, triangular or hastate-cordate, ovate, oblong or lanceolate, truncate or attenuate at base, 1-nerved; margin entire, somewhat revolute, smooth: racemes axillary and terminal, solitary, simple, lax and leafless, rarely contracted; bracts about equaling the pedicels: achenes subglobose, 3-angled. Chile and Peru.

M. adpréssa, Meissn. Large, diffuse, bushy plant, with small pink fls. in paniculate spikes: lvs. up to 2 in. long, broadly oblong, often cordate, glabrous. Austral. B.M. 3145 (as Polygonum).—Cult. in Eu.—*M. nàna,* Hort., is said to be a dwarf form. The botanical status is uncertain.

K. M. WIEGAND.

MUHLENBÉRGIA (Dr. H. Muhlenberg, who wrote a work upon American grasses in 1817). Sometimes spelled *Muehlenbergia*. *Gramineæ*. Spikelets 1-fld.; lemma firm, mucronate or awned. About 60 species, mostly American. **M. racemòsa**, BSP. (*M. glomeràta*, Trin.). An erect perennial, with rather short appressed lvs.: panicle contracted and spike-like; glumes nearly equal, 1-nerved, extending into short awns; lemma longer than empty glumes, excluding the awns. Dept. Agric., Div. Agrost. 7:109. Wet ground, nearly throughout N. U. S.

A. S. HITCHCOCK.

MUÍLLA (an inversion of Allium). *Liliàceæ*. Bulbous plants closely allied to Allium.

Perianth subrotate, persistent, of 6 nearly equal slightly united segms., spreading, closely 2- to 3-nerved; stamens in one row at the base; anthers versatile; filaments slightly thicker at the base; ovules 8–10 in a cell; style club-shaped, persistent and at length splitting: caps. obovate or subglobose, sessile or nearly so: fls. greenish white: pedicels not jointed: lvs. several.—One species from Calif., W. Nev. An unimportant plant advertised by specialists in Pacific coast bulbs. It has a slender scape 3–12 in. high, bearing early in the year an umbel of 5–15 greenish white fls., each about ½in. across. Differs from Allium, in that instead of a true bulb it has a fibrous-coated corm, and also lacks the onion-like odor.

marítima, Wats. Lvs. several, not sheathing at base, scabrous, as long as the scape: corm small: caps. ¼in. long, with usually 3 seeds in each cell. Calif., W. Nev. —Saline regions.

A. C. HOTTES.†

MÙKIA: *Melothria*.

MULBERRY: *Morus*. **French M.**: *Callicarpa americana*. **Indian M.**: *Morinda*. **Paper M.**: *Broussonetia*. The wild *Rubus odoratus* is improperly called mulberry in some parts of the country.

MULCHING is the covering of the soil or earth with some protecting material. It has six or more general objects: (1) to conserve moisture by preventing or hindering evaporation; (2) to protect plants from winter injury; (3) to keep the surface of the soil loose and friable; (4) to add plant-food to the soil; (5) to protect berries or flowers from dirt spattered up by rain, as in the case of strawberries; (6) to keep down weeds.

The moisture available to agricultural plants is held in the soil by means of capillary or film attraction. The soil may be conceived to be full of irregular capillary tubes or connecting interstices which have a general vertical direction. The upper ends of these spaces are in contact with the atmosphere, and they are constantly giving off moisture into the air. If the upper openings of these interstices are covered, as with a board or a mulch, the evaporation into the atmosphere is relatively slight. If they are covered with a mulch of ashes or sawdust, a similar result may be attained. A dry earth-mulch may be made on the spot by tilling the upper 2 or 3 inches of soil. The philosophy of summer tillage is to prepare and to maintain this mulch of soil, thereby interposing a relatively non-capillary stratum between the moist soil and the air. This earth-mulch may itself be dust-dry, but it protects the soil beneath. There is more or less evaporation into the interstices of the earth-mulch itself, and some of the moisture ascends through the mulch and escapes into the atmosphere; but it has been found by long experience and by experiments that the earth-mulch greatly lessens evaporation. The frequent stirring of the surface soil in summer is said to make the land moist; as a matter of fact, it keeps it moist. When it is impracticable to keep a surface mulch by means of tillage with horse tools or a rake, it is sometimes advisable to use straw or manure. Mulching newly set trees is often desirable when it is not possible to till the land or not practicable to water them. The ideal mulch to conserve moisture, however, is the loose layer of earth, since the stirring of the soil not only provides the mulch but also sets at work various chemical and biological forces that make the plant-food more available.

All herbaceous plants and most shrubs are benefited by a mulch in the fall, no matter how hardy they may be in the given locality. Nature's mulch is the debris of fallen leaves, grass and other litter. The autumn leaves that blow into the borders and the clumps of shrubbery, afford the very best winter mulch; and yet it is a common practice scrupulously to collect and burn these leaves in the fall, and then if the plants are mulched to apply manure. This is doubtful wisdom. The herbaceous border will be benefited by a loose open mulch, 4 to 6 inches deep. If the mulch is of such character as to become very hard and dense, and to hold too much water, it may be injurious. Leaf-mold, loose muck or peat, autumn leaves mixed with some litter that will prevent them from packing too hard, manure which is not too strong in nitrogen and potash, fine straw, sawdust, shavings, pine-needles, evergreen boughs—these are some of the materials that may be used as a mulch to good advantage. If the mulch has thoroughly decayed by spring, it may be left on the land and it will make a fine loamy covering that will be much like the vegetable-mold found in the woods. Too often the passion for cleanness sacrifices the welfare of the border. Persons will collect and burn every stray autumn leaf, but will not notice many kinds of dirt which are really objectionable. The mulch keeps the surface of the soil loose and mellow because it protects it from the beating of heavy rains and the weight of snow. The vegetable-fiber that works into the surface also prevents the particles of heavy clay soils from running together or puddling. Soils that are covered with a mulch do not bake.

Fall-set herbaceous plants, as pansies, should be covered with 2 or 3 inches of straw or other material to protect them from "heaving" and from the direct injury of alternating conditions.

Whenever the mulch contains soluble plant-food, the soil receives the leachings and is enriched. Stable-manure is an ideal mulch for enriching the soil, but if the manure is fresh and strong, it is likely to injure the crowns of some plants.

L. H. B.

MULGÈDIUM (name alludes to the milky juice). *Compósitæ*. A group by most authors united with Lactuca, but differing in the blue to white rays, and the oblong mostly beaked achene. It is also closely allied to Sonchus. Some species are offered as outdoor garden herbs; annual, biennial and perennial. Plants of easy culture. The following species might properly be included in the account of Lactuca, although the nomenclature of some of the garden forms is open to doubt.

alpìnum, Less. (*Lactùca alpìna*, Benth. & Hook.). Perennial, 3 ft., erect: lvs. alternate, the radical lyrate-dentate and petioled, the terminal lobe large: fls. deep blue, like those of wild chicory, numerous, in a corymbose cluster; involucre of unequal scales in several series, hairy. Eu., in mountains and far N., prized for its abundant foliage and attractive fls.; requires a moist somewhat shaded place.

thianschánicum, Regel & Schmalh. Glabrous, robust, 3–5 ft. tall: lvs. sharply dentate or the upper ciliate-dentate; the lower lyrate with the terminal lobe very large, lateral lobes confluent with the broadly winged petiole, cordate and clasping at the base: raceme much elongated, simple, or branched at the base only; heads oblong, many-fld.; involucre glabrous; fls. blue, twice as long as the involucre: achenes linear-oblong, multistriate, narrowed toward the apex; pappus hairy, deciduous. Cent. Asia.

macrophýllum, DC. Perennial: st. strict, hispid at top: lvs. ample, sublyrate, cordate at base, hairy beneath, the terminal lobe large and cordate: panicle lax, hispid, with blue-rayed heads of size of chicory; involucre sparsely hispid.—Said by the older botanists to come from N. Amer., but probably European.

M. Bourgæ̀i, Boiss.=Lactuca Bourgæi, described on p. 1766.—*M. gigantèum*, Hort. (Lactuca gigantea, Hort.) Perennial, 6–8 ft.: fls. blue-violet, paniculate. Probably of garden origin, or a form of some robust species.—*M. Plumièri*, DC. (Lactuca Plumieri, Gren. & Godr.). Perennial, glabrous: st. erect: lvs. runcinate-pinnatifid, somewhat glaucous beneath: panicle sub-corymbose, bearing rather large blue-rayed heads. Mountains of Cent. and S. Eu.

L. H. B.

MULLEIN: *Verbascum.* **M. Pink:** *Lychnis Coronaria.*

MURRÆ̀A or MURRÀYA (one of the *Rutaceæ*, named for J. A. Murray, 1740–1791, professor in Göttingen) is now referred to Chalcas (Volume II, page 729). There is only one of the species in general cultivation, the orange jessamine, *Chalcas exotica* (or *M. exotica*), from India, China, Australia and the Pacific islands. P. J. Berckmans writes (A. F. 11:1367, with picture) that it "needs ample pot room and a liberal supply of plant-food. An annual application of bone-meal when repotting in February intensifies the color of the foliage, increases the size of the flowers, and causes it to bloom more frequently. When properly treated, the first crop of flowers usually appears here [Georgia] during May, another during July, and this is succeeded at intervals of from four to six weeks until fall. For winter, give it the temperature of a cool greenhouse, but during summer it thrives best when given full sunshine outdoors." The other species of Chalcas, of which there are perhaps a half-dozen in the Indo-Malay region, are probably not in cultivation in this country. *Chálcas paniculàta*, Linn. (*M. paniculàta*, Jack), is probably a form of *C. exotica*. It is the satinwood or cosmetic bark tree. Arboreous: corymbs few-fld. or fls. solitary.—The wood of this species is considerably used because of its strength and endurance and light yellow color. The bark is used as a cosmetic.

C. Kœ̀nigii, Kurz. (M. Kœnigii, Spreng.). Lvs. 10–20-foliolate, pubescent or rarely glabrous. Along the foot of the Himalayas in India.—A small, strong-smelling tree. The bark, lvs. and roots of this species are used in India as a tonic. Other little-known species occur in India and Indo-China.

Walter T. Swingle.†

MÙSA (named after Antonio Musa, physician to Octavius Augustus, first emperor of Rome, 63–14 B. C.). *Musàceæ.* The largest of tree-like herbs, grown for the ornament of their large striking foliage, for fruit, and for fiber.

Bulbous or with perennial rootstocks: lvs. usually gigantic, entire, oblong or elliptic, pinnately parallel-veined, arranged in a loose rosette, sometimes dark above and glaucous beneath, with a narrow red edge, usually bright green on both sides; in the young state with narrow hyaline margins beautifully crimsoned or white; midrib with a deep rounded groove above; sheathing petioles long or short, forming a false st.-like structure: fls. unisexual, in half-whorl-like clusters in a terminal spike (Fig. 462, Vol. I), each cluster subtended by a large spathe-like, colored bract, and all borne on a long or short often velvety or puberulent rachis emerging from the center of the leafy envelopes at the top of the false st.; lower clusters female, upper male (actually hermaphrodite female and hermaphrodite male, the opposing parts being dwarfed, functionless or sometimes absent); perianth consisting of a calyx at first tubular but soon splitting down one side with a 3–5-toothed apex and opposite the calyx a single simple or 3-toothed petal; stamens normally 6, 5 with 2-celled vasifixed anthers, the sixth usually suppressed; ovary inferior, 3-celled, cells with many superposed ovules: fr. a large berry, short or elongated, pulpy or dry, angular, oblong or cylindrical; seeds when produced are ⅛–⅝in. diam., subglobose or angled by pressure. testa hard, indented at the base and apex, albumen mealy, embryo subtruncate.—Sixty-seven species and over 200 cult. varieties are known, native of Trop. Asia, Afr., Austral. and adjacent islands. The fruit of the banana is of great importance in the tropics for food. It is imported in large quantities into the U. S. from W. Indies and Cent. Amer. and grown in the Gulf States (see *Banana*). Several ornamental species are grown extensively in the N. and are hardy from 38° north to 35° south latitude. Latest publications: Baker, Species and Principal Varieties of Musa, K.B. 229–314 (1894). Schumann, Das Pflanzenreich 45:13–28 (1900). Fawcett, The Banana, Its Cultivation, Distribution and Commercial Uses, 1913. Popenoe, Origin of the Banana, Journal of Heredity 5:273–280 (1914).

When plants of a most gorgeous tropical effect are wanted, they will always be found among the musas. To grow these plants to perfection, a large greenhouse will be required. The musas can be increased from suckers, which are found around old plants, and which can readily be separated from the parent plant with a piece of root. These suckers may be potted up into 4-, 5- or 6-inch pots, using a compost of fibrous loam three parts, well-decayed cow-manure one part, enough sand to keep it open and porous, and a good dash of bone-meal. Pot each sucker firmly. These young plants should be placed in a very close and humid atmosphere so as to encourage quick growth. They prefer a night temperature of not less than 68° with about 10° to 20° more during the day. These young plants may be started anywhere from the middle of February up to the first of April. When they have filled their pots with roots, they can be shifted into pots two sizes larger. These shifts can be kept up until they are in tubs 2 feet square. As the shifts become larger make the compost richer, as they are rank feeders. When musas are grown for decorative purposes, it will be found convenient to have them in tubs as they are more easily moved. When they are wanted to show the production of fine fruit, they should be planted out in the middle of a roomy house where the night temperature does not fall below 65°. During the spring and summer months, let the temperature increase in proportion to the outside conditions, as musas delight in a high temperature. They will stand much feeding and should be given liquid manure once or twice a week during the spring and summer months. By giving care to watering, syringing and ventilation, they will grow rapidly. While musas like plenty of sunshine, they are some-

2403. Musa Ensete.

times better for a slight shading during the middle of the day, but only enough to prevent scorching of the foliage. During the winter the night temperature may be lowered to 60°. They will also require less water and syringing. The musas used for subtropical beds and gardens are grown from seed, such as *M. Ensete*, *M. Basjoo*, *M. superba*, and the like. These seeds may be planted in pans or flats in a compost of loam, leaf-mold and sand in equal parts. The seeds should be covered about four times their size in depth and pressed firmly. These pans should be placed where they can have plenty of bottom-heat. When the seedlings appear, pot them off and grow on the same as above. These plants can be lifted in the fall and the soil shaken off and placed in some house or cellar where the temperature does not go below 45°. (J. J. M. Farrell.)

INDEX.

Abaca, 13.
abyssinica, 2.
africana, 1.
amboinensis, 13.
Arnoldiana, 9.
Basjoo, 14.
Carolinæ, 21.
Cavendishii, 11.
Champa, 15*a*.
chinensis, 11.
cinerea, 15*c*.
coccinea, 16.
Dacca, 15*d*.
Ensete, 2.
Fehi, 12.
Fei, 12.
Gilletii, 8.
Holstii, 3.
humilis, 11.
japonica, 14.
Lacatan, 15*j*.
Livingstoniana, 6.
magna, 15*h*.
Mannii, 17.
Martinii, 10.
Martretii, 5.
mindanensis, 13.
oleracea, 15*k*.
orientum, 15*a*.
ornata, 21.
palustris, 15*d*.
paradisiaca, 15.
religiosa, 4.
rosacea, 21.
rubra, 15*b*, 19.
sanguinea, 15*e*, 18.
sapientum, 15, I.
Seemanii, 12.
seminifera, 15, III.
silvestris, 13.
sinensis, 11.
speciosa, 21.
suaveolens, 15*i*,
sumatrana, 20.
superba, 7.
ternatensis, 15*g*.
textilis, 13.
textoria, 13.
troglodytarum, 12, 13, 15, II.
Uranoscopos, 12, 16.
ventricosa, 1.
vittata, 15*f*.

A. *Sts. short, bottle-shaped: male fls. many to a bract, free petal usually 3-toothed: fr. not edible: usually not stoloniferous. (Subgenus Physocaulis.)*

B. *Free petal entire: seeds few, large (about 1 in. diam.).*

1. **ventricòsa,** Welw. (*M. africàna*, Bull, young form). Whole plant 8–10 ft. high, not stoloniferous: sts. much swollen, 4 ft. diam. at base: lvs. oblanceolate-oblong, 4–5 ft. long, thick in texture, bright green; midrib pale red: spike drooping; calyx entire; free petal entire, ⅓in. long: fr. coriaceous, dry, 2–3 in. long; seeds about 1 in. diam., angled by pressure. Angola, in rocky places near rivulets.—Cult. in S. Calif. Tender but more ornamental than *M. Ensete*.

BB. *Free petal 3-toothed or lobed.*

C. *Seeds few, large (about ¾–1 in. diam.).*

D. *The seeds smooth.*

2. **Ensète,** Gmel. (*M. abyssinica*, Hort. *Ensète edùle*, Horan.). ABYSSINIAN BANANA. Fig. 2403. Whole plant 30–40 ft. high, not stoloniferous: st. 13–20 ft. high, swollen at the base: lvs. oblong, acute, often 20 ft. long by 3 ft. wide; midrib red: bracts densely imbricated, 9–12 in. long, dark claret-brown: spike erect; fls. whitish, 1½–2 in. long, often 20 or more in a cluster; calyx 3-lobed; free petal short, 3-lobed: fr. coriaceous, dry, 2–3 in. long; seeds 1–4, black, glossy, nearly 1 in. diam., with a prominent raised border around the hilum. Mountains of Abyssinia. B.M. 5223, 5224. R.H. 1861, p. 124, note; 1888, p. 32. G.C. II. 15:435; 21:19; III 16:697. Gn. 47, p. 5; 48, p. 406. V. 5:53. F.E. 11:470. G.M. 52:655; 54:375.—The largest known, as well as one of the oldest (being represented in ancient Egyptian sculptures), and most widely cult. of all decorative bananas. Cult. in S. Calif. and Fla. Prop. entirely from seed in hotbeds. Yields a good fiber.

DD. *The seeds longitudinally ribbed.*

3. **Hòlstii,** K. Schum. Whole plant 15–20 ft. high: lvs. 15–18 ft. long by 3 ft. wide: spike very large, drooping; upper bracts covering the male fls. 8–10 in. long, persistent; male fls. about ½in. long, stalked; calyx 1¾in. long, more or less deeply lobed, lobes linear, hooded at apex; free petal ½–¾in. long, broadly elliptic, 3–5-lobed, the middle lobe oval and laterally toothed: fr. pyriform, about 4 in. long by 2 in. wide; seeds about ¾in. diam. German E. Afr., in deep wooded ravines at 3,600–3,800 ft. altitude.—Intro. into cult. in 1905. Decorative.

CC. *Seeds many, comparatively small (⅛–½in. diam.).*

D. *Foliage glaucous.*

E. *Lvs. mucronate pointed, thick.*

4. **religiòsa,** Dybowski. Whole plant about 8 ft. high, forming a true bulb like *M. Gilletii*, 2–2½ in. diam., but differing in having roots from the whole bulb instead of from the top of the bulb only: lvs. glaucous, oblong-lanceolate or elliptic, mucronate pointed, dying down, the bulb going through a resting-period: fls. undescribed: fr. full of seeds, inedible; seeds smooth, black, brown or gray. French Congo. R.H. 1901, pp. 157, 158.—The lvs. are thick and not easily broken by the wind. Considered by some to be more ornamental than *M. Ensete*. Intro. into U. S. about 1908.

EE. *Lvs. not mucronate pointed, thin.*

5. **Martrétii,** Cheval. Whole plant 20–25 ft. high: lvs. large, glaucous: fr. cylindrical, short, yellow; seeds smooth, black, ⅜–½in. diam. Guinea.—The fr. is edible, but the pulp is not abundant and of indifferent quality. A good ornamental for S. Calif. and Fla. Intro. into U. S. in 1908.

DD. *Foliage not glaucous.*

E. *The seeds tuberculate.*

6. **Livingstoniàna,** J. Kirk. St. conical, 10–12 ft. high, 2–3 ft. diam. at the base: lvs. crowded, narrow, oblong, as long as st.; petiole broad, clasping, deeply grooved: fr. 4 in. long, many-seeded; seeds ⅓in. diam., globose, angled by pressure, dull brown, tuberculate; hilum deeply depressed, surrounded by prominent edges. S. E. Trop. Afr., up to 7,000 ft. altitude.—Decorative. Yields a good fiber. Intro. into U. S. in 1907.

EE. *The seeds smooth.*

F. *Fls. 10–15 in a row.*

7. **supérba,** Roxbg. Whole plant 10–12 ft. high, not stoloniferous: st. 2–2½ ft. diam. at base, narrowing to 1 ft. below lvs.: lvs. 5 ft. long, oblong, narrowed to base; petiole very short, deeply grooved: spike at first globose, 1 ft. diam., one-third the length of st.; bracts orbicular, dull claret-brown, up to 1 ft. long; fls. in dense rows of 10–15 each; calyx 1 in. long, whitish, formed of 3 loosely cohering segms.; free petal short, 3-toothed with a long linear central tooth: fr. oblong, subcoriaceous, 3 in. long, 1½ in. diam.; seeds very numerous, ⅓–½in. diam., smooth, brown, subglobose, angled by pressure. India. B.M. 3849, 3850. G.C. III. 35:83. R.H. 1877, p. 277; 1888, p. 33. F. 1873, p. 273. Roxburgh, Plants of Coromandel, 3:223. Wight, Icones Plantarum, 2017.—Decorative, and yields a poor fiber.

FF. *Fls. 3–7 in a row.*

G. *Fr. 2 in. long: free petal ½in. long.*

8. **Gillétii,** De Wild. Whole plant 5–8 ft. high, not stoloniferous: lvs. about 5 ft. long: spike short, drooping; fls. 5–6 in a row; free petal 3-toothed, nearly ½in. long: fr. about 2 in. long; seeds 9 or 10, about ⅓in. long. Congo Free State.—Cult. in Fla.

GG. *Fr. 4 in. long: free petal ⅔in. long.*

9. **Arnoldiàna,** De Wild. Whole plant 12–15 ft. high, not stoloniferous: lvs. 7 ft. long, 13 ft. diam. at base: spike short, drooping; fls. 3–7 in each row; free petal 3-toothed, about ⅔in. long: fr. nearly 4 in. long; seeds 12–16, about ½in. long, smooth, broadly pyriform. Congo Free State. G.W. 9:401.—Decorative and showy. Cult. in S. Eu.

AA. *Sts. cylindrical; usually stoloniferous: male fls. many to a bract: fr. usually edible.* (*Subgenus Eumusa*).

B. *Fls. rose-red.*

10. **Mártinii,** Hort. Similar in habit to *M. paradisiaca:* lvs. oblong, long-petioled, firm in texture, bright green above, glaucous beneath with reddish veins: fls. bright rose-red: fr. small, yellowish. Intro. from Orotana Botanical Garden, Teneriffe, in 1893. R.B. 18, p. 107.—A good foliage plant for exposed places.

BB. *Fls. yellowish white.*

C. *Sts. short* (*1–6 ft.*)*: petioles short.*

11. **Cávendishii,** Lamb. (*M. chinénsis,* Sweet. *M. sinénsis,* Sagot. *M. hùmilis,* Perr.?). Chinese Dwarf Banana. Dwarf Jamaica. Whole plant 4–6 ft. high, stoloniferous: st. 2–3 ft. high: lvs. 6–8 in a dense rosette, spreading, oblong, 2–3 ft. long, 1 ft. wide, rounded at base, glaucous; petiole short, stout, deeply grooved; blades when young spotted and blotched with red: spike dense, short, drooping; bracts red-brown or dark, lower 6 in. long, upper 3–4 in. long; male fls. and their bracts persistent; calyx yellowish white, 1 in. long with 5 obtuse lobes; free petals about ½in. long: fr. as many as 200–250 in a bunch, oblong, 6-angled, slightly curved, 4–5 in. long, 1½ in. or more diam., obtuse, gradually narrowed to the sessile base, seedless, edible; skin rather thick; flesh delicately fragrant. S. China. Intro. from Mauritius in 1827. P.M. 3:51. Gn. 32, p. 243; 40, p. 263; 44, p. 496; 50, p. 161. G.C. III. 22:167.—Stands more cold than most bananas, and its dwarf growth readily allows for protection. Good for shipping and may be planted N. Extensively grown along the coast of the southern states and in the W. Indies.

CC. *Sts. tall* (*over 6 ft.*)*: petioles long.*

D. *Spikes erect or suberect.*

12. **Fèhi,** Vieill. (*M. Fèi,* Nadeaud. *M. Seèmanii,* F. Muell. *M. Uranoscópos,* Seem. *M. troglodytàrum,* S. Kurz., not Lour.). Stoloniferous: st. 15–20 ft. high, full of violet juice: lvs. larger and firmer in texture than *M. paradisiaca,* with stouter veins; base unequally rounded; petiole 1–1½ ft. long: spike long, erect, slightly curved at the base; fls. 6–8 in a cluster, sessile; calyx with 5 unequal lobes, finally splitting nearly to the base: free petal short: fr. many in a bunch, oblong, angled, 5–6 in long, 1 in. or more diam., nearly straight, yellow when ripe, skin thick; pulp moderately firm; seeds small, dull black. Tahiti and New Caledonia. Seedless at low levels but bearing seeds at elevations of 3,000–3,600 ft. G.C. III. 8:182.—Cult. in Eu. Fruits not very palatable when raw but excellent when cooked.

DD. *Spikes drooping.*

E. *Outer calyx-lobes with horn-like hooks.*

13. **téxtilis,** Née (*M. mindanénsis,* Rumph. *M. silvéstris,* Colla. *M. troglodytàrum textòria,* Blanco. *M. Abacá,* Perr.). Abaca. Manila Hemp. Whole plant 13–22 ft. high, stoloniferous: lvs. oblong, deltoid at base, bright green above, glaucous beneath, often with large brown spots; petiole 1 ft. or more long: spike drooping, shorter than lvs.; male fls. deciduous; calyx 5-lobed, about 1½ in. long, the outer lobes with a curved, threadlike horn near the apex: fr. obscurely 3-angled, curved, 2–3 in. long, 1 in. diam., not edible, filled with seed; seeds black, turbinate, ⅙in. diam., angled by pressure. Philippine Isls.—Furnishes one of the most valuable fibers known for the manufacture of rope. Cf. p. 171, Vol. I; also Cyclo. Amer. Agric., Vol. II, p. 286. Much grown in the Philippines.

Var. **amboinénsis,** Miq. (*M. amboinénsis,* Rumph.). Not so tall and spike not so drooping: fr. about 3 in. long, black at maturity. Amboina.—Cult. in the Philippine Isls. and used in the manufacture of Manila hemp.

EE. *Outer calyx-lobes without horn-like hooks.*

F. *Free petal nearly as long as the calyx.*

14. **Basjoò,** Sieb. & Zucc. (*M. japónica,* Hort.). Japanese Banana. Whole plant 12–18 ft. high, stoloniferous: st. 6–9 ft. high, 6–8 in. diam.: lvs. oblong, thin bright green, 6–9 ft. long, 1½–2½ ft. broad, deltoid at base; petiole stout, about 1 ft. long: spike dense, 1½ ft. long; female clusters 3–4, close, 12–15 fls. each; bracts oblong, dull brown, lower 8–12 in. long; male clusters 8–12, their bracts much imbricated, persistent; calyx whitish, 2 in. long, shortly 5-toothed at apex: fr. 30–60, oblong, pointed, 3-angled, 3 in. long, narrowed to a sessile base; seeds few. Liu Kiu Archipelago. B.M. 7182. R.B. 22, p. 152. R.H. 1896, p. 203. G.M. 54:376.—Cult. in Japan for fiber. Decorative and hardy as *M. Ensete.*

FF. *Free petal half the length of the calyx.*

15. **paradisìaca,** Linn. Plantain. Cooking Banana. Adam's Fig. Whole plant 20–30 ft. high, stoloniferous: st. 20–25 ft. high: lvs. oblong, thin, bright green, 5–8 ft. long, 1½–2 ft. wide, usually rounded at base; petiole 1–1½ ft. long: calyx drooping, often 4–5 ft. long; bracts mostly persistent, lanceolate or oblong-lanceolate, dull violet, more or less glaucous outside, the lower 1–1½ ft. long, the upper ½ft. long, often red inside, several expanded at once, the edges of the upper not involute; male fls. mostly persistent; fls. about a dozen to a cluster, yellowish white, 1½ in. long; calyx 5-toothed at the top; free petal oval, half as long as the calyx: fr. cylindrical, ½–1 ft. long, usually yellow or yellowish green when ripe, 40–80 in a bunch, flesh firm, not so sweet as the banana. Native of India. R.H. 1888, p. 69. L.B.C. 7:684. Redouté, Liliaceæ, 443, 444.—Universally cult. in the tropics, especially in the W. Indies and Cent. Amer. Not suitable to eat without cooking.

Subsp. (I) **sapiéntum,** Kuntze (*M. sapiéntum,* Linn.). Common Banana. Male fls. deciduous: fr. yellow, somewhat 3-angled, 3–8 in. long, 1½–2 in. diam. India. Trew, Plantæ Selectæ, 21–23. Rheed, Hortus Malabaricus 1:12–14.—Most of the commercial bananas are obtained from the numerous varieties of this subspecies.

a. *Fr. with thin skin.* (Subsp. *sapientum.*)

Var. (a) **Chámpa,** Baker (*M. Chámpa,* Hort. *M. oriéntum,* Hort.). Hart's Choice. Lady Finger, or Golden Early Banana. Chumpa. St. and midrib of lf. tinged with red: fr. pale straw-color, about 6 in. long; skin soft and thin; flesh luscious, delicate in flavor, ripening quickly.—Hardy in cool climates. Best of all for growing in Fla. Much grown in the W. Indies.

Var. (b) **rùbra,** Baker (*M. rùbra,* Firming, not Wall.). Baracoa, Red Jamaica, or Red Spanish Banana. St., petiole, fls. and midrib of lf. dull red: fr. at first dark red, ripening to yellowish red. This is the red banana of commerce formerly imported in large quantities from the W. Indies. Fine for decorative purposes but tender. G.C. III. 29:335. R.H. 1905:68.—The golden banana with fr. golden yellow or reddish, 8–9 in. long and blunt, is intermediate between this and var. *Champa.*

Var. (c) **cinèrea,** Blanco. Letondal or Chotda Banana. Fr. short, whitish, not angled, thin-skinned; flesh somewhat grayish; delicious; skin splitting and turning back at maturity; perfect seed frequently found.—Intro. from India by a French priest named Letondal. Cult. in the Philippine Islands and Guam.

aa. *Fr. with thick skin.* (Subsp. *sapientum.*)

Var. (d) **Dácca,** Baker (*M. Dácca,* Horan. *M. palùstris,* Hort.). Dacca Banana. St. pruinose: lvs. paler green than in the subspecies, glaucous beneath; border of the petiole red: fr. yellow, 4 in. long, 2 in. diam., tip and base bright green, skin very thick. India.—Flavor good. Tender.

Var. (e) **sanguínea,** Welw. Lvs. and fr. strongly tinged with blood-red.—Intro. into cult. in Eu. in 1903.

Var. (f) **vittàta,** Hook. Lvs. and long frs. copiously striped with white and rose: bracts bright red inside. Isl. of St. Thomas, W. Afr. B.M. 5402.—Very decorative.

Var. (g) **ternaténsis,** Blanco. Chotda Dama. Whole plant 5–6 ft. high: fls. about 20 to a cluster; calyx often coronate at maturity; free petal pitted at the outer tip: fr. with 3–5 prominent angles; seeds rare. Philippine Isls.—Cult. also in Guam. One of the most palatable varieties.

Var. (h) **mágna,** Blanco. Chotda Tandaque. Fr. 3- to several-angled at maturity, over 1 ft. long by 3 in. diam., more palatable when cooked. Philippine Isls.—Cult. also in Guam. Cloth is made from the fiber but it is not of as good quality as that from abaca.

Var. (i) **suavèolens,** Blanco. Bungulan. Fr. usually green, with yellowish spots at maturity; angles not conspicuous, obliterated at maturity; flesh fragrant and very palatable. Philippines.—Cult. in Guam.

Var. (j) **Lacatàn,** Blanco. Lacatan. Fls. about 14 to a cluster; calyx 5-toothed, the 3 alternate teeth large: fr. angled-obtuse at apex; flesh fragrant, firm. Philippines. Cult. in Guam. Blanco, Flora de Filipinas, 12:88 (1877).—One of the most palatable varieties.

aaa. *Fr. unknown.* (Subsp. *sapientum.*)

Var. (k) **oleràcea,** Baker (*M. oleràcea,* Vieill.). A flowerless form with a glaucous, violet st. and elongated, thick, turnip-like rhizome, which is boiled or roasted like a yam, and resembles it in taste. Intro. from New Caledonia, where it does not flower. B.M. 7802.—The tubers have "eyes" like a potato and the plant may be prop. by division. Cult. in Eu. where fls. have been produced but no fr.

Subsp. (II) **troglodytàrum,** Baker (*M. troglodytàrum,* Linn.). Spike erect in the lower half, drooping in the upper half: fr. small, crowded on the lower erect portion, oblong, cylindric, reddish yellow, containing rudimentary seeds; flesh sweet, yellow. India and Malaya. Blanco, Flora de Filipinas 12:88 (1877).—The favorite food of elephants. Rarely cult. in the U. S.

Subsp. (III) **seminífera,** Baker (*M. seminífera,* Lour.). Frs. small, oblong, full of seed, yellowish or greenish. Not edible. This apparently represents the wild seed-bearing form. Found wild in India, the Malayan and Philippine Isls.

AAA. *St. slender, cylindrical: male fls. few to a bract: fr. not generally edible: usually stoloniferous.* (*Subgenus Rhodochlamys.*)

B. *Lvs. green on both sides.*

C. *Rachis of the infl. glabrous.*

D. *Free petal nearly as long as the calyx.*

16. **Uranoscòpos,** Lour. (*M. coccínea,* Andr.). Stoloniferous: st. 4–5 ft. high, 2–3 in. diam.: lvs. oblong, 2–3 ft. long, 6–9 in. wide; petiole long and slender: spike erect, dense, about 1 ft. long; bracts brilliant scarlet, tipped with yellow, the lower 6 in. long; calyx yellow, 1 in. or more long; free petal nearly as long as the calyx: fr. oblong, 3-angled, not edible; seeds very small, rarely produced in cult. S. China. Botanists Repository 47. Redouté, Liliaceæ, 307, 308. B.M. 1559. L.B.C. 5:475. F.S. 7:722, 723. Martius, Flora Brasil. 3:1.—Intro. into cult. in 1791 and now widely distributed. Very showy. May be grown in 10-in. pots for winter decorations of tropical houses.

DD. *Free petal much shorter than the calyx.*

17. **Mánnii,** Wendl. Stoloniferous: sts. slender, cylindrical, tinged with black, 2–3 ft. high, 3½ in. circum. at base: spike erect, 6 in. long; female fls. in 3 clusters of 3 fls. each, their bracts deciduous; male bracts crowded, pale crimson, 3–4 in. long; calyx pale yellow, 1½ in. long: free petal much shorter: fr. small, 3–4 in. long, fusiform with a broad truncate apex. Assam. B.M. 7311.—Intro. into Eu. in 1893, and into U. S. in 1901.

CC. *Rachis of the infl. pubescent.*

D. *Free petal nearly equaling the calyx.*

18. **sanguínea,** Hook. f. Stoniferous: st. very slender, 4–5 ft. high: lvs. oblong, thin, bright green, 2–3 ft. long, 5–8 in. wide; petiole slender, 1 ft. long: spike at first erect, drooping when mature; female fls. in 2–6 clusters of 2–3 fls. each; male clusters few, dense; bracts lanceolate, somewhat persistent, blood-red, lower 6 in. long; calyx bright yellow, 1–1½ in. long; free petal nearly as long as the calyx: fr. oblong, 3-angled, rather pulpy, pale green variegated with red, glabrous, 2 in. long; seeds angled, small, black, tubercular. Assam. B.M. 5975.—Decorative and showy.

DD. *Free petal much shorter than the calyx.*

19. **rùbra,** Wall. St. slender, 4–6 ft. high: lvs. oblong-lanceolate, 1½–2 ft. long, 6–9 in. wide; petiole long and slender: spike dense, erect; bracts bright red, lower 1 ft. long and sterile, upper 2–4-fld.; calyx yellow; free petal half as long as the calyx: frs. in 3–4 clusters of 3–4 each, cylindrical, dry, 1½–2 in. long; seeds smooth, dull brown, ⅙in. diam. India. B.M. 7451.—Cult. in Eu.

BB. *Lvs. glaucous beneath.*

20. **sumatràna,** Becc. Whole plant 7–8 ft. high: st. slender: lvs. 5–6 ft. long, 1½ ft. wide, glaucous, with irregular blotches of claret-brown; petiole 1 ft. long; rachis pubescent: spike more or less drooping; lower bracts distant: fr. dry, cylindrical, curved, 2–3 in. long, ½in. diam. Sumatra, 1,100 ft. altitude. I.H. 27:375. F.S. 10:1061 (as *M. zebrina,* probably a young form of this species, and is very decorative).

BBB. *Lvs. red beneath.*

21. **rosàcea,** Jacq. (*M. ornàta,* Roxbg. *M. speciòsa,* Ten. *M. Carolinæ,* Sterler.). Whole plant 4–6 ft. high, stoloniferous: st. 3–5 ft. high, 3–4 in. diam.: lvs. linear-oblong, firm, 3 ft. long, 9–12 in. wide, purplish beneath: spike more or less drooping, 1 ft. long; bracts ovate-lanceolate, pale blue or reddish lilac, the lower 6–8 in. long; male fls. deciduous, more numerous than the female; calyx yellow, 1 in. long: fr. oblong, obscurely 4–5-angled, yellowish green, 2–3 in. long; pulp very scant, scarcely edible; seeds ⅙in. diam., black tubercled, rarely produced in cult. plants. India. B.R. 706. L.B.C. 7:615.—Intro. into Calif. in 1898.

M. assámica, Hort. Bull. Trunk about 1½ ft. high: lvs. about 1 ft. long, crowded, running out into a slender tendril-like point, green with a narrow purple border. Assam. This elegant dwarf plant allied to M. sanguinea is well suited for table decoration.—*M. imperiàlis,* Sprenger. A magnificent species with perennial rootstock and enormous somewhat lanceolate lvs. Related to M. Ensete. Kamerun. Cult. in Eu. Fls. and fr. not described.—*M. Rhodochlàmys,* Hort. A subgenus of Musa improperly used in some trade catalogues as a species. See species 16–21.

P. L. Ricker.

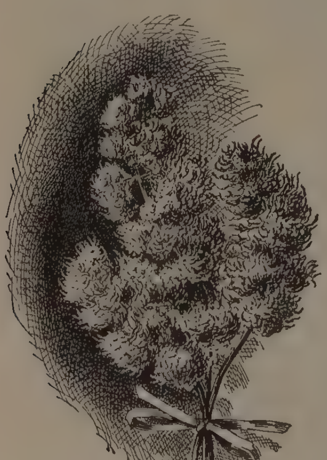
MUSÁNGA (W. African name). *Moràceæ.* One W. Trop. African tree allied to Cecropia, recommended abroad as shade in cocoa and coffee plantations and also as an ornamental foliage plant: lvs. large, alternate, long-petioled, peltate, divided into 11–15 entire segms.: panicle of small male fls. solitary in axils, of the female twin in the axils. *M. cecropioìdes,* Br. (*M. Smíthii,* R. Br., not Benth.), is described by Hiern as "a very elegant tree, 12–15 ft. high, branched a little above the base, with a broad head and good wood suitable for house-building: lvs. digitate; lfts. 6, 1–1½ ft. long; common petiole more than 7 in. long. (*M. Smíthii,* Benth, Niger Fl.=*Macaranga heterophylla,* Muell. Arg., a plant apparently not cult.)

MUSCARI (Latin name referring to the musky odor of *M. moschatum*). *Liliàceæ.* Grape Hyacinth. Excellent hardy spring-blooming bulbs.

Flowers in racemes or spikes; perianth urn-shaped, slightly or distinctly constricted at mouth; segms. 6-dentate, commonly reflexed; stamens in a double cylindrical tube; ovary 3-celled, sessile, globose-trigonal: caps. sessile, globose; seeds subglobose, black, glistening: bulbs membranous, tunicated.—About 45 species in Sicily, Algeria, European Medit., Spain, Asia Minor, and the Orient. All grape hyacinths are very much alike and are very interesting, botanically, horticulturally and from the artistic point of view. The group needs botanical revision badly. The chief literary sources are Baker in Jour. Linn. Soc., Vol. 11 (1871), and in G.C. II. 9:798 (1878); also Boissier's Flora Orientalis. The width of the lvs. is an important character, and Baker's measurements seem to refer to herbarium specimens. Live plants should be wider. (A line is a twelfth of an inch.) They are something like a hyacinth, but the clusters are smaller, and the individual fls. are smaller and of different shape, the grape hyacinths being constricted at the mouth and having 6 small teeth instead of the prominent perianth-segms., as in the true hyacinth.

The common grape hyacinth, which every garden lover knows, is called *M. botryoides*, which means "like a bunch of grapes." Everybody who has any ground for gardening should have some bulbs of this common kind, both blue-flowered and white. All the other kinds described below are fancier's plants, interesting chiefly to skilled amateurs. Among them the most remarkable is the feathered hyacinth (*M. comosum* var. *monstrosum*), which is a mass of lilac shreds (see Fig. 2404). Any species of Muscari is likely to have some sterile flowers at the top of the cluster which are often of a different color, but in the feathered hyacinth there is no suggestion left of the urn-shaped flower, sterile and fertile flowers all being cut into fine strips. This attractive plant has been sold for fancy prices by a few progressive florists.

Grape hyacinths are neat little early flowering bulbous plants, good-sized colonies of which give dainty effects in the border from February to May. There are numerous species of these, flowering at different times. They are mostly dark purple in color, either self-colored or tipped with white. There are also a few white and yellow forms, and several species with true blue flowers, the rarest color among flowers, though this would never be discovered in catalogues. *M. Szovitsianum*, one of the true blue forms, is quite the prettiest of the genus. The plant known to the trade as *M. lingulatum*, or *Hyacinthus azureus*, has the true blue of *M. Szovitsianum*, and is fully a month earlier. The usual forms grown in gardens are mostly blue (purple) and white forms of *M. botryoides*. *M. conicum* is very dark. The Dutch catalogues offer numerous kinds to suit amateurs and differing conditions. Muscari offer no difficulties in cultivation. A medium soil perhaps suits them best, but they are usually thrifty growers, and persistent in the garden if foliage is allowed to ripen. They mostly make offsets freely, and produce abundant seed. (J. N. Gerard.)


2404. Muscari comosum var. monstrosum.

INDEX.

album, 4, 8.
armeniacum, 9.
atlanticum, 15.
atrocæruleum, 16.
Aucheri, 6.
botryoides, 4.
cæruleum, 4.
carneum, 4, 13.
commutatum, 16.
comosum, 2, 16.
compactum, 18.
conicum, 8.
dipcadi, 1.
flavum, 1.
græcum, 3.
grandiflorum, 4, 13.
Heldreichii, 5.
latifolium, 14.
Lelievrei, 4.
leucophæum, 4.
lingulatum, 6.
macrocarpum, 1.
major, 1.
majus, 4.
micranthum, 10.
minor, 1.
monstrosum, 2, 16.
moschatum, 1.
multiflorum, 15.
neglectum, 15.
pallens, 12.
pallidum, 4.
paradoxum, 7.
plumosum, 2, 16.
polyanthum, 17.
præcox, 6, 13.
racemosum, 13.
suaveolens, 1.
Szovitsianum, 11.
violaceum, 16.

Subgenus I. Moscharia. Perianth urn-shaped, but with a relatively long-tubular base; segms. minute, even for the genus, roundish, spreading and thickened on the back.

1. **moschàtum,** Willd. (*M. suavèolens,* Fisch.). Musk or Nutmeg Hyacinth. Lvs. 5–6, 1 ft. long, ½–¾in. wide: raceme loose, 1–3 in. long; fls. 20–50, blue. Asia Minor. B.M. 734. Gn. 26, p. 137.—Has the odor of musk. Seems to enjoy a warm dry border where bulbs mature properly. Sometimes fails to bloom after first year. Vars. **màjor** and **mìnor** are advertised. *M. dipcadi major* and *minor* have appeared in the catalogues since 1878, but these names have no botanical standing and represent cultural forms, of which there are several.

Var. **flàvum,** Lam. (*M. flàvum,* Van Tubergen. *M. macrocárpum,* Sweet). Fls. yellowish (Van Tubergen says clear yellow). B.M. 1565.

Subgenus II. Leopoldia. Perianth obovoid-urn-shaped, grooved above, 3–4 lines long; segms. triangular, reflexed, not thickened on the back: raceme loose, and longer than in the next. Particularly characterized by the conspicuous bearded appearance of the sterile fls.

2. **comòsum,** Mill. Lvs. 3–4, 1–1½ ft. long, ½–1 in. wide: raceme loose, 6–12 in. long, 40–100-fld.; lower fls. fertile, olive, tipped brown, borne on long horizontal pedicels; upper fls. sterile, blue or violet, borne on long upcurved pedicels, making a corymbose cluster. Medit. region, Orient. B.M. 133 (as *Hyacinthus comosus*).—An interesting form, but rare in cult., being greatly surpassed in popularity by var. *monstrosum*.

Var. **monstròsum,** Hort. Feathered Hyacinth. Fig. 2404. All the fls. sterile, and cut up into fine shreds. Gng. 7:290. A.F. 14:1286. Gn. 26, p. 137.—A most interesting plant. Also called fair-haired or tasseled hyacinth, and shredded lilac. Sold also as *M. monstrosum, M. plumosum, M. plumosum monstrosum,* etc. For other trade synonyms, see under *M. commutatum.*

3. **grǽcum,** Heldr. Differs from *M. comosum* in having its sterile fls. in a short, dense, conical spike, the pedicels of which are very short. Greece.

Subgenus III. Botryanthus. Perianth more or less urn-shaped, grooved or not above, 1–2 or rarely 3 lines long; segms. triangular, usually reflexed: raceme dense, 1–2 in. long. Sterile fls. inconspicuously bearded or hardly at all.

A. *Fertile fls. a little longer than broad, obovoid-globose.*

B. *Lvs. 3–4: fls. 12–20.*

4. **botryoìdes,** Mill. Common Grape Hyacinth. Fig. 2405. Lvs. linear-lorate, 3–4 lines wide: scape 6–9 in. long; fls. pale blue, odorless, 12–20. Eu., Orient. B.M. 157 (as *Hyacinthus botryoides*). A.F. 13:1197. Gn. 26:136. R.B. 20:3. Gn.M. 2:117.—The following varieties are offered: *álbum* (G.M. 51: 694. G. 27:235. Gn. 76, p. 106. Gn.W. 22:331. J.H. III. 58:464), *cárneum, cærùleum, leucophǽum, Lelièvrei,*

màjus, pállidum and *pállidum grandiflòrum.* These range from white through flesh-color to sky-blue.

BB. *Lvs. 5–6: fls. 8–12.*

5. **Héldreichii,** Boiss. Lvs. linear-filiform, subterete, 1½ lines wide: scape 4–6 in. long; fls. 8–12, amethyst-colored, with conspicuous white teeth. Greece. Gn. 26:136.

BBB. *Lvs. 2–3: fls. 6–10.*

6. **lingulàtum,** Baker (*M. Aùcheri* var. *lingulàtum,* Boiss.). Lvs. 3 lines wide: raceme ovate. G. 34:243 (as *M. azureum*). Asia Minor.—This is apparently a good species, but it is said that the plant sold under this name is the same as *Hyacinthus azureus* (Vol. III, p. 1616). Var. **prǣcox** is evidently a small form. Cilicia. Gn. 63, p. 75.

AA. *Fertile fls. 1½ times as long as broad, obovoid-oblong.*

B. *Color of fls. black-blue.*

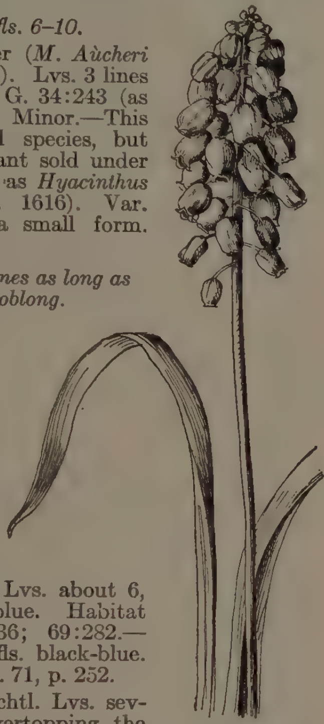
7. **paradóxum,** C. Koch. Lvs. 3, ½–¾in. wide: fls. rather longer than broad, deep black-blue. Armenia. B.M. 7873.

BB. *Color lively dark lilac or blue.*

C. *Lvs. ¼in. broad.*

8. **cònicum,** Baker. Lvs. about 6, narrower: fls. violet-blue. Habitat unknown. Gn. 51:136; 69:282.—Van Tubergen says fls. black-blue. Var. **álbum,** white. Gn. 71, p. 252.

9. **armenìacum,** Leichtl. Lvs. several, linear, much overtopping the raceme, reaching a foot at flowering: scape 4–6 in. long, tinted brown at base; raceme dense, 2 or more in. long; axis bright violet; perianth bright deep violet; teeth erect whitish; sterile fls. pale blue. Armenia.—One of the most handsome species, flowering the latest.



2405. Muscari botryoides. (×½)

CC. *Lvs. 1/12 to ⅙in. broad.*

10. **micránthum,** Baker. Lvs. several, overtopping the raceme: scape slender, 5 in. long; fls. bright violet, fragrant; sterile fls. few, sessile, pale blue. Habitat unknown.

11. **Szovitsiànum,** Baker. Lvs. several, 5–6 in. long: scape 4–5 in. long; fls. bright blue, considerably larger (⅙in. across, but only 1/12in. across in *M. micranthum*), faintly odorous: very large bulb, bearing several racemes of bloom. Persia, Caucasus. B.M. 6855.

BBB. *Color nearly white.*

12. **pállens,** Fisch. Lvs. numerous, filiform: scape 3–5 in. long; raceme 12–20-fld.; fls. white or nearly so. Caucasus, Iberia.

AAA. *Fertile fls. twice as long as broad, obovoid-cylindrical.*

B. *Lvs. almost cylindrical (subterete).*

13. **racemòsum,** Mill. Lvs. 5–6, 5–6 in. long, 1/12in. thick, almost cylindrical: fls. odorous, dark blue. Medit. Caucasus. B.M. 122 (as *Hyacinthus racemosus*). Vars. *cárneum* and *grandiflòrum prǣcox* are offered.

BB. *Lvs. oblanceolate.*

14. **latifòlium,** J. Kirk. Lvs. always solitary, ¾–1 in. wide, oblanceolate: sterile fls. 6–10, much paler than the others. Phrygia. B.M. 7843.

BBB. *Lvs. lorate, i.e., strap-shaped.*

15. **negléctum,** Guss. Lvs. numerous, 9–12 in. long, lorate, 1½–2 lines thick: fls. odorous, dark blue. Medit. region. Gn. 26:136. J.H. III. 61:249.—This differs from *M. commutatum* and *M. polyanthum* in having the segms. of the perianth triangular and reflexed. *M. negléctum multiflòrum* and *M. negléctum atlánticum* are trade names. See supplementary list under *M. Argæi.*

16. **commutàtum,** Guss. Lvs. 5–6, 5–6 in. long, 1½–2 lines wide: fls. odorless, dark blue; segms. very short, not recurved. Sicily.—Krelage advertises vars. *atrocærùleum comòsum, plumòsum, plumòsum monstròsum,* and *plumòsum violàceum.* It is apparent that he regards *M. comosum* and its forms as varieties of *M. commutatum.*

17. **polyánthum,** Boiss. Lvs. 2–3 lines wide. Differs from *M. neglectum* and *M. commutatum* in having longer pedicels and the caps. a half smaller, not more than 2 lines wide.

18. **compáctum,** Baker. Described only as *Botryanthus compactus* in an obscure work, which states that the fls. are nearly black, with whitish teeth which are semi-orbicular, obtuse, spreading-recurved. Baker places *M. compactum* next to *M. commutatum,* in spite of the fact that the original description says the fls. are obovate. Baker adds that this *M. compactum* is the *M. neglectum* of some authors in part. The plant in the trade as *M. compactum* may be a variety of some common species, since Van Tubergen says the fls. are pale blue.

M. Argǣi, little known botanically, is said to be extra good. In the trade, M. atlanticum is given as a synonym. Baker said he could not distinguish M. atlanticum from M. neglectum.—*M. atlánticum.* Consult the preceding entry, M. Argæi.—*M. azùreum,* Hort., is said by Van Tubergen to be the same as Hyacinthus azureus, which in turn is referred to H. ciliatus by Index Kewensis. Gn. 36:126. Van Tubergen also advertises var. amphibolis (M. Freynianum).—*M. Motelàyi,* is offered by Van Tubergen.

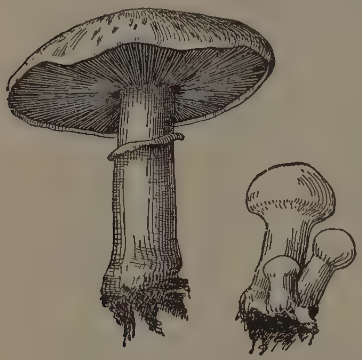
WILHELM MILLER.
A. C. HOTTES.†

MUSÈNIUM: *Musíneon.*

MUSHROOM. The best usage sanctions the use of the word "mushroom" as a comprehensive term applicable to any and all of the higher fleshy fungi, whether good, bad, or indifferent with respect to edible qualities. With this usage it is then proper to speak of edible, inedible, and poisonous mushrooms of all types. From some quarters there is an inclination to regard only the agarics, or more especially the centrally stalked gill-bearing Agaricaceæ, under this name; thus we would have the field agaric, or field mushroom, the fly agaric, or fly mushroom, and so on. In a commercial sense, *Agaricus campestris* and the allies of this species are everywhere in America the dominant, and usually the only species of interest; so that among certain classes of persons it is not strange to find a tendency toward the restriction of the word to the commoner cultivated forms. The same persons with wider experience would doubtless abandon this usage, and employ the above-mentioned broader application now more generally used, which is also the one of the "mushroom" books.

Another use of the term is as a counterpart of toadstool,—"mushroom" denoting any edible species, and "toadstool" all the inedible or at least poisonous ones. With this criterion we would collect and throw into the "mushroom" basket all species as fast as they might in some way or other receive approval, and we would cast into the toadstool limbo all uncertain or untried and dangerous forms. On the basis of such distinctions, applied to European conditions, there might be on the markets of Munich, Germany, about fifty species for sale as "mushrooms," since this number is approved by the authorities; but in Berlin, at the dictation of stricter tastes, or rules, the number of recognized "mushrooms" would be scarcely half that of Munich. "Toadstool" is a term which might well be held sacred to the fairy tales of mushroom life.

It seems probable that mushroom is derived from the old French mouseron or moucheron, now mousseron. An obsolete English form is musheron, while mushrump and mushrome have also been used. Among consumers of French canned "champignons" (fungi) there seems to be the feeling that this general term is used only for the cultivated forms, but this is merely a special trade use, and even in popular mushroom books the cultivated forms are carefully distinguished as "champignon de couche."



2406. Agaricus campestris (the true mushroom). (×½)

The only mushrooms cultivated extensively in Europe or America are the "common mushrooms," or field mushrooms, consisting probably of several closely related species, which are usually designated *Agaricus campestris.* In reality, there is a group of species, including at least *A. arvensis, A. campestris* and its near relatives, *A. villaticus,* probably *A. Rodmani* and *A. fabaceus,* any of which may be cultivated. It is not too much to hope that in time representatives of several other genera of the fleshy fungi may be cultivated for special purposes, but it is doubtful whether any species in culture would yield more abundantly than do the forms now grown. These species closely resemble one another in general characteristics and in life history, so that a description of a common type of *A. campestris* will define all with sufficient accuracy for the present purpose, and it will indicate in general the terminology of all the Basidiomycetes, that is, the class of fungi which contains the larger part of the fleshy forms.

Characteristics of Agaricus campestris (Fig. 2406).

The full-grown expanded plant is somewhat umbrella-like, with a central stalk (stipe) supporting a rather thick cap (pileus). The stem may be from 2 to 5 inches in height, about 1 inch in diameter, and above the middle there is typically a ring or annulus, but there are no other appendages about the stem. The cap bears on the under surface the gills, blade-like lamellæ reaching for the most part from near the stem to the periphery of the cap. When the cap of the young mushroom begins rapidly to expand, it breaks away from its attachment to the stem, and the veil of tissue which has hidden the gills from view is ruptured at the periphery of the cap, leaving the ring or annulus already mentioned. When the gills are first disclosed they are of a beautiful pink color, but with age they darken and ultimately become brown-black.

The coloration of the gills referred to is due chiefly to the formation of spores or propagative cells, in large number. If one places the cap of a maturing mushroom on a piece of white paper, gills downward, protecting the cap from rapid drying out, a perfect spore print of the brown-black spores may be made. The number of these produced by a single mushroom expressed in figures is too great to be adequately grasped. The spores are small ovoidal cells, as shown in Fig. 2407, and they are borne upon club-shaped structures termed basidia,—these being organs which are characteristic of the whole class of the Basidiomycetes. The entire surface of the parallel gills is studded with the basidia, each basidium bearing from two to four spores.

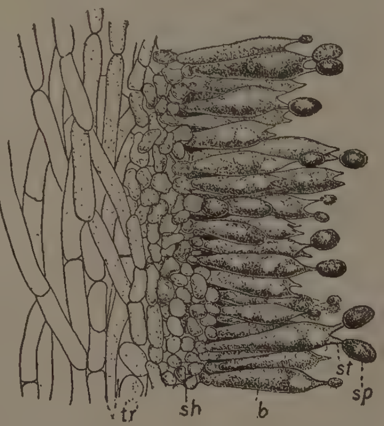
Vegetative and fruiting stages.

In the open the spores doubtless germinate, but the conditions for their germination are not so well understood that they can be readily duplicated in the laboratory. At any rate, germination of the spores yields a mycelium or thread-like growth that is characteristic of most fungi. The development and growth of the mycelium in rich earth, compost, or manure yields a characteristic "spawn," for "spawn" is merely the abundant development of the mycelium, or vegetative stage of the fungus, in any suitable substratum. In this connection it is well to note that the mycelium of other fungi may invade a great variety of substrata. Rich earth, the moist leaves of the forest floor, fallen timber, and even the trunks of living trees are all invaded by a variety of species, each having its particular growth-requirements. Fresh spawn of *Agaricus campestris* has a fine aroma of mushrooms combined with that of almonds. By this aroma alone it may be easily recognized, and therefore distinguished from the mycelium of common mould fungi. By pure-culture methods, mushroom spawn may also be developed from fragments of the tissue, as subsequently indicated. Spawn is appropriately called the vegetative stage of the fungus.

The mycelium not only absorbs from the substratum the necessary water, together with the organic and inorganic food materials necessary for its immediate growth, but obviously there is accumulated a considerable amount above the growth needs, which serves as a fine adjustment to the heavy demands for food made somewhat later when fruiting begins. With a vigorous development of spawn in earth or compost, fruiting, or mushroom formation, will proceed. At this time the threads of spawn become more strongly corded and matted, attended by the formation of spherical "pinheads," and the latter develop directly into the well-known "button" stages, the appearance and rapid development of which give such satisfaction to the novice in mushroom-growing. With the increase in size of the button and the differentiation of gills, there is next a rapid expansion of the cap and the elongation of the stem, followed by the rupture of the veil. The mushroom is then full grown, at which time the shedding of spores begins.

Mushroom-culture.

In times past, it has been the custom to regard mushroom-growing as more or less of a mystery. It was therefore considered impossible to lay down specific rules for the guidance of others. This was due primarily to the fact that there had been very little experimental work from which to deduce the principles on which successful culture depends. There is now no reason why an intelligent person should not be able to produce mushrooms successfully if he



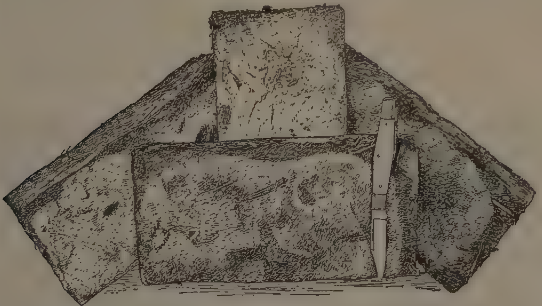
2407. Section of a gill of Agaricus campestris, enlarged: *tr,* trama; *sh,* hymenium; *b,* basidium; *st,* sterigma; *sp,* spore.

is able to give to his work the care and attention which would be bestowed upon the cultivation of delicate flowers or the rearing of poultry.

Within the past dozen years, sufficient has been done to demonstrate the fact that the general principles of production are comparatively simple. The limits of conditions permitting production are narrower than those usually applying to other horticultural crops, yet it is true that the principles in the one case are just as definite as in the other. To state this in terms of its causation, it may be said that many of the more important biological problems concerned in the growth of mushrooms are sufficiently understood to enable us to comprehend the meaning and relative values of the practices which have grown up about this industry, and in many instances to modify these practices advantageously. As a matter of fact, since mushrooms should be grown only in situations which permit the practical control of conditions—that is, of the substratum or compost, the amount of moisture, the temperature, and other factors of the environment,—it should now be, and in the hands of many growers is, a more certain crop than many others commonly regarded as table necessities.

It is no uncommon thing to hear the question asked, "Why is it not possible to produce mushrooms successfully in fields and lawns?" This question might be answered by anyone who reflects for a moment on the commercial success or failure of the pasture and lawn occurrence of mushrooms. One could predict that dandelions would be a successful lawn crop because whether one wills or no they are produced on our lawns in quantity, and sometimes they threaten to take possession where they may not be wanted. Mushrooms also occur in the lawn and field, but how sporadic and unreliable is the supply! One expects to find them in the early fall, but if they are not found, or occur in very limited quantity, it is easy to explain their absence on the ground of insufficient rain, unexpected cold weather, early summer drought, or other obvious causes. This merely indicates that mushrooms are not in any way commercially successful in such situations.

Mushrooms are indeed very sensitive to conditions, and commercial out-of-door culture is possible only in a region where the temperature conditions are fairly uniform throughout a considerable period of time. Moisture is not quite so important, because even in the open this often may be adequately controlled. Out-of-door culture is practised to a limited extent in England and in France, but in no section of the world is the common cultivated mushroom grown in the open successfully to compete with the product produced in mushroom-houses, cellars, or caves. Owing to the overwhelming importance of the indoor culture, therefore, it is only necessary to describe this as of commercial importance.

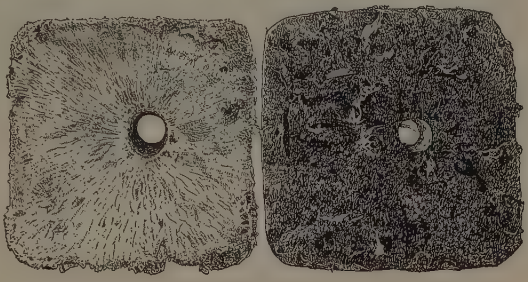


2408. Common commercial spawn of Agaricus campestris.

It was stated above that rules may be laid down for the cultivation of this crop. Rules must be in a measure arbitrary if they are to be successfully applied by the beginner. One who has mastered the principles may vary these advantageously for all changes of conditions. The more important factors involved in mushroom-growing, and about which recommendations must center, may be enumerated as follows: compost, spawn, temperature, moisture, and sanitation.

Compost.

Stable-manure furnishes the only satisfactory compost known for commercial mushroom-growing. By a suitable period of fermentation, or composting, the manure becomes more suitable for the growth of the mushroom spawn and less likely to support the succession of mould fungi which would otherwise first run its course. The manure should contain ample bedding material. Straw, shavings, and sawdust are used for this purpose; but straw is preferable from the mushroom-growing viewpoint, as it not only reaches in a short period of time a certain desirable stage of decomposition, but good straw makes likewise a substratum of excellent texture and water-holding capacity.



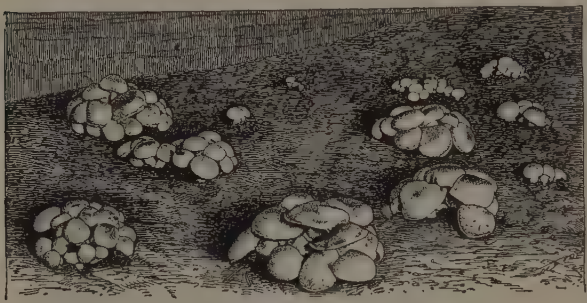
2409. Spawn of Agaricus campestris, pure culture.

When the amount of fresh stable-manure is sufficient, it should be wet and somewhat packed. In a few days the temperature will rise to perhaps 120° to 140° F., which is indicative of an active fermentation. The compost is then forked over, or "turned," care being taken to mix the outer with the inner material, and water is sprinkled upon it whenever needed to maintain the compost in a condition which is moist throughout. With straw manure, it is often sufficient to "turn" three times, but a somewhat longer fermentation is not harmful. The turnings may be after intervals of three to five days, the total time required for fermentation in summer being from eighteen to twenty days. When shavings and sawdust occur in some quantity, a longer interval will be required. As soon as the fermentation is complete the beds may be prepared, as described on page 2085.

Spawn (Figs. 2408, 2409).

Prior to 1903 no mushroom spawn had been made in the United States, the larger part of the spawn used being brick spawn imported from England. French flake spawn was also used to some extent. Pure cultures derived by the tissue culture method were first employed by the writer as a source of material for the inoculation of bricks in 1903. Since that time the brick spawn-making industry has become successfully established in this country. In fact, the enormous development of mushroom-growing within the past ten years has been due more to reliable spawn and to the dissemination of information explaining the growth-requirements of these plants than to all other causes combined.

The percentage of failures by amateur growers has steadily declined. It is not to be understood, however, that all failures are due to poor spawn. Still, when one hears the complaint that "the cellar was constantly at a temperature between 50° and 60° F., and not a mushroom appeared," one can be fairly certain that the spawn was dead. Other causes may determine a poor crop, but seldom no crop. In spite of the fact that reliable spawn is now made, some small dealers will, of course, continue to offer for sale old spawn which has lost all vitality just as they may offer old seeds. It is necessary to be even more careful in the purchase of spawn than of field or garden seeds. Experiments have shown that spawn stored under the conditions which usually prevail in the cellars or basements of seed-stores is seldom alive for more than one year after it is made.



2410. Mushrooms growing in a cellar.

Temperature.

The most favorable temperature for mushroom-production is about 54° F. Perhaps there is no appreciable difference between 52° and 56° F. More important as principles are the limits of temperature, and the effects of more or less heat than that mentioned. No one should attempt to grow mushrooms in any house or cellar where the temperature is constantly above 60° F. In the warmer atmosphere, all kinds of insects and other mushroom enemies will be active; in fact, insects that are practically torpid at 50° may be extremely harmful and multiply rapidly at 60° F. Apparently at 60° F. the spawn in the beds will be affected more or less by the growth of other organisms, the requisite humidity is not so readily maintained, and "fogging off" is frequent. Moreover, even if the higher temperature lasts only a few days at a time, the quality of the product will be affected. In hot weather the mushrooms are smaller, long-stemmed, and quickly expanded. At a temperature continuously 45° F., mushrooms will develop so slowly as to be unprofitable. A few days of low temperature is not in any sense injurious, for it merely causes delay in production. If one wishes to obtain particularly heavy mushrooms, this can be best accomplished by keeping the temperature fairly low, and occasionally permitting it to fall below 50° F. for a few successive days. Even light freezing does not kill the mycelium in the beds.

Moisture.

It has been noted that after the first watering when the stable-manure is being prepared for compost, the rule is "moist but not soaking wet." No better rule can be given. It is scientifically more accurate to say that the compost in the beds should contain about 60 to 65 per cent of its oven-dry weight of water, but the best practical test of 60 to 65 per cent is that when compressed firmly in the hand it will moisten the hand but drops of water will not be squeezed out with ordinary exertion. When the beds are cased, the surface soil must also be kept moist. Even if the compost below is moist, no satisfactory mushrooms will be produced in a dry soil. On the other hand, to keep the soil wet it is not necessary to drench the bed. The latter serves to make the compost too wet, and the soil may soon be dry again. In the ideal mushroom house, watering should be required to the extent of no more than one light sprinkling each day; but in small cellars or houses where the heating is by means of stoves, or other similar dry heat method, more frequent sprinkling will be required. The humidity of the atmosphere should be from 60 to 75 per cent. There should be a gradual but slow evaporation. Walls and ceiling may be conveniently sprayed, when necessary, with a Vermorel spray nozzle.

Sanitation.

Sanitation involves (1) good drainage and ventilation, (2) removal of all waste mushrooms, also the clotted and spent mycelium at the bases of mushroom clusters, and especially fogged specimens, and (3) the trapping of insects, whenever they become evident, as well as the regulation of conditions, if possible, so as to prevent their activity. Drainage is a minor matter if the application of too much water is assiduously avoided. Ventilation is particularly necessary in caves and low cellars. Waste mushroom material, whether on the bed or about the cellar, is a constant menace. When mushrooms are picked in clusters, the little buttons in the vicinity which are injured should be removed. All old bases of clusters should be lifted and a handful of fresh earth applied.

Where mushrooms may be grown (Figs. 2410, 2411).

Since the control of conditions is the essential point in the culture of these fungi, it is obvious that mushrooms may be grown in any house, cellar, or cave which will permit the regulation of moisture and temperature, and incidentally of ventilation. It is not the purpose of this article to attempt the discussion of the various types of construction which may be employed in the erection of suitable houses for mushroom work. Any kind of building material may be used, but since a considerable amount of water is necessarily employed, it is well to provide against "sweating," and the drip which accompanies this. As a rule, an air-space in walls is an effective preventive of this condition. The ceiling of the mushroom house may be high or low, depending upon the number of tiers of beds to be used. When it is desired to place the beds on the floor only, the ceiling should be as low as will permit men to work comfortably; for the additional air-space above the bed will be disadvantageous with regard to the control of both heat and moisture. Persons who are making a first trial with mushroom-growing, or those who intend to use a small amount of space for the production of a small quantity intended merely for home consumption, will preferably choose for the purpose any cellar, shed, or other space which may be available. Such space may be adapted more or less

2411. Mushroom-growing in a portland cement cave.

to the special use to which it is put by temporary partitions, false floors, or by other means which will suggest themselves. In those cases in which cellars or caves are used, it is important that there shall be good ventilation. So-called "stagnant" air is almost as bad in mushroom-growing as in greenhouse work. In such air, moreover, the mushrooms will tend to become long-stemmed and the caps will be relatively small. The amount of ventilation will depend upon circumstances, but in all cases it should be sufficient so that there will be a constant, but slight drying of the beds from day to day, requiring occasional sprinkling. There are probably only a dozen places in the United States where mushrooms may be grown advantageously in mushroom beds in the open, and this is primarily due to the variability of the temperature, but partially also, to the difficulty of maintaining the requisite humidity.

Preparation and care of beds.

When the stable-manure has been composted for a period of eighteen to twenty days, it will have lost practically all objectionable odor, the temperature will probably have fallen to 120° to 130° C. (248° to 266° F.), and the texture will be adhesive or oleaginous. In this condition, it may be made into beds. The type of bed commonly employed in the United States and England is a flat bed from 6 to 8 inches deep, and from 2½ to 4 feet wide, depending upon whether it is accessible from one or from both sides. In France the ridge bed is more commonly employed. Somewhat more labor is required in the construction of the latter, but the surface area is considerably increased. The ridge-bed system is seldom employed when the beds are arranged in tiers. It is far more applicable to the growing of mushrooms in caves or cellars. The use of flat beds in tiers, or in the nature of shelves, will often permit one to multiply to the extent of four- or five-fold the amount of available space.

The compost is thrown into the space to be occupied by the bed, arranged as required, and immediately "firmed." The beds should not be hammered down with a wooden mallet as is the custom with some growers. Usually the temperature of the bed rises after the first day, and the maximum is promptly attained. Within a few days the temperature will begin to fall and the bed may be spawned at 70° to 75° F., with the temperature on the decline. In no case should the amateur grower attempt to spawn his beds when the temperature is above 75° F. It does no harm at all to spawn at 60° to 70° F., but a growth begins somewhat more rapidly at the temperature first mentioned. Within a week or so, the temperature should fall to that which has been mentioned as normal for mushroom-growing, that is, about 54° F.

When brick spawn is used, each brick may be broken into about twelve pieces, and one piece will be required for each square foot of bed space. Insert each piece from 1 to 2 inches below the surface, holding it with one hand while pressing the compost firmly about it with the other hand. In the course of about ten days the new growth should become evident about each piece of spawn, and when an examination of the bed discloses this fact, the bed may be smoothed and again firmed, or slightly compressed, such that a person might stand on it without sinking in the substratum more than from 1 to 2 inches. If there has been any drying of the surface layers, the beds should be sprinkled, and it is then ready for the "casing" of loamy soil. A good casing soil is an ordinary light loam, but almost any good garden soil is serviceable for this purpose. The presence of a considerable amount of woods mold in the soil is to be avoided. The soil is applied evenly to a depth of 1 to 1½ inches, and it should be firmed as applied.

Subsequent to the casing, the beds will require no attention except with respect to the regulation of temperature and moisture. The soil should be kept constantly quite moist, but water should never be applied copiously while the spawn is spreading. Employing good spawn, mushrooms should begin to appear in six to seven weeks, although a longer period of time may be required if sawdust or shaving compost has been used. Under uniform conditions, mushrooms will appear quite regularly all over the bed, and they will, especially at first, have a tendency to come in flushes. When the first flush has been picked, there may be an interval for that bed of several days, or a week, before a second flush will appear.

In harvesting mushrooms, it is usually best to take them before or just at the time that the veil begins to break. At about this time they will have attained their maximum weight, and they make a far better appearance than later. The common method of harvesting requires the operator to take hold of the cap firmly, twisting it slightly, as a result of which the mushroom is often removed from the bed without cutting. When, however, the mushrooms grow in clusters, the assistance of a knife is needed; and it is often possible to remove those sufficiently developed without endangering the growth of smaller ones in the cluster. In preparing the product for the market, the basal portion of the stem is cut off, and the plant is brushed with a medium-sized paint-brush so that it is made free from soil-particles. The best markets require that the product shall be graded into large, medium, small, and old mushrooms. Small growers, however, can seldom afford to adopt this system, and they should cut with such regularity as will insure a fairly uniform size.

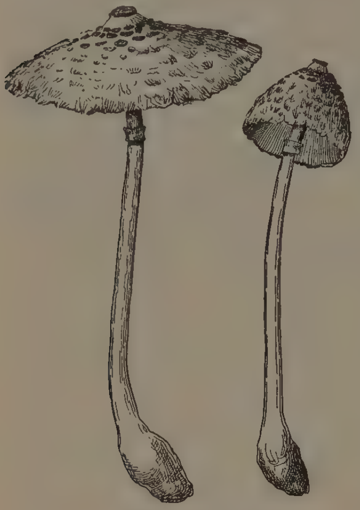
Mushrooms, families of.

The cultivated mushroom is one type of the Agaricaceæ, a family in which the spore-bearing, or fruiting surface (hymenium) is in the form of leaf-like plates, or gills. The spore prints of the fifty or more genera of this family vary in color from near black through all shades of brown and ochre to pure white.

Agaricus campestris, the common cultivated mushroom, or field mushroom, has already been described. It is important to note for this, as for all species of the genus, the brown-black spores, the central stalk, the characteristic ring or annulus, and the gills changing from pink or light brown to brown-black free from the stem. In general, *A. campestris* possesses a simple ring, the stem is fairly uniform in diameter, and the cap varies from a cream-color to various shades of brown or gray-brown. The upper surface is usually smooth, but with alternate wet and dry weather or, as a result of the growth in rooms with variable artificial heat, it may be broken into more or less diamond-shaped areas exposing the white flesh. There are probably several cultivated varieties of this species, but it is often difficult to determine whether a given variety in culture belongs to this or to some related species. Three trade forms—based largely on color—are generally recognized, but within these color limits there are undoubtedly many varieties. The three trade names referred to are: "Alaska," relatively small, white or very light gray forms; "Bohemia," large brown varieties, one of which at least may be *A. campestris;* and "Columbia," which is the name for the large cream-colored forms which may apparently be referred to one of several species.

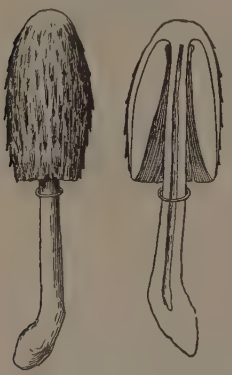
Agaricus arvensis, ordinarily known as the horse mushroom, has much the same season and habitat as *A. campestris*, and forms occur which seem to be intergrading. Typical forms of the horse mushroom are larger and stouter than the field mushroom and distinguished from the latter by the possession of a double ring. There is some diversity of opinion regarding pileus (color) characters; but in any event there would appear to be several varieties in cultivation which may be properly referred to this species. Under cultivation the writer has been unable to find any better flavor in *A. campestris* than in *A. arvensis*. *A. Rodmani* and *A. villaticus* are closely related to *A. arvensis* and *A. campestris*, but there is some doubt as to whether either of these should be regarded as distinct species.

Agaricus fabaceus (*A. subrufescens*) is the almond-flavored and almond-fragrant mushroom, sometimes found in greenhouses or in flower-beds. This species is readily distinguished by (1) the long-persistent membranous veil, the lower surface of which is covered with soft frosty scales; (2) the red-brown to gray-brown (with age) pileus; and the enlarged lower part of the stem. It has been cultivated, but requires a higher temperature than *A. campestris* and is said to be less prolific. It deserves further trial. The spawn grows vigorously in the usual bricks. *A. placomyces* is a woodland species, and it is sometimes found from early summer until late fall. The cap is large, flat, and thin, appearing smoky above from the presence of numerous small, dark scales, which are closer together near the center. The veil is like that of *A. arvensis*, and the base of the stem is enlarged. The writer has made spawn of this species, and cultivated it in small quantity.


2412. Lepiota procera. Parasol fungus. (×⅓)

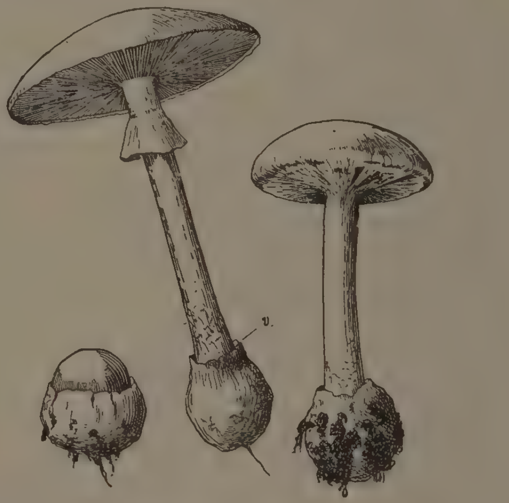
Agaricus silvicola, also an inhabitant of woods, is almost pure white except as to gills. It is sometimes tinged with yellow, and is always a rather small species, occurring in the summer. Its value in cultivation could be only with relation to its resistance to high temperature.

The question of temperature-resistance is an important one, however, and the discovery of an acceptable edible species which might be grown at from 60° to 70° F. would make it possible to extend the mushroom-growing season to ten or eleven months.


2413. Coprinus comatus (Horsetail mushroom).

Coprinus.—Aside from Agaricus, Coprinus is the only other genus of the Agaricaceæ with black spores which is sufficiently important from an economic standpoint to require consideration. The genus is characterized more particularly by the deliquescence of gills and other parts of the pileus at maturity to an inky black liquid. There are three edible species of common occurrence, appearing usually in lawns in the spring. *C. comatus* (Fig. 2413), the shaggy-mane mushroom, is the largest, and one of the best of the fungi. The whole plant is often 6 inches in height, with a cylindrical cap frequently not less than 3 inches long and 1½ inches in diameter. The name is derived from the shaggy scales on the pileus. As the plant approaches maturity the gills are of a salmon-color and there is a free or movable ring. *C. atramentarius*, the true ink-cap, is a shorter form than *C. comatus*, and it commonly occurs in clusters. The shorter, oval cap is slaty gray in color, due to the background of dark gills showing through the hygrophorus tissues. *C. micaceus* is much smaller than either of the preceding, and occurs often in solid phalanx covering several square feet of space about old stumps or over decaying roots. When young, the tan-colored cap is covered with temporary, glistening scales, like minute particles of mica. The only disagreeable feature about the Coprini is their deliquescence, but they are of fine flavor and quality, if eaten fresh.

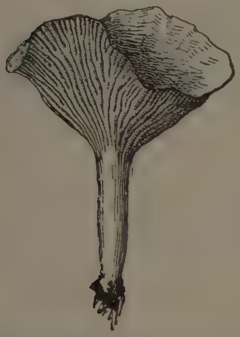
Lepiota.—The genus Lepiota corresponds to Agaricus in general characteristics, except that the spores in the former are white. There are many species of this genus, of which the more important are *Lepiota procera* (the parasol mushroom) and *L. naucinoides*. Both are found widely distributed in lawns, fields, or meadows. The parasol mushroom is one of the most conspicuous of the edible agarics, standing frequently 10 inches high with a pileus often 5 to 6 inches in diameter, reddish brown in color, with darker blotch-like scales. The stem is delicate except for the bulbous base. The ring is large and free. *L. naucinoides* in prime condition is usually pure white. It is about the average size of the cultivated mushroom, but with a thinner cap and a stem more slender, thickening toward the base. One who is not an expert should remember that the deadly amanita is also white. See *Amanita*, below.



2414. Amanita phalloides, poisonous. V. volva. (×⅓)

Armillaria mellea, the honey agaric, commonly brownish yellow in general appearance, is typically an autumn plant growing in clusters about stumps and the bases of trees, or appearing through the sod over decaying roots. It is one of the more abundant mushrooms in wooded sections. In form this plant differs from Lepiota largely in the fact that the gills are attached to the stem. The spores are white but the gills become discolored with age. This species is parasitic on a number of trees. The mycelium develops a characteristic cord-like, or rhizomorphic stage. This plant is acrid and disagreeable raw, but cooked it is said to be of good flavor.

Amanita.—The genus Amanita is interesting for two reasons: (1) because it contains some handsome species, which are quite likely to attract the attention of every beginner in identification; and (2) because among these species there are several which are the most deadly poisonous of all mushrooms. Unless one is an expert, therefore, it is well to learn the characters of the genus in order to avoid any inclination toward using them for food. The genus contains, it is true, several edible species, and when one knows them there is no danger. Amanita possesses all of the general characters of Lepiota, likewise certain additional ones which serve clearly to distinguish it. The white spores (and usually white gills), the annulus, and gills free from the stem are just as in Lepiota; but there is in Amanita also a volva, or universal veil, which in the mature mushroom appears usually as a cup at the base of the stem, and sometimes remnants of it are carried up by the pileus as frosty scales. In the button stage this universal veil is an outer skin or envelope, and as the plant expands it bursts through the envelope leaving more or less of a cup, or at least a basal ring, at the base; and if the upper part of the envelope adheres to the cup, it is broken into mere scales, or frosty patches, as the pileus grows. Now if one pulls up an Amanita carelessly, the volva might not be detected. On the other hand the ring, or veil, might be broken, and then with a volva and no ring the plant might be mistaken for an Amanitopsis—a genus with many edible species. Young stages in meadows have been mistaken, indeed, for buttons of *Agaricus campestris*. The *Amanita phalloides*, deadly amanita (Fig. 2414), is widely distributed in the United States, occurring especially in woods and meadows. The plants may attain a height of 6 inches and a pileus diameter of 4 inches. In general appearance it might be mistaken for a Lepiota, especially *L. naucinoides*, as some forms of the species may be entirely white. As a rule, however, the upper surface of the cap is grayish, brownish, or greenish. Usually, there are no scales, at any rate no small scales, on the cap, and the volva is cup-like. *A. verna*, the destroying angel, is a pure white plant, regarded by some as one of the white forms of *A. phalloides*. *A. muscaria*, the fly agaric, is only somewhat less poisonous than those above mentioned. It is one of the handsomest mushrooms of the forest. The plant may be larger than *A. phalloides*, and the cap varies from yellow to orange-red in color, with frosty or creamy white scales or patches. In this species the volva is not so prominent, since the universal veil breaks transversely into a number of small incomplete rings, which remain at the base of the somewhat bulbous stem in the form of interrupted rings of scales. The gills and stem are white. *A. Cæsarea*, the royal agaric, has also an orange-red cap, but in this species there is a very definite cap-like volva, and the gills of the plant are yellow to orange. This species has been much prized since the earliest historical times, but no one should attempt to use it who is not able clearly to distinguish the different species of Amanita.



2415. Cantharellus cibarius (chanterelle). Edible. (×⅓)

Tricholoma personatum, the masked tricholoma, is a representative of a genus differing from Lepiota in possessing no ring, and further in having the gills attached to the stem, yet notched near the point of attachment. This species is usually pale violaceous or lilac when young, and the pileus is plane or distinctly wavy. The flavor is esteemed. It has been cultivated in experimental beds.

Clitocybe.—In this genus the spores are white and the gills are not only attached but decurrent upon the stem. *Clitocybe velutipes* grows in clusters about stumps and trees, and is readily recognized by the bright red-brown viscid pileus, the pale yellowish gills, and the dark stems clothed at the base with a growth of hairs velour-like in texture. This fungus is a late fall and winter mushroom, prized by many, in spite of an apparent toughness in the raw state.

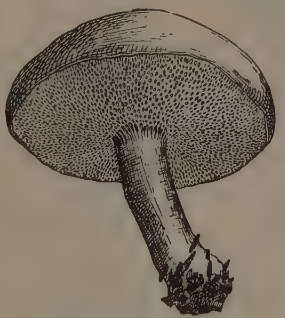
Pleurotus.—The members of this genus which are of special interest horticulturally grow on decayed places in the trunks of trees, or on logs, and they are readily distinguished from all other white-spored agarics by the excentric stem. It is typically a clustered mushroom—the clusters being sometimes of enormous size. The plants are white or lightly tinted, and the gills are generally decurrent. *Pleurotus ostreatus*, *P. sapidus*, and *P. ulmarius* are the commoner large species, all of which are edible, but not keenly sought.

Lactarius, the mushrooms which yield a milky juice when the gills are cut or injured, is represented in our woods by several species, of which the commoner edible ones are *Lactarius deliciosus* and *L. volemus*. In form these plants are much like a Clitocybe, but the gills are not strictly decurrent. *Lactarius deliciosus* is yellow-buff or light orange, mottled with darker spots or zones, and the juice is orange-colored. The plant is often about 4 inches high and the pileus about 3 inches in diameter. *L. volemus*, a somewhat smaller plant, is of uniform color, brown-orange, or tawny, with white juice. The peppery lactarius, a large white species, is very acrid. Closely related to Lactarius is the genus Russula,—lacking the milky juice,—of which many species with pilei white, greenish, violaceous, or red are found in our woods in summer and early autumn.

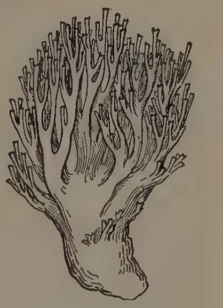
Cantharellus cibarius (Fig. 2415), the chanterelle, is one of a group the members of which are barely agarics, for the gills are often almost vein-like, rounded on the margin and often reticulate. The chanterelle is uniformly yellow to orange in color, small, more or less unsymmetrical in form. It is also an inhabitant of the woods, and it is much used as a vegetable food in Europe.

Other Basidiomycetes.

It has been indicated that the larger part of the fleshy fungi are included among the Basidiomycetes, and while the Agaricaceæ furnish the greater number of forms of paramount interest to the average layman, nearly all families of these fungi contribute showy or edible species—and some families numerous species. In the Polyporaceæ and Boletaceæ the spore-bearing surfaces are in the form of pores. In the genus Polyporus the plants are tougher in texture than those usually edible, and the larger number grow on wood and trees—some causing the more destructive diseases of wood and timber. One of the edible forms frequently observed and most conspicuous is *Polyporus sulphureus*, which forms immense clusters of sulfur-yellow and orange, bracket-like sporophores on a variety of trees and stumps. Many species of Boletus are edible, but some are to be avoided, and



2416. Boletus subtomentosus.



2417. Clavaria aurea.—Coral fungus. Edible. (×½)

some positively toxic. *Boletus edulis* (la cèpe, der Steinpilz) probably furnishes more than any other one species of the fresh wild fungi sold on the markets of European cities. *Boletus subtomentosus* (Fig. 2416) is not poisonous, but is of inferior quality.

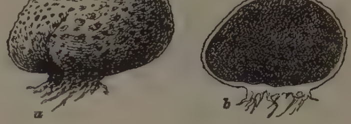
Fistulina hepatica, often known as the beefsteak mushroom, is a juicy, fleshy species with red pileus. The plants are bracketed, and grow from the stumps of several hardwoods. The fungus is prized by many, and while widely distributed it occurs sparingly.

The Hydnaceæ are characterized by a spore-bearing surface spread over teeth or spines arising either from a cap-like pileus or from a tubercular or much-branched structure. Among the edible species *Hydnum repandum* possesses a pileus and true stem. It is of a smoky color and occurs in the autumn on the ground in moist woods. *H. coralloides* (coral hydnum) and *H. erinaceus* (satyr's beard) are both delicate white or creamy fungi—both found in the autumn, on logs or trees.

2418. Lycoperdon craniforme.

In moist wooded places there appear in the late summer and early fall along with Boletus, Russula, and other species, several members of the Clavariaceæ (stag horn or fairy club fungi). In this family the spores are borne over the whole horn or club-like body. These are of various colors from buff to orange or sooty gray. All species which are of sufficient size to be usable are considered edible. *Clavaria aurea* (Fig. 2417), *C. formosa,* and *C. botrytes* are among the larger forms. In the Thelephoraceæ, which include species more or less leathery in texture, the spores are on the lower or outer surface, where that may be distinguished. The horn of plenty, *Craterellus cornucopioides,* a smoky-blue horn-shaped species, is practically the only edible species of interest in this family. The gelatinous fungi, including the Tremellaceæ and allied families, are not of sufficient interest to require special description.

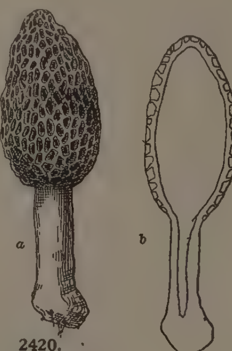
Among the Basidiomycetes in which the spores are differentiated internally, or remain long covered, the puff-balls (Lycoperdaceæ) furnish a number of species of economic importance. All of these plants with white flesh are edible, and some are valuable food accessories. They should be eaten only so long as the flesh is white, and when discolored with age—normally due to the formation of the spores—they must be discarded. The largest species, *Lycoperdon giganteum* (giant puff-ball), frequently attains a diameter of 16 inches, while specimens over 2 feet in diameter have been reported. This species occurs in gardens and meadows. The flesh is pure white until practically full size is attained. *Lycoperdon cyathiforme,* the beaker-shaped puff-ball, is common in pastures in the fall. In the young stages the plants vary in color from creamy white to pink-brown, with white flesh. With the formation of spores it becomes purplish throughout, and leaves a purple beaker-shaped sterile basal part. This is perhaps the puff-ball of highest flavor, and consequently the one which should be known by all persons interested in edible mushrooms. *Lycoperdon craniforme* (Fig. 2418) is found in meadows or in open woods. At maturity the plant shrinks, and may become considerably furrowed, from which character the specific name is derived. Resembling smaller members of the Lycoperdaceæ externally is a fungus, *Scleroderma vulgare* (Fig. 2419), which is black within, tough and inedible.



2419. *a,* **Scleroderma vulgare;** *b,* **section of same.** (×½)

Ascomycetes.

While the larger part of the flesh fungi belong to the Basidiomycetes, nevertheless the few families of the Ascomycetes furnish some forms of special interest. The family Helvellaceæ includes the genus Morchella (morels), as well as Helvella (saddle fungi) and Gyromitra (contorted saddle fungi). There are several species of morels often appropriately called sponge mushrooms, the latter designation being given both on account of the color of the plant and the porous character of the pileus. The morels are widely distributed in the United States. All appear after the warm rains of the spring. They constitute, therefore, about the earliest edible mushrooms. The season is often limited to one or two weeks of favorable weather. *Morchella esculenta* (Fig. 2420) is a common species, and one which appears to be *M. crassipes* is frequently found in the Central States at least. The tuber family (Tuberaceæ) includes all truffles, very aromatic subterranean fungi found for the most part in southern Europe, and there constituting a considerable article of commerce. The mycelium of these plants is associated with the roots of certain trees and shrubs, especially oaks. The species most highly prized are *Tuber melanosporum,* the typical French or black truffle, sometimes called the Périgord truffle, which is commercially much more important than all other species combined; *T. æstivum,* which is the summer truffle of France; and *T. magnatum,* a large smooth species with onion-like flavor, which is the commoner form in Italy. The terfas, or false truffles (Terfeziaceæ), are also subterranean fungi found associated with the roots of certain species of Cistaceæ and Compositæ. The regions of their occurrence are primarily semi-arid sections of northern Africa and localities in the Asiatic Mediterranean country. They are apparently the truffles of ancient times. The plants are spherical or ovoidal in form, and at maturity they have a general resemblance in size and texture to a potato.



2420.
Morchella esculenta. (×¼

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B. M. Duggar.

MUSÌNEON (a name for fennel, another plant of this family). Spelled also *Musìneum* and *Musènium*. *Umbelliferæ*. Four species of resinous perennial herbs in Cent. and W. N. Amer., stemless or branching, decumbent or ascending, 2–12 in. high. Lvs. pinnately decompound: fls. yellow or white, in compound naked umbels: fr. ovate or ovate-oblong, somewhat compressed laterally; ribs 5, filiform, slightly prominent, with 2 or 3 oil-tubes in the intervals.

Hoòkeri, Nutt. (*M. trachyspérmum*, Nutt.). Decumbent or ascending, scabrous: lvs., except the radical, opposite, bipinnatifid: fls. yellow: fr. scabrous. Spring. Colo., north.—Procurable from dealers in western native plants.

MUSK. The common musk plant of the gardens is *Mimulus moschatus*, an American plant. The wild musk plant of Europe, however, is *Erodium moschatum.*

MUSK HYACINTH, or GRAPE HYACINTH: *Muscari moschatum.*

MUSK MALLOW: *Hibiscus Abelmoschus* and *Malva moschata.* The musk seed of commerce is *Hibiscus Abelmoschus.*

MUSKMELON: *Melon.*

MUSSÆNDA (a native name in Ceylon). *Rubiàceæ.* Warmhouse or greenhouse plants grown for the flowers and the colored floral bracts or calyx-leaves.

Erect or climbing shrubs or undershrubs, sometimes herbs: lvs. opposite or in 3's, with stipules between, sessile or petiolate: fls. in terminal cymes, yellow, scarlet or white, the corolla tubular and usually funnel-shaped above and the lobes 5; calyx with an oblong or turbinate tube, one of the 5 lobes usually enlarged (in the cult. species) into a white or colored petioled lf. which may make the plant worth cult.; stamens 5, on the corolla-throat or -tube; ovary 2-celled, the style filiform and the stigmas 2: fr. a fleshy many-seeded berry, with an areole at top.—Species probably 40, in the tropics of Afr., Asia and Polynesia. The few species that are sometimes grown are of easy cult.; prop. in spring by cuttings.

A. *Enlarged calyx-lobe or sepal white.*

frondòsa, Linn. Variable species: low erect shrubs, hirsute or glabrate: lvs. either petioled or sessile, oblong to ovate, acuminate; stipules variable, often 2-parted: fls. yellow, the corolla pubescent or hirsute; calyx with an orbicular or elliptic white leafy lobe: berry obovoid, glabrous, with broad areole. India. B.M. 2099 (as *M. pubescens*).

Sanderiàna, Ridley. Compact in habit, 5–6 ft., sometimes prostrate: lvs. close-set, nearly sessile, lanceolate, cordate, silky hairy: fls. yellow, small and tubular, in numerous terminal cymes; petaloid calyx-lobe white, more than 3 in. long, silky-hairy, very showy. Indo-China. G.C. III. 52:228.

AA. *Enlarged calyx-lobe or sepal red.*

erythrophýlla, Schum. & Thonn. Climber or trailer (or apparently sometimes erect), 30–40 ft., the shoots pubescent: lvs. ovate, acuminate, about 6 in. long, with about 10 lateral veins either side the midrib: fls. to 1½ in. long, in dense pedunculate cymes; calyx-tube very short, the lobes red and hirsute and one of them usually produced into a bright vermilion roundish lf. 2–4 in. long; corolla-tube cylindrical, red-hairy, the rounded apiculate lobes white or yellowish inside: fr. nearly or quite 1 in. long, egg-shaped, red-hairy. Trop. Afr. B.M. 8222. G.C. III. 50:91. Gn.W. 4:553.

M. lutèola, Delile. Slender erect twiggy shrub, pubescent: lvs. to 2 in. long, ovate-lanceolate to oblong-lanceolate, acuminate, thin, entire: fls. in 3's in few-fld. cymes, long-tubed, yellow; leafy calyx-lobe white or yellowish, ¾in. or less long, oblong or ovate-cordate. Trop. Afr. B.M. 5573.—*M. Treùtleri*, Stapf. Shrub, somewhat pubescent: lvs. ovate to ovate-elliptic, short-acuminate, to 12 in. long, entire: fls. orange, in many-fld. dense terminal clusters; leafy sepal or calyx-lobe white, shape of the lvs. Trop. Himalaya. B.M. 8254.

L. H. B.

MÚSSCHIA (named after Jean Henri Mussche, of the botanic garden at Ghent). *Campanulàceæ.* Two large robust subshrubs or perennial herbs in Madeira, sometimes grown by amateurs: lvs. radical and cauline, the former large and dentate and the latter few and small: fls. rather large, yellow, or fulvous, in pyramidal panicles; calyx-lobes 5, somewhat foliaceous, colored like the corolla or purple; corolla-tube short, cylindrical, with a 5-lobed spreading or recurved limb; stamens 5, free from the corolla; ovary inferior, 5-celled, many-ovuled, the stigma 5-lobed: caps. opening by numerous transverse lateral slits.

M. aùrea, Dum. (Campanula aurea, Linn. f.). Herb, stemless or developing a st. a few inches high, with thick and fleshy roots, smooth and shining: lvs. in radical tufts, elliptic or elliptic-oblong or lanceolate, serrate: corolla yellow; calyx deeper yellow. B.R. 57.—*M. Wóllastonii*, Lowe. Shrubby, pubescent, the st. simple or somewhat branched: lvs. obovate-oblong, thin and flaccid, sharply serrate: fls. dull dark brownish green or purple. B.M. 5606. G.W. 2, pp. 362, 363.

L. H. B.

MUSTARD, species of Brassica (which see), chiefly *B. alba*, *B. nigra*, *B. juncea* and *B. japonica*. There are two types of mustard-growing,—for the leaves, which are used as a vegetable; for the seeds, which yield oil and are used as a condiment. Table mustard (the flour) is the product mostly of *B. nigra* (Fig. 636, Vol. I), although seeds of *B. alba* and *B. juncea* are also used for making it. The mustards often become prolific weeds, particularly in grain-fields; they are now controlled by herbicides (see *Weeds*). In California, *B. nigra* covers thousands of acres, thriving best on heavy adobe soils. When the winter rains come, it grows lustily, reaching 16 feet high and more. The bulk of the mustard sold in the United States comes from the county of Santa Barbara, Lompoc being the center of the supply.

As a culinary vegetable, mustard is used for "greens" (which see). For this purpose, the large soft basal leaves are desired. These leaves grow best in early spring, although they do fairly well in autumn. If sown late in the season, the plant makes few bottom leaves and runs quickly to seed. Perhaps the best of the mustards for greens in this country is *B. japonica* (Fig. 634, Vol. I), a species which has long been grown in this country, but which has no other well-known name than "mustard." This often seeds itself and comes up the following spring. Some of the large-leaved forms of Chinese mustard (*B. juncea*, Fig. 635) are excellent, and should be better known. One of the oriental species (*B. napiformis*) makes an edible turnip-like root (Fig. 632, Vol. I). Mustard needs a rich quick soil for the producing of the best foliage. Sow the seeds in drills 1 foot or more apart, and thin to 6 inches in the row.

L. H. B.

MUTÍSIA (named after Jos. C. Mutis, 1732–1808 or 1809, botanist of South America). *Compósitæ.* Showy-flowered shrubs, those in cultivation being tendril-climbers; greenhouse or planted out.

Erect or scandent, in cult. likely to be herbaceous, glabrous or tomentose: lvs. alternate, simple or pinnate, the midrib usually produced into a tendril: heads large, heterogamous, usually long and the involucre cylindrical or campanulate, solitary on the ends of branches, the few rays purple, rose-colored or yellow; ray-florets in one series, pistillate; disk-florets hermaphrodite, fertile or sterile; receptacle naked, nearly flat: achene angular, turbinate or oblong, crowned with rigid plumose pappus bristles in one series.—Species about 60, in S. Amer., tropical and extra-tropical. The mutisias have never been popular, although long known to cult. They are plants of attractive habit and showy heads. Some of the species need warmhouse treatment, but the following require cooler treatment, and are probably adaptable to growing permanently out-of-doors in the southern limits of the country. Prop. by cuttings.

A. *Lvs. pinnate.*

Clématis, Linn. f. Climbing herb, rather woody, woolly-pubescent: lvs. pinnate, the rachis extended into a tendril; lfts. 4–5 pairs, short-stalked, oblong-lanceolate, mucronate, entire: heads long-pendulous, oblong-cylindrical, nearly 3 in. long and more than 2 in. across the rays, the latter 9–10, bright red, recurved. Trop. Andes. B.M. 8391. G.C. III. 45:415; 54: suppl. Nov. 29 (colored).—A very vigorous grower, making a good cool greenhouse climber.

AA. *Lvs. simple.*

ilicifòlia, Cav. Climbing slender shrub glabrous or cobwebby: lvs. 1–2 in. long, sessile, cordate or auricled at base, oblong, spiny-toothed and stiff, bright green above, the apex of the blade truncate or 2-lobed, the tendril stout: heads peduncled and solitary in the axils, 3 in. diam., the 8–12 rays pale pink or purplish (pale mauve as described by some). Chile. B.M. 6009. G.C. III. 50:449; 54:383.—The ilex-like foliage is interesting.

decúrrens, Cav. Climbing, the sts. somewhat branched, glabrous: lvs. remote, oblong-lanceolate and entire, acuminate, dark green above and glaucous beneath, tendril bifid, the base of the blade decurrent: head solitary, 4½ in. across, the rays brilliant orange. Chile. B.M. 5273. F.S. 23:2408. G.C. III. 50:451, 452. Gn.W. 24:784.—Perhaps the best species. L. H. B.

MYALL: *Acacia.*

MYÓPORUM (Greek words referring to the translucent resinous dots in the leaves). *Myoporàceæ.* Coolhouse shrubs, more or less heath-like, grown for the small white or purplish flowers; some are trees.

Erect and tall, or diffuse, glabrous or glutinous: lvs. alternate, rarely opposite, entire or toothed, with pellucid glands: fls. axillary, usually clustered, small or medium-sized, mostly white; calyx 5-cut or 5-parted; corolla somewhat bell-shaped or funnel-shaped, the tube very short or long; lobes usually 5, nearly equal or the anterior perhaps larger; stamens 4, or sometimes 5–6; ovary 2–10-celled: fr. a small more or less succulent drupe.—Species 25–30, Austral., New Zeal., China, Japan, Pacific Isls. The genus is divided by Bentham & Hooker into 5 sections based on the shape of the fls., the number of the corolla-lobes and stamens, and the number of cells in the ovary. Usually the calyx-segms. are small and narrow, but in one section they are leafy. One of the species (known in cult. as *M. parvifolium*) was once a favorite heath-like plant in France. In 1883 it was stated in the Garden that for 20 years many thousand plants of it had been sold annually in the flower-markets of Paris. One grower always had a stock of 30,000 plants. The plants were grown in small pots for room and window decoration in spring. "It is most beautiful as seen with its pale green branches drooping gracefully around the pot sides, and more especially so when the shoots are wreathed with sweet, snow-white blossoms." Prop. by cuttings taken in spring. This species is practically unknown in Amer. Some of them are said to be useful in Calif. for planting near the seacoast. The American gardener may get some general suggestions from the experience recorded under *Epacris* and *Erica*.

A. *Tree of some size.*

sandwicénse, Gray. BASTARD SANDALWOOD, from the sandalwood odor of the wood. NAIO. "A very handsome tree which reaches a considerable size" (Rock): lvs. crowded toward the ends of the branches, alternate, elliptic-lanceolate or oblong-lanceolate, acute or acuminate, fleshy when growing at the seacoast or low elevations, to 6 in. long, entire or serrate, the young ones viscous: fls. white or deep pink, in clusters of 5–8: drupe dry or somewhat fleshy, globose or ovate, white. Hawaiian Isls.; offered in S. Calif.—"Its thick bark is of a dark gray color and deeply irregularly corrugated." Sold as a substitute for sandalwood.

AA. *Shrubs, or the second one sometimes a small tree.*

B. *Lvs. linear or nearly so.*

parvifòlium, R. Br. (*M. álbum,* and *M. rosmarinifòlium,* Hort.). Procumbent shrub: sts. 2 ft. long or more: lvs. ¾–1 in. long, linear or linear-spatulate, thick, sparingly dentate toward the apex: fls. with rather acute lobes which are woolly within. Austral. B.M. 1693. L.B.C. 9:837. Gn. 24, p. 361. R.B. 25:253. G.W. 12, p. 150. V. 7:20.—Not advertised in Amer.

BB. *Lvs. lanceolate to obovate or elliptic.*

lætum, Forst. f. (*M. perforàtum,* Hort.). Shrub or small tree: lvs. 2–4 in. long, lanceolate or obovate-lanceolate, acute or acuminate, finely serrate above the middle, bright green, shining, almost fleshy: fls. small, 2–6 in a fascicle, white spotted purple, 4–9 lines wide, with rounded lobes, which are hairy inside. New Zeal.

acuminàtum, R. Br. Erect glabrous shrub, very variable: lvs. alternate, from elliptic-oblong to lanceolate or linear, somewhat acuminate, to 3 in. long, entire or very few-toothed: fls. in clusters of 2–4 or somewhat more, or solitary, white, the corolla almost campanulate and about ⅓in. long, bearded within, the lobes shorter than the tube: drupe ¼in. or less in diam., almost globular. Austral.; cult. in Calif.

serràtum, R. Br. Erect or somewhat diffuse shrub, usually glabrous, exceedingly variable: lvs. elliptic-oblong or lanceolate, obtuse or acute, more or less serrate or entire: fls. usually smaller than in *M. acuminatum,* white and purple, the corolla-lobes usually as long as the tube. Austral.—Offered abroad.

M. píctum and *M. verrucòsum* are mentioned in lists, but their botanical standing is uncertain.

WILHELM MILLER.
L. H. B.†

MYOSOTÍDIUM (Greek, *like* a *myosotis* or forget-me-not). *Boraginàceæ.* GIANT FORGET-ME-NOT. A monotypic genus confined to the Chatham Isls., off New Zealand, a promising blue-flowered herb for mild climates.

Myosotidium differs from Myosotis in its greater size, mostly large radical lvs., and large winged nutlets. **M. nóbile,** Hook. (*Cynoglóssum nóbile,* Hook. f.), is a stout pilose perennial with long thick cylindrical rootstock, succulent, 1–3 ft. high: radical lvs. broadly ovate-cordate or nearly reniform, petioled, thick and fleshy, 6–12 in. long, but becoming much larger under good conditions in cult.; cauline lvs. few, oblong or broad-ovate, sessile: fls. scentless, dark blue in center and lighter toward the edges (a white-fld. form is reported) in dense corymbose cymes which are 3–6 in. across; calyx deeply 5-parted, the lobes broad-oblong and obtuse; corolla rotate, ½in. diam., the tube short and the rounded lobes spreading: fr. to ¾in. diam. Sandy soil near the sea "once very abundant on the coast-line of the Chatham Isls.," according to Cheeseman, "but now fast becoming rare in a wild state." B.M. 5137. Gn. 30:566; 50, p. 150; 71, p. 143; 75, p. 580. G.C. II. 25:681; III. 21:293; 44:7; 54:47. G.M. 31:219; 52:87. J.H. III. 32:327. G. 32:355. R.H. 1908, pp. 370, 371.—In the south of England near the sea the plant thrives well, making fl.-heads 8 in. across, and with foliage as strong as that of rhubarb; it needs to be renewed from seeds. It is reported not to have succeeded at Santa Barbara. L. H. B.

MYOSÒTIS (Greek, signifying *mouse-ear,* from the leaves). *Boragináceæ.* FORGET-ME-NOT. SCORPION GRASS. A large group of low perennial or annual, more or less hairy, branching, diffuse or erect herbs, inhabiting both the North and South Temperate zones, but the cultivated forms coming mainly from Europe.

Leaves alternate, entire: fls. small, in 1-sided, bractless, at first recurved, terminal racemes; calyx small, 5-cleft; corolla salverform, 5-lobed, the throat crested; stamens 5, included; ovary of 4 almost separate lobes, in fr. forming 4 smooth nutlets attached to the receptacle by their bases.—Thirty to 40 species.

The following are all hardy at the North and are grown in America mainly for out-of-door planting. The flowers are normally blue, often purple when young and turning blue with age. White-flowered forms of all the species may occur. Forget-me-nots prefer moist half-shady places, but an open sunny border will do if it is not excessively dry. The perennials are easily propagated by division or cuttings. Forget-me-nots of gardens (mostly *M. sylvatica* and *M. alpestris*) are spring-flowering, making a good combination with hyacinths, tulips and pansies, although they make attractive masses by themselves. Seeds may be sown from spring to August for the next season's bloom; the plants should have protection in winter. Early-started plants may be used for forcing in a cool greenhouse. Renew the outdoor plants often.

A. *Hairs of the calyx all straight, appressed: perennials.*

B. *St. and lvs. densely setose-hispid with reflexed hairs.*

azòrica, H. C. Wats. Decumbent at the base and diffusely branched, 1 ft. high, densely setose-hispid, with reflexed hairs: lvs. oblong, obtuse or retuse, appressed hairy above, hirsute with reflexed hairs below: racemes sub-secund, dense; calyx almost 5-parted; teeth linear, spreading, clothed with erect, appressed hairs; pedicel about equaling the calyx; corolla larger than in *P. laxa,* 3–3½ lines broad, deeper indigo-blue; throat with a whitish eye. Azores. B.M. 4122. V. 6:75. J.F. 4:340.—Suitable for planting in damp, shady soil. Var. **cœléstina,** Hort., is a form with light blue fls.

BB. *St. and lvs. strigose pubescent or glabrous.*

C. *Infl. not leafy: st. angled.*

D. *Calyx toothed above: fls. large.*

scorpioìdes, Linn. (*M. palústris,* Lam.). TRUE FORGET-ME-NOT of Europe. Sts. from slender, stolon-like rootstocks, slender, decumbent, and rooting below, appressed pubescent or nearly glabrous, 6–18 in. long: lvs. oblong-lanceolate or oblanceolate, nearly sessile: raceme loosely-fld.; pedicels in fr. much longer than the calyx, spreading; lobes of the calyx deltoid, acutish; corolla bright blue, with a yellow eye, limb flat, 3–4 lines broad: nutlets angled and keeled on the inner side. May, June. Eu., Asia. G.C. III. 22:307. Gn. 52, p. 461. G.Z. 6:144 (var. *Goeppingeri*). G. 35:489.—Requires damp, shady ground. Escaped from cult. in the eastern states. Var. **semperflòrens,** Hort., is a dwarf form, 8 in. high, flowering all summer.

DD. *Calyx lobed to the middle or below: fls. small.*

láxa, Lehm. Similar to the preceding species, and also rooting at the lower nodes, pubescence all appressed and scanty or wanting: racemes even more loosely-fld.; calyx-lobes much longer, ovate-lanceolate, acute; corolla-limb smaller and concave, about 2 lines broad, paler blue; throat yellow: nutlets equally convex both sides. May, June. N. Eu., Asia, Amer.—Grows best in muddy places.

2421. Myosotis sylvatica. (×½)

CC. *Infl. leafy toward the base: st. terete.*

cespitòsa, Schultz (*M. Rehsteìneri,* Wartm.). Plant appressed-hairy: st. erect, terete or with short decurrent lines below lvs.: rootstocks short and clustered: lvs. linear-oblong: raceme obtuse, leafy-bracted among lower fls.; pedicels longer than 5-cleft calyx; corolla small, 2 lines diam. Swamps and inundated places. Summer. Eu.—Very similar to *M. laxa* but said to have more terete st., more pubescence and longer pedicels.

AA. *Hairs of the calyx, or at least some of them, hooked and spreading: annuals, biennials or perennials.*

B. *Corolla small, about 1 line broad; limb concave; calyx-hairs nearly all hooked.*

arvénsis, Lam. Annual or biennial, erect, branched, 7–20 in. high, hirsute-pubescent: lvs. oblong or oblanceolate, sessile, obtuse or acutish: raceme loosely-fld.; pedicels in fr. much longer than the calyx; calyx deeply 5-parted; lobes equal, linear, acutish; corolla blue or white, 1–1½ lines broad: nutlet convex outside, keeled inside. June–Aug. Eu., Asia.—Will grow well in dry ground.

BB. *Corolla larger, 3–4 lines broad; limb flat: calyx with only the lower hairs hooked.*

C. *Nutlets sessile: plant hirsute and often cinereous.*

D. *Pedicels 1½–2 times length of calyx: plant 1–2 ft. high.*

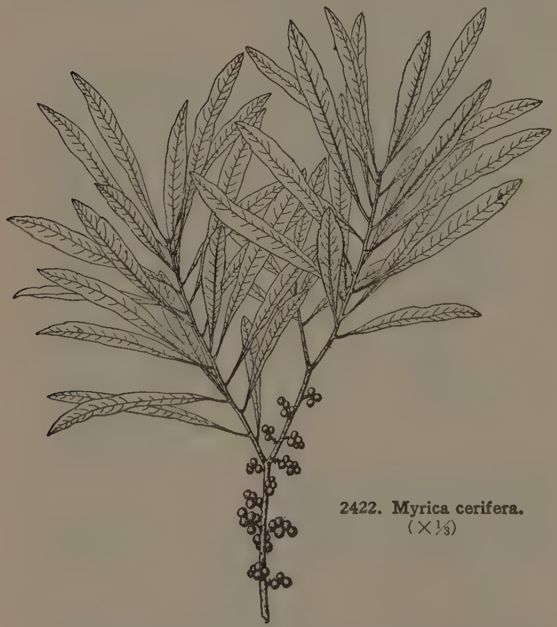
sylvática, Hoffm. Fig. 2421. Perennial, hirsute-pubescent, green or cinereous, erect, 1–2 ft. high, branched above: lvs. oblong-linear or oblanceolate, nearly sessile, acutish: pedicels usually much exceeding the calyx; calyx deeply cleft, hirsute, the hairs, except a few at the base, erect and straight: racemes long and loose; corolla blue, 3–4 lines broad, with a yellow eye: nutlets more or less margined and carinate ventrally, sessile. Spring. Dry soil, Eu., N. Asia. G. 28:520.—Common in cult.

DD. *Pedicels about equaling the calyx, thicker, ascending: plant 3–8 in. high.*

alpéstris, Schmidt (*M. rupícola,* Smith). Similar to the last but dwarf, 3–8 in. high: raceme more dense with shorter thicker ascending pedicels which slightly exceed the calyx: nutlets larger. Summer. Eu. G.C. III. 17:650. Gn.W. 25:544. S.H. 2; p. 25 (1898, f. 203) (as var *stricta*). Gt. 1896, p. 609 (as var. *stricta*). G.W. 2:550 (as var. *stricta*). Gn. 33, p. 93.—Fls. said to be fragrant in the evening. Var. **stricta,** Hort. All the branches erect and strict: appearance peculiar. Var. **aùrea,** Hort. Foliage golden yellow. Commonly cult.

CC. *Nutlets stipitate: plant appressed pubescent.*

dissitiflòra, Baker. Biennial: very similar in habit to *M. sylvatica,* but lower, 6–8 in. high, whole plant clothed with erect-spreading or appressed short hairs: lvs. large, spatulate-oblong, acute, bright green: fruiting racemes more elongated; pedicels ascending or incurved, 2–3 times longer than the calyx; hooked hairs almost absent; calyx-segms. lanceolate, much longer than the tube; corolla 4–5 lines diam. The most important difference is in the nutlets, which are distinctly stipitate. Spring. Switzerland. R.H. 1896, p. 278. S.H. 2, p. 409 (1898, fig. 385). Var. **elegantíssima,** Hort. Lvs. white-edged. The name *M. elegantissima* has also been applied to forms of *M. palustris* and *M. sylvatica.*


2422. Myrica cerifera. (×⅓)

M. Victòria is a fasciated form with hollow st., much crowded, branched, condensed and malformed infl. and irregular enlarged corolla. It is said to come true to seed. Probably derived from M. alpestris. See G.C. III. 10:159; 17:650 (1895).—*M. Wélwitschii,* Boiss. & Reut. A Spanish species with large blue fls.

K. M. WIEGAND.

MYRCIÀRIA (name probably related to Myrtus). *Myrtàceæ.* Brazilian trees and shrubs, of which several species are cultivated for their fruits; sometimes united with Eugenia.

Leaves opposite, entire: fls. sessile or nearly so, axillary, clustered, rarely solitary or in panicles; calyx 4-lobed; petals 4, perigynous, inserted opposite the sepals, deciduous; stamens many; filaments free, filiform; anthers oval or oblong, dehiscing longitudinally; style filiform; stigma simple, rarely capitate; ovary inferior, bilocular, with 2 ovules in each locule; disk small, rarely crowned by the persistent sepals: fr. a berry; seeds 1–4, embryo exalbuminous.—Probably 50 and more species. See *Jaboticaba,* p. 1713.

cauliflòra, Berg. JABOTICABA. The best-known species, considered by Barbosa Rodrigues the handsomest of all the Myrtaceæ. Tree, up to 35 ft.: lvs. elliptical-lanceolate, acute at base and apex: calyx-lobes lanceolate, ciliate: fls. shortly pedicellate, produced directly from the bark of the trunk and branches: fr. ½–1½ in. diam., globose, purplish violet in color, exocarp astringent. Mountains of Rio de Janeiro and Minas Geraes. Pacific Garden, June 1915, p. 12.

jaboticàba, Berg. JABOTICABA DE SÃO PAULO. JABOTICABA DE CABINHO. Tree, 20–30 ft.: lvs. lanceolate or ovate-lanceolate, acute, the base obtuse: calyx-lobes acute, ciliate: fls. shortly pedicellate, produced directly from the bark of the trunk and branches: fr. similar to that of *M. cauliflora* in general appearance; depressed-globose, almost black, ½–1 in. diam., peduncle usually longer than in *M. cauliflora.* Forests of São Paulo and Rio de Janeiro.

F. W. POPENOE.

MYRÌCA (ancient Greek name, possibly applied originally to the tamarisk). *Myricàceæ.* WAX MYRTLE. Ornamental woody plants grown chiefly for their handsome foliage and attractive fruits and some species for their edible fruits.

Leaves alternate, short-petioled, without stipules, entire or serrate, resinous-punctate: fls. diœcious or monœcious, without perianth, in unisexual catkins; stamens 2–16, usually 4–6; ovary 1-celled, with 2 slender filiform stigmas: fr. a drupe, dry or succulent, usually coated with a waxy exudation; nut thick-walled, 1-seeded.—About 50 species in the temperate and warmer regions of both hemispheres.

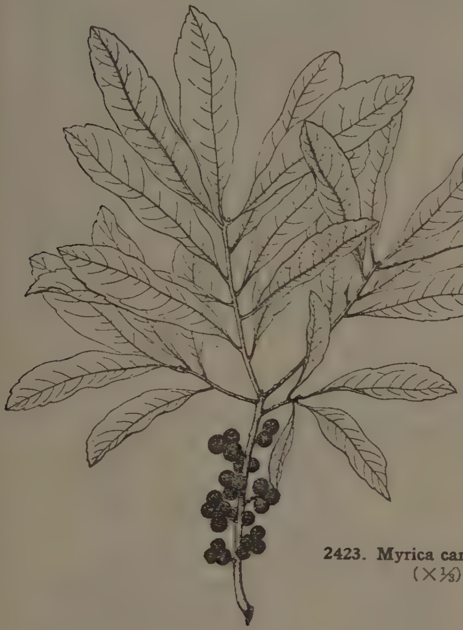
The wax myrtles are aromatic shrubs or small trees with deciduous or evergreen generally oblong leaves and inconspicuous flowers followed by ornamental grayish white or red fruits. Wax is obtained from the fruits of several species; some are cultivated for their succulent and edible fruits. The bark is astringent and used medicinally and in tanning. *Myrica Gale* and *M. carolinensis* are hardy North; *M. cerifera* is somewhat tenderer and *M. californica* is still more tender, while *M. rubra* and *M. Faya* can be grown in subtropical regions only. *M. Gale* and also *M. cerifera* prefer moist and peaty soil, while *M. carolinensis* and *M. californica* grow well in sandy and sterile soil and are widely distributed along the Atlantic and Pacific coasts respectively. Propagation is by seeds sown after maturity; also by layers, and some species, particularly *M. Gale,* by suckers.

A. *Lvs. persistent, or deciduous: fr. globular or ovoid, often coated with wax: fls. with or after the lvs. (Morella.)*

B. *Color of fr. grayish white: fr. dry, densely covered with wax: lvs. often deciduous: stamens 2–6.*

cerífera, Linn. (*Morélla cerífera,* Small. *Cerothámnus cerífera,* Small). Fig. 2422. Slender tree, occasionally to 40 ft., nearly glabrous: lvs. persistent, oblong or oblanceolate, usually acute, cuneate at the base, coarsely serrate above the middle, or entire, dark green above, paler and sometimes pubescent beneath, golden resinous, 1–3 in. long, about ½in. broad: staminate aments cylindric, pistillate aments short: fr. ⅛in. across. March, April. Md. to Fla., Texas and Ark. S.S. 9:459. G.F. 7:476 (adapted in Fig. 2422).—The plant cult. as *M. cerifera* is usually the following species.

carolinénsis, Mill. (*M. pensylvánica,* Lois.). *Morélla carolinénsis,* Small). Bayberry. Fig. 2423. Shrub, 2–8 ft. high: branchlets often pubescent: lvs. subpersistent or deciduous, oblanceolate to obovate, usually obtuse or sometimes acute, cuneate at the base, entire or with a few shallow teeth above the middle, dark green and dull above, sometimes pubescent beneath, resinous, 2–4 in. long and ½–1½ in. broad: fr. ⅙in. across. March, April; fr. in Sept., Oct. Nova Scotia to Fla. and Ala., also on the shores of Lake Erie. G.F. 7:477 (adapted in Fig. 2423). F.E. 23:825 (as *M. cerifera*).—Handsome shrub, hardier than the preceding, with which it is often confused; conspicuous in winter when covered with its grayish white frs. which stay on the branches until spring.



2423. Myrica carolinensis. (×⅓)

bb. *Color of fr. red: lvs. evergreen.*

c. *Frs. distinct in small clusters on short scaly stalks: staminate fls. in simple catkins.*

califórnica, Cham. Slender tree, occasionally to 40 ft.: branchlets pubescent: lvs. lanceolate or oblong-lanceolate, acute, cuneate, remotely serrate, dark green and lustrous above, glabrous or puberulous beneath and marked with minute black dots, 2–4 in. long and ½–¾ in. broad; stamens 5–8: fr. globose, about ¼in. across, papillose, thinly coated with wax. May, June; fr. in Sept., falling during the winter. Wash. to Calif. S.S. 9:461. J.H.S. 1852:283.—One of the prettiest Californian native shrubs, but not easily transplanted and difficult to prop.

rùbra, Sieb. & Zucc. (*M. Nàgi,* DC., not Thunb.). Shrub or small tree: branchlets slightly pubescent: lvs. oblong-lanceolate, acutish, cuneate, entire or serrate above the middle, dark green above, paler beneath, glabrous, 3–5 in. long: staminate catkins cylindric; stamens 6–10: fr. globose or ovoid, tuberculate, deep red-purple, ½–1 in. across; stone ovoid, compressed. April, May; fr. in July. S. China, Japan. B.M. 5727. S.I.F. 2:6.—Cult. for its edible fr. There is a variety with rose-colored finer flavored fr. The berries are vinous and sweet with a pleasant acid taste and are used like blackberries; the fresh juice makes an agreeable beverage. The tree is supposed to stand about 15° of frost. Intro. in 1889. The *M. Nagi,* Thunb., is *Podocarpus Nagi.*

cc. *Frs. 3–4 in small subglobose heads resembling a single 3–4-celled fr.: staminate fls. in panicles.*

Faỳa, Ait. (*Faỳa fragífera,* Webb). Shrub or small tree, to 25 ft.: branches glabrous: lvs. oblong-lanceolate, acute, cuneate, entire or serrate, glabrous, 2–4 in. long: staminate fls. with 4 stamens; pistillate fls. and frs. in elongated spikes: fr. red, edible, ¼in. across. Canary Isls., Madeira, Azores. N.D. 2:56.

aa. *Lvs. deciduous: frs. inclosed by 2 persistent wing-like bracts, forming dense ovoid-oblong, cone-like catkins: fls. before the lvs.* (*Gale.*)

Gàle, Linn. (*Gàle palústris,* Chevalier). Shrub, 1–5 ft.: branches dark brown: lvs. oblanceolate, obtuse, rarely acute, cuneate, serrate toward the apex, dark green and glabrous above, usually pubescent beneath, 1–2½ in. long: staminate catkins about ½in. long, brownish: fr. compressed, 3-pointed, yellowish, golden-resinous, in catkins about ⅓in. long, crowded at the end of last year's branches. April; fr. in Sept. N. Amer., south to Va., Mich. and Wash., Eu., N. Asia. H.W. 2, p. 97. B.B. (ed. 2) 1:584. Var. **subglàbra,** Fern. Lvs. glabrous or nearly so.

M. aspleniifòlia, Linn.=Comptonia aspleniifolia.—*M. sápida,* Wall. Allied to M. rubra. Tree: branches pubescent: lvs. oblong to oblanceolate, 3–6 in. long: staminate fls. in panicles: fr. in elongated spikes, ellipsoid, ⅓in. long; nut pointed at both ends, edible. Himalayas, India, Malay Archipelago. Wallich, Tent. Fl. Nepal. 45.

Alfred Rehder.

MYRICÀRIA (derived from *Myrica,* probably the ancient name for the tamarisk, in allusion to the close affinity of the genus to the tamarisk). *Tamaricàceæ.* A genus of about 10 species distributed from Eu. through Cent. Asia to China; closely related to Tamarix, chiefly distinguished by the 10 stamens being connate one-third to one-half, by the 3 sessile stigmas and the stalked tuft on hairs on the seeds. They are hardy shrubby or suffruticose plants with alternate scale-like lvs. and with the fls. in terminal, often panicled racemes. **M. germánica,** Desv. (*Támarix germánica,* Linn.), is a glabrous undershrub, 4–6 ft. high, with upright, wand-like branches: lvs. minute, bluish green, lanceolate, glandular-dotted: fls. light pink or whitish, in 4–6 in. long, terminal racemes, usually with lateral ones at the base; bracts produced into a narrow lanceolate point, broadly winged below, exceeding the buds; stamens connate about one-half. Cent. and S. Eu., W. Asia. S.O.B. 3:131. G.W.H. 38. **M. dahùrica,** Ehrenb. (*Támarix dahùrica,* Willd.), is very similar, but racemes usually lateral, the bracts oblong-ovate, acute with a membranous margin all around, not exceeding the buds, and stamens connate only one-third. Dahuria, Transbaikalia. The cult. is the same as of tamarix; they prefer sandy, moist soil. Alfred Rehder.

MYRIOCÉPHALUS (Greek, *ten-thousand-headed*). *Compósitæ.* Annual or perennial herbs, all Australian, often hoary, especially when young.

Leaves alternate, entire: clusters or compound heads terminal, usually globose or hemispherical; heads exceedingly numerous and sessile on a broad, very flat receptacle, surrounded by a general involucre of numerous narrow bracts in many rows, each usually with a scarious tip or radiating appendage. In *M. Stuartii* these appendages are 1–2 lines long, broad, white and very conspicuous.—About 8 species.

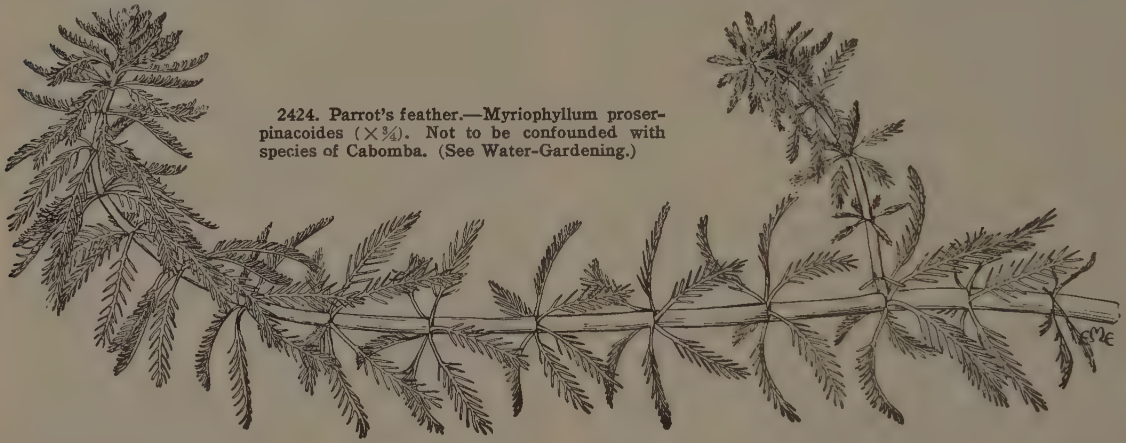
Stùartii, Benth. (*Polycalýmma Stùartii,* F. Muell. & Sond.). Pubescent or woolly, not much branched: lvs. linear or lanceolate, half st.-clasping, 1–2 in. long: clusters hemispherical, 1 in. or more across; partial heads 5–8-fld.: seeds woolly; pappus of numerous ciliate bristles.—Very rare in American collections. An odd sort of everlasting flower, known to the trade as *Polycalymma Stuartii.* It is a half-hardy plant, growing about 1½ ft. high and bearing yellow and white heads.

N. Taylor.†

MYRIOPHÝLLUM (Greek, *myriad-leaved*). *Haloragidàceæ.* Parrot's Feather. Water plants, used in aquaria, fountains and pools.

One of the eight genera of the widespread water-milfoil family, other genera being Gunnera, Hippuris and Proserpinaca, all with minute or inconspicuous individual fls. but interesting and various in foliage. Lvs. whorled or alternate, emersed and immersed, the former entire, dentate or pinnate, the latter divided into capillary segms.: fls. usually monœcious, diœcious or polygamous, in axillary clusters or spikes; calyx none, or present and minutely 2–4-lobed; petals 2–4; stamens 4–8; ovary 2–4-celled, each cell with a solitary ovule.—Species about 20, in fresh water in many parts of the world, from the tropics to the frigid zones. Various native species are likely to be transferred to ponds and aquaria.

The parrot's feather is a favorite aquatic plant, with delicate feathery foliage, composed of numerous whorls of finely cut leaves. The one often seen in vases and fountains in public parks has the uncomfortable name of *Myriophyllum proserpinacoides.* It is a half-hardy plant from Chile, with weak stems which grow out of the water about 6 inches. It may be planted in a water-tight hanging-basket, and if water can be kept standing on the surface, the plant will hang gracefully over the edges. Although detached floating branches will persist for some time, the plant needs earth in which to root. The other species here described are hardy plants, which are common in our eastern ponds. Any one of them may be gathered for the aquarium, and the last two are procurable from dealers in aquatics and aquarium supplies. All of them are readily propagated by long cuttings inserted in the earth or mud of the aquarium or pond. (William Tricker.)


2424. Parrot's feather.—Myriophyllum proserpinacoides (×¾). Not to be confounded with species of Cabomba. (See Water-Gardening.)

A. *Lvs. all alike.*

proserpinacoìdes, Gill. Parrot's Feather. Fig. 2424. Lvs. in whorls of 4–6, 7–12 lines long; segms. 10–25. Chile. G.W. 15, p. 680.—It has escaped from cult. in N. J., but apparently has not persisted. Differs from the 2 following in being diœcious. The female plant is the one in cult.

AA. *Lvs. above the surface of the water different from those below.*

B. *Lvs. whorled in 3's and 4's.*

verticillàtum, Linn. Floral lvs. pectinate or pinnatifid, longer or shorter than the fls.; submerged lvs. in crowded whorls, the divisions very fine or slender: stamens 8; petals deciduous: carpels even. Canada and N. U. S. Eu.

BB. *Lvs. whorled in 4's and 5's.*

heterophýllum, Michx. Floral lvs. ovate, lanceolate, sharply serrate, or even entire, much longer than fls.: stamens 4 or 6; petals rather persistent: carpels 1–2-ridged and roughened on the back. Lakes and rivers. Ont. to Fla. and Minn.

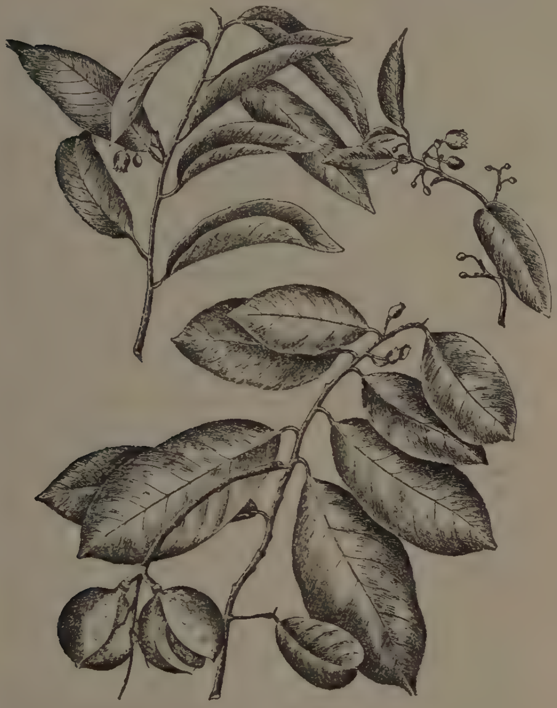
Wilhelm Miller.
L. H. B.†

MYRÍSTICA (Greek, alluding to the aromatic qualities of the plants). *Myristicàceæ.* Nutmeg. Myristicas are of many species, but most of the nutmegs of commerce are the product of **M. fràgrans,** Houtt. (*M. moschàta,* Thunb. *M. officinàlis,* Linn. f. *M. aromática,* Lam.), shown in Figs. 2425, 2426. This tree is cult. and naturalized in the W. Indies. The genus Myristica is the only one in the family under the old treatment, but it is now divided by Warburg into 8 genera. As delimited, Myristica comprises about 80 species in farther India, Austral., and Pacific Isls. As formerly defined they are diœcious trees with alternate, entire, pinnate-veined lvs., and small fls. in axillary clusters: perianth 2–4- (usually 3-) lobed, in a single series; anthers 3 or more, connate; ovary single, 1-loculed, ripening into a fleshy fr. The nutmeg of commerce is the seed. This is surrounded by a ruminate aril, which furnishes the mace of commerce. The fr. of *M. fragrans* is short-pear-shaped, to nearly globular, 1½–2 in. long, hanging, reddish or yellowish, somewhat fleshy, splitting at maturity into 2 valves and disclosing the scarlet aril or mace. Inside the aril is the hard nut or shell, and inside the shell is the nutmeg. The details of the mace and nutmeg are shown in Fig. 2426. For a full illustrated and historical account of the nutmeg, see B.M. 2756, 2757 (1827). The nutmeg has not been grown to any extent in the western hemisphere, the commercial supply of nuts and mace coming mostly from the E. Indies.

L. H. B.

The nutmeg tree requires a position in well-sheltered, hot, moist valleys in the tropics from sea-level up to 400 or 500 feet; it will grow and produce fruit in Jamaica up to 2,000 feet, but the fruit is not so abundant nor the nut so large as at lower elevations. The soil must be a deep rich loam, well drained. The seedlings have a tap-root which is very easily injured in transplanting. The method usually adopted for growing them is to sow the seeds in bamboo pots, one in each. When they are ready for planting in their permanent places, the bamboo is slit, and the soil, with the plant, gently put into the prepared hole. It is only when they first flower that it is possible to tell the sex of the tree. Nothing is known of the conditions which determine the sex. In Grenada (British West Indies), the usual proportion of male trees to female is said to be as three to one, though sometimes forty or fifty trees close together will all be either male or female. As the trees generally flower when they are six or seven years old, there is great waste in the growth of male trees. In the Botanic Gardens in Jamaica, it has been found possible to graft the nutmeg, so that a loss of this kind should not occur again; the plan is, take young seedlings and graft, by approach, the thinnest twigs of a female tree.

Wm. Fawcett.



2425. Myristica fragrans—the nutmeg. The upper sprays are from the staminate tree. (×¼)

MYRMECÒDIA (*murmekos*, an ant: the ants nest in excavations that they make in the great tubers). *Rubiàceæ.* From 20–25 remarkable epiphytic sub-shrubs of E. Asia and the Pacific Isls., sometimes grown by the curious. They require the treatment of epiphytic orchids. The plants are glabrous, with 4-angled thickish or fleshy branches: lvs. crowded at the ends of the branches, opposite, obovate; stipules persistent, curiously transformed into scales: fls. small, white, sessile amongst the lvs. and modified stipules. *M. Antòinii,* Becc. (*M. echinàta,* Ant.). Tuber very large, 6 in. or more diam., dull gray, tuberculate and spiny: st. inclined and flexuous, 4-grooved, the ribs covered with imbricating woody shields (stipules): lvs. at top of st., 4 or 5 in. long, elliptic-ovate to obovate, acute: fls. ½in. long, white, sessile on the ribs; corolla clavate, 4-lobed. Torres Straits. B.M. 7517. G.W. 13, p. 117; 14, p. 524.

L. H. B.

MYROBALAN: One of the genus Myrobalanus, now referred to Terminalia (which see). **Myrobalan Plum:** *Prunus cerasifera.*

MYRÓXYLON (*myrrh wood*, from the scent). Syn. *Toluífera. Leguminòsæ.* A few balsam-bearing trees of S. Amer., scarcely cult. horticulturally. Lvs. odd-pinnate; lfts. exstipellate, glandular-punctate: fls. more or less papilionaceous, white or whitish, in axillary simple racemes or paniculate at ends of branches; calyx irregularly dentate; standard orbicular; 4 inferior petals subequal, narrow and free; stamens deciduous with the petals, free or connate at base: pod stalked, compressed, indehiscent, at the apex hardened and 1-seeded, the basal part long and narrow and 2-winged. See also *Toluífera. M. toluíferum,* HBK. (*Toluífera Balsàmum,* Linn.). Tolu-Balsam Tree. Tree, to 75 ft. or more, with thick rough bark and a straight trunk: lfts. 7–11, alternate, oblong and acuminate, quite glabrous, 2–3½ in. long: the balsam is secured from incisions in the bark. *M. peruíferum,* Linn. f. Peru-Balsam Tree (but not the source of Balsam of Peru, which is from *M. Pereiræ,* of San Salvador). Beautiful tree: lfts. 9–13, ovate-oblong, alternate and emarginate at the apex, entire, puberulous on the midrib and petiole, punctate, 1½–3 in. long: fls. in simple racemes 4–5 in. long, long-pedicelled.

L H. B.

MÝRRHIS (from the Greek word for perfume). *Umbellíferæ.* Myrrh. One perennial herb native to Europe and an immigrant to other countries, sometimes grown in gardens for its pleasing scent and anciently used as a flavoring in salads. In America Myrrhis is represented by Osmorhiza (which some writers now call Washingtonia), which is known as sweet cicely. Two or three of the American plants have been named under Myrrhis, but the genus is now excluded from this country. It is closely allied to Chærophyllum. Technical characters distinguish the two genera.

The myrrh of the Arabs is the gum of *Balsamodendron Myrrha,* a burseraceous tree which is now referred to Commiphora; not in cult.

odoràta, Scop. Myrrh. Sweet Cicely of Eu. Soft-hairy or pubescent, erect, branching, 2–3 ft.: lvs. thin and soft, 2–3-pinnate, with narrow-toothed or pinnatifid lanceolate segms.: fls. small, whitish, in a compound umbel which is devoid of a general involucre: fr. ½in. long, longitudinally ribbed. Eu. Gn. 72, p. 18. G.W. 15, p. 131.—Herbage sweet-scented. Rarely seen in this country, but interesting for its graceful foliage; seed may be sown in autumn as soon as ripe, and the plants will come up in spring; prop. also by division; the plant persists for years.

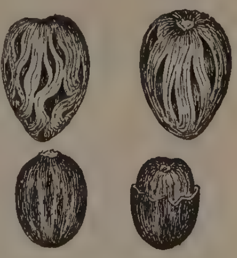
L. H. B.

MYRSÌNE (an old Greek name for the myrtle, of no application; the myrtle is *Myrtus communis*). *Myrsinàceæ.* Shrubs and trees with coriaceous leaves and whitish or yellowish small flowers, of tropical and warm countries.

As formerly constituted and accepted by botanists, a genus of about 80 species: glabrous or tomentose: lvs. leathery, mostly entire: fls. small, sessile or peduncled, in axillary or lateral clusters, polygamo-diœcious; floral parts in 4–5's, the corolla-lobes imbricated in the bud; anthers short and usually blunt: fr. a pea-shaped drupe, dry or fleshy, 1-stoned; seed globose. The family has been re-elaborated by Mez (in Das Pflanzenreich, IV:236 1902), and the genus Myrsine is restricted to 4 species in Asia and Afr. The species here described then become Rapanea and Suttonia.

a. *Fls. with separate petals.* (*Suttonia.*)

Lessertiàna, A. DC. (*Suttònia Lessertiàna,* Mez). Tree, 60 ft., with trunk to 2 ft. diam. with gray bark: lvs. elliptic to obovate, sessile or short-petioled, obtuse and mostly rounded at apex, black-dotted above: fls. yellowish, with reddish dots, in fascicles in the older axils and along the branchlets and on projecting spurs; petals broad-elliptic, twice longer than calyx: drupe globose, reddish or black. Hawaii; intro. in S. Calif.

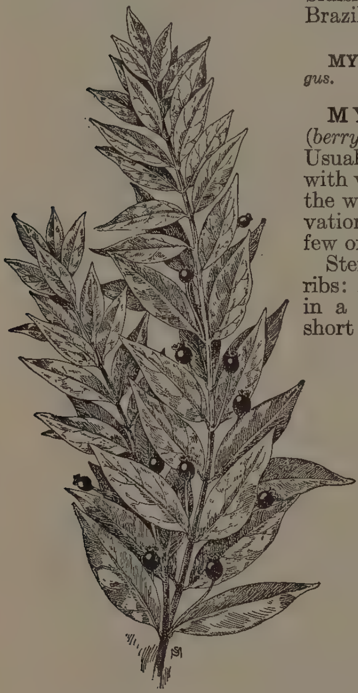


2426. Nutmegs. The upper specimens show the aril or mace. The lower left specimen shows the nut after the mace is removed. The lower right specimen shows part of the shell removed, disclosing the nutmeg. (×⅓)

aa. *Fls. gamopetalous.*

guyanénsis, O. Kuntze (*Rapànea guyanénsis,* Aubl. *Myrsìne Rapànea,* Roem. & Schult. *M. floribúnda,* R. Br. *M. floridàna,* A. DC.). Glabrous shrub or small tree: lvs. 3–4 in. long, mostly at ends of branches, leathery, obovate-oblong, rounded or notched at top, revolute at margin, rusty and dotted beneath, devoid of pellucid dots: fls. sessile or very nearly so; corolla rotate, whitish, much longer than the purple-spotted sepals: drupe small (⅙in. diam.), bluish or black. S. Fla. to Brazil and Paraguay.

L. H. B.



2427. Myrtus communis. (×½)

MYRSIPHÝLLUM: *Asparagus.*

MYRTILLOCÁCTUS (*berry* and *cactus*). *Cactàceæ.* Usually large trees or shrubs with very many branches in the wild state, but in cultivation often small, with few or no branches.

Stems with few angles or ribs: fls. very small, several in a cluster, diurnal, with short tubes and widely spreading petals: fr. a small edible berry.—The genus contains 3 or 4 species.

geométrizans, Console (*Cèreus geométrizans*, Mart.). Plants 10–15 ft. high: ribs 5–9, obtuse, with broad intervals: spines 3–6, the central one much longer and dagger-shaped: fr. the size of an olive, bluish, much eaten by the Mexicans. Common on the tableland of Cent. and S. Mex.

Còchal, Brit. & Rose (*Cèreus Còchal*, Orcutt). Said to grow 10 ft. high: ribs 4–8, obtuse: spines few, the central not so long as in the last: fr. said to be red. Low. Calif.—Not common, and not to be recommended for small collections.

J. N. Rose.

MYRTLE: *Myrtus communis.* **Crape M.**: *Lagerstrœmia.* **Running M.**: *Vinca minor* and others. **Sand M.**: *Leiophyllum.*

MÝRTUS (*Myrtos*, the ancient Greek name). *Myrtàceæ.* Myrtle. Mostly shrubs, grown for the aromatic qualities, attractive foliage, flowers and fruits.

Leaves opposite, entire, penniveined, usually aromatic: fls. white or rose-tinged, axillary, 1 to many, the central on short lateral or long pedicels; calyx-tube turbinate, 5- (rarely 4-) lobed, usually persistent; petals 5 (rarely 4); stamens numerous, in several rows, free; ovule 2–3-celled: fr. a berry, adnate to, or included in the calyx-tube.—A genus of perhaps 70 species, mostly subtropical natives of S. Amer. and Austral., but also in S. Eu. and W. Asia. Some of the myrtles are now referred to Eugenia and other genera. In common speech, the word myrtle is applied to other small-lvd. evergreens as to the vincas or periwinkles.

Myrtles are grown in pots for greenhouse, window or room decorations, or in California and the South as outdoor ornamental shrubs. In pots, they make excellent lawn and terrace plants, being given protection in winter. They are easily cultivated and readily propagated from firm or partially ripened cuttings. They like an abundance of water in summer.

commùnis, Linn. The classic Myrtle. Fig. 2427. A handsome evergreen shrub, 3–10 ft. or more (sometimes a small tree) high, both fls. and lvs. strongly scented: lvs. small in the variety usually cult., ovate or lanceolate, entire, smooth and shining, acute, coriaceous: peduncles solitary, 1-fld., length of lvs. or shorter, bearing 2 linear bractlets below the white and reddish pretty fls.: berry blue-black. Azores to Beluchistan; well known in the Medit. region. G.C. III. 45:18.—Several varieties are cult., which differ chiefly in the shape and size of the lvs. and in stature; there is also a variegated form. Makes a good hedge in S. Fla. Ever-blooming in S. Calif. It blooms in 2–3 years from cuttings in England. Following are some of the important named forms: Var. **melanocárpa**, DC. Fr. black. Var. **leucocárpa**, DC. Fr. white. Var. **latifòlia**, Hort. Lvs. very broad. G.W. 6, p. 595. Var. **microphýlla**, Hort. Lvs. small, dark green, linear-lanceolate and long-pointed. Var. **mucronàta**, Linn. Lvs. linear-lanceolate, acuminate. Var. **lusitánica**, Linn. Lvs. lanceolate-ovate, acute. Var. **itálica**, Mill. Shoots or branches nearly or quite erect, the lvs. rather small, ovate-lanceolate, sharp-pointed. Var. **boètica**, Mill. Branches short, lvs. crowded and thickish rather large, broadly ovate-lanceolate. Var. **bélgica**, Mill. Lvs. broad-lanceolate, long-sharp-pointed. Var. **angustifòlia**, Hort. Lvs. medium size, lanceolate. Var. **romàna**, Mill. Lvs. broad-ovate, large, sharp-pointed, light green, often 3–4 at a node. Var. **tarentìna**, Mill. Shoots short, lvs. ranged in 4 rows, short, ovate, sharp-pointed. Of some of the above, there are forms with variegated and white-margined lvs. and double forms. The different manifestations of *Myrtus communis* appear not to have been given adequate trial. It is not unlikely that the summers are too hot for them even where the winters are not too frosty; but there must be localities where they can be grown and treatments under protection of buildings or walls that would cause them to thrive. In ancient times, wreaths of myrtle were worn by magistrates and by victors. The plant yields perfumery, and the green and dried frs. are sometimes used as condiments. The wood is very hard and of interesting texture and grain.

Arayán, HBK. Lvs. 1–2 in. long, ovate-oblong, acute, membranaceous, reticulate, glabrous and shining: pedicels axillary, solitary, 1-fld., 2-bracted; fls. size of *M. communis;* calyx 5-parted: fr. globose, red, 2-celled and 2-seeded. Peru.—Listed in S. Calif.

Úgni, Molina (*Eugènia Úgni*, Hook. & Arn. *Úgni Molìnæ*, Turcz.). Ugni or Chilean Guava. As usually seen under cult., a shrub 4 ft. high, but in its native habitat it is said to become a tree 100 ft. high: pedicels 1-fld.: berry purple, glossy, edible, with a pleasant odor and taste. Chile; hardy in S. Calif. B.M. 4626. R.H. 1879, p. 409.—Wood very hard and heavy, much used in Chile for press-screws, and select implements.

M. Lùma=Eugenia apiculata, p. 1163.—*M. macrophýlla*, Spreng.=Eugenia malaccensis, p. 1163.—*M. tomentòsa*, Soland.=Rhodomyrtus tomentosa.

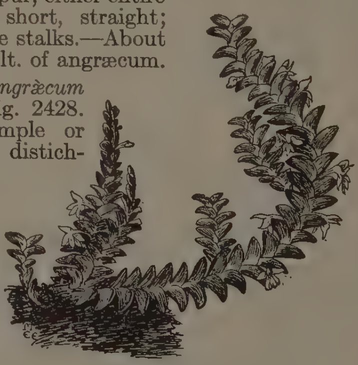
J. Burtt Davy. L. H. B.†

MYSTACÍDIUM (Greek, on account of bearded appendages of the column). *Orchidàceæ.* In habit resembling Angræcum. Sepals and petals similar, lip immovably attached to base of column, furnished with a long thin basal spur, either entire or 3-lobed; column short, straight; pollina upon 2 separate stalks.—About 20 species, in Afr. Cult. of angræcum.

dístichum, Pfitz. (*Angræcum dístichum*, Lindl.). Fig. 2428. Sts. 3–6 in. long, simple or branched: lvs. fleshy, distichous, grooved above, laterally compressed: fls. axillary, small, white. Sierra Leone. B. M. 4145. B. R. 1781.

M. gracíllimum, Rolfe. Scapes very slender; fls. white; spur long and very slender. Uganda.

George V. Nash.



2428. Mystacidium distichum. (×⅓)

N

NAEGÈLIA (Karl von Naegeli, once professor of botany at Munich). *Gesneriàceæ.* Trop. American herbs allied to Achimenes, but the fls. arranged alternately in a leafless terminal panicle (in Achimenes the fls. are axillary). In cult., the plants are oftener called gesnerias than naegelias, but they are distinguished from that genus in usually having an annular or ring-like disk at the base of the corolla, rather than a deeply lobed disk. Tubers usually none, the plant rhizomatous or repent: st. nearly simple: lvs. opposite, soft, long-petioled, usually cordate: fls. showy, mostly red, sometimes yellowish white or suffused, alternate in a terminal cluster with very small bracts at base of pedicels; corolla declined or hanging, oblique and usually more or less spotted in throat, much exceeding calyx.—Species about a half-dozen, Mex. and Cent. Amer. Naegelias hybridize with other gesnerias. One hybrid race is known as Naegelio-Achimenes and another (F.S. 10: 987, 988) as Mandirola. Because of the panicled fls., naegelias are very ornamental plants. They are warm-house subjects, prop. by stolons or offsets.

Because of conflict with another genus of the same name, Kuntze proposes the name Smithiantha for this genus; but the way seems to be clear for the use of the well-established Naegelia. See *Smithiantha.*

In general, the cultural methods given under Achimenes (Volume I, page 206) suit naegelias well (compare also Gloxinia). The roots should be stored in the pots in which they have been grown. It is a poor plan to keep any bulbs or tubers of the Gesneriaceæ in dry sand in a dry storeroom. After being well ripened, naegelia roots should be kept in the greenhouse under the benches. Keep them out of the drip, but water them occasionally. (T. D. Hatfield.)

A. *Fls. nearly scarlet, or brick-red, marked with white.*

cinnabarìna, Lind. (*Gesnèria cinnabarìna,* Lind. *Smithiántha cinnabarìna,* Kuntze). Fine winter-blooming plant, 1½–2 ft. tall, soft-hairy: lvs. round-ovate and cordate, crenate-dentate, thickish, green, with red or purplish hairs: fls. about 1½ in. long, hanging on the ends of spreading pedicels, gibbous-tubular to the very base, the calyx-lobes acute and spreading, the short corolla-lobes unequal and obtuse, the fl. cinnabar-red or nearly scarlet on the upper side, but paler and spotted on the under side. Mex. B.M. 5036. Lowe, 33. H.F. II. 5:4 (var. *rosea*).

AA. *Fls. orange-scarlet or scarlet, marked with yellow.*

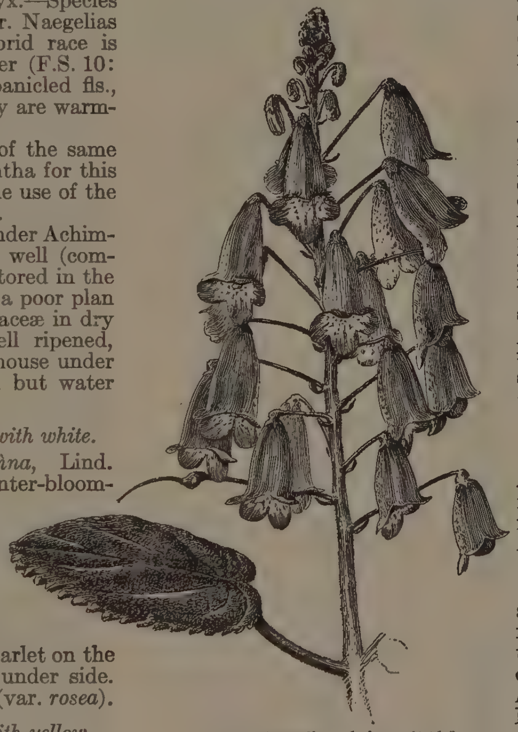
zebrìna, Regel (*Gesnèria zebrìna,* Paxt. *Smithiántha zebrìna,* Kuntze). Fig. 2429. Much like the above, but brighter colored, red-dotted below and yellow within and on the under side: calyx-lobes short and appressed; corolla contracted toward the base, whereas they are gibbous or swollen to the very base in *N. cinnabarina.* Brazil. B.M. 3940. B.R. 28:16. P.M. 8:271.—A fine plant, of which there are several forms. The commonest species. Names belonging here are *Gesneria regalis* and *G. splendens.*

achimenoìdes, Bart. (*Smithiántha achimenoìdes,* Fritsch). Hybrid of *N. zebrina* and Achimenes or Gloxinia (said to be with *A. glabrata;* see *Gloxinia,* Vol. III, p. 1350): fls. very large (often 2 in. long), yellowish rose on the outside, yellow and rose-spotted on the inside, the segms. clear rose.

AAA. *Fls. white, cream-color or rose.*

multiflòra, Hook. (*N. amábilis,* Decne. *Smithiántha amábilis,* Kuntze. *Gesnèria amábilis,* Hort.). Fls. white or cream-color, numerous, hanging, the tube curved and not much swollen, the obtuse lobes subequal: plant bearing long, glandular hairs in addition to the velvety covering: otherwise much like *N. zebrina.* Mex. B.M. 5083. F.S. 12:1192 (as *Achimenes* [*Naegelia*] *amabilis*). G.C. III. 22:413. Gn. W. 23:335. G. 22:631.—The tenable name of this species is sometimes held to be Decaisne's *N. amabilis,* which goes back to 1857, but *Gloxinia multiflora,* Mart. & Gal., dates from 1842.

hyacínthina, Carr. Of horticultural origin, probably a hybrid: fls. white or rose, in a very compact pyramidal panicle. R.H. 1877, p. 29.



2429. Naegelia zebrina. (×½)

N. fúlgida, Ort. Fls. vermilion: lvs. large, oval, deeply toothed. Mex.—*N. Geroltiàna,* Regel (Smithiantha Geroltiana, Kuntze). Continuous-flowering plant, allied to N. zebrina. Mex. F.S. 2:97.—*N. sceptre corail,* Carr. Fls. many in an open panicle, cinnabar-red, yellow-spotted inside. R.H. 1869, p. 154 and col. pl. For pictures of varieties and hybrids, see F. S. 16:1671-1672; 10:987-988.

L. H. B.

NAEGÈLIO-ACHÍMENES is a former trade name mentioned under *Naegelia.*

NÀMA (Greek, a *stream* or *spring,* referring to habitat of the first-described species). *Hydrophyllàceæ.* Low herbs or subshrubs, little known in planting. Annual and perennial, sometimes spiny: lvs. mostly alternate, entire, dentate or crenulate: fls. blue or white, solitary or in various clusters; corolla campanulate or nearly salverform to funnel-shaped or somewhat rotate, 5-lobed; stamens 5, inserted in base of corolla-tube, the filaments usually dilated or appendaged at base; styles 2, with small capitate stigmas: fr. a membranaceous ovoid or subglobose dehiscent caps.—Species 36, as defined by Brand in Das Pflanzenreich, hft. 59 (IV. 251:1913), mostly in W. N. Amer. and Mex., but also in W. Indies, S. Amer., and 1 in Hawaii. One species is offered as a garden plant in Calif.

Párryi, Gray (*Eriodíctyon Párryi,* Greene). Shrubby perennial, 3–6 ft., stove, the st. over ½in. diam.: lvs. many, dark green, linear or linear-lanceolate, dentate or undulate, villous, sessile: fls. violet-blue in small lateral clusters that are aggregated into a long terminal spike or narrow thyrse; sepals oblong-lanceolate; corolla tubular-funnelform, about ½in. long. Calif. May–July. L. H. B.

NAMES AND NOMENCLATURE. Every plant that is known and recorded must have a name or appellation; the system or scheme of naming is known as nomenclature (pronounced nò-menclature).

It is now the universal custom with botanists to name a plant with two words,—one designating the genus or group into which it falls, and the other distinguishing the particular plant from all other plants in the group. The genus or group may be *Rubus*, the raspberries, blackberries and dewberries; the particular species of Rubus may be *villosus;* and the complete name is therefore *Rubus villosus*. It will be seen, therefore, that this two-word or binomial appellation both classifies and names the plant. When other species of Rubus are discovered, they receive special, or specific, names in the genus, as *R. frondosus*, *R. allegheniensis*, *R. Millspaughii*.

In scientific language, a plant may have only one name. Confusion would arise if it had two or more. But it sometimes happens that two or more persons give a name to the same species (either because unaware of an earlier name or because the authors regarded a given form of the plant as a distinct species or as separate enough to receive another name), and to distinguish one name from another the author's name goes with the plant-name that he makes. So it comes that "*Rubus villosus*, Ait.", means that the name *Rubus villosus* was made by Aiton. Botanists know when and what Aiton wrote: therefore they can trace the name and description to its source. "*Rubus villosus*, Gray," may be a very different plant; but only the oldest name, if it is the proper or accepted genus, may stand, and all other names become synonyms or duplicates. It happens that the *Rubus villosus*, Gray, is not a species so named by Gray in ignorance of Aiton's name, but a misapplication of Aiton's *R. villosus* to another species than that which Aiton had in hand, as will be understood from the narrative below.

2430. Some of the cases in which is kept the priceless herbarium of Linnæus.

It would seem to the layman to be the simplest matter to make the name *Rubus villosus*—*villosus* is only a Latin word signifying "hairy;"—but, in fact, it is a serious undertaking. It is always considered the mark of a good botanist that he make new names with the greatest caution. In the first place, it is allowable to make a name only when the plant is nameless. When the botanist finds a plant that he suspects to be new, he must exercise all reasonable caution to determine whether anyone in all the world has named it. He must determine its genus, and be able to write a sufficient description of it. He must give it a name that has not been used before in that genus: if any plant has been named *Rubus villosus*, he cannot give another rubus that name. Then he must publish the name and description in some publication of recognized standing; and once published, it is established in botanical literature and neither he nor anyone else can ever modify it. Always is his own name associated with the name of the plant; and if the name is an error or the description inaccurate, he must take the responsibility so long as botanical literature shall last.

The description is made for the purpose of enabling anyone to identify the plant. Amongst the hosts of plants, however, the confusion may be so great that even the best description will not positively identify the plant. A picture will help, and illustrations are often published when the plant is first described. But a poor picture may be misleading and thereby be worse than none. Every botanist, therefore, preserves a specimen or specimens as a type of his new species. This specimen is dried, "mounted" or stuck on a sheet of stiff white paper, and laid away in the herbarium. Custom dictates that this sheet of paper shall be about 11½ inches wide and 16⅜ inches long; and only one species is glued on a sheet (see *Herbarium*, Volume III). In case of dispute, this type specimen is consulted, and it takes precedence over descriptions and pictures. It alone is final, as determining what plant the author meant to designate by the name. Even the author himself cannot ignore or replace the original "type specimen;" it is part of the ethics of the profession that this specimen shall not be destroyed or modified. So it happens that type specimens become increasingly valuable as time goes on.

The larger part of the new species are "made" or described at the great centers of botanical study, and the specimens are preserved in these public or semi-public collections; but any botanist anywhere may describe a new species, in which case he may send his type specimen or an authentic duplicate of it to one of the great herbaria, where it may be consulted by other students; and at his death his collections are likely to find their way to one of the botanical centers.

In all the great collections, quantities of unnamed or undetermined specimens may accumulate, particularly from travelers in little-frequented regions. In time, some student of the flora of the region may study these specimens, perhaps finding undescribed species among them; or a student of one special group may go over them to find the plants that fall within the range of his studies; or if the given accumulation is interesting and valuable in itself, some student may study it as a collection and publish on it, describing new species, adding to the descriptions of recognized species, and correcting ranges and habitats. Specimens and even whole collections are sometimes loaned to reputable students of special groups. These specimens are always to be returned without subtraction, injury or modification. Very often the student, in returning the specimens, adds material of his own to enrich the collection. It will be seen, therefore, that the herbarium becomes more precious year after year as successive students contribute their interpretations to it.

While the above outline may seem to make the naming of plants a relatively simple and direct process, nevertheless many complications and confusions may arise. First of these difficulties are the varying interpretations placed on the specimens by the different students, some of them regarding differences as having specific value (wide enough to justify the separation of the material into two or more species) whereas others may consider them to be only variations within the species. The process of combining, separating and recombining introduces many names of different relative values, all of which must be considered and accounted for by subsequent students or authors. Again, older authors may be found, in books or publications overlooked, who have made names and descriptions. Or the rules of nomenclature accepted by different botanists may not be harmonious, and the differences must be adjusted as completely as possible. There may be different standards or conceptions of genera between different authors, resulting in shift and re-shift from genus to genus. These and other situations make the subject of botanical nomenclature very complicated.

Some of the inharmonies in nomenclature have been resolved by the action of botanical congresses, but there is yet wide divergence in practice and it is difficult to foresee any close agreement even in the formal rules and precepts, while it is scarcely to be expected that concurrence can be attained in the underlying concepts as to what are species and what are not, although it ought not to be impossible to reach something like a uniformity on genera.

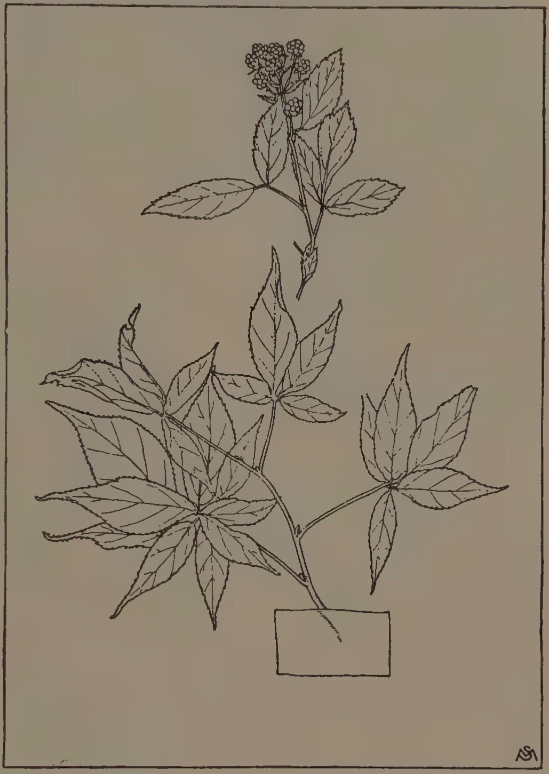
The situation of this Cyclopedia.

A cyclopedia of horticulture includes species from around the world, deriving its names and descriptions from the publications of many countries; its nomenclatorial method should be international so far as such a method exists. Therefore, this Cyclopedia follows, as a policy, the regulations of the International Botanical Congress held in Vienna in 1905 (see page xi, Volume I). It would not be desirable, as it would also not be practically possible, to endeavor in a compilation of this kind, and for popular use, to recombine the names of plants from all over the world to conform to any special or regional school of nomenclature.

The Cyclopedia is not primarily a botanical treatise. Its first obligation is to the horticultural fraternity, to those who apply and use the results of botanical study. It must regard the value of names that are long established in commerce and in literature. Binomial names do not belong exclusively to botanists. There is merit in usage and in the end it controls. Whenever all botanists of authority agree upon a set of changes, the horticulturists should of course adopt them; but a cyclopedia of this kind is not under obligation to be "up to date" in respect to recent changes that may represent only individual opinion or which are likely to be overturned or at least not adopted by other botanists of standing. So far as possible, a cyclopedia of horticulture should represent settled practices. This work, therefore, adopts a conservative attitude in nomenclature.

The International or so-called Vienna rules contain regulations or "articles," and recommendations. The articles deal with the principles, and the recommendations with cases and practices. The articles are broadly stated and often allow of considerable latitude of application; and the recommendations are left to the option of the author. Therefore, the application of the Vienna Rules is not invariable.

But other and somewhat opposite considerations weigh in the compilation of the Cyclopedia, seeing that many authors contribute. While it is desired that all these authors conform as nearly as practicable to one system, nevertheless the author himself, when he is a special and authoritative student of the group, must be allowed to use his preferred method even though the combined result as between the different articles should prove to be somewhat inharmonious. A distinction is clearly to be made between work that is compilatory and editorial, and that which is the result of original studies with the material; the former may follow the accepted method of the Cyclopedia, but the latter may follow the method of the particular author's monographic work. Thus it is, for example, that the citrous tribes, the cacti, and some of the groups of trees and shrubs, present such wide departures.

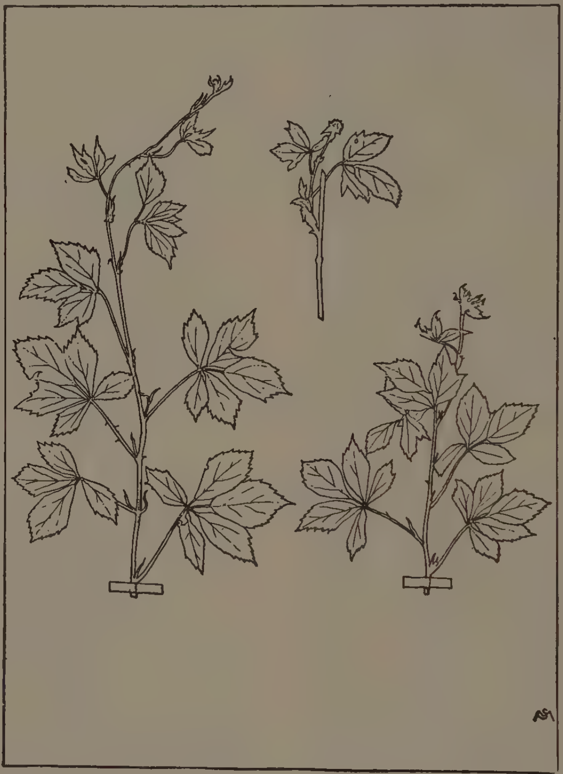


2431. Linnæus' sheet of Rubus canadensis.

It has been the desire, however, to avoid the making of new binomials or combinations, for the cyclopedia is not intended as a "place of publication" of botanical names. In the course of the work, however, it has been impossible to avoid re-combinations in some cases and yet present the subjects acceptably.

Double citation of authorities for botanical names has been avoided. This is in the interest of simplicity and convenience. The double citation is for the use of botanists to aid them in tracing the history of the name. The identification of a name by citing the author of it, is one thing; the record of the history of a name in the double citation is quite another thing. But whatever the justification in technical botanical work, the gardener and the horticulturist in general should not be burdened with these details, particularly when they are cumbersome and awkward in themselves. Thus, *Lippia nodiflora*, Michx., is sufficient for our purpose, showing that Michaux first used this combination; the double citation is *L. nodiflora*, (Linn.) Michx., showing that the use of *nodiflora* as a name for this plant began with Linnæus under another genus, although the double citation does not indicate the number of transfers from genus to genus that may have been made in the meantime.

In the prefatory pages to Volume I, the method of nomenclature employed in this Cyclopedia is briefly stated; but it may be well to make an explanation of the use of capital letters in specific names. It is the rule in English that proper adjectives are capitalized, as American, African, Canadian. This is not the practice in all other languages, however. For the sake of uniformity, it is now the practice with many authors to decapitalize all specific names. The specific name should agree with its genus in gender; but some of the old substantive or generic names are used as specific names in defiance of gender terminations, and the use of the capital letter explains the exception. Thus *Dracocephalum Moldavica* indicates that Moldavica is an old substantive (used once as a genus) and is used in apposition and not as an adjective; otherwise it would be *D. moldavicum*, meaning the moldavian dracocephalum. Other substantives are not Latin and cannot be Latinized, as *Dolichos Lablab;* the word Lablab is not an adjective qualifying Dolichos. Bearing these distinctions in mind, such names as *Campanula Medium, Dioscorea Batatas, Cornus Amomum, Schinus Molle, Mapania Pandanophyllum* are understood. The Vienna Code makes a recommendation on the use of capitals: "Specific names begin with a small letter except those which are taken from names of persons (substantives or adjectives) or those which are taken from generic names (substantives or adjectives)." Under this recommendation, descriptive names are not capitalized. A special category are the geographical names, but they may be fairly regarded as descriptive and be used with small letters; this is the practice in this Cyclopedia, for the purpose of conforming to the recommendation. A few confusions arise in decapitalizing geographical names. For example, *Syringa persica*, one of the lilacs, takes the small p because the name means Persian; whereas *Prunus Persica*, the peach, takes the large P because the word was once used for a genus (*Persica vulgaris*, the peach), although that generic word was derived from the country Persia whence the peach was supposed, at that time, to have come. In some cases, the same or similar specific names may be personal or geographical, and many geographical names are derived directly from persons, as Bolivia, Rhodesia, Colombia, America; but in practice little or no confusion arises. The practice in this Cyclopedia, then, is to capitalize specific names derived from persons (either in the genitive as *Hookeri*, or in adjective as *Hookeriana*), and all substantives used in apposition, as *Pyrus Malus, Alpinia Allughas, Vaccinium Vitis-Idæa, Phlox Stellaria, Ipomœa Nil, Polygonum Posumbu.*



2432. Aiton's sheet of Rubus villosus, preserved in London.

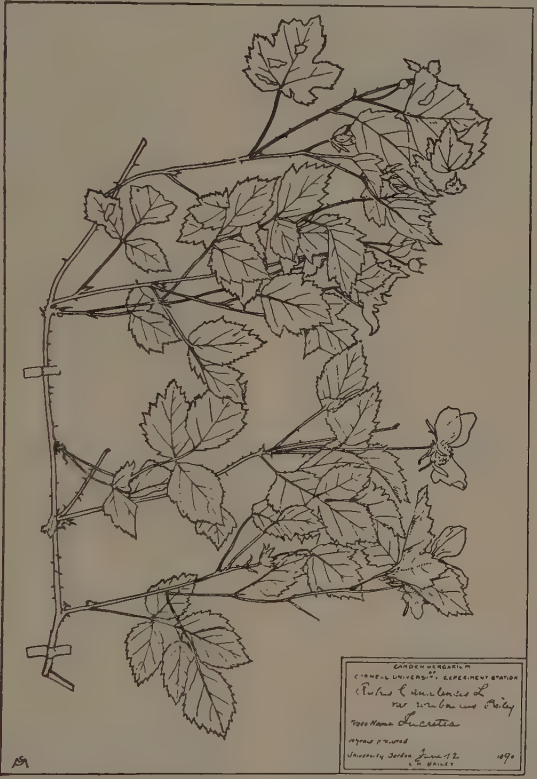
How a plant is named.

A personal narrative may illustrate some of the complexities in nomenclature. The case that is here chosen for elucidation is not more interesting or important than scores of others that might be taken from the experiences of botanists, but it will afford an example.

Blackberries and dewberries (which are of the genus Rubus) are variable. This is the botanist's way of saying that there are many intermediate forms and that it is difficult to distinguish one kind from another. On different soils and in different places, the plants look different. They may intergrade. With them, evolution has probably not yet proceeded far enough to obliterate the intermediates, and the "missing links" may not have disappeared. The species are not "well marked." Therefore it is not strange that botanists disagree as to what are species and what are varieties of species. What one botanist calls a species of Rubus, another prefers to call a variety, or a mere "form" perhaps due to influence of soil, elevation or exposure. The general tendency is to make more species in all genera than did the old botanists, because we know the plants more intimately and recognize differences that were not seen or understood one hundred years and more ago. What Linnæus thought was one species we may now think is several; and if we break up his one species into several, we must know which one of these forms he had, in order that we may retain his name for it;—and we determine this fact by consulting his herbarium (if a specimen is preserved) which is now in London.

Or, again, we may misunderstand what Linnæus meant to designate by a given name, and may use his name for a different plant from that which he had in mind. Even if we see his specimen, we may make an error in identifying it,—for it is not always an easy matter positively to identify and classify a dried specimen, particularly if the specimen was fragmentary or poor in the beginning or has become broken or insect-eaten. It sometimes happens, therefore, that when two men examine the type specimen of a "critical" species, they arrive at different conclusions as to what that species is. Each may publish his views, applying the name as seems right to him, and botanists choose the one determination or the other according as they accept one man or the other. The naming of plants, therefore, is not an exact procedure.

The name "*Rubus villosus*" is one that Aiton gave in 1789 to a plant that grew in the gardens at Kew, near London. The plant, he said, came from America. It was described in brief Latin phrase, with little indication as to its habit of growth. Before this time, even as early as 1753, Linnæus, the great Swede, had described a blackberry, which the traveler Kalm had discovered in Canada, as *Rubus canadensis*, the "Canadian rubus." In 1809, Willdenow, a Prussian systematist, described *Rubus inermis*, from specimens growing in the Botanic Garden at Berlin, said to have come from America; and in 1822, Link, also of Berlin, described, under similar circumstances, a plant that he called *Rubus argutus*. When American botanists began to write books, in the early part of the nineteenth century, two well-marked species of blackberries were made out,—one a trailing plant or dewberry, and the other an upright plant or high-bush blackberry. The descriptions given by Linnæus and Aiton were looked up and compared: the *Rubus canadensis* of Linnæus was thought to designate the dewberry, and the *Rubus villosus* of Aiton the high-bush blackberry. Since there were only two wild blackberries, the names made by Willdenow and Link must be mere duplicates; and they were regarded as synonyms of *Rubus villosus*, having no standing in the manuals.


GARDEN HERBARIUM OF CORNELL UNIVERSITY EXPERIMENT STATION
Rubus Canadensis L
var roribaccus Bailey
Trade Name Lucretia
University Garden June 12 1890
L H BAILEY

2433. An herbarium sheet of a form (var. roribaccus) of Rubus villosus.

Years passed. Botanists found that the rubuses did not match the descriptions in the books and they seemed to "run into each other," so that they could not be clearly separated or told apart. Therefore they were not carefully studied, for it has been the history of botany that the "best defined" species have usually been collected most freely, so completely have we been dominated by the old idea of the original entity of species. But gradually the dried specimens accumulated in the herbaria. One by one the puzzling genera were taken up for study. Finally Rubus had its turn.

It was found that there are several species of blackberry-like plants growing wild in the eastern states, rather than two. Amongst the rest was found a thornless blackberry in the mountains of West Virginia, and in 1891 it was named *Rubus Millspaughii*, in honor of C. F. Millspaugh, its discoverer. Thereupon botanists searched their herbaria, and sprigs of the plant were found, under various names, representing collections from Canada to Carolina. But there were still other species than this, and it began to be seen that the botany of American rubi is complex. This fact should have been no surprise, for the European species of rubi have long been known to be amongst the most puzzling of plants. What should be the names of these newly understood species? Linnæus and Aiton were consulted, but their descriptions did not distinguish. The type specimens must be seen.

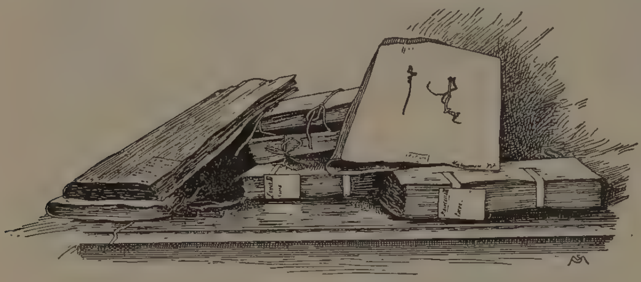
It seemed to fall to the writer to undertake the inquiry. To see the two dried plants of Linnæus and Aiton did not seem worth a trip to Europe. Therefore an artist near London was engaged to make a drawing of Linnæus' specimen in the rooms of the Linnæan Society, in Picadilly, and of Aiton's in the Natural History Museum at South Kensington, London. These pictures gave such unmistakable evidence that we had misunderstood these old botanists, that it seemed desirable not to publish the results until the specimens had been examined. The picture of Linnæus' plant left little doubt as to the identity of the species that he had, but that of Aiton's was a puzzle, for it seemed to represent clearly no American blackberry.

In the Linnæan herbarium is the sheet of *Rubus canadensis* (Fig. 2431), supposed for nearly a century and a half to represent the common running dewberries of the fields, but which was identified to be in reality the *Rubus Millspaughii* of recent years. From the time that Peter Kalm collected the plant in Canada before the middle of the eighteenth century until 1891, this plant had been overlooked. Now, therefore, this thornless blackberry must be known as *Rubus canadensis*, and the name *Rubus Millspaughii* becomes a duplicate or synonym having historic and literary value, but no longer to be used, if the determination is correct, as the name of the plant. In the meantime, the common dewberry, erroneously known as *Rubus canadensis*, is left without a name.

In the collections of Aiton is his specimen of *Rubus villosus* (Fig. 2432). It is difficult to determine just what this plant is, because the specimen was taken from the tip of a strong verdurous shoot, and therefore does not represent the usual form of any blackberry as seen in herbaria. It is, in fact, the tip of a prostrate shoot of the common dewberry, the very plant to which we had supposed Linnæus gave the name *Rubus canadensis*. The dewberry (Fig. 2433), therefore, must be called *Rubus villosus*, notwithstanding the fact that the name itself is not specially appropriate; but the tips of strong shoots—rarely mentioned in descriptions—are somewhat hairy. But a name is a name, not a description; and even though it is inappropriate as to the attribute it seems to ascribe to a plant, it still serves all the purposes of a designation. This unrepresentative specimen proved to be very puzzling; and a year later it was re-examined; and in the collection at South Kensington specimens were deposited of the tip growths of the dewberry which are good counterparts of Aiton's old type.

The thornless blackberry and the dewberry were now provided with names; but the common high-bush blackberry of east-American fields, which we had been accustomed to call *Rubus villosus*, was left nameless.

In the effort to find a name for the high-bush blackberry, the Rubus names given by Willdenow and Link must be accounted for. The descriptions made by these authors are not sufficient positively to determine the plants. The dried specimens themselves must be seen in Berlin. Willdenow's name, *Rubus inermis*, suggests that it may have been applied to the thornless blackberry, for *inermis* means "without thorns." In the great herbarium at the Botanical Garden, Willdenow's plants are preserved in stout blue paper wrappers (Fig. 2434). His *Rubus inermis* is amongst them (Fig. 2435), but it turns out to be a blackberry of Greece. In the old garden at Berlin, early in the century, American and European plants were growing, each species occupying a little space of earth and marked by a stake label. In time, one of the American plants probably had perished and a Grecian plant occupied its place, growing behind an American stake. Specimens of the plant were taken for the herbarium, and not recognizing it as an American plant, Willdenow described it as a new species; but before his time this Grecian plant had been described as *Rubus ulmifolius*—the "elm-leaved rubus"—and Willdenow's name, supposedly applied to an American plant, now becomes a synonym of a European species.


2434. Bundles from the herbarium of Willdenow.

Willdenow's name having failed us, we next take up Link's *Rubus argutus* (Fig. 2436), and here is still another difficulty; it is an American plant, but of a distinct species from the high-bush blackberry. Other names, not mentioned in this account, must be considered,—Trattinnick's, with specimens in Vienna, Michaux's in Paris, Bigelow's of Boston, and others. All were looked up, and none of them could be applied to the common blackberry, and the plant was given a new name, *Rubus nigrobaccus.*

It must not be supposed, however, that the case was now disposed of and settled. Every subsequent student has the liberty of his own interpretation. Some botanists consider the common *Rubus nigrobaccus* to be but a form of *R. allegheniensis* of Porter, a name which dates from 1896 whereas *R. nigrobaccus* dates from 1898; in this case, *R. allegheniensis* holds and *R. nigrobaccus* becomes a synonym. So all the other forms may be separately judged, and every author has the right to his own judgment and to the use of the name that goes with it. Other interpretations have been made more recently as to the species-lines in Rubus. In a group so difficult and variable as Rubus, the judgments naturally will be diverse and agreement is not to be expected, perhaps not even to be desired.

(See name lists, end Vol. VI.) L. H. B.

Historical development of botanical nomenclature.

The present universally accepted binomial nomenclature started in 1753 with the publication of Linnæus' "Species Plantarum," when for the first time all known plants were named according to a uniform system based on the principle that for the designation of a plant two names, a generic and a specific, each consisting of one word only, should be sufficient.

Before that time there was no uniformity in naming plants; most of them were designated by longer or shorter descriptive phrases, as *Aralia caule aculeato, Narcissus niveus odoratus circulo rubello, Mespilus apiifolio virginiana spinis horrida fructu amplo coccineo, Acer foliis palmato-angulatis floribus subapetalis sessilibus fructu pedunculato corymboso;* others by a single Latin or vernacular name, some by common nouns like *Centrum galli, Corona imperialis, Capillus Veneris;* not unfrequently the descriptive phrase was reduced to one word, as in *Iris germanica, Nymphæa lutea, Berberis vulgaris,* combinations which were already in use in the sixteenth century. This more or less lawless naming is usually referred to as pre-Linnæan nomenclature. Its beginnings may be traced back more than 2,000 years to the writings of Theophrastus (371–286 B. C.), a disciple of Aristotle, to the works of Pliny (33–79 A. D.), and of Dioscorides, who lived at nearly the same time, and to other ancient writers. Later writers on natural history and medicine up to the fifteenth century added little to the knowledge of the plant world; their writings consisted chiefly of commentaries to the classical works and of scholastic discussions on the meaning and application of the names used by the ancient writers and on the medical virtues of the plants as set forth by them. A new era started in the beginning of the sixteenth century when men like Brunfels, whose "Herbarum Vivæ Eicones" appeared in 1530, Bock, Fuchs and Cordus, began to study the native plants and found that many of them were unknown to the old writers; they published figures drawn from nature and descriptions of these new plants and gave new names to them. The coining of botanical names derived from personal names was inaugurated at that time, and Conrad Gesner (1516–1563) was probably the first one to name plants in compliment to his friends, e. g., Cortusa, Aretia, Vollata and others. A fairly complete enumeration of the plant names with their synonyms known up to 1623 was published in that year by Caspar Bauhin in his "Pinax Theatri Botanici;" this work shows the extent of the botanical knowledge at that time and is valuable as a key to the nomenclature of the older writers.

Progress in nomenclature is hardly possible without classification. In the earlier works the plants were either enumerated alphabetically or roughly divided into trees, shrubs and herbs or arranged according to their uses. One of the first attempts toward classification was made by Cesalpini in his "De Plantis Libri XVI" (1583), who arranged the plants roughly according to their fruits. Other more natural systems and at the same time a clearer conception of genera and species were introduced by Jung, Morison, Ray and Rivinus.

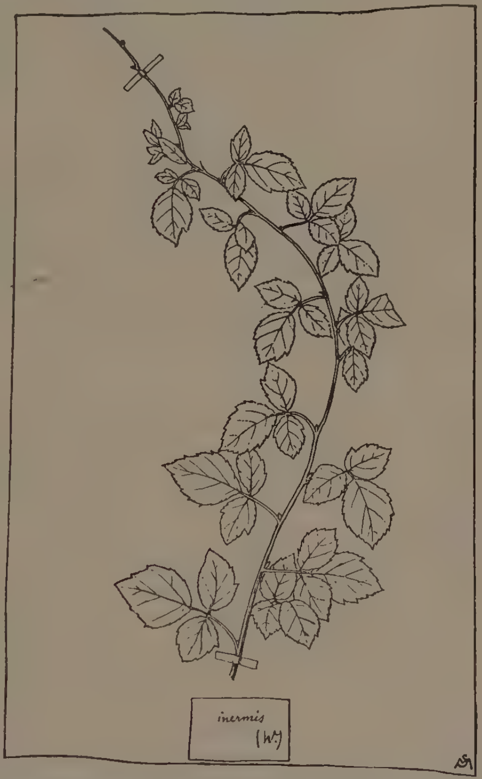
Morison was the first botanist to publish a monographic treatment of a natural group in his "Plantarum Umbelliferarum Distributio Nova" (1672). Ray in his "Methodus Plantarum Nova" (1682) distinguished families like Labiatæ, Papilionaceæ, Siliquosæ (Cruciferæ), Grasses, Monopetalæ, while Rivinus based his classification chiefly on the corolla and distinguished Monopetalæ with regular and with irregular flowers and Pentapetalæ and Tetrapetalæ with the same subdivisions. The older writers had often united under one generic name very different plants: e. g., *Clematis sylvatica latifolia* (=*Clematis Vitalba*), *C. daphnoides* (=*Vinca minor*), *Clematis tetraphylla* (=*Bignonia capreolata*), *C. indica* (=*Passiflora*); and as another example, *Viola Martia purpurea* (=*V. odorata*), *V. matronalis* (=*Hesperis matronalis*), *V. lunaria* (=*Lunaria rediviva*). The botanists named above, in consequence of their better understanding of natural affinities, proved the unnatural character of such genera and divided them into different genera under distinct names.

In 1700, Tournefort published in his "Institutiones Rei Herbariæ" a complete enumeration of all the known genera with descriptions and illustrations; he is considered the founder of the modern conception of the genus and of its nomenclature, and therefore the year 1700 has been proposed by some botanists as the starting-point for generic nomenclature. Tournefort, however, still retained a few of the inconvenient generic names which consisted of two words, as *Corona imperalis*, *Centaurium minus* and *Centaurium majus*, *Ferrum equinum*. These disappeared forever with the publication of Linnæus' "Genera Plantarum" in 1737, which contained, like Tournefort's work, a complete enumeration of the known genera, but much clearer and more concisely characterized and arranged according to the sexual system of which Linnæus had published an outline two years before. About the same time, in 1736 and 1737, Linnæus laid down his principles of botanical nomenclature in his "Fundamenta Botanica" and "Critica Botanica," but it was not until 1753 that he took the last step in his reform of botanical nomenclature and proposed for each known species a *nomen triviale*, that is a name which consisted of a single word and was intended to replace for general use and reference the cumbersome descriptive phrases previously used.

This simplified and convenient nomenclature found the speedy approval of nearly all botanists and was soon universally adopted. Very few botanical works of importance were published after that time which did not accept the binomial nomenclature; the most notable are perhaps Patrick Browne's "Civil and Natural History of Jamaica" (1756), and the sixth edition of Philip Miller's "Gardeners' Dictionary" (1759), but in the seventh edition (1768) Miller adopted the binomial nomenclature. Although little or no objection was raised against the nomenclatorial system itself, many attempts were made to change specific and also generic names for various reasons; for example, Salisbury in his "Prodromus Stirpium in Horto ad Chapel Allerton Vigentium" (1796) conceived the idea that all specific names ought to be descriptive adjectives and therefore changed names like *Lonicera Caprifolium* to *L. suavis*, *L. Periclymenum* to *L. odora*, *Rhamnus Frangula* to *R. nemoralis*, and others. Likewise many other botanists felt themselves at liberty to change names they did not like or did not consider quite correct, and the law of priority had little weight up to the first quarter of last century. The general tendency was then, and in fact has been for a much longer time, to give preference to names published in important and easily accessible works and to follow the lead of men considered to be great authorities. Fortunately, nearly all great systematic botanists, about the middle of last century, as the De Candolles, Endlicher, Martius, Hooker, Bentham, Asa Gray, Baillon, were more or less guided by the law of priority, but with the increasing botanical activity about that time the necessity was felt to have definite and uniform rules for the ever-increasing number of botanical workers. Therefore Alphonse De Candolle was charged to prepare for the International Botanical Congress at Paris in 1867 a code embodying the rules to be followed in botanical nomenclature. The code which was presented to the Congress and adopted contained as the fundamental principle the strict observation of the law of priority. It ruled that in transferring a species from one genus to another the oldest specific name had to be preserved; also that in changing a variety to a species or *vice versa* the oldest name must be retained. Although most continental botanists followed more or less this Paris Code, or as it is sometimes called Candollean Code, the British botanists under the leadership of Kew preferred the first combination under the correct genus, the so-called Kew rule. The Paris Code, however, even by its professed adherents, was hardly ever applied consistently in all its consequences. This was pointed out forcibly by Otto Kuntze in his "Revisio Generum," of which the first part appeared in 1891; in this work he essayed a rigid application of the Paris Code, resulting in thousands of new combinations under hundreds of unfamiliar generic names. This avalanche of new names raised a storm of protest in many quarters. For years Kuntze fought for the strict application of the Paris Code of which he proposed several amendments, and for the acknowledgement of his new names, but his uncompromising and unyielding attitude and the often intemperate language used against those in opposition made him many enemies, and he therefore did not accomplish so much as he might have effected, if he had tried more persuasive methods; but nevertheless he set the reform under way.

In 1892 the Botanical Club of the American Association for the Advancement of Science at the Rochester meeting drew up a short code of eight articles, somewhat amended at the Madison (Wisconsin) meeting the following year, which embodied about the same rules as were contained in the more amplified Philadelphia Code of 1905. In the following year, the International Botanical Congress at Genoa added a few but rather unimportant amendments to the Paris Code. In 1897, the botanists of the Berlin Botanical Museum agreed on a set of rules mainly for the guidance of the collaborators of Engler & Prantl's "Natürliche Pflanzenfamilien." The chief feature of these rules was a provision against replacing well-known generic names by old half-forgotten names which had failed to become established within fifty years after their publication, thereby allowing the principle of usage to predominate in certain cases over the principle of priority.

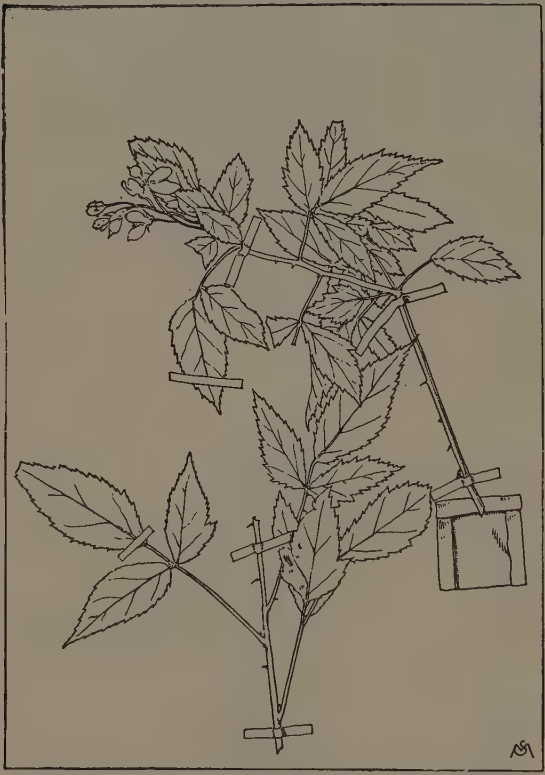
In 1900, at the International Botanical Congress at Paris, a commission was formed to make the necessary arrangements for a representative meeting of botanists at the time of the Congress at Vienna in 1905 to come to some agreement on the fundamental rules of nomenclature. Botanists of the whole world were invited to make propositions and amendments to the Paris Code, which had been decided upon as the base of the new code. Propositions were freely offered, and all were incorporated in a publication which was sent to lead-



2435. Willdenow's specimen of Rubus inermis, in Berlin.

ing botanical institutions and to those botanists who had offered propositions. During the Congress the different propositions were discussed and voted upon by a representative gathering of botanists of the whole world in special nomenclatorial sessions which extended through a whole week. The new code, which was the result of this Congress, is known as the International Rules, sometimes called Vienna Code.

The fundamental principle of this code is the acceptance of the law of priority with 1753 as the starting-point for the nomenclature of the vascular plants. However, to avoid disadvantageous changes in the names of well-known genera, a list of about 400 generic names, "nomina conservanda," was provided which must be retained in all cases. The oldest specific name, under whatever genus it had been published, is to be preserved in transferring a species from one genus into another except when the same combination already exists in the new genus, e. g., *Azalea pontica*, if transferred to Rhododendron cannot become *R. ponticum*, as this combination already exists for another species in the genus. Also a specific name must be changed if it repeats simply the generic name in the new genus, e. g., the specific name of *Bignonia Catalpa* when transferred to Catalpa must be changed, as *Catalpa Catalpa* is not admissible. Varietal and specific names cannot compete with each other; that is, for a variety the oldest varietal name given under any other species or genus holds, even if there should be an older specific name for the same plant, and *vice versa.* Under the Paris Code, however, the oldest name must be retained in any case whether published as a specific or as a varietal name. When two or more groups with names of the same date are united, the author chooses. A name or combination of names which is universally regarded as a synonym may be used again for another plant, although it ought to be avoided. The whole code contains fifty-eight articles and thirty-seven recommendations. It gives detailed rules for the formation of names, citation of authors, validity of genera, species and varieties, transfer of species and varieties, changes of names, rejection of names, and other practices. A conveniently accessible reprint of the English version of the code will be found in Rhodora 9:33–55 (1907). There are also German, French and English versions in "Verhandlungen des Internationalen Botanischen Kongresses in Wien 1905," published in 1906 by Gustav Fischer in Jena.


2436. The sheet of Link's Rubus argutus in the herbarium at Berlin.

A number of American botanists had submitted to the Congress an entirely new code and proposed that it should be accepted instead of amending the Paris Code. This, however, could not be done, as it was understood from the beginning that the new code should be based on the Paris Code. After the Congress, the authors and supporters of this new code came together and voted not to accept the decision of the International Congress, but to retain their code, which is known as the Philadelphia Code or American Code. Only in one point was a change introduced and the decision of the Vienna Congress followed, namely, that specific and varietal names cannot compete with each other. In the Philadelphia Code, much stress is laid on the method of types. to which little attention is paid in the International Rules. Besides this the following points are the most important in which the two codes differ. The Philadelphia Code recognizes no exceptions in the priority of generic names; it has no list of "nomina conservanda." In the case of union of group-names published at the same time in the same book, those having precedence of position in the publication or on the page are regarded as having priority. A name or combination of names can never be used a second time for a different group, while according to the International Rules it can be used again if the older is not valid. In transferring a specific name to another genus, repetition is allowed, which makes names like *Glaucium Glaucium* and *Symphoricarpos Symphoricarpos* admissible. The use of the genitive and the adjective form of the same personal name for different species in the same genus is not admissible, while according to the International Rules they cannot be rejected, e. g., *Lysimachia Hemsleyi* and *L. Hemsleyana* are admissible according to the International Rules, but not according to the Philadelphia Code. The whole Philadelphia Code contains nineteen canons, besides rules on orthography, citation, and other matters. It is published in the Bull. Torr. Bot. Club. 34:167–178 (1907).

In 1910, the International Botanical Congress held at Brussels added several amendments to the International Rules and fixed the starting points for the nomenclature of the lower cryptogamous plants. In conjunction with this congress, an International Horticultural Congress was held, of which a subsection on nomenclature was charged to consider nomenclatorial questions in regard to horticulture. It was resolved that the International Rules should be accepted with a few exceptions and modifications concerning the nomenclature of horticultural varieties and hybrids. The employment of Latin names for horticultural forms is restricted to descriptive terms like *compactus, nanus, fastigiatus;* other names ought to be given in a vulgar tongue and must not be translated when transferred to other languages; the names should be expressed so far as possible in one word, the employment of three words to be the maximum. Bigeneric hybrids ought to receive a generic name formed by the combination of the generic names of the parents into a single word, while according to the International Rules they must be placed under one of the parent genera. Trigeneric hybrids are preferably designated by affixing the ending *ara* to a personal name. (See *Adamara, Linncara, Lowiara.*) The Horticultural Code consists of sixteen articles; the English version of it will be found in the Jour. Roy. Hort. Soc. 37:149–151 (October, 1911).

The International Rules have been adopted and are followed by nearly all botanists of the Old World and of this continent outside of the United States. In England there are perhaps a few who still follow the Kew rule, and an example of a very recent horticultural book in which this rule is adhered to is Bean's "Hardy Trees and Shrubs." In Germany there is one horticultural writer, A. Voss, who holds to the Paris Code as amended by O. Kuntze, as appears from his botanical contributions to the "Landlexikon" edited by K. von Putlitz & L. Meyer and in course of publication. In this country, a large number of botanists have adopted the International Rules, but the greater part follow the Philadelphia Code. The differences that the application of these codes produces on the nomenclature of our native plants may readily be seen by comparing the two manuals of the flora of northeastern North America, namely the seventh edition of Gray's Manual by Fernald and Robinson and the second edition of Britton's Manual; the first follows the International Rules the second the Philadelphia Code.

An interesting secession from the Philadelphia Code is constituted by E. L. Greene and two or three other botanists; they do not recognize any fixed starting point in botanical nomenclature and go back to Theophrastus, Dioscorides and Pliny, accepting the occasional binomial names found in the works of pre-Linnæan writers. They quote, e. g., *Populus nigra*, Pliny; *Hesperis hortensis*, C. Bauhin; *Rorella Cordi*, Lobelius (=*Drosera rotundifolia*); *Bucanephyllum americanum*, Plukenett (=*Sarracenia purpurea*); *Spiræa*, Theophrastus. Other examples may be found in articles published in the "American Midland Naturalist."

It is to be hoped that there will be no more secessions from the two chief nomenclatorial codes, but that instead the followers of these two codes will find, by mutual concessions, some common ground to agree on a universal code acceptable to all botanists of the world.

Alfred Rehder.

NANDÌNA (Japanese name). *Berberidàceæ*. A small, tender shrub with bright red or white berries, said to be cultivated in every little garden in Japan.

Erect plant: sts. about as thick as a finger: foliage evergreen, graceful at all times, twice or thrice ternately cut; lfts. entire: young growth prettily tinged with red, and the bases of the lower stalks often swollen into red globular bodies: fls. small, numerous, white and panicled. It agrees with the common barberries in having 6 stamens and an indehiscent berry, but the fls. are differently colored and the sepals more numerous. There are about 6 petals, but the numerous sepals gradually pass into petals, the outer ones being small, green and leathery, the inner larger and whiter: ovules 2, ascending from the base: berries red, in clusters terminating the branches, handsome.—Species 1, **N. doméstica**, Thunb. Japan and China. B.M. 1109. Gn. 23, p. 329; 58, p. 13. G.M. 51:665. G. 29:43.

This shrub is rarely grown North under glass. Pot-grown plants or seeds are procurable from Japanese dealers. The seeds are said to be of an uncommon shape, being convex on one side and concave on the other. Ernest Braunton writes as follows about the plant in California: "*Nandina domestica* is an old-time favorite in southern California, ultimately reaching to 8 feet in height, though of slow growth. For a few years past its use in local gardens has steadily increased and bids fair to rival that accorded it in Japan, where it is to be found in nearly every garden. It grows well in whole or partial shade and if well supplied with water does equally well in the hottest sunshine. If used in sunny position it will be found to thrive best when planted in lawns, evidently needing more atmospheric humidity than our climate naturally affords. Its terminal trusses of white flowers, followed by brilliant scarlet berries, added to a winter change of foliage from green to red, unite to make it an interesting and attractive shrub throughout the year." The plant is held in great reverence in China; it there withstands considerable frost when the wood is well ripened.

Wilhelm Miller.

NÁNNORHOPS (*dwarf bush*, because of its low stature). *Palmàceæ*. One tufted small fan-lvd. palm, Afghanistan and India, *N. Ritchieàna*, Wendl., scarcely cult. St. or rhizome prostrate, several feet long, branched: lvs. rigid, plicate, with whitish powder, the segms. curved and 2-lobed, the petiole unarmed (and thereby distinguished from *Chamærops humilis*): spadix much branched: spathes tubular and sheathing: fls. polygamous; corolla 3-parted; stamens 6–9: fr. a small globose or oblong 1-seeded drupe the size of a grape. G.C. III. 51:66.

In the mountains of Afghanistan it grows where covered with snow in winter. In sheltered places there it reaches a height of 15–25 ft.: lvs. 3 ft. long, the petiole half as long as the blade, the 8–15 lf.-divisions 1 ft. long. The hard bony seed is said to be surrounded with an edible pulp.

L. H. B.

NANÒDES (a *pigmy:* the plants are small). *Orchidàceæ*. Two or 3 epiphytic S. American orchids now referred to Epidendrum. In that genus it forms a section or subgenus, with lip adnate to column, and 4 pollen-masses on ovate glands. **E. Medùsæ,** Pfitz. (*Nanòdes Medùsæ*, Reichb. f.), from the Andes, is a very singular fleshy-stemmed pendent orchid with distichous imbricated, twisted glaucous lvs., and 2 or more large terminal fls. with greenish sepals and petals shaded dark brown, and a fringed dark purple lip: pseudobulb about 1 ft. long. B.M. 5723, where Hooker remarks: "Amongst the many bizarre fls. which Orchideæ present, few are more singular than this Nanodes, to which Mr. Reichenbach has most felicitously given the name of *Medusæ*. Altogether the flattened, stout culms, and the extraordinary appearance and lurid purple of the flower give it a most sinister appearance, and, for an orchid, a most unusual one."—**E. Máthewsii,** Reichb. f. (*Nanòdes Máthewsii*, Rolfe). Rhizome creeping, many-rooted: st. nearly erect: lvs. linear, acute, canaliculate at base, distichous: fl. single, large; sepals lance-acuminate; petals linear, acute; lip emarginate. Peru.

L. H. B.

NAPǼA (name refers to a *glade* or *dell*). *Malvàceæ*. One species, *N. dioìca*, Linn., a rough-pubescent perennial herb, 5–9 ft. high, st. nearly simple, growing in valleys and bottom-lands, Pa. to Minn. and Tenn., said to be sometimes cult. for ornament. The fls. are small, white, in terminal corymbs, diœcious, the staminate with 15–20 anthers and the fertile with sterile stamens and an 8–10-carpelled ovary; petals entire; calyx 5-toothed and no involucel: lvs. large, the radical ones often 1 ft. or more across, palmately 9–11-cleft and the lobes pinnatifid. This plant is not to be confounded with *Sida Napæa* (or properly *S. hermaphrodita*), of similar range and habit and said also to be cult. in old gardens, but which has hermaphrodite fls. See *Sida*.

NAPOLEÒNA (after Napoleon Bonaparte). *Lecythidàceæ*. A small but botanically remarkable genus of Trop. W. Afr., very little known in cult. and demanding no treatment here. The fls. are of interesting structure. They are shaped like a saucer, about 2 in. diam., and the dominant color is reddish and bluish. The petals, staminodia and stamens are in 4 concentric rows, and more or less joined at the base to form the saucer or cup; the petals, on the outside, are connate and form a circular membrane or rim with many folds: the staminodia, free or nearly so, form a second row; the third row of connate staminodia: inner row of good stamens also connate at base. In the Flora of Trop. Afr. the fls. are said to be red, white or blue. Elsewhere it is stated that the fls. turn bluish as they decay. The names and illustrations of the species are confused. The names met in horticultural literature are *N. imperiàlis*, Beauv., *N. Heudelòtii*, Juss., *N. Whítfieldii*, Lem., *N. Mánnii*, Miers, *N. cuspidàta*, Miers, *N. Mìersii*, Hook. f. In B.M. 7199, some of the synonomy of the species is explained, with references to figures.

NARCÍSSUS (name probably derived from the story of the youth Narcissus, in mythology). *Amaryllidàceæ.* Narcissus. Daffodil. Well known and desirable mostly spring-blooming bulbs, hardy and also used for forcing.

Plants with tunicated bulbs, from which arise the foliage and the fl.-scapes: lvs. linear or even subulate, usually appearing with the bloom: fls. white, yellow or seldom green, erect or pendent, solitary or umbellate on the top of the scape or peduncle, the spathe 1-lvd. and membranous; perianth salverform, the tube varying in shape, the 6 segms. equal or nearly so and ascending, spreading or reflexed, the throat bearing a corona or crown which is long and tubular (trumpet daffodils), or cup-shaped, or reduced to a ring; stamens 6, attached in the perianth-tube, the filaments short or long; ovary 3-celled, the style filiform and the small stigma 3-lobed: caps. membranous, loculicidal, bearing globose or angled seeds.—The species of Narcissus grow natively in Cent. Eu. and the Medit. region and eastward through Asia to China and Japan. Many species-names are in the literature, most of them representing variants or hybrids, for the plants are extensively cult. and have received much attention from fanciers; probably 25 or 30 species represent the original stocks. The prominent species-types from the horticultural point of view are *N. Pseudo-Narcissus* (the common daffodil), *N. Bulbocodium* (hoop-petticoat daffodil), *N. Tazetta* (polyanthus narcissus), *N. Jonquilla* (jonquil), *N. poeticus* (poet's narcissus).

2437. Narcissus Bulbocodium var. monophyllus. (×⅔)

It is customary to throw the cultivated narcissi into three main groups, founded on the length or size of the crown or cup in the perianth: I. The true daffodils or trumpets (Magnicoronati; Figs. 2437–2442), those with crowns equaling or surpassing the perianth-segments in length; here belong *N. Pseudo-Narcissus*, *N. Bulbocodium.* II. The star-narcissi or chalice-flowers (Mediocoronati; Figs. 2443–2446), with crowns about half the length of the segments, as *N. triandrus*, *N. incomparabilis.* III. The true narcissi (Parvicoronati; Figs. 2447–2450), in which the crown is very short or reduced to a rim, as *N. poeticus*, *N. Jonquilla* and *N. Tazetta.* With the introduction of hybrid races, this old and usual classification becomes confused. It is suggested, therefore, by S. Eugene Bourne, an English authority, in "The Garden," "that the first step to an improved classification—a step which requires a very slight alteration in the present system—should be to form group I exclusively of true daffodils, and group III exclusively of true narcissi. All seedlings resulting from the union of two true daffodils should be placed in group I, all those from the union of two true narcissi in group III. All cross-bred forms containing both true daffodil and true narcissus blood should be put with the two species of intermediate character, Triandrus and Juncifolius, in group II, to be called, perhaps, intermediate narcissi. In subdividing this middle group, forms having special characteristics must be carefully distinguished from each other (for example, hybrids of Triandrus from hybrids of Poeticus, and so on), but subject to such distinctions, arbitrary crown-perianth measurements would be usefully employed." Discarding, for the garden forms, the older grouping into the three crown-lengths, the Royal Horticultural Society recently adopted eleven groups of Narcissi, as follows (subdivisions omitted except in I):

I. Trumpet Daffodils. Trumpet or crown as long as or longer than the perianth-segments.
  Yellow.—Perianth and trumpet yellow.
  White.—Perianth and trumpet white.
  Bicolor.—Perianth white, trumpet yellow.
II. Incomparabilis. Cup or crown not less than one-third but less than equal to the length of the perianth-segments.
III. Barrii. Cup or crown less than one-third the length of the perianth-segments.
IV. Leedsii. Perianth white, and cup or crown white, cream or pale citron, sometimes tinged with pink or apricot; embracing different dimensions.
V. Triandrus Hybrids.
VI. Cyclamineus Hybrids.
VII. Jonquilla Hybrids.
VIII. Tazetta and Tazetta Hybrids.
  Poetaz.—Hybrids between Poeticus and Polyanthus sorts.
IX. Poeticus Varieties.
X. Double Varieties.
XI. Various. To include *N. Bulbocodium*, *N. cyclamineus*, *N. triandrus*, *N. juncifolius*, *N. Jonquilla*, *N. Tazetta* (sp.), *N. viridiflorus*, etc.

In the present account, it is desired to keep the type-species in view, and therefore a botanical classification is followed. In this systematic treatment, use has been made of Bourne's "Book of the Daffodil," although it is founded on Baker's "Handbook of the Amaryllideæ." A "Key to the Daffodils" by Wilhelm Miller and Leonard Barron in Kirby's "Daffodils, Narcissus and How to Grow Them," New York, 1907, arranges the species and the main garden races. In this systematic account, only the main types or well-recognized races are described; other forms will be found in the supplementary list at the end of the article.

Into the second or medium-crowned group may be placed a number of good and popular horticultural strains which are actually or presumably hybrids between long-crowns (or trumpets) and short-crowns. Very likely *N. incomparabilis* and *N. odorus* are themselves hybrid series. Forms of *N. triandrus* might very well be classed with the long-crowns. The other garden series in this group are undoubtedly of hybrid origin, as: *N. Barrii* (Fig. 2446) had yielded about fifty named forms when Baker wrote in 1888. It is one-flowered: perianth-segments spreading, somewhat imbricated, to 1¼ inches long, sulfur-yellow, twice or more the length of the crown, the latter somewhat expanded, yellow and more or less margined with darker yellow or red. *N. Leedsii* is one-flowered: flowers slightly drooping, with spreading milk-white segments twice or more the length of cup-shaped very pale yellow crown, which usually changes to white. Other group-series, as *N. Humei*, *N. tridymus*, *N. Backhousei*, will be found in the supplementary list (page 2113).

The narcissi are among the most popular of all spring-flowering plants, being mostly hardy, free-blooming and showy, and of interesting forms and colors There are a few autumn-bloomers in the genus, but these are little known horticulturally. They are *N. viridiflorus*, *N. serotinus* and *N. elegans*. The hybrid narcissi have now introduced many forms, and races of varieties, and the nomenclature is mixed; but these forms and tribes add greatly to the resources of the cultivator. In this country, there is less amateur interest in the group than in European countries, although some of the kinds are forced in great quantities and many of them are widely popular among planters.

Narcissus has an interesting literature. Some of the older standard works in English are Burbidge's "The Narcissus," with many colored plates, and Peter Barr's "Ye Narcissus or Daffodyl Flowre, and hys Roots." Haworth wrote a monograph of narcissi in 1831, in which he made sixteen genera of the plants that are now referred to Narcissus. For 300 years and more, some of the species have been known as cultivated plants, and the literature runs through all the gardening books and periodicals. The number of good illustrations is also very large; some of the available portraits of the species and varieties in recent periodical literature are indicated in the systematic account herewith under the names that they bear in the journals. Some of the pictures used in this article are adapted from G.F. 5:209–13.

Usual outdoor culture of Narcissus. (J. N. Gerard.)

The narcissi are among the oldest of cultivated plants, but were much neglected for many years. Within the last twenty-five to thirty years there has spread a renewed interest in the group, with the usual result in such cases that the habitats have been closely searched for new forms, and hybrids have been raised till we have now a surprising number of beautiful flowers. Recently many of these have become so plentiful that they are within reach of the most impecunious gardener, and there is no reason why American gardens should not be filled with good collections of these beautiful flowers, or why florists should not force a more interesting list.

With few exceptions, the narcissi are hardy and strong-growing under ordinary cultivation. The "bunch-flowered" or polyanthus narcissi (*N. Tazetta*) and corbularias (*N. Bulbocodium*) are better grown under glass. The moschatus varieties, which are white (or properly sulfur-white) forms, seem to be of rather tender constitution in most gardens. Otherwise the narcissi as a rule succeed in good turfy loam, but no manure, rotted or otherwise, must touch the bulbs. Of course drainage should be good, and moisture plentiful in the growing season. In the garden it is well to plant very strong bulbs say 6 or 8 inches deep, and 3 inches at most apart, and allow them to remain till they form strong groups, or until they show signs of too much exhaustion from numerous offsets. Weak or small bulbs should not go so deep. It is advised to cover the bulbs once and one-half their own depth or size, measuring the solid body part of the bulb and not the soft neck or top. They may be placed a little deeper in light soils. The large bulbs may be 4 to 6 inches apart, and the smaller ones 3 to 4 inches. As decaying foliage is unsightly in the garden, a good plan is to dress the beds in the fall with rich manure, either animal or chemical, and in early spring start seedlings of annuals to cover the beds when the narcissi are through flowering, the dressing being necessary for the sustenance of the double crop. Too strong cultivation of the narcissi is not to be recommended, an extra vigor of growth being detrimental to the purity of the color of the flowers. If the object is to increase one's stock as quickly as possible, biennial or even annual lifting and separation of bulbs is advantageous. For naturalizing in waste places, in the grass, or near water, many of the strong-growing kinds will succeed perfectly.

The proper time to plant is in late summer or early autumn, and the poeticus kinds should not be kept out of ground longer than possible. Knob-like excrescences at the base of the bulbs indicate that growth is beginning and that planting should not be delayed. Partial shade, or at least protection from midday sun, is desirable, as the blooms last longer, and the colors are likely to be better. The old-fashioned or unimproved kinds will last for many years, but the more highly developed strains may need renewal every three or four years.

A most satisfactory planting of narcissi for house decoration is the use of flat lily pots, say 8 inches in diameter, placing the bulbs close together. The flowers carry best and keep better if cut when half open.

The intending collector will perhaps be confused when he opens a list of say 200 varieties, and it may be as well to say that a moderate beginning may be made by choosing a few of each section into which these are usually divided in good lists, bearing in mind that price is not an indication of the beauty or usefulness. As a matter of fact, the lower price is usually an indication that these are not uncertain and are probably more valuable in the garden.

2438. Narcissus Pseudo-Narcissus. (×⅓)

Narcissi for naturalizing and bedding. (David Lumsden.)

Many attempts have been made to naturalize the narcissi in this country. Often, however, very little success has been achieved. The difficulties are due in a measure, first, to climatic conditions, the very dry summer weather being apparently detrimental to their growth; second, the cultural treatment afforded the plants. The former can be overcome to a considerable degree by planting the bulbs in a cool sheltered position where they will not be exposed to the prevailing dry winds. The latter difficulty can be remedied by changing cultural methods. Frequently the bulbs are placed in a lawn, and as soon as their flowering period is over the foliage is cut down to the ground. This practice is to be condemned as it seriously impairs the vitality of the plants, and in a comparatively few years they succumb. When naturalization of bulbs in the grass is desired, a part of the estate or grounds should be taken where the grass may remain unclipped until the ripening period of the bulbs approaches. This period is readily discernible, as the foliage will develop a yellow hue and wither. It is then that the grass may be mown and the bulbs will suffer no injury.

In colonizing narcissi bulbs, it is advisable to plant early in autumn or as soon as the bulbs are received, which is usually the month of October. The bulbs should be set 4 to 6 inches deep, the larger sorts 5 to 6 inches apart; and the smaller species and varieties 3 to 4 inches apart. The plants may be massed by the side of ponds or streams, along sides of shady, or partially shady, walks. Planting in open, bleak, and especially in windy situations, should be avoided. Under trees, the bulbs are likely to be short-lived unless they are well supplied with moisture and available food.

Bedding.—The daffodil lends itself admirably to formal bedding work, and it is especially attractive when planted in combination with other bulbous or spring-bedding plants, such as *Scilla sibirica* or *Myosotis scorpioides*, the blue flowers of the scillas or myosotis making an attractive groundwork in contrast with the golden yellow trumpets of the daffodils. The daffodil also stands cold weather well and will recuperate after being subjected to a late spring freeze, showing no apparent sign of injury.

List of narcissi arranged in order for successional blooming in beds, border and garden.

By careful selection, narcissi may be had in bloom from the early part of April through the month of May. Some allowance must be made for abnormal seasons, late planting and uncongenial soils. In the following list, arrangement is made according to the order of earliness. The narcissus season in the northern states is April and May. Species and varieties marked (a) are early flowering; (b) second early; (c) intermediate; (d) late; (e) very late.

Section I. Large Trumpet Class.

(a) *Narcissus Pseudo-Narcissus* (Lent lily).

minimus
princeps
tortuosus
Golden Spur
obvallaris (Tenby daffodil)
Henry Irving

(b) *Narcissus Pseudo-Narcissus.*

Horsfieldii
King Alfred
maximus
Victoria

(c) *Narcissus Bulbocodium* (the hoop-petticoat daffodil).

Narcissus Pseudo-Narcissus.

Emperor
Rugilobus
Empress
J. B. M. Camm

(d) *Narcissus Pseudo-Narcissus.*

Glory of Leiden
Madame de Graaff
Madame Plemp

(e) *Narcissus Pseudo-Narcissus.*

Grandee

Section II. Medium-crowned Class.

(b) *Narcissus Leedsii.*

amabilis
Beatrice

(c) *Narcissus Leedsii, Barrii* and others.

Duchesse de Brabant
Mrs. Langtry
C. J. Backhouse
Stella
Duchess of Westminster
Minnie Hume
Cynosure
Grand Duchess
White Lady
Sir Watkin

(d) *Narcissus Leedsii, Barrii* and others.

Barrii conspicuus
Flora Wilson
Barbara Holmes

Section III. Small-crowned Class.

(d) *Narcissus Burbidgei.*

(e) *Narcissus poeticus.*

recurvus (pheasant's eye)
Patellaris
King Edward VII
ornatus

Section IV. Poeticus-Tazetta Class (Poetaz).

(d) *Narcissus poetaz.*

Alsace
Ideal
Aspasia
Irene
Elvira
Klondyke

The forcing of narcissi under glass. (David Lumsden.)

Of late years the forcing of narcissi under glass has assumed immense proportions. Tens of thousands of these bulbs are forced annually by many of the larger florists' establishments in this country. With few exceptions, these bulbs are imported, France and Holland supplying the major part. The earlier species, such as *Narcissus Pseudo-Narcissus* var. *obvallaris* (trumpet), *N. Pseudo-Narcissus* var. *spurius*, Golden Spur, and *N. Tazetta* var. *papyraceus* (paper-white narcissus), are received from France and arrive early in August, while the larger importations of the various species are received from Holland the latter part of September. The French bulbs therefore give the earlier bloom.

When the bulbs arrive, they should at once be placed in the pots or boxes in which they are to be grown. Immediate potting is a necessity, as the flowering quality of a bulb is greatly impaired if it is kept out of the soil any great length of time. This is especially true if the bulb is exposed to the influence of a dry warm office or storeroom. If the bulbs are to be grown for home or conservatory decoration, a pot or pan, preferably 6 to 8 inches in diameter, is used, five to nine bulbs being placed in each, according to the size of the bulbs. If grown in boxes for cut-flowers, 24 by 12 by 3 inches is a convenient size to handle.

The soil should be rich and composed of two-thirds good garden loam and one-third leaf-mold or well-decayed stable-manure, with an admixture of sand sufficient to keep the compost open. The pots should be well drained with crocks or cinders, and the soil pressed firmly around the bulbs, leaving the tips just visible. Allow ½ inch of space between the top of the soil and the top of the pot to insure that the plants are well watered when being forced. When the bulbs are potted they should be placed close together in a cold-pit or frame and given a thorough watering, covering them at once with 5 or 6 inches of screened cinders or sand, which acts as a non-conductor. The object of this is to keep them from drying out, and at the same time to maintain a low temperature which will induce them to develop good root-action. Before removing any bulbs from the coldframe or pit to the forcing-house, it is imperative that they be well rooted, as many of the failures in bulb-forcing are due to disregard of this essential precaution. A temperature of 55° to 60° F. at night in the forcing-house will be adequate. It will require four to six weeks' forcing to bring the bulbs into flower, depending in a measure on the season and the varieties forced.

Bulbs of the hardy narcissi which have not been unduly forced, may be planted outside when the ground is in condition in spring. These bulbs will yield a display of flowers in the garden the second year after forcing, and continue for years if the conditions are right.

The following species and varieties are among the most useful for forcing:

N. Tazetta var. *papyraceus* (paper-white narcissus) is the most useful of the florists' narcissi. Its pure white flowers are of great value to the trade. It is one of the easiest to force and the first to appear on the market.

N. Pseudo-Narcissus var. Van Sion (double daffodil) is grown both in boxes for cut-flowers, and in bulb-pans and pots to be used for conservatory and home decoration. Not being adapted to early forcing, the first batch of plants should not be brought into the forcing-house before the end of December or early January.

Narcissus Pseudo-Narcissus var. *obvallaris major* (Tenby daffodil), *N. Pseudo-Narcissus* var. Golden Spur, *N. Pseudo-Narcissus* var. Princeps, Emperor, Empress, and King Alfred, *N. incomparabilis* var. Sir Watkin, *N. Leedsii* var. Duchess of Westminster, *N. Barrii* var. *conspicuus*, *N. Jonquilla*, *N. Tazetta*, *N. poeticus* and *N. poeticus* var. *patellaris* are all desirable forms. For very early forcing, *Narcissus Pseudo-Narcissus* var. *obvallaris*, *N. Pseudo-Narcissus* var. Golden Spur, and *N. Tazetta* var. *papyraceus* are most

LXX. Narcissus poeticus.—The poet's narcissus; hardy and good.

largely grown. Only first-class bulbs should be used for forcing purposes. Bulbs potted early in September will be well rooted by the middle of October, at which time some of the earliest narcissi may be placed in the forcing-house; and by bringing in a batch each week, a continuous display of flowers may be had from November until Easter. For the best results in forcing bulbs, the night temperature should not exceed 60° F.

Growing bulbs in water on pebbles.—Recently much interest has been taken in growing narcissus bulbs in vessels containing water and pebbles. The culture is simple, and such bulbs may be readily grown under dwelling-house conditions. The bulbs should be placed in shallow jardinieres or saucers with clean white pebbles arranged around them to keep them in position and to hold them up. The jardinieres should be kept supplied with water sufficient to keep the roots submerged. *Narcissus Tazetta* var. *papyraceus* (paper-white narcissus) and *N. Tazetta* var. *orientalis* (Chinese sacred lily) are the most popular and useful for this purpose.

INDEX.

For other trade names, see supplementary list, at end of article.

Ajax, 2, 3.
albicans, 2.
albus, 4, 5, 12.
angustifolius, 13.
aurantus, 5.
aureus, 8.
Bertolonii, 8.
bicolor, 2, 8.
biflorus, 12.
bifrons, 9.
breviflos, 2.
Bulbocodium, 1.
calathinus, 4, 6.
Campernellii, 6.
canariensis, 8.
candidissimus, 2.
cernuus, 2.
Chinese Sacred Lily, 8.
citrinus, 1.
Clusii, 1.
concolor, 4.
conspicua, 1.
Corbularia, 1.
corcyrensis, 8.
cupularis, 8.
cyclamineus, 3.
dubius, 8.
fœtida, 5.
gaditanus, 7.
Gouani, 5.
gracilis, 10.
Graellsii, 1.
heminalis, 6.
hispanicus, 2.
Horsfieldii, 2.
incomparabilis, 5.
intermedius, 9.
italicus, 8.
Johnstonii, 2.
Jonquilla, 11.
jonquilloides, 11.
juncifolius, 7.
lacticolor, 8.
lætus, 6.
longiflorus, 2.
lorifolius, 2.
majalis, 13.
major, 2.
maximus, 2.
minimus, 2.
minor, 2, 6, 7, 11.
minutiflorus, 7.
monophyllus, 1.
moschatus, 2.
muticus, 2.
nivalis, 1.
nutans, 4.
obvallaris, 2.
ochroleucus, 8.
odorus, 6.
orientalis, 8.
ornatus, 13.
pachybolbos, 8.
pallidulus, 4.
Panizzianus, 8.
Paper White, 8.
papyraceus, 8.
patellaris, 13.
patulus, 8.
plenus, 13.
poetarum, 13.
poetaz, 8.
poeticus, 13.
polyanthos, 8.
præcox, 1.
Primrose Peerless, 12.
primulinus, 9.
propinquus, 2.
Pseudo-Narcissus, 2.
pulchellus, 4.
Queltia, 5, 7, 8.
radiiflorus, 13.
recurvus, 13.
Requienii, 7.
rugulosus, 6.
rupicolus, 7.
spurius, 2.
stellaris, 11, 13.
Tazetta, 8.
Telamonius, 2.
tenuifolia, 1.
tenuior, 10.
triandrus, 4.
trilobus, 4, 6.
Trumpet, 2.
Webbii, 11.

A. MAGNICORONATI *or* LARGE-CROWNED *species: corona or crown as long as the segms. or even longer, trumpet-shaped or cylindrical.*—DAFFODILS. (*Forms of No. 4 may be sought here.*)

B. *Lvs. green, few (often only 1), very slender and nearly terete, channelled.*

1. **Bulbocòdium,** Linn. (*Corbulària* species). HOOP-PETTICOAT DAFFODIL. A slender small plant, with bulb 1 in. or less in diam., and the very slender lvs. (usually 3 or 4 to each st.) mostly overtopping the blossoms: fl. 1, ascending or horizontal (not declined), 1½ or 1¾ in. long in most forms, normally bright yellow in all parts, the very prominent thin flaring corona entire or crenulate; perianth-segms. very narrow, ascending, to ¾in. long, the keel green, the same color as crown; stamens inserted near the base of the tube, declined, rather long. S. France to Morocco. May. B.M. 88. J.H. III. 54:393. Gn. 69, p. 222. G. 5:131.—Runs into many garden forms and hybrids. Fls. usually borne 5–8 in. above the ground. Minor forms are var. *conspicua*, a large yellow kind, 6 in.; var. *præcox*, large, yellow, early-flowering, 6 in.; var. *tenuifòlia*, small, early-flowering, golden yellow, 3 in.

Var. **Graéllsii,** Baker (*N. Graéllsii*, Webb). Lvs. about 2: perianth about 1 in. long, whitish or primrose-yellow. Castile. B.M. 6473 B.

Var. **monophýllus,** Baker (*N. monophýllus*, Moore. *N. Clùsii*, Dunal. *Corbulària monophýlla*, Dur.). Fig. 2437. An Algerian form, winter-blooming, usually with 1 lf., and fl. sessile and white: corona crenate. B.M. 5831. Gn. 60, p. 199; 76, p. 94. J.H. III. 42:287.

Var. **citrìnus,** Baker. Fls. large, 1–2 in. long, pale lemon-yellow or sulfur-yellow, the corona somewhat crenulate and 1 in. diam.; stamens and style included. Gn. 78, p. 189.

Var. **nivàlis,** Baker (*N. nivàlis*, Graells). Lvs. 2–3, erect and slender, the scape 2–4 in. long: perianth orange-yellow, ¾in. or less long; style and stamens exserted. Spain.

BB. *Lvs. glaucous, several, flat.*

C. *Segms. of perianth spreading horizontally.*

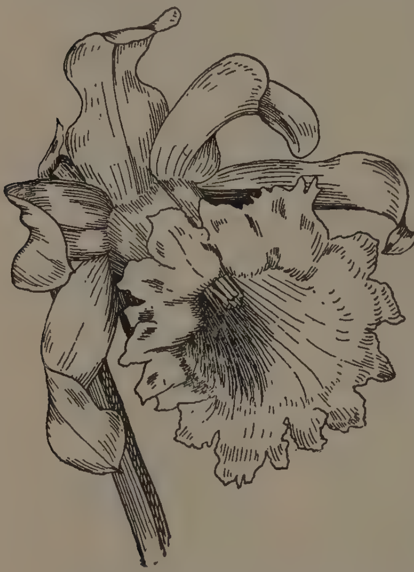
2. **Pseùdo-Narcíssus,** Linn. (*Ájax Pseùdo-Narcíssus*, Haw.). COMMON DAFFODIL. TRUMPET DAFFODIL. LENT LILY. Fig. 2438. Strong plant, 12–18 in. tall, with bulb 1½–2 in. and more diam.: lvs. 4–6, glaucous, narrow but flat, erect, usually about reaching the blossoms: fl. about 2 in. long, horizontal or ascending, pale yellow, the segms. and corona usually of different shades, the corona deeply crenate or almost crenate-fimbriate, more or less plicate; stamens inserted near the base of the perianth, much shorter than crown; style little longer than stamens. From Sweden and England to Spain and Austria.—Exceedingly variable in size, shape and coloring of fls. There are full double forms (common daffodil) in which the corona disappears as a separate body, and supernumerary segms. are present. This is one of the hardiest and commonest of narcissi.

2439. Cernuus—a form of N. Pseudo-Narcissus var. moschatus. (×⅔)

This species is the Trumpet narcissus, so named from the long corona. The Ajax daffodils are of this species and its derivatives, separated by Salisbury, Haworth and others as a distinct genus (*Ajax*). The normal forms are Yellow Trumpets, but the Bicolor Trumpet, var. **bícolor,** Baker (*N. bícolor*, Linn.), has pure white, spreading and much imbricated segms. and yellow corona. To this variety Baker refers *Ájax bréviflos*, Haw. (B.M. 1187), and *Hórsfieldii*, Burb. Horsfield and Empress are trade forms belonging in this group, the former being the earlier of the two. The White Trumpets are var. **moschàtus,** Baker (*N. moschàtus*, Linn.; B.M. 1300), which has cream-white or white fls., the perianth-tube obconic and nearly as broad as long, the segms. more or less ascending, twisted, sulfur-tinged and becoming pure white, crown about as long as segms., the throat crenate-plicate and about 1 in. across. Gn. 78, p. 89. J.H. III. 60:443. G. 28:231; 36:192. To this set, Baker refers *N. candidíssimus*, Red., *N. longiflòrus*, Salisb. (B.M. 924), with twisted segms. shorter than crown; *Ájax álbicans*, Haw., with large fl. and more imbricated segms.; *A. cérnuus*, Haw., with a more drooping fl. and tube longer than broad, the segms. sometimes longer than crown. The *cernuus* of the trade (Fig. 2439) has segms. equaling and sometimes exceeding the trumpet.

Other main forms or types of *N. Pseudo-Narcissus* are var. **màjor,** Baker, to which Baker refers *N. hispanicus*, Gouan, *Ajax propinquus*, Haw., *A. maximus*, Haw., *A. spurius*, Haw., *A. Telamonius*, Haw., *A. lorifolius*, Haw., and others. More robust and larger than the type of *N. Pseudo-Narcissus*, the fls. 2–2½ in. long, tube obconic, long and broad, segms. mostly spreading not imbricated and lemon-yellow; crown same length and shade as segms., and with a much crisped margin. B.M. 51; 1301. Spurius of the trade belongs here, with a hooded perianth and trumpet wide open at mouth; Golden Spur and Henry Irving are forms of it. The garden form *maximus* (Fig. 2440) has a very large fl., deep golden yellow, segms. twisted at ends, crown with spreading limb. G. 6:505; 25:132 (as *maximus superbus*); 28:145. J.H. III. 43:274. *Obvallàris*, Hort. (Tenby daffodil) is a sub-variety of var. *major*. It is a distinct form of medium size, somewhat dwarf, very floriferous, almost self-yellow, the perianth wheel-like with rather short segms. Gn. 63, p. 245. Var. **mìnor,** Baker (*N. mìnor*, Linn. *Àjax mínimus*, Haw.), is much smaller in all its parts than the type of *N. Pseudo-Narcissus;* lvs. 3–4 in. long and ¼in. broad: fls. to 1¼ in. long, with obconic tube and oblong sulfur-yellow segms.; crown deeper yellow, with deeply 6-lobed spreading throat. The garden *minimus* (Fig. 2441) is very small in all ways; said to be the smallest and earliest Trumpet narcissus. Gn. 76, p. 563. G. 36:171. Var. **mùticus,** Baker (*Àjax mùticus*, Gay). General stature of *N. Pseudo-Narcissus*, with somewhat broader lvs.: fl. to 1½ in. long, with obconic tube and sulfur-yellow segms.; crown deep lemon-yellow, as long as segms., ¾in. diam., the throat very truncate: from the Pyrenees. Gn.W. 5:593. Var. **Jóhnstonii,** Baker (*N. Jóhnstonii*, Hort.), is described by Baker as "a Portuguese form with a tube ¾in. long, ⅓in. broad at the throat, a pale truncate corona, and style much longer than the stamens." Bourne calls *N. Johnstonii* "a typical hybrid. Found wild in Portugal (Pseudo-Narcissus × triandrus). Slightly variable in form. In color from soft sulfur to pale lemon. Long straight, funnel-shaped corona; perianth-segms. somewhat reflexed. Is best grown in grass or coldframes."

According to Bourne, "the recognized type fl. of *N. Pseudo-Narcissus* is the wild daffodil of England. Trumpet yellow; perianth-segms. pale sulphur." White varieties are found wild here and there in England. There are many hybrids and intermediate forms with Latin names. See supplementary list, page 2113.

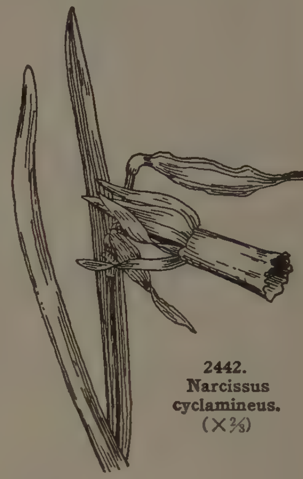


2440. Narcissus maximus.—A form of N. Pseudo-Narcissus. (×⅔)

2441. Narcissus minimus.—A form of N. Pseudo-Narcissus. (×⅔)

cc. *Segms. reflexed or pointing backward.*

3. **cyclamíneus,** Baker (*Àjax cyclamíneus*, Haw. *N. Pseùdo-Narcíssus* var. *cyclamíneus* Baker). Fig 2442. Lvs. narrow and linear, deeply grooved, the scape slender and subterete: fl. very drooping, the tube obconic and very short, the segms. lemon-yellow, ¼in. broad, abruptly reflexed (hence *cyclamineus*, or cyclamen-like); crown equaling the segms., orange-yellow, crenate. Portugal. B. M. 6950. Gn. 59, p. 352; 69, p. 148; 71, p. 252. J.H. III. 42:287; 64:305.



2442. Narcissus cyclamineus. (×⅔)

AA. MEDIOCORONATI *or* MEDIUM-CROWNED *species: corona or crown usually about half the length of the segms., cup-shaped. (Forms of N. triandrus may have large crowns.)*

B. *Segms. narrow, standing straight backwards (reflexed).*

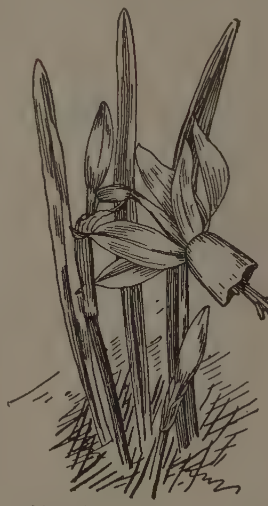
4. **triándrus,** Linn. (*Ganymèdes álbus*, Haw.). Fig. 2443. Slender most dwarf rush-lvd. species (scape 10–15 in. tall), bulb ¾in. or less diam.: lvs. few (2–4), very slender and semi-cylindrical and not overtopping the blossoms, channeled: scape very slender, semi-cylindrical: fls. 1 to several, horizontal or drooping, an inch long, but variable in size, both the lanceolate sharply-reflexed segms. and the entire cup-shaped corona (which is half as long as segms.) pure white in the type; stamens sometimes a little exserted. Spain and Portugal. G. 17:114; 19:355.—There are several forms, as var. *cóncolor*, Hort. (*Ganymèdes cóncolor*, Haw.), pale self-yellow; var. *pallídulus*, Hort. (*N. pallídulus*, Graells), primrose-yellow. B.M. 6473 *A;* var. *pulchéllus*, Hort. (*Ganymèdes pulchéllus*, Haw.), segms. yellow, corona white. B.M. 1262. (as var. *luteus*). Gn. 75, p. 604; var. *nùtans*, Hort. (*Ganymèdes nùtans*, Haw. *N. trílobus*. B.M. 945), corona a deeper yellow than the segms., crenulate.

Var. **calathìnus,** Hort. (*N. calathìnus*, Red., Burbidge, not Ker). Crown or corona larger, nearly, or quite as long as the segms., the fl. pale yellow. Isl. of Brittany. Gn. W. 20:297. Gn. 77, p. 459.

BB. *Segms. oblong or broader, spreading.*

c. *Foliage glaucous,*

5. **incomparábilis,** Mill. (*N. Gouáni*, Red. *Quéltia fœtida*, Herb.). Fig. 2444. Strong fine ornamental plant, with large bulb (1½ in. diam.) and 3–5 lvs.: lvs. flat (but narrow) and glaucous, nearly or quite the length (1 ft. or more long) of the distinctly 2-edged scape: fl. always 1, not fragrant, horizontal or



2443. Narcissus triandrus. (×⅔)

somewhat ascending, on a very short pedicel, the tube usually greenish, and subcylindrical, the segms. and crenate-plicate 6-lobed corona pale yellow in the type (but varying to other color combinations), the stamens and style not exserted. S. France and Spain to the Tyrol; by some considered a hybrid race of *N. Pseudo-Narcissus* × *N. poeticus*. B.M. 121. G. 4:127.—One of the commonest species in cult., the fls. often 3–4 in. across, and in many varieties. Double forms are frequent. Var. **álbus,** Hort., has white fls., with the corona usually pale yellowish. Var. **aurántus,** Hort., has the corona orange at the top.

2444. Narcissus incomparabilis. (×⅔)

cc. *Foliage green.*

6. **odòrus,** Linn. (*N. calathìnus,* Ker. *Philógyne odòra,* Haw. *N. Campernéllii,* Hort.). Campernelle Jonquil. Lvs. half the width (¼in.) of those of *N. incomparabilis,* the bulb nearly or quite as large, the peduncle subterete: fls. about 2 (sometimes 4), fragrant, the tube more slender than in *N. incomparabilis,* and the obconic shortly 6-lobed crenate corona somewhat smaller, the fl. bright yellow throughout; segms. obovate-oblong, cuneate below, spreading and not imbricated, to 1¼ in. long; style exceeding the anthers and reaching about half way of the crown. France and Spain and eastward; although found wild, by some regarded as a hybrid of *N. Jonquilla* × *N. Pseudo-Narcissus.* B.M. 934.—A good hardy species, differing from *N. incomparabilis* chiefly in its narrow lvs., 2 or more blossoms to a peduncle, fls. fragrant. Var. **trìlobus,** Baker (*N. trìlobus,* Linn., *N. lætus,* Salisb. *N. odòrus* var. *lætus,* Hort. *Philógyne heminàlis,* Haw.). Fls. smaller, the segms. about ¾in. long and imbricated; crown lobed, much shorter than segms. B.M. 78. Var. **mìnor,** Burb., fls. 1 in. diam. and the crown very small. Var. **rugulòsus,** Hort. (*Philógyne rugulòsa,* Burb.), has shorter oblong imbricated perianth-segms. Queen Anne's Jonquils are double forms of *N. odorus.*

7. **juncifòlius,** Lag. (*N. Requiénii,* Roem. *Quéltia juncifòlia,* Herb. *Philógyne mìnor,* Haw.). Very small slender species, with bulb about ½in. diam., and very narrow rush-like terete lvs., about 6 in. long: scape slender and terete, 6–12 in. long: fls. 1–4, horizontal or ascending, the tube slender-cylindrical (½in. long), the ovate spreading imbricated segms. and the cup-shaped, crenulate corona bright yellow or the corona sometimes darker; style reaching the throat of the tube; segms. about twice as long as corona. S. France and south.—A choice fancier's plant. Var. **minutiflòrus,** Baker (*N. minutiflòrus,* Willk.), has about 4 very small fls., the perianth-tube ⅓in. and the ovate segms. ⅙ in. long; corona truncate. Var. **rupícolus,** Baker (*N. rupícolus,* Dufour), Fig. 2445, has pedicels none or very short, perianth-tube ¾in. long and limb ¾in. across; corona 6-lobed. B.M. 6473 C. Var. **gaditànus,** Baker (*N. gaditànus,* Boiss.). Fls. 4 or 5, with rather long pedicels; segms. of perianth ⅙in. or less long, broadly ovate; corona truncate, nearly equaling segms.

2445. Narcissus rupicolus.—A form of N. juncifolius. (×⅔)

2446. Narcissus Barrii. (×⅔)

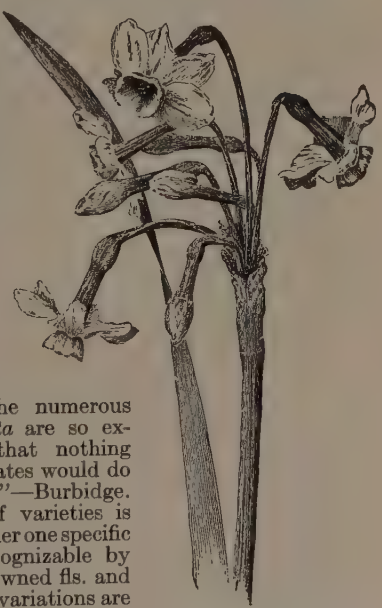
In this medium-crowned section belong many hybrid races derived from the long-crowns (or trumpets) and the short-crowns. Perhaps the best-known of these races in gardens are those called *N. Barrii* (Fig. 2446) and *N. Leedsii* (see pp. 2106 and 2113).

aaa. Parvicoronati *or* Small-crowned *species: corona usually much less than half the length of the segms., mostly saucer-shaped.*

b. *Corona soft and uniform in texture: lvs. various.*

c. *Lvs. ½in. or more broad, flat, mostly somewhat glaucous.*

8. **Tazétta,** Linn. Polyanthus Narcissus. Fig. 2447. Strong variable species, the bulb often 2 in. diam., the 4–6 lvs. 1½ ft. or less long, about the length of the flattened peduncle: fls. several (4–8 or 12), horizontal or declined on slender pedicels, the tube less than 1 in. long and greenish, the spreading obovate imbricate segms. pure white, and entire cup-shaped corona lemon-yellow, the whole fl. about 1½ in. across; stamens and style barely exserted. Canary Isls. to China and Japan.—Perhaps the commonest species and very variable. "Of the multiform Tazetta narcissi about 100 have received specific names."—Baker. In his monograph, he describes 14 subspecies, named in italic below. "The numerous forms of *N. Tazetta* are so extremely variable that nothing short of 50 folio plates would do the plant justice."—Burbidge. All this wealth of varieties is readily grouped under one specific type, which is recognizable by the many small-crowned fls. and the broad lvs. The variations are largely in color and in size of fls. Baker makes three groups:


2447. Polyanthus narcissus.—N. Tazetta. (×⅓)

(*a*) *bicolores*, the perianth white and the corona yellow. Here are to be placed *lacticolor, corcyrensis, patulus, ochroleucus* and many others.

(*b*) *albæ*, entire fl. white. Here belongs the "Paper White" (var. *papyràceus*, Hort. *N. papyràceus*, Ker. B.M. 947) very popular for winter bloom. G. 26:137. Here are to be referred the names *Panizzianus, dubius, canariensis, pachybolbos, polyanthos.*

2448. Jonquil.—Narcissus Jonquilla. (×½)

(c) *luteæ*, entire fl. yellow. Here belong *aureus, cupularis, Bertolonii, italicus.*

Var. **orientàlis,** Hort. (*N. orientàlis*, Linn. *Quéltia orientàlis*, Salisb.). Chinese Sacred Lily. Considered by Baker and others to be probably a hybrid between *N. incomparabilis* and *N. Tazetta:* robust: lvs. flat and green, ⅓in. broad: scape much compressed: fls. 3–4, on long erect or curving pedicels: tube of perianth subcylindrical, ½in. long and green, the segms. oblong, acute, sulfur-yellow, 1 in. long and half as wide; corona cup-shaped, one-third length of segms., orange-yellow, irregularly 3-lobed with erect margin; stamens and style not exserted. B.M. 948.—Grown in bowls of water; very fragrant.

N. pòetaz, Hort., is a hybrid race, from *N. Tazetta* × a form (*ornatus*) of *N. poeticus*. It is a promising race, with several poeticus-like fls. on the scape, the fragrance less cloying than that of *N. Tazetta.* They force readily. Writing of the origin and characteristics of the poetaz section, Joseph Jacob says in The Garden that they originated in 1885 in the bulb-fields of R. van der Schoot & Son, at Hillegom, Holland, from *N. ornatus* used as seed parent crossed with different kinds of *N. Tazetta.* "In their general appearance, this new race partakes of the characters of both parents. The Poet shows itself in the larger fls. and in some of the cups, while the Tazetta appears in their having several fls. upon one st. To sum up, they may be described as a large-fld. Polyanthus narcissus having from 2–6 blooms on a st., more pleasantly scented, and, generally speaking, with a looser and more artistic perianth." The *Poetico-Tazetta* narcissi are of this group or race.

cc. *Lvs. ¼in. or less broad, mostly terete or subterete, not glaucous.*

9. **intermèdius,** Lois. A yellow-fld. species, thought by some to be a hybrid between *N. Tazetta* and *N. Jonquilla*, distinguished from *N. Tazetta* chiefly by its subterete deep-channeled green lvs., which are only ¼in. wide: scape nearly terete: fls. 4–10; crown one-fourth or less the length of the oblong slightly imbricated spreading perianth-segms.; fls. soft yellow, the segms. described as lemon-yellow and the corona as orange-yellow: except for the subcylindrical green lvs. it might be taken for a form of the yellow race of Tazettas. S. France and Spain. Var. **primúlinus,** Hort. (*Hérmione primúlina*, Haw.), has imbricated segms. and the corona or crown with a 6-lobed spreading margin. B.M. 1299. Var. **bífrons,** Hort., has narrow perianth-segms. and deep crown.

10. **grácilis,** Sabine. Smaller, rush-lvd., 1 ft. high, the scape slender and weak and subterete, 1 ft. long: lvs. bright green, ⅙in. or less wide and very convex on the back: fl. pale yellow, the corona usually somewhat deeper colored than the oblong acute imbricated segms.; stamens and style not exserted. S. France probably, but known chiefly as an old garden plant, and perhaps, a hybrid of *N. Jonquilla* × *N. Tazetta* or *N. juncifolius* × *N. Tazetta.* B.R. 816. Var. **ténuior,** Hort. (*N. ténuior*, Curt.), the "silver jonquil," is more slender in all parts, the paler fls. changing to white. B.M. 379.

11. **Jonquílla,** Linn. Jonquil. Fig. 2448. Very slender and graceful hardy plant, 1½ ft. or less tall, the lvs. and subterete scape about equal in height: lvs. glossy dark green and very narrow and rush-like, 2–4 to a st.: fls. 2–6, fragrant, the slender cylindrical tube greenish yellow and 1 in. or less long; segms. yellow, obovate and scarcely overlapping; corona very short (⅛in. or less long), crenate, cup-shaped, the same color as the segms.; stamens and style barely exserted. S. Eu. and Algeria. B.M. 15.—One of the old-fashioned fls., perfectly hardy in N. Y. There is a double-fld. form. Var. *mìnor*, Baker (*N. Wébbii*, Parl. *Jonquílla mìnor*, Haw.), is a dwarf form: lvs. very slender: perianth-limb ½in. diam. Var. *stellàris*, Baker. Segms. lanceolate, reflexing; crown 6-lobed. Var. *jonquilloìdes*, Baker (*N. jonquilloìdes*, Willk.). Tube of perianth ½in. long, the limb ¾in. diam., the segms. obovate and imbricated; crown more than half as long as segms., the throat plain.

BB. *Corona with a prominently hardened or dry rim: lvs. broad.*

12. **biflòrus,** Curt. Primrose Peerless. Strong fragrant-fld. species, with globose bulb 2 in. or less in diam.: lvs. about 4 to a st., 1–2 ft. long and nearly or quite ½in. broad, and slightly glaucous, channeled, usually equaling and sometimes exceeding the stout 2-edged scape or peduncle: fls. 1–3, usually 2, white, with a pale yellow cup, the tube greenish white and 1 in. long, the segms. milky white, broad-obovate and over-lapping; the corona pale yellow, ⅛in. long, with a crisped scariose erect edge; stamens and style barely exserted. S. Eu. B.M. 197. G. 13:55; 27:295.—This plant has a wide range in the wild state, but some persons regard it as a hybrid of *N. Tazetta* and *N. poeticus.* Apparently little known in this country. Var. *álbus*, Hort., has white fls.

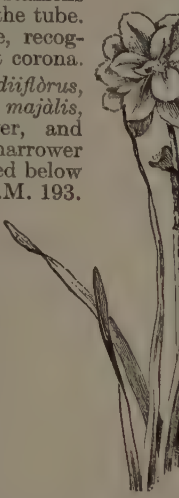
13. **poéticus,** Linn. Poet's Narcissus. Pheasant's Eye. Fig. 2449. A beautiful and popular strong-growing and hardy species, 1½ ft. high, the bulb 1 in. or more thick: scape or peduncle as long as the lvs., 2-

2449. Narcissus poeticus. (×¼)

edged: lvs. about 4 to a st., linear, ⅙in. broad, somewhat glaucous: fls. solitary (rarely 2), fragrant, horizontal, wide open, the obovate overlapping segms. white, about 1 in. long in native plants; corona much crisped and red-edged, ⅙in. or less long; tube of perianth cylindrical, greenish, 1 in. long; stamens and style barely exserted from the tube. Medit. region.—An old favorite, recognized by the red-margined short corona.

Var. **radiiflòrus,** Burb. (*N. radiiflòrus,* Salisb. *N. angustifòlius* and *N. majàlis,* Curt.). Slender; lvs. narrower, and shorter than the scape: corona narrower and more erect; segms. narrowed below so that they do not overlap. B.M. 193. An early-fld. form, often known as var. *angustifòlius.* Var. **ornàtus,** Hort. (*N. ornàtus,* Haw.) is an early-flowering kind, distinct in its perfect form: segms. of good substance, imbricated, broad and rounded. Var. **poetàrum,** Hort. (*N. poetàrum,* Haw.), blooms after var. *ornatus:* fls. large; segms. imbricated and slightly recurved; corona red or reddish to base.

Horticultural forms of *N. poeticus* are: *plènus* (Fig. 2450), double, late-fld.; *recurvus,* lvs. much recurved, and segms. recurving; *patellàris,* fls. flat, crown large, segms. much imbricated; *stellàris,* has a much distended bladder-like spathe. For poeticus forms, see Pugsley, Journ. Bot., Aug., 1915.



2450. Narcissus poeticus var. plenus. (×⅓)

N. abscíssus, Schult.=N. Pseudo-Narcissus var. muticus.—*Ajax* is an old generic name for N. Pseudo-Narcissus; this species is now sometimes called the Ajax narcissus.—*N. Báckhousei,* Hort. (N. Pseudo-Narcissus × incomparabilis; or N. Pseudo-Narcissus × Tazetta, or N. bicolor × poeticus) has single horizontal sulfur-yellow fls. with tube about half equaling the segms., the latter about 1–1¼ in. long; crown lemon-yellow, nearly equaling segms., erect, deeply lobed and plicate.—*N. Bárrii,* Hort. (N. poeticus × Pseudo-Narcissus or N. incomparabilis × poeticus), of the medium-crowned section, has yellow horizontal fls. with long, slender neck; "covers a series of forms intermediate between incomparabilis and poeticus, nearer the former than the latter" (Baker); Fig. 2446. G.M. 51:644. Gn. 73, p. 599; 78, p. 458 (all as N. Barrii conspicuus). A popular form (see p. 2106).—*N. Bernárdii,* Hen., is like N. Macleaii, but with a more plicate and deeper-colored corona, which is orange or lemon-yellow, and half as long as the spreading white segms. Pyrenees, said to occur where N. Pseudo-Narcissus var. muticus and N. poeticus grow together.—*Bunch-flowered daffodils* are N. Tazetta.—*N. Broussonètii,* Lag. Lvs. linear, about 4 to a st.: scape 1 ft., 2-edged: fls. many in an umbel, the cylindrical tube whitish, the oblong obtuse segms. ½in. long and pure white; crown rudimentary; anthers exserted. Morocco.—*N. Búrbidgei,* Hort. (probably N. incomparabilis × poeticus, in a series of forms). Short-crowned: it has the habit of N. poeticus, with a solitary drooping fl. with white horizontal or somewhat reflexed segms. and a very short corona with a yellow base and red rim.—*Cambricus* is an early bicolor form of N. Pseudo-Narcissus: segms. sulfur-white; crown or trumpet yellow.—*Capax plenus* is an old double form, lemon-yellow.—*N. CookSoniæ,* Hort., is a creamy-white variety of the Leedsii type. G.C. III. 47:336.—*Corbularia* narcissi are the N. Bulbocodium forms. Corbularia is an old generic name for this species.—*Daffodil.* The word daffodil is variously used. In this country it means usually the full double forms of N. Pseudo-Narcissus, plants that are very common in old gardens. Modern named varieties of this daffodil type are Van Sion and Rip Van Winkle. In England, however, daffodil is a more general term, used for most species except the Poet's narcissus (N. poeticus).—*N. élegans,* Spach (N. autumnalis, Link). Autumn-flowering: bulb globose, ½in. diam.: lvs. 1–4, appearing with the fls., very narrow, subterete: scape stiff and erect: fls. 2–6, on erect pedicels; perianth-tube cylindrical, whitish, about ½in. long; segms. spreading, lanceolate, pure white; crown very short, saucer-like, yellow. Italy, Algeria.—*N. Ënglehéartii,* Hort. Hybrids of N. incomparabilis and N. poeticus, the name of recent origin: much like N. Burbidgei but the flat crown or cup is ruffled or fluted. This comprises the relatively new section of "flat-eyes" or "flat-crowns," although the cup may take the form of a shallow wide-mouthed funnel.—*N. Fósteri,* Lynch. Garden hybrid between N. Bulbocodium var. citrinus and N. triandrus, the latter probably the male parent: scapes 2-fld.: fls. have the Bulbocodium character in size and shape of perianth, lanceolate segms. and declinate stamens: lvs. much like those of N. triandrus; crown and segms. pale yellow, tube greenish. G.C. III. 47:342.—*Flat-leaved* narcissi are the various forms of N. Pseudo-Narcissus.—*Ganymedes* is an old generic name for N. triandrus and its forms.—*Giganteus*=Sir Watkin.—*Grandiflorus* is applied to a large-fld. white form of N. Tazetta.—*N. Hùmei,* Hort., has a single nodding medium-crowned yellow fl. with long, straight cup about 1 in. long (often equaling the segms., but variable in size); segms. oblong, somewhat ascending, 1½ in. long: fls. said to have "a deformed clipt-off appearance." Ascribed to N. Pseudo-Narcissus and N. poculiformis.—*Incognita,* one of the Engleheartii forms, or by some referred to N. Barrii. Gn. 71, p. vii, Nov. 30 (1907); 73, p. 301. G.M. 54:300.—*N. Leèdsii,* Hort., has horizontal or drooping fls. with white segms. and yellow to whitish medium corona; described by Baker as having perianth-tube subcylindrical, ¾in. long; segms. spreading, oblong, acute, milk-white, to 1¼ in. long and to ¾in. broad; crown cup-shaped, ½in. long, sulfur-yellow, erect and irregularly crenate-plicate; style overtopping anthers and reaching nearly to throat of crown: intermediate between N. poculiformis and incomparabilis, but said by some to be produced by crossing white N. Pseudo-Narcissus varieties with N. poeticus. (See p. 2106.)—*Lent Lily*=N. Pseudo-Narcissus.—*Lobularius* is a confused name, usually applied to the deep yellow double daffodil, N. Pseudo-Narcissus.—*Lusitanicus* is a name for a bicolor N. Pseudo-Narcissus.—*N. Maclèaii,* Lindl., is a 1-fld. plant of small growth, bearing horizontal short-tubed fls. with milk-white segms. and medium-sized yellow crenate corona half or more the length of the lobes; segms. much imbricated, about ¾in. long, crown about ½in. long, minutely crenulate; style included. Of doubtful origin, several species having been suggested as parents. B.M. 2588. B.R. 987. Gn. 69, p. 103.—*N. Mastersiànus* is a hybrid of N. Tazetta and N. poculiformis.—*N. Mílneri,* hybrid of N. incomparabilis and N. Pseudo-Narcissus var. moschatus.—*N. minicýcla,* Hort. A garden hybrid between N. cyclamineus and N. minimus.—*N. montànus,* Ker=N. poculiformis.—*N. Nélsonii,* Hort., a subtype of N. Macleaii, very robust, and fls. larger (2–3 in. across), the lemon-yellow corona more than half as long as the segms.—*N. pallidus,* a whitish form of N. Pseudo-Narcissus.—*Pallidus præcox* is a pale sulfur-colored early form. Gn. 60, p. 320; 65, p. 271. G. 30: 215.—*Peerless* narcissi are the forms of N. incomparabilis.—*N. poculifórmis,* Salisb. (N. montanus, Ker; B.R. 123) has 1 or 2 nodding medium-crowned white fls. and a cup-shaped corona about half the length of the segms.; origin doubtful: by some regarded as a hybrid and by others as a native of the Pyrenees.—*Princeps,* sulfur-yellow and yellow-crowned, a form of the N. Pseudo-Narcissus type. G.C. III. 29:182.—*Queltia* is an old generic name to distinguish the group comprising N. incomparabilis.—*Rip Van Winkle* is a double variety of N. Pseudo-Narcissus.—*Roman* narcissus is a name for double-fld. N. Tazetta, white with orange cup. —*Rugilobus,* large-fld. variety of N. Pseudo-Narcissus, with primrose perianth and yellow trumpet. G. 16:89.—*Salmonetta,* raised by Engleheart: perianth clear white; cup salmon-orange; fl. star-like. Gn. 63, p. 393.—*Scoticus,* N. Pseudo-Narcissus with deep yellow corona and whitish segms.; known as Scotch garland lily. There is also a double form.—*N. serótinus,* Linn. Autumnal: bulb globose, 1 in. or less in diam.: lvs. appearing after the fls., very slender: scape very slender and jointed low down: fls. 1 or 2; tube subcylindrical, greenish; segms. oblanceolate, obtuse, spreading, pure white, about ½in. long; crown very short, 6-lobed, lemon-yellow. Medit. region.—*Sir Watkin* or *giganteus* is a very large-fld. form of N. incomparabilis.—*N. Spréngeri vomerénsis* is a garden hybrid between N. Pseudo-Narcissus and N. Tazetta. Carl Sprénger, Naples.—*Spurius,* a yellow N. Pseudo-Narcissus, a subform of var. major.—*Stella,* one of the star-narcissi of the N. incomparabilis group; now represented by Stella Superba, about twice the size, with long white spreading segms. and cup clear yellow. J.H. III. 43:269.—*Telamonius plenus* is the common sulfur-yellow double daffodil, N. Pseudo-Narcissus. Gn. 73, p. 227.—*Tortuosus* has twisted segms.: a form of N. Pseudo-Narcissus.—*Tridymus* is like N. Nelsoni, but has 2–3 smaller fls., with tube usually obconic (N. Pseudo-Narcissus × Tazetta).—*Van Sion* is a large pure yellow and very double form of N. Pseudo-Narcissus of the Telamonius set; much used for forcing. There is also a single Van Sion. —*Variiformis* is a form of N. Pseudo-Narcissus with canary-yellow corona and white segms., the fls. variable.—*N. viridiflòrus,* Schousb. Autumnal: bulb globose, 1 in. diam.: lvs. 1 or 2 to st., subterete, not appearing with the bloom: fls. 2–4, on a slender fragile scape, green in all parts; perianth-tube cylindrical and slender, about ½in. long; segms. lanceolate, reflexing, short; crown very short, 6-lobed; anthers barely exserted. Gibralter, Morocco; very late. B.M. 1687. G.C. III. 40:375.

L. H. B.

NARTHÈCIUM (the name may be derived from *Narthex,* the Greek name of Ferula, the stems of which were used as rods; or by others explained as an anagram of Anthericum). *Liliàceæ.* BOG-ASPHODEL. Perennial rhizomatous herbs.

Flowers yellowish green, the solitary pedicels subtended by a narrow bract, and bearing a small linear bractlet; perianth-segms. linear-lanceolate, obscurely 3-nerved, reflexed or spreading in fl., soon erect, persistent; stamens 6, included; filaments subulate, woolly; anthers linear-oblong; style none; the slightly lobed stigma sessile upon the attenuated apex of the ovary: caps. narrowly oblong, membranous, prolonged upward, splitting into 3 valves; seeds long with a straight tail at each end: lvs. 3–8 in. long, often less than ⅙in. broad; grass-like and vertical: sts. 1–2 ft. tall.—About 6 species, natives of northern hemisphere, Eu., E. Asia, Atlantic states, Calif.

The genus is close to Tofieldia in having a persistent perianth, simple racemes, and grass-like lvs.; resembles Simethis in the bearded filaments and simple style. The perianth is firmer than in most liliaceous plants and shows an approach to Juncaceæ, with which many botanists associate it. Some botanists call this genus Abama and assign it to the family Melanthaceæ.

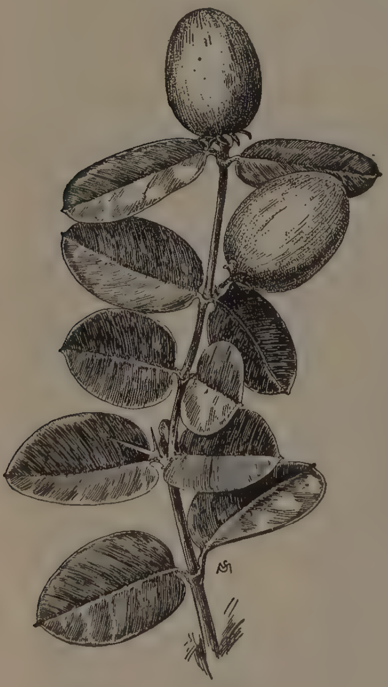
califórnicum, Baker. Lvs. iris-like; basal ones ⅛–⅙in. broad; cauline lvs. 2–3 in number, short: raceme 3–5 in. long, loose: sts. 18–20 in. high: fls. 30–40, yellowish green: caps. of paper-like texture, slender at top, 3-valved, when ripe a bright salmon-color; seeds, including the points or tails, ½in. long. Swamps, Calif.—Intro. by dealers in native plants in 1888 or 1889.

M. B. Coulston.
A. C. Hottes.†

NASEBERRY: *Sapodilla.*

NASTÚRTIUM (classical Latin name of some cress, referring to its pungent smell: *nasus*, nose, and *tortus*, distortion). *Cruciferæ.* The name Nasturtium is used for two very different groups of plants. As a flower-garden name, it is used for plants of the Tropæolaceæ (see *Tropæolum*). It has also been used for certain crucifers, including the water-cress and horse-radish; but as a generic name it is now replaced, mostly by *Radicula*, which see.

NATAL PLUM, a handsome shrub (*Carissa grandiflora*, of the family *Apocynaceæ*), originally from South Africa, is cultivated in southern Florida and southern California for ornament and for its scarlet edible fruits the size of a plum. Fig. 2451. It is considered one of the best hedge plants in South Africa, and is sometimes used for this purpose in the United States. See *Carissa.*



2451. Natal plum.—Carissa grandiflora. (×½)

The Natal plum is a large shrub, eventually attaining to 15 or 18 ft., much branched and spreading, and armed with stout bifurcate spines: foliage dense, glossy green in color; lvs. opposite, ovate-acute, mucronate, thick and leathery, 1–2 in. long: fls. star-shaped, fragrant, about 2 in. across and borne in small terminal cymes; calyx composed of 5 oblong-acute lobes about ⅛in. long; corolla salverform, with a slender tube about ¾in. long and 5 oblong-obovate lobes twice the length of the tube and twisted to the left in bud; stamens 5, inserted upon the tube; style clavate; ovary superior, 2-celled, with several ovules in each cell.

The plant blooms most abundantly in early spring, but produces a few scattering flowers throughout the year; their waxy texture and fragrance are suggestive of the jasmine. The fruits, most of which ripen in summer, are ovoid or elliptic in form, commonly 1 to 2 inches long, with a thin skin inclosing the firm granular reddish pulp toward the center of which are several thin papery almost circular seeds,—sometimes as many as twenty or more. The fruit is very attractive in appearance, but is not generally relished when eaten out of hand; its flavor suggests the raspberry or cranberry, and when stewed it yields a sauce which greatly resembles that made from the latter fruit. It is also used for jelly and preserves. It is not of commercial importance in the United States, but is frequently planted in gardens for ornament and fruit. It seems well adapted to cultivation in both Florida and California, withstanding several degrees of frost without injury, and being somewhat drought-resistant. Among seedlings, however, there is great variation in productiveness, so that vegetative means of propagation must be used to perpetuate good varieties. Firminger states that grafting on *Carissa Carandas* renders the species more productive.

When used as a hedge-plant it withstands shearing admirably, but yields little fruit under these conditions. Its growth is compact and low, and it has the interesting habit of branching dichotomously. It succeeds on a variety of soils, from the lightest sand to heavy clay or adobe, and when left to itself will form a shapely attractive bush.

Seeds are easily germinated by planting in pans of light sandy loam. They should be as fresh as possible and barely covered with soil. Cuttings, when planted directly after removal from the parent bush, do not root very readily, but a method has been discovered by Simmonds whereby nearly every one will grow: this consists in notching young branchlets while still attached to the plant, making a cut half way through the stem 3 or 4 inches from the tip; the branchlet is then bent downward and allowed to hang limply until the end of the second month, when a callus will have formed on the cut portion, and the cutting may be removed and placed in sand under a lath shade, requiring another month to strike roots. The plant is also easily propagated by layering, and it is not difficult to bud, using the common method of shield-budding, essentially the same as practised with the avocado. Late spring is the best time to do the work.

Another species of Carissa in cultivation and which is sometimes confused with *C. grandiflora* is *C. bispinosa* (*C. arduina*). This can be distinguished from *C. grandiflora* by the much smaller size of the flowers, which are only ½inch broad, with the corolla-segments much shorter than the tube, and by the oblong-obtuse fruit which is only ½inch in length and contains one or two instead of many seeds lanceolate in outline.

Carissa Carandas, a species common in India, where it is known as karaunda, has also been introduced to this country. It is distinguished from the above two by the corolla-lobes being contorted to the right instead of to the left (as stated on page 664), by the oblong or elliptic-oblong leaves with rounded or obtuse tips, and by the spines being simple in place of bifurcate. Its fruits are ½ to 1 inch long, containing three or four seeds, and are much used in India for pickles and preserves.

F. W. Popenoe.

NATHÙSIA (Gottlob Nathusius, 1760–1838, Prussian plantsman). *Oleàceæ.* Four trees of India and tropical Africa seldom cult., for which see *Schrebera.*

NATIVE PLANTS. The desire for native and natural plants is one of the dominant notes of the present time. It is not strange that wild plants are not appreciated in a new country. The first necessity of civilization is to fell the trees that ground may be tilled and habitations be built. The necessities of life are imported; the literature is exotic; the plants are transported from other lands. In Europe the conditions of living had become established. People had outgrown the desire to remove. They appreciated their own plants and also those from the New World. American plants attracted attention in Europe rather than in America.

Twenty-five years ago, the writer made a census of indigenous American plants known to have been introduced to cultivation. The statistics were published in "Annals of Horticulture for 1891." It was found "that there are in North America, north of Mexico, about 10,150 known species of native plants, distributed in 1,555 genera and 168 families. Of these, 2,416 species are recorded in this census, representing 769 genera and 133 families. Of this number, 1,929 species are now offered for sale in America; 1,500 have been introduced into England, of which 487 are not in cultivation in this country." All these species are there catalogued. The only other account of the entire cultivated flora is that which was compiled in the "Cyclopedia of American Horticulture," 1900–1902, and for which the lists of twenty-five years ago were a preparation. That Cyclopedia described 2,419 species of plants native to North America north of Mexico. A brief sketch of the history of recent efforts toward the introduction of native plants is given in the preface to the catalogue of 1891.

Formerly, the term "American plants" had a technical meaning in England. William Paul in his book on "American Plants," published in London in 1858, writes as follows: "The history of American plants may be briefly told. The term is popularly applied to several genera, principally belonging to the natural order Ericaceæ. They are generally 'evergreen,' producing their flowers for the most part in the months of May and June." The book is devoted largely to rhododendrons, azaleas and kalmias, although European and other heaths are included.

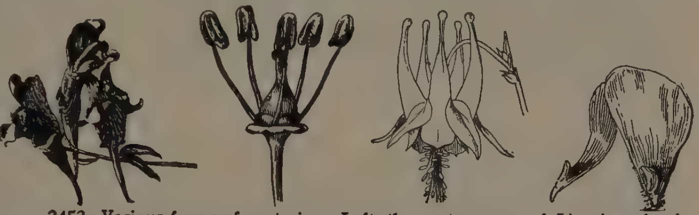
There is a strong tendency toward the production of peculiarly American types and races even in species domesticated from other countries, as of the carnation and sweet pea. As American plant-breeders give greater attention to native species, the divergencies between the horticulture of the Old World and that of the New World will be accentuated. The recent multiplication of books about native plants has stimulated interest in the indigenous resources. L. H. B.

NAUMBÙRGIA: *Lysimachia.*

NAUTILÓCALYX (apparently *nautilus-shaped calyx*). *Gesneriàceæ.* Herbs of Trop. S. Amer., usually referred to Episcea, but lately separated and re-defined by Sprague (Kew Bull. 1912, 85). As now constituted, it comprises species named in Episcea and Alloplectus, 9 being included altogether. Two of these may be mentioned here, although apparently not in the American trade. The species of Nautilocalyx have the general habit and appearance of Episcea, but differ in having ovules on the inner surface only of the placental plates rather than on both surfaces. They are distinguished from Alloplectus in being herbs rather than shrubs and undershrubs, and in bearing a larger corolla-limb.

N. Fórgetii, Sprague (*Alloplèctus Fórgetii*, Sprague). Fls. pale yellow, corolla hairy outside, the calyx-segms. much shorter than the corolla-tube: lvs. with very wavy margins, somewhat truncate at base, green above and red along the ribs and veins beneath: petioles 2 in. or less long, villous. Peru. *N. pállidus*, Sprague (*Alloplèctus pállidus*, Sprague). Fls. creamy white, the corolla hairy outside and the front part of the tube purple-striped inside and the back part with broad band of purple blotches: lvs. gradually narrowed to base, nearly glabrous above, minutely puberulous beneath. Peru. B.M. 8519. L. H. B.

NECTAR. Most flowers pollinated by insects possess nectar-glands, simple or composite, located upon some part of the floral structures. To designate nectar by its chief constituent would be simply to call it a sugar solution, more or less watery or dense, depending upon the flower, or upon the conditions under which produced. However, several sugars may be present, as well as small quantities of other substances. Just as in honey, the predominant form is fruit-sugar, with cane-sugar next in importance, and always with small amounts of aromatic substances yielding the odor and affecting the taste of the product. Sometimes mucilaginous substances are present. Honey contains less water than nectar, also other aromatic compounds and small amounts of waxes and pollen. The abundant secretion of nectar is, to a large extent, dependent upon external conditions, and usually is favored by conditions inducing the perfection of the flowers.



2452. Various forms of nectaries. Left, the nectar-spurs of Linaria vulgaris; the cushion-like nectaries in a grape flower; nectaries of columbine; right, the nectar-scales on petals of ranunculus.

Nectaries occur on various parts of the flowers, often about the base of one or more petals, or even stamens; again, they may take the form of glandular protuberances or ridges arranged between any of the whorls of floral members; while the most interesting and conspicuous modifications involving the nectaries are those in which one or more of the petals or other floral leaves may be changed into pockets, spurs, or receptacles. Some of the interesting types of modification may be noticed in the violet, columbine, nasturtium, and certain orchids. An extreme form is found in a Madagascar orchid, angræcum, in which the nectar-tube may be 6 inches long. Various nectaries are shown in Fig. 2452. In all cases, the nectar is secreted from glandular cells located either superficially or more deeply in the tissues, and in the latter case connected with the receptacle by nectar-ducts. The secreting cells may be confined to a single small spot or may be spread over a larger area or zone.

The development of the curious and complicated nectaries referred to indicates a remarkable adjustment for insect pollination, and whatever may be the immediate explanation of the development of these structures, they serve a most useful purpose in effecting cross-pollination. It is necessary to add, however, that the secretion of sugary liquids by plants is not confined to nectaries, and oftentimes the relation of these secretions to any useful purpose is not clear. The production of "honey-dew" by certain plants, normally or through the incitation of aphid punctures, is allied to nectar-secretion. The opportunities determining the excretion of sugars by nectaries have been considerably studied by physiologists; but, for these facts, the reader must seek information in papers dealing more extensively with the osmotic properties of cells, as the subject is too technical for discussion here. B. M. DUGGAR.

NECTARINE, a smooth-skinned peach (*Prunus Persica* var. *nucipersica*). Fig. 2453. It was formerly thought to be a distinct species of plant. By DeCandolle it was called *Persica lævis.* Roemer in 1847 made

2453. Nectarines.

two species of it, *Persica violacea*, the freestone nectarines, and *P. lævis*, the clingstone nectarines. It is now known, however, that nectarines often come from seeds of peaches, and peaches have come from seeds of nectarines; and yet it is not impossible that a distinct species is involved in the nectarine group. Either may originate from the other by means of bud-variation. (See Darwin's "Animals and Plants under Domestication" for historical data.)

The cultivation of the nectarine is in all ways like that of the peach. Because of the smooth skin of the fruit, it is perhaps more liable to the attacks of curculio. It is less popular in the market than the peach, and therefore is less grown, although in California it is planted on a commercial scale. In that state it does well on almond stocks. Nectarines are usually inferior to peaches in quality, probably because less attention has been given to the breeding and selection of varieties, and from the fact that there is no conventional standard of excellence. Nectarines thrive in the peach regions. Varieties are few, as compared with peaches. The most prominent in this country are Boston, Downton, Hardwick, Early Newington, Pitmaston Orange, Stanwick, Humboldt, Lord Napier, Advance, Elruge. In color, size and season, nectarines vary as do peaches. See also *Peach*, and *Prunus*.

L. H. B.

The nectarine is grown in California almost exclusively for drying and cannning, and even for these uses is but of minor importance. As compared with peaches for canning, the product of nectarines is only about one-eighth of 1 per cent that of the peach, and for drying only about 1 per cent that of the peach. The varieties grown for both canning and drying are the white varieties, because they do not color the syrup in canning and because when sulfured they make a beautiful amber-colored translucent product. E. J. Wickson.

NEGÚNDO: *Acer*, page 204.

NEÌLLIA (named after Patrick Neill, at the beginning of the nineteenth century secretary of the Caledonian Horticultural Society at Edinburgh). *Rosàceæ.* Ornamental shrubs chiefly grown for their graceful habit, the handsome bright green foliage and the attractive flowers.

Deciduous: lvs. stipulate, alternate, short-petioled, doubly serrate and usually more or less lobed: fls. in racemes; calyx-tube rather large, campanulate or almost tubular, with 5 short erect sepals exceeding the 5 oval petals; stamens 10–30, carpels 1 or 2 with terminal slender styles: pod dehiscent only at the inner suture, with several shining seeds. From Spiræa it differs, like the allied genera Physocarpus and Stephanandra, by its stipulate lvs. and shining crustaceous seeds.—About 10 species in China and the Himalayas.

The neillias are graceful shrubs, with spreading branches, bright green generally ovate leaves and with pink or whitish rather small flowers in terminal racemes. *N. sinensis*, which is the handsomest of the species in cultivation, and *N. longeracemosa* have proved fairly hardy at the Arnold Arboretum, while *N. thyrsiflora* requires protection even in the Middle States, and is often killed to the ground in severe winters, but usually vigorous young shoots spring up and bloom and fruit in the same season. On account of their graceful habit and handsome foliage they may be used as border plants for shrubberies. They grow in any good moderately moist soil. Propagation is readily effected by greenwood cuttings under glass and also by seeds treated like those of spirea.

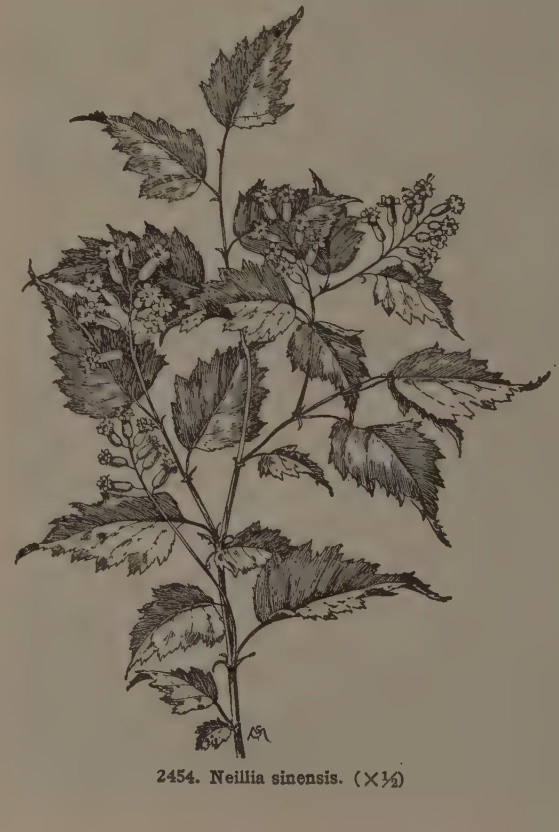
A. *Fls. whitish; racemes collected into terminal panicles.*

thyrsiflòra, D. Don. Upright shrub, to 6 ft. high, but usually not exceeding 2 ft. if annually killed to the ground: branches angular, glabrous: stipules rather large, serrate: lvs. ovate to ovate-oblong, cordate at base, long-acuminate, usually 3-lobed, incised-serrate, glabrous above, pubescent on the veins or glabrous beneath, 2–4 in. long: fls. short-pedicelled, in terminal and axillary racemes 1½–3 in. long and crowded into terminal panicles, rarely solitary; calyx-tube campanulate, pubescent, with the sepals about ⅓in. long. Aug., Sept. Himalayas. R.H. 1888, p. 416.

AA. *Fls. pink; racemes solitary.*

longeracemòsa, Hemsl. Shrub, to 10 ft.: branchlets terete, pubescent: lvs. ovate to ovate-oblong, acuminate, rounded or subcordate at the base, incised-serrate, rarely 3-lobed, glabrous above, pubescent on the veins and veinlets beneath, 1½–2½ in. long; stipules lanceolate, entire: fls. pink, about ⅓in. long, short-pedicelled, in dense racemes 1½–3½ in. long or sometimes longer; calyx tubular-campanulate; ovary hairy only at the apex. June, July. W. China.

sinénsis, Oliver. Fig. 2454. Shrub, to 6 ft.: branchlets terete, glabrous: lvs. ovate to ovate-oblong, acuminate, rounded at the base, incised-serrate, usually lobed,



2454. Neillia sinensis. (×½)

sparingly hairy or nearly glabrous, 1½–2½ in. long; stipules lanceolate, entire, usually conspicuous: fls. about ½in. long, slender-pedicelled, in terminal racemes 1–2½ in. long; calyx tubular, glabrous or with glandular bristles; ovaries hairy at the apex. May, June. Cent. China. H.I. 16:1540.

N. affìnis, Hemsl. Closely allied to N. longeracemosa. Branchlets glabrous: lvs. broader, nearly glabrous: racemes shorter; calyx sometimes bristly; ovary villous. W. China.—*N. amurênsis*, Nichols.=Physocarpus amurensis.—*N. opulifòlius*, Brew. & Wats. =Physocarpus opulifolius.—*N. Tanákæ*, Franch. & Sav.=Stephanandra Tanakæ.—*N. thibética*, Franch. Closely allied to N. longeracemosa. Lvs. cordate, pubescent beneath, slightly 3-lobed; stipules ovate, often sparingly toothed: calyx-tube cylindric, pubescent and often bristly; ovary silky pubescent. W. China.—*N. Tórreyi*, Wats.=Physocarpus monogynus.

Alfred Rehder.

NELÚMBO (Ceylonese name). Usually written *Nelumbium. Nymphæàceæ.* Nelumbium. Two strong-growing aquatics, one yellow-flowered and native to North America, the other white or cyanic-flowered and native of the Orient.

From Nymphæa, or the true water-lilies, Nelumbo differs technically in having distinct carpels, which are imbedded in the receptacle, with a single ovule in each. Nelumbiums have strong and thick and usually tuber-bearing rhizomes, which creep in the earth in the bottoms of ponds and slow streams: lvs. peltate, orbicular or nearly so, entire, usually very large and long-petioled and mostly standing high above the water (floating when from young plants or in deep water): fls. large and showy, single, on peduncles which equal or exceed the lvs.; sepals 4 or 5; petals many, erect or erect-spreading; stamens many, on broad, short filaments: fr. a large, flat-topped perforated receptacle (Fig. 2455), in which are immersed the many carpels. The bold and characteristic form of the nelumbiums lends itself well to conventional designs, as in Fig. 2456.

Nelumbiums are bold plants, suitable for large ponds and for masses. They may be grown in tubs, or better in the open pond, as the rhizomes may run 30 or 40 feet in a year. *N. lutea* flowers well only when thoroughly established and in entire freedom; it is sometimes crowded out by *N. nucifera.* The latter species, commonly but incorrectly known as Egyptian lotus, is one of the best of large pond plants, being grown for its stately habit and showy flowers. Its roots should not freeze. Covering the pond with boards and litter, or filling it with water, may be made to afford ample protection.

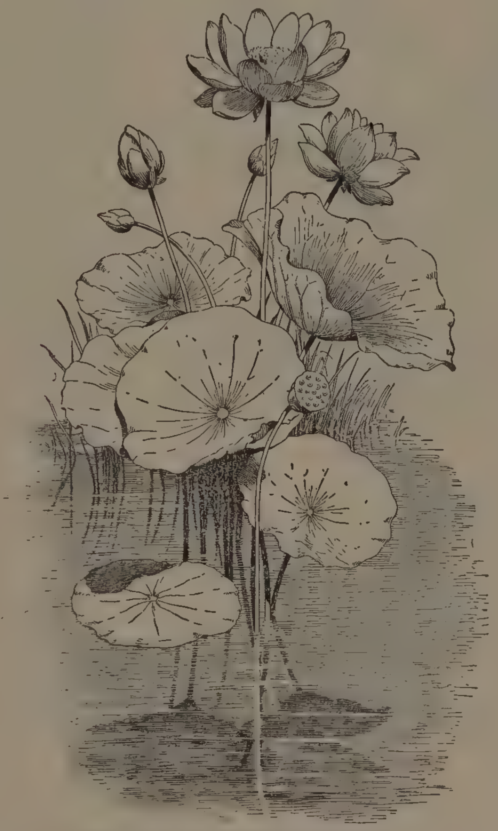
A. *Fls. yellow.*

lùtea, Pers American Lotus, or Nelumbo. Water Chinkapin. Lvs. usually raised 2–6 ft. out of shallow water, cupped or depressed in the center over the attachment of the petiole, 1–2 ft. across: fls. pale sulfur-yellow, 4–10 in. across, with obovate-obtuse concave petals and hook-appendaged anthers. S. Ont. to Minn., Neb., Fla. and La.; usually local. G.F. 9:375. Mn. 10:113. V. 19:9.—A bold and useful plant for colonizing, deserving to be better known. *N. flavéscens*, Hort., produces more but smaller fls. and has a red spot at center of lf.; possibly a hybrid.

AA. *Fls. pink, red or white.*

nucífera, Gaertn. (*Nelúmbium speciòsum*, Willd. *Nelúmbo índica*, Pers., and *N. Nelúmbo*, Karst.). East Indian Lotus. Fig. 2455. Lvs. usually larger than those of *N. lutea*, glaucous: fls. fragrant, usually pink except in horticultural varieties, overtopping the lvs. Caspian Sea to Japan, Philippine Isls., India and N. Austral.; naturalized at Bordentown, N. J., where it was intro. by E. D. Sturtevant. A.G. 15:334. C.L.A. 4:275; 5:301. G. 7:16; 28:395. Gn. 28, pp. 426, 429; 43:463; 44, pp. 229, 435; 50, pp. 267, 469; 57, p. 397; 66:171; 76, p. 447. Gng. 5:114; 6:295; 15:334. G.C. III. 52:119. G.M. 38:809; 40:34; 41:833–5. G.W. 2:377. I.H. 42:27. R.H. 1900, p. 243. V. 15:97.—This plant is known to the trade as Egyptian lotus, but the lotus of the ancient Egyptians is a Nymphæa. This plant is not native to the Nile region. Many named forms are cult., e.g.: Fls. white: Var. **álba** (*N. álba*, Hort.), the "magnolia lotus." Gn. 28, p. 427. G.C. III. 14:41. Var. **álba grandiflòra**, larger-fld. A.F. 14:726. A.G. 20:369. Gng. 7:146. Mn. 9:73. Var. **álba striàta**, edge of petals striped and tipped with red. Var. **pygmæ̀a álba**, dwarf: lvs. 6 in.: fls. 4 in. across. Var. **álba plèna** (*N. Shiròman*), large, double Japanese form. A.F. 16:229. F.E. 10: suppl. Feb. 12. Gn. 60, p. 158. Gng. 9:3. Var. **pygmæ̀a álba plèna**, dwarf, double. Fls. pink to red: Var. **Kinshìren**, white shaded pink. Var. **kermesìna**, light rose. Var. Grossherzog Ernst Ludwig (=*N. flavescens* × *N. Osiris*), salmon-rose. Var. **pygmæ̀a ròsea**, dwarf, bright rose. Var. **ròsea**, Hort., deep rosy pink. Var. **Osìris**, deep rose. Gn. 72, p. 457. Var. **púlchra**, dark rosy red. Var. **pekinénsis rùbra**, rosy carmine. Var. **gigantèa**, very large, rose-purple. Var. **ròsea plèna**, double, deep rosy pink. G.W. 5:411. Var. **pekinénsis rùbra plèna**, very large, double, rosy carmine.

H. S. Conard.



2455. The Indian lotus, Nelumbium speciosum, of the trade, but properly Nelumbo nucifera.

Nelumbium in cultivation.

Whilst it may be historically true that the Egyptian lotus is not a Nelumbium, the *Nelumbium speciosum* (or more properly *Nelumbo nucifera*) is everywhere known under that name, and it has been so distributed in good faith. In fact, it is doubtful whether it is worth while to change the common name at this time.

America may be honestly proud of possessing such a fine aquatic plant as *Nelumbo lutea*, the well-known American lotus. While China and Japan are the recognized homes of the splendid *Nelumbo nucifera*, they do not possess a yellow lotus. In the central states and near the Great Lakes, *N. lutea* is found in abundance, but it is scarce in the Middle Atlantic and eastern states. When well established it is a magnificent plant, and when in blossom it is a sight worth traveling miles to see.

Nelumbiums, with nympheas and other aquatic plants, were among the few flowers known or cultivated by the ancients. No mention is made in history of a yellow lotus prior to the discovery of America by white men, but over four centuries ago it was well known to the Indians and cultivated by them in the waters of the Tennessee and Cumberland rivers, and was abundant on the tributaries of the Mississippi. It was carried northward and eastward by the Indians, and was established as far east as Connecticut. At the present time (1914), it is established and cultivated in most of the states of the Union.

2456. Metal fountain in Nelumbo form.

The late Isaac Buchanan received tubers of *N. nucifera* from Japan, which were planted in a stream on Long Island, but there they perished. Later, other efforts were made, and some tubers from the same source were received and planted by Samuel Henshaw in an artificial pond in the gardens of the late Mr. Green, at New Brighton, Staten Island, New York, where they grew most satisfactorily, some of the original stock being still in evidence on the estate.

About the same time E. D. Sturtevant, of Bordentown, New Jersey, who had introduced a number of tender water-lilies into commerce, and knowing of its being grown in the Jardin des Plantes, Paris, made an examination of the condition under which it existed there and determined to experiment in the culture at Bordentown, New Jersey. Roots were obtained from Kew Gardens and afterward planted in shallow water in a sheltered spot in a millpond near Bordentown. Here the plant grew amazingly, and its success and hardiness were fully established. From here was disseminated the now famous Egyptian lotus, *Nelumbo nucifera,* to all parts of the United States. Several varieties have since then been introduced from Japan, including white and delicately tinted varieties, also deep rose, and double forms of both white and rose.

The cultivation of the nelumbium is of the simplest. The roots or tubers should not be transplanted until there is evidence of growth, as the tubers, being usually buried deep in the soil below the water and out of the reach of frost, are not affected by the warm rays of sunshine as early as nympheas and other terrestrial plants. If nelumbiums are dug before they start into growth, the tubers should be kept in a warm place or planted where the temperature is such that growth will begin at once. In the Middle Atlantic States and eastward and westward, May is the best time to transplant; southward earlier. Tubers may be planted in shallow water near the margin of the pond where it is intended they shall grow. The tuber should be placed horizontally in the soil, first making a little trench or opening to receive the same and covering with about 3 inches of soil. Means must be employed to keep the tuber securely in position and, if necessary, a stone or brick laid over the tuber. When the season is late or circumstances delay the planting season until June, it will be safer to secure plants in pots or tubs. These, beside being somewhat advanced, will transplant with a greater degree of certainty and more satisfactory results. In artificial ponds a walled section should be built to hold the soil and keep the roots within bounds. The walls should have no corners at right angles; where there are such they should be rounded off, so that the runners are not intercepted and crowded in bunches at the corners. The natural soil and deposits in ponds are, in most cases, all that is required for these plants. They will flourish equally well in a stiff or tenacious soil, but when grown in artificial ponds it is best to use a mixture of two parts turfy loam and one part thoroughly rotted cow-manure. Do not use fresh or green manure, and when possible have sods cut in the fall and stacked with the manure (in this case it may be fresh). In early spring, have the same turned over two or three times before using. Resort may be had to cultivation in tubs, but the lotus being such a gross feeder, the result in most cases is that the plants are starved into rest at an early date. The leaves turn a sickly yellow and present a sorry appearance, and in many cases produce no flowers. If no other method can be adopted, then secure the largest tubs possible and during the growing season use liquid or artificial manure liberally. An excellent method to grow nelumbiums under artificial conditions is to excavate a hole 5 to 6 feet in diameter and 2½ feet deep with slightly sloping sides. Have a form in readiness to place inside the excavation, leaving about 4 inches clear for concrete. The form can be of light material, the size of the pool desired, so braced as to hold the concrete in place until set. Place heavy chicken wire netting in the opening for reinforcement and secure in place when filling so as to be in the center of wall. When finished, this makes an ideal pool for nelumbiums or water-lilies, watertight and frostproof. Use two bags Portland cement, three wheelbarrows of sand and five wheelbarrows gravel or finely broken stone.

It must be understood that while the nelumbiums are hardy, they are so only as long as the tubers are out of the reach of frost. The depth to which frost penetrates the soil or water may be termed a dead-line.

The tubers are farinaceous and edible, and are of considerable market value in Japan, but a taste must first be cultivated for them in the United States. The muskrat, however, has developed a highly cultivated taste for these sacred morsels, and it is necessary to watch these animals lest they take up their abode near ponds where the nelumbiums grow. There are now in cultivation in the United States a dozen or more varieties, including single and double forms, pure white to deep rose, and yellow.

As to insect pests, black-fly or black aphis is sometimes troublesome. The best remedy is the lady-bird beetle and its larvæ. Also spray with tobacco water. The leaf-cutter, or roller, is prevalent in some sections, and both young and old leaves are attacked, also the stems of the leaves and flowers. These have their natural enemies in the form of wasps and even sparrows, and as no liquid insecticide can be used, only such as are in the shape of a dry powder can be depended on. Paris green, mixed with land plaster or plaster and powdered slaked lime, is excellent, but dry hellebore in powder-form, or slugshot applied by a powder bellows is the best material to exterminate them. A borer in the leaf-stalks sometimes does great damage, killing nearly all the leaves, so that no blooms are made. Apply "slug-shot" with a bellows. Sometimes the diseased leaves are mowed off and destroyed, and a second growth may escape the borers.

Wm. Tricker.

NEMÁSTYLIS (Greek, *thread-like styles*, because the styles are not united). Syn., *Nemastylus. Iridàceæ.* Tender American bulbs, with blue six-lobed flowers about an inch across which last only a day.

Erect plants, with slender, usually branched sts.: root-lvs. linear: spathes 1 or more, peduncled: fls. rather large, more than 1 to a spathe; perianth of 6 segms. without a tube; inner segms. a little smaller than the outer; ovary 3-celled; filaments more or less united; anthers short; ovules many, superposed; style-branches alternate with the anthers: caps. loculicidally 3-valved, oblong, ovoid or obovoid.—Strictly, Nemastylis is a genus of 3 species, found only in the S. U. S. and characterized by having the filaments nearly free. Baker, however, in his Handbook of the Irideæ, includes Chlamydostylis as a subgenus of 17 species found from Mex. to S. Amer. and characterized by having the filaments united in a column to the summit. Some of the following species have been rarely advertised by dealers in native plants; the others by Dutch bulb-growers.

A. *Filaments nearly free.* (*Subgenus Nemastylis proper.*)

B. *Cluster of fls. single: spathes usually 1-fld.*

cœléstina, Nutt. Root-lvs. 1–2, 1 ft. or more long: st. 1½–2 ft. long, bearing 3–4 reduced lvs.: fls. sky-blue. Pine barrens, Fla. to Ga., and westward through Texas.—Differs from *N. acuta* in having more broadly ovate perianth-lobes.

BB. *Clusters of fls. 2–3: spathes 2–3-fld.*

acûta, Herb. (*N. geminiflòra,* Nutt.). NORTHERN NEMASTYLIS. Root-lvs. 2–3, ½–1 ft. long: st. ½ ft. long, bearing 1 large linear lf. at the fork, and sometimes another below it: fls. bright blue or purple: bulb dark colored, ovoid, scaly, 1 in. or less long: caps. obovoid. Texas, to Mo., La., and Kans., Ark. and Tenn. B.M. 6666. F.S. 21:2171.

AA. *Filaments united in a column to the summit.* (*Subgenus Chlamydostylis.*)

B. *Fls. brownish purple, inner segms. tipped yellow.*

brúnnea, Wats. St. 1 ft. long, bearing a single lf. 6–8 in. long and a sheathing bract at the base of the peduncle: spathe 2½ in. long, several-fld.: outer perianth-segms. obtuse, inner ones acuminate, brown-purple, the inner segms. tipped yellow; anthers yellow. Mex.

BB. *Fls. pale blue.*

Prínglei, Wats. St. usually simple, with a single lf. at the middle: radical lvs. shorter than st., 2–3-nerved: spathe 1½ in. long: fls. fragrant; outer segms. obtuse, inner ones minutely apiculate, pale blue: caps. oblong. Mex., province of Chihuahua.

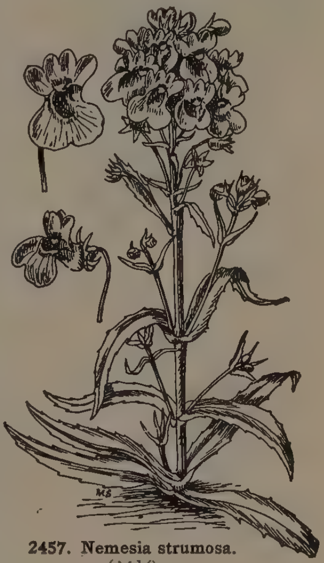
WILHELM MILLER.
A. C. HOTTES.†

NEMÈSIA (old name used by Dioscorides for some sort of snapdragon). *Scrophulariàceæ.* The genus includes attractive flower-garden half-hardy annuals.

Herbs annual or perennial, sometimes undershrubs, the annual kinds having come into cult: lvs. opposite: fls. very variable in color, from yellow to white and purple, in terminal racemes or axillary (racemose in the garden kinds), the pedicels bractless; calyx 5-parted; corolla with short tube which in front bears a spur or pouch; corolla-limb 2-lipped, the upper or posterior lip 4-notched or -cleft and the lower or anterior of one shallow-notched or entire lobe with palate at base; stamens 4, didynamous, the anthers 1-celled and usually cohering about the stigma; ovary 2-celled: caps. with boat-shaped valves.—Species about 50, of which a very few are Trop. African and the remainder S. African. Cf. Hiern, Flora Capensis, IV: II (1904). *N. strumosa* was one of the horticultural novelties in the last part of the 19th century. The fls. are very distinct in shape and have a wide range of color. They are about an inch across and borne in great profusion. If started indoors in March and transferred to the open in May the plants will furnish continuous bloom from June to Sept. The colors range from white, through pale yellow and rose, to orange and crimson, with numerous intermediate shades and a great variety of throat markings. This species has been known to botanists nearly a whole century; it grows only 50 miles from Cape Town, and it exhibits all these colors in the wild, yet it was never exploited until 1893, the first live plants seen in Eu. being shown in 1892. Sixteen distinct color varieties were recognized in the first batch of cult. plants, and the process of selecting strains has probably only begun. The nemesias are of easy cult. They may stand about 6 in. apart in the garden beds.

A. *Fls. with a sac or pouch at the base.*

strumòsa, Benth. Fig. 2457. Erect, branches, 4-angled, glabrous below and more or less pilose above, 6–24 in. high: root-lvs. oblong-spatulate, entire or dentate; st.-lvs. lanceolate or linear, dentate, sessile: racemes in wild plants, 2–4 in. long, terminal, becoming subcorymbose and afterward elongating; fls. white or in shades of yellow and purple, often purple-marked on the outside, the bearded throat spotted on a yellow ground; upper lip about ½in. long and often 1 in. broad; lower lip about 1 in. broad: caps. 4–6 lines long, 3–4 lines wide. S. Afr. B.M. 7272. G.C. III. 12: 277. R.H. 1898, p. 87 (var. *grandiflora*). V. 16:7. G. 31:315.—It varies into a number of forms, some of them compact. Var. **Súttonii,** Hort., is a series of improved forms, with large fls. of many colors, pale yellow, rose-pink, white, rich orange, crimson and scarlet being now offered separately. G.M. 35: 459; 43:311. Gn.W. 9:289; 18:637. J.H. III. 51:58.



2457. Nemesia strumosa. (×¼)

AA. *Fls. with a spur at the base.*

versícolor, E. Mey. Erect or ascending, nearly glabrous below and slightly pilose above, simple or branched, 1 ft. or more high: lowest lvs. somewhat stalked and ovate or narrower; upper lvs. few, sessile, oblong, lanceolate or linear, entire or toothed: racemes sub-corymbose and lengthening, 1–3 in. long in the wild; fls. "variable in color, either white and striate outside or cinnabar-red, striate outside and sulphur-coloured on the throat or sulphur-colored and not striate" (Hiern); lobes of the upper lip equal among themselves and as long as the lower lip; throat with 2 callosities, pubescent; spur incurved or nearly straight, about as long as the lower lip. S. Afr. Var. **compácta,** Hort. (*N. compácta,* Hort.). A compact and attractive free-flowering race, 8 in. to 1 ft., excellent for borders and rock-gardens, with fls. in white, rose, violet, and blue. Var. **compácta trícolor,** Hort., has white, rose, and violet in the fls. R.H. 1898, p. 87.

floribúnda, Lehm. Erect, 6–15 in., glabrous below and somewhat pilose above, the sts. 4-angled: lower lvs. stalked, oval or ovate, dentate; upper ones few, small, ovate or lanceolate, subsessile: racemes rather open, subcorymbose or oblong, 1–5 in. long in the wild; fls whitish; upper corolla-lobes oblong, very short; lower lip somewhat longer and 2-lobed; mouth closed; spur nearly straight and obtuse long-conical. S. Afr. B.R. 24:39.—Fls. smaller and with a narrower range of colors than in *N. strumosa.*

lilácina, N. E. Br. Much branched, minutely glandular-pubescent, to 15 in. high: lvs. narrow-lanceolate, to 1½ in. long, toothed: racemes to about 1 ft. long, loose, the pedicels slender; fls. small, lilac; upper lip scarcely ⅛in. long, purple-striped; lower lip about same length, yellow-marked on the palate; spur whitish, short. German S. W. Afr.

Wilhelm Miller.
L. H. B.†

2458. Nemopanthus mucronata. (×¼)

NEMOPÁNTHUS (from the Greek, referring to the thread-like flower-stalks). Also spelled *Nemopanthes. Aquifoliàceæ.* Mountain Holly. Ornamental shrub planted for its attractive fruit and handsome foliage.

Deciduous: lvs. alternate and partly fascicled, slender-stalked, entire or slightly toothed: stipules small, caducous: fls. polygamo-diœcious, small, whitish, 1 or few on slender axillary pedicels; calyx in the staminate fls. of 4–5 deciduous teeth, ovate in the fertile fl.; petals distinct, 4–5, linear; stamens 4–5, free, with slender filaments: fr. a drupe with 4–5 bony nutlets.—One species in N. E. N. Amer. Closely allied to Ilex, which differs chiefly in the persistent calyx and in the stamens being adnate to the petals, which are slightly united at the base.

The mountain holly is a much-branched upright shrub with medium-sized generally oblong bright green leaves, inconspicuous whitish axillary flowers followed by attractive globose red fruits on slender drooping stalks. It is hardy North and prefers moist soil; it does well in partly shaded situations. Propagation is by seeds; also by greenwood cuttings under glass.

mucronàta, Trel. (*N. canadénsis,* DC. *N. fasciculàris,* Raf. *Ilicioìdes mucronàta,* Brit.). Fig. 2458. Shrub, to 10 ft.: young branches purplish, older ones ashy gray: lvs. elliptic-oblong, mucronate, entire or sometimes slightly toothed, paler beneath, glabrous, 1–1½ in. long: fls. solitary or few, small, on slender peduncles ½–1 in. long: fr. subglobose, ¼–⅓in. across, dull red. May, June; fr. in Aug., Sept. Canada to Wis., Ind., and Va. B.B. (ed. 2) 2:490. I.T. 3:81.

Alfred Rehder.

NEMÓPHILA (Greek, *nemos,* a grove, and *phileo,* to love; referring to the habitat of some species). *Hydrophyllàceæ.* Hardy annual herbs blooming abundantly from early spring to late summer.

Whole plant more or less hairy: st. diffuse, becoming prostrate: lvs. alternate or opposite, pinnately lobed or divided, petiolate: fl.-stalks usually longer than the lvs., terminal or lateral, slender, 1-fld., in one or two species inclined to be racemose; fls. blue, white, purple, or variously spotted; calyx 5-parted; lobes erect or spreading, with 5 supplementary reflexed lobes alternating with them, increasing in size when fruiting; corolla broadly bell-shaped or wheel-shaped, deeply 5-lobed, with 10 scaly appendages on the inside of the throat; ovary hairy; styles glabrous: caps. globose, hairy, smaller than calyx-lobes. The chief source of information is in the monograph of the Hydrophyllaceæ in Das Pflanzenreich, hft. 59, p. 42, by A. Brand; also in Syn. Flor. of N. Amer., vol. II, part I, p. 155, by Asa Gray. Brand recognizes 18 species and over 50 subspecies and varieties, all from N. Amer.

Nemophilas are of dwarf, compact habit, and produce an abundance of showy bell-shaped flowers from early spring to late summer; hence they are valued for bedding and for the border.

A. *Lvs. mostly alternate, all with an ear-shaped and clasping base or winged petiole.*

aurìta, Lindl. St. 1–3 ft. long, weak, with stiff, recurved bristles by which the plant tends to climb: lvs. mostly alternate, the lower opposite, deeply cut above into 5–9 oblong or lanceolate segms. which are usually turned back: later fls. not accompanied by lvs., and hence appearing to be in loose racemes; corolla about 1 in. broad, violet. Blooming from March till May, low, shady grounds. Calif. from Sacramento Valley to San Diego. B.R. 1601.

phacelioìdes, Nutt. Sparsely hairy, 1–2 ft. tall: lvs., all but earliest, alternate; lf.-segms. obtuse, margin slightly ciliate; lower lvs. narrowed into a short naked petiole; lobes notched at end: corolla bell-shaped, blue with white or pale center: seeds slightly pitted. Low ground. W. N. Amer., Ark., Texas. B.R. 740. B.M. 2373.

AA. *Lvs. opposite.*

B. *Fls. one color, or dotted or veined.*

Ménziesii, Hook. & Arn. (*N. atomària,* Fisch. & Mey. *N. modésta,* Kellogg. *N. pedunculàta,* Benth.). St. straggling, succulent, procumbent, pilose: lvs. pinnatifid, the lobes ovate, nearly entire, slightly hairy: fls. light blue to nearly white, marked with dark brown spots toward the center or sometimes with a dark eye. Low grounds, W. Amer., Calif. to Ore. B.R. 1940. B.M. 3774. P.M. 5:99. V. 2:267. Brand makes 19 subspecies and botanical varieties of this species, of which some are important horticulturally. Var. **discoidàlis,** Hort., in which the spots on the corolla are confluent into a large, brownish purple eye. Other garden forms are: var. **vittàta,** Hort., velvety black margined with white (Gn. 9, p. 232); var. **élegans,** Hort. (*N. atomària* var. *élegans,* Hort.), fls. pure white, with chocolate center.

2459. Nemophila Menziesii var. insignis. (×½)

(V. 2:268); var. **oculàta**, Hort., white, with purple center, and var. **argéntea**, Hort., white fls., lilac stripes.

Subsp. **insígnis**, Brand. Baby Blue-Eyes. Fig. 2459. Lvs. pinnately parted into 7–9 oblong segms., which are sometimes 2–3-lobed or toothed: fls. ½–1 in. wide; corolla bright clear blue, the scales within its base short, partly free, covered with short hairs. Low ground, Calif. B.R. 1713. B.M. 3485. P.M. 3:151. V. 2:268; 5:168; 8:215. Gn. 74, p. 367.—There are many garden varieties. Among these are var. **grandiflòra**, with large, clear blue fls. (Gt. 34:370); var. **álba** fls. pure white; var. **marginàta**, or **variegàta**, Hort., fls. blue, edged with white.

Var. **crambeoìdes**, Hort. Corolla 15–18 in. diam., light blue, veined not spotted.

BB. *Fls. white; corolla-segms. each spotted deep purple.*

maculàta, Benth. Lvs. lyre-shaped, the 5–9 short lobes obtuse, entire; upper lvs. wedge-shaped, sometimes only 3-lobed: fls. white, with a deep purple blotch at the apex of each of the broad lobes, 1–2 in. wide, showy; sometimes the purple blotch is poorly defined. Common in W. and Cent. Calif. Blooms April and May. P.M. 16:6. F.S. 5:431. R.H. 1849:201. V. 2:267. J.H. III. 51:567.—Good garden forms of this are var. **álbida** and var. **grandiflòra**. Var. **variegàta** has variegated lvs.

S. W. Fletcher.
A. C. Hottes.†

NÉNGA (Malayan name). *Palmàceæ.* A few graceful spineless feather-leaved Malayan palms, one of which is cultivated as *Areca pumila.*

In Areca, the ovule is erect and fastened at the base, while Nenga belongs to a large group in which the ovule is attached on the side and more or less pendulous. Nenga is distinguished from the 5 cult. genera of this group (which are listed under Hedyscepe) by the following characteristics: staminate fls. with narrow sepals much surpassing the petals; stamens 6; anthers erect. Trunks erect, slender, ringed: lvs. terminal, equally pinnatisect; segms. linear, acuminate or obliquely 2-fid or 3-fid; margins folded back at the base; primary nerves sparsely scaly below; rachis 3-sided; petiole short; sheath cylindrical, strongly oblique at the throat: spadix with a short peduncle and slender pendent branches; spathes 2, the lower symmetrical, lanceolate, folded, 2-crested, the upper unsymmetrical, persistent, or lacking: bracts 3-fld.; bractlets scaly: fls. white: fr. ellipsoidal, smooth, reddish orange. Cult. as in Kentia.

Wendlandiàna, Scheff (*Arèca pùmila*, Blume). St. 10–20 ft. high, 2–3 in. diam.: lvs. 8–9 ft., pinnate nearly to the base; pinnæ alternate, ensiform, acuminate, 2½ ft. long, ½–1½ in. wide, bright green, coriaceous, 2-ribbed; petiole slender; sheath sub-ventricose, 2 ft. long. Java.

Jared G. Smith.

NEOBENTHÀMIA (in honor of Geo. Bentham). *Orchidàceæ.* Orchids with slender leafy sts.: fls. in racemes; sepals and petals similar, contracted, the lateral sepals forming a short chin with the column-foot; lip fleshy, entire, crisped on the margin; column short and thick; anther helm-shaped, upright; pollinia 2, with short stalks.—Species 1, in Zanzibar.

grácilis, Rolfe. Sts. up to 4 ft. long, sparingly branched: lvs. linear, acuminate, sheathing at base: fls. in a short terminal raceme, white, on long pedicels, campanulate; lip spreading from base, obovate-oblong, nearly truncate at apex, disk yellow in middle, with 2 rows of red spots. B.M. 7221. G.C. III. 10:273; 24:430, 431.—Cult. as for Cymbidium.

George. V. Nash.

NEOGLAZIÒVIA (*new Glaziovia*). *Bromeliàceæ.* Two Brazilian plants allied to Billbergia, but with ovules few rather than many in each locule. Plants terrestrial and on rocks, with spiny lvs. that furnish good fiber for ropes. *N. variegàta*, Mez (*Bromèlia variegàta*, Arr. *Billbérgia variegàta*, R. & S. *Dýckia Glaziòvii*, Baker), the Caroá of Brazil, is 3 ft. or more tall, with glabrous or very minutely lepidote lvs., marked with lighter transverse bars in the living specimen: fls. scarlet. *N. cóncolor*, C. H. Wright, the Makimbeira of Brazil, has a very short st.: lvs. uniformly white-lepidote, the younger parts woolly: calyx scarlet and petals violet. B.M. 8348.

NEÓGYNE (*new pistil*). *Orchidàceæ.* Pseudobulbous orchids with many-fld. racemes: fls. withering; sepals erect-connivent, free, saccate at base, longer and broader than the flat petals; lip concave, 3-lobed, saccate at base, the lateral lobes large, rounded, inclosing the column, the middle lobe small; column shorter than lateral lobes of lip, winged upward; anther dependent, convex; pollinia 4, waxy, dorsally compressed, the inner face deeply sulcate.—Species 1, native of the Himalayas.

Gardneriàna, Reichb. f. (*Cœlógyne Gardneriàna*, Lindl.). Lvs. narrowed into a petiole much shorter than pseudobulb, cuneate-elliptic, acuminate, up to 15 in. long and 3 in. wide: fls. white with a lip marked yellow, about 2 in. long. P.M. 6:73. G.W. 15, p. 86.—Cult. of warmhouse Cœlogyne; midwinter.

George V. Nash.

NEOLAÙCHEA (the type species flowered in the collection of Prince Johannes Liechtenstein, in honor of whose gardener, Herr Lauche, the genus was named). *Orchidàceæ.* One species, a native of Brazil, has been described. Primary sts. pro-repent, secondary sts. thickened into 1-lvd. pseudobulbs: infl. terminal; peduncle filiform, 1-fld.; pollinia 8. Closely allied to Cœlia.

pulchélla, Kränzl. (*Meiracýllium Wettsteìnii*, Porsch). A small plant with ovate pseudobulbs ⅖in. tall, terminated by a linear lf. 4 in. long, scarcely 1⅓ in. wide: peduncle shorter than the lf.; fl. purplish, about ⅖in. long; upper sepal and the petals lanceolate; lateral sepals coherent below the middle, free portion triangular; labellum with the lateral lobes minute, rounded, auriculæform; middle lobe rhombic; disk between the lobes thickened, minutely papillose. July.

Oakes Ames.

NEONICHOLSÒNIA (name in compliment to the late George Nicholson, curator at Kew, author of Dictionary of Gardening). *Palmàceæ.* Two Central American stemless palms with pinnate lvs. 4–6 ft. long, yet little known. Fls. monœcious; male fls. small, trifid, the petals 3 and longer than calyx, stamens connate at base in a short ring, the filaments subulate, anthers long-sagittate and with a thin subulate connective that forms a mucro beyond the apex, pistil a conical rudiment; infl. spicate: allied to Calyptrogyne. The genus is founded and the two species described by Dammer in G. C. III. 30, pp. 178, 179 (1901).

N. Geòrgei, Dammer, has lvs. about 4½ ft. long, petiole and all; pinnules 10 or 11 on each side the rachis, lanceolate, acuminate, with 1 central and 2 marginal primary nerves and 6–8 secondary nerves, 12–16 in. long and ⅓–2 in. broad, the first pair opposite and the others alternate, terminal pair confluent only at the base and 8 in. long by 1 in. broad. Costa Rica. *N. Wátsonii*, Dammer (named for W. Watson, Nicholson's successor at Kew), differs in its longer lvs., which are about 6 ft. long; and pinnules 9 or 10 on each side, elongate-lanceolate, caudate, 13–18 in. long and 1–2 in. broad, more or less opposite, the terminal pair confluent only at base and 10 in. long by 2 in. broad. Costa Rica.

L. H. B.

NEÓTTIA (meaning a *bird's nest*, and referring to the curiously interlaced roots). *Orchidàceæ.* A very few small terrestrial saprophytic orchids of Eu. and

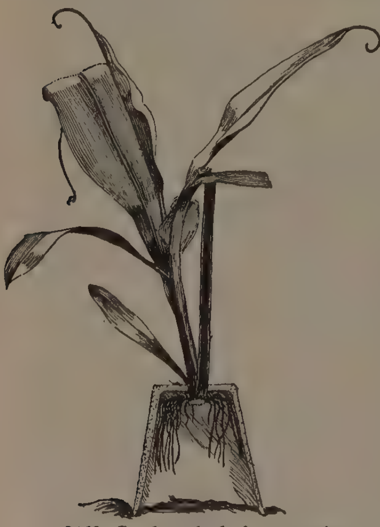
Asia, sometimes transferred to grounds, but little known as cult. plants. The *N. Petola*, Blume, of orchid collections, is *Macodes Petola*, which see. *N. speciosa*, Jacq., is Spiranthes, and *N. pubescens*, Willd., is *Goodyera pubescens*.

Leafless and brown, the st. with sheathing scales rather than lvs.: fls. brownish, in a raceme or spike; perianth hooded; lip deflexed and 2-lobed; column long and free, the anther hinged on the back of it. *N. Nìdus-àvis*, Linn., is the bird's-nest orchid of Great Britain and the continent, frequenting beech woods particularly: root a mass of interlaced stout fibers from the extremities of which young plants are produced: st. 12–18 in. high: fls. many in a dense spike ⅓in. long, with short bracts. L. H. B.

NEOTTÓPTERIS (name means *bird's-nest fern*). *Asplenium Nidus*, of which *N. australasicum* is by botanists considered to be a synonym, although by others kept distinct. *A. Nidus* is widespread in Tropical Asia and the Pacific Islands, and is a most striking large fern. B.M. 3101. G. 13:85, where distinctions are made between *N. australasicum* and *N. Nidus*.

NEPÉNTHES (from Greek for *without*, and *care*). *Nepenthàceæ*, the only genus of the family. The genus includes those forms that are popularly called PITCHER-PLANTS, and consists of about seventy species, all of which are found in the Orient. The generic name was given in allusion to the statement in the "Odyssey," where Helen so drugged the wine-cup that its contents freed men from care and grief. Linnæus in naming the genus truly expressed the feeling that some travelers have since experienced when he said "If this is not Helen's Nepenthes, it certainly will be for all botanists. What botanist would not be filled with admiration, if after a long journey he should find this wonderful plant? In his astonishment past ills would be forgotten when beholding this admirable work of the Creator."

All of the nepenthes are climbing or rarely upright plants of rather straggling habit and semi-woody consistence. In height they vary from a foot to 60 or 70 feet, while the stem varies from the thickness of a pencil to an inch across. In their native haunts the plants spread their rootage abundantly through the decaying humus of moist "scrub" land, and when planted in an open greenhouse border, they grow equally vigorously. But the roots always spread near the surface, and free oxygen exchange is necessary. Some of the more striking species, like *N. Veitchii* and *N. Edwardsiana*, are often or habitually epiphytic. The former has become so adapted to this mode of life, that its stem creeps horizontally or obliquely upward along tree branches, while the leaves with their yellow-green pitchers spread in double rows on either side. Such forms, therefore, succeed only under cultivation when treated like the epiphytic orchids. Well-known species, like *N. ampullaria* and *N. Rafflesiana*, may form long rope-like stems amid the rather open forest vegetation of their native haunts, and then spread out amongst the tree crowns, there to bear the graceful pitchers and the racemes of nectariferous flowers. These latter, according to Burbidge, are often encircled by groups of insects.



2460. Good method of propagating nepenthes.

The cutting is placed in an inverted pot. The stick at the right wedges the cutting and keeps it tight; it may also carry the label. The pot is cut in two vertically to show how the roots form in the air, without the aid of sand, water or even moss.

Each fully developed leaf is of complicated structure. It may be either sessile or stalked, but always has a lower flattened blade portion, that is traversed lengthwise by two to ten or twelve veins, all of which are braced together in turn by transverse or oblique nerves. The number and disposition of the former yield valuable aid in classification of the species. The midrib is then prolonged as a tendril of varying length, but of great tenacity. This can wind around supports, and alike helps the stem in bearing the crown of leaves, and supports the pitchers with their often considerable weight of water.

The pitcher is the greatly expanded and hollowed-out end of the midrib. It usually bears two fringed or ciliate wings in front, that in the seedling leaf are continuous with the blade below, and gradually become separated from it as older leaves are produced. They represent, therefore, lobes that are separated off from the blade portion in the early history of the leaves. The margin of each pitcher, except in *N. Lowii* (Fig. 2462), is widened or thickened without and within into a collar-like rim or peristome, that is striated, corrugated or even ridged from within outward, and is of shining aspect. The inner, or the outer, or both rim-margins may be curved downward and inward, so as to give a cylindric aspect to the peristome (Fig. 2463), or it may be widely expanded as a spreading collar (Fig. 2465). The pitchered or hollowed-out midrib ends in a small spur at the back of the peristome, and just behind the insertion of the lid that next deserves notice. This lid represents two terminal lobes of the leaf formed on either side of the spur, and which have grown forward, have fused, and so have caused the lid to be traversed by two main veins from which minor ones may branch off.

All of the above details would be comparatively unintelligible did we not refer shortly now to the numerous secreting glands that are formed over the leaf, and to the function of these in securing the capture and digestion of insects or other prey. Over the lower blade surface, here and there along the tendril, over the pitcher and lid exterior, but most abundantly over the inner lid surface, small spots can readily be detected that exude a honied juice. This is greedily licked by ants, cockroaches, and other—mostly running—insects. They are thus attracted to the edge of the peristome, or upward to the inner lid surface with its rich nectar supplies. In either case they usually step ultimately on the shining surface of the peristome. But the finely or coarsely serrated inner edge of this carries the openings of large sunken glands. These exude a juice that is greatly liked by insects. In attempting to reach the droplets they often slide off into the pitcher interior. This shows a different but equally noteworthy device. In some species, like the commonly grown *N. ampullaria*, *N. Hookeriana* and *N. Chelsonii*, the entire pitcher interior is smooth and glistening, but abundantly studded with small glands that excrete an acid peptonizing fluid, capable of converting albuminous substances like animal flesh or white of egg into a dissolved peptone or even into a simpler tryptophan product that can readily be absorbed and assimilated by the inner pitcher wall.

In most species and hybrids, however, now under cultivation, the upper one-third or one-half, of the pitcher interior is extremely smooth and bluish or purplish waxy in aspect. This forms a sliding or "conducting" surface, that ensures dropping of insects into the lower area, where digestive glands occur as already described. So following the nomenclature of Hooker and the writer, the general external leaf area with its scattered honey-glands forms the "alluring" surface. The inner lid area and the peristome rim with their concentrated honey-glands, form the "attractive" surface, the smooth upper part of the interior that is devoid of glands can well be named the "conducting" surface, while the glistening lower area with its abundant digestive glands, forms the "detentive" and digestive surface.

In greenhouses where ants and cockroaches occur, the captured prey soon accumulate in such pitchers as *N. hybrida*, *N. Hookeriana* or *N. khasiana*, at times also to such an extent that the ammoniacal fumes of the decaying contents cause a brown discoloring of the pitcher-wall. The loose stuffing, therefore, of the pitchers with wadding or moss has been recommended by some growers. But it appears certain that the pitchers are thereby prevented from securing, digesting, and absorbing animal prey that seems to aid in the nutrition of the plant under wild as under cultivated conditions.

Another feature deserves mention here from the cultural and physiological standpoints. The leaves bear an abundance of minute brown peltate hairs, that appear to the naked eye as dark specks. Even though nepenthes be almost wholly deprived for a time of their roots, the plants remain healthy if kept in a moist atmosphere. This and other evidence, that cannot here be cited, suggest that atmospheric moisture may be absorbed directly through the leaf surface, though such a view is contrary to current physiological opinion.

In contrast to the above relations, it has been shown by three observers that several species of insects and also a spider are capable of living, and even, in some cases, of breeding, in the pitcher liquid, while they are able with impunity to ascend and pass out from the pitcher cavity. Their ability to live in the pitcher liquid that digests other insects seems to be due to their having an antagonistic or neutralizing ferment to that in the pitchers.

The size, shape, and color-markings of the pitchers vary greatly. The pitchers of the rare *N. bicalcarata* are usually yellow-green, but may be of a faint brick-red. Projecting downward from the top of its high neck and so overhanging the pitcher-cavity are two strong sharp spines. These have been considered by Burbidge to act as protective spines against the thieving habits of a small lemur (*Tarsius spectrum*) that attempts to rifle the pitchers of their insect prey. When it tries the above it is often caught by the nape of the neck, and tumbled into the pitcher. Equally curious in the same species is the thickened end of the tendril alongside the pitcher, that is always thickened, and in the wild state is drilled by ants which form a home or myrmicarium in the interior.

N. Lowii (Fig. 2462) has large leathery urnshaped pitchers of a greenish yellow hue, each strongly constricted in the middle, and so in outline resembling the finely colored *N. ventricosa* and *N. Burkei*, now in cultivation from the Philippines. *N. Rajah*, found about 6,000 feet on Kinabalu only, attains a height of 5 to 6 feet, but its huge claret-crimson goblet pitchers sit in the moist moss of the ground at the ends of the large dependent leaves which spread out from the stout stem. *N. villosa* and *N. Edwardsiana* are soil-growers or often epiphytes with brilliant crimson pitchers of striking aspect that grow on Kinabalu at 8,000 to 10,000 feet elevation. Two splendid new species, *N. Merrilliana* and *N. truncata*, have recently been described from the Philippines, which suggests that these islands may yet yield other attractive types.

The flowers appear in panicled or simple racemes on the young wood, and each raceme is opposite a bract-leaf that differs usually in shape and venation from the other foliage-leaves. In greenhouses of the north-eastern states, these inflorescences appear as a rule, from July to October, but only on plants or on shoots that have been allowed to grow long. Thus racemes appear on *N. maxima* (*N. Curtisii*), *N. Hookeriana*, and *N. phyllamphora* when the shoots are from 5 to 12 feet long. The plants are always diœcious, and so for production of seeds under cultivation a staminate and pistillate plant must be in bloom simultaneously. Failing this, it has been shown experimentally that pollen from a staminate plant can be kept good for days or even weeks, if preserved in tinfoil or in paraffin paper and in a cool place. Taplin adopted this method in order to secure some of his fine hybrids, while *N. Dicksoniana* (page 2128) was got in the Edinburgh Botanic Garden from the seed-parent *N. Rafflesiana*, by applying to it pollen of *N. Veitchii* forwarded from the Veitch establishment in London.

2461. A simple propagating-frame. Used by Robert Shore for propagating nepenthes, dracenas and other tropical subjects.

The staminate flowers are produced in dense paniculate cymes as in *N. ampullaria*, or in loose simple racemes as in *N. gracilis* and *N. sanguinea*. Each consists of four green, yellowish, red or claret-colored sepals, about ⅜ by ¼ inch in size on the average, and of rather thick texture. The inner surface is closely dotted over with honey-glands that resemble the attractive lid-glands, and which pour out an abundant nectar secretion at the time of blooming. This is often accompanied by a heavy somewhat fetid odor, and the two attractions draw small insects in great numbers to the flowers. Becoming dusted with pollen they carry this to pistillate flowers on other plants. The stamens rarely may be from twenty to twelve in number, commonly they are from ten to eight, or they may be as few as four. The filaments are fused into a short pillar that bears the terminal anthers in a rounded crowded mass. When the latter dehisce the whole appears as a dusty ball of pollen.

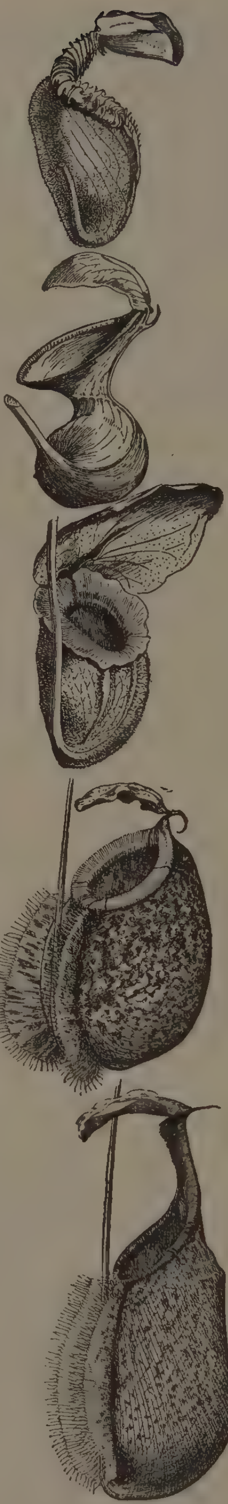
The pistillate flowers bear sepals like those of the staminate. The pistil consists of four carpels that are united below to form a four-celled ovary. This incloses many minute elongated ovules, which after fertilization continue to lengthen, and swell up in the middle to form the seeds. The style is either very short and thick, or is practically absent. The stigma is four-lobed to rounded, and forms an expanded thickened mass on top of the short style or of the ovary. It, as well as the sepals, persists during maturation of the fruit. The fruit when ripe is a dry glabrous and shining or a hairy capsule that dehisces loculicidally into four valves. The seeds vary in number, according to the species, from 100 to 500 in a capsule. Each is a light delicate elongated thread-like body, due to great elongation of the loose seed-coat on either end of the central mass. From their extreme lightness they can readily be blown to considerable distances, and this fact, along with the direction of the prevailing monsoon winds, seems to explain the distribution of the species along the western and northwestern sides of the foothills or the mountains where they mainly occur.

The literature of the group has been recently summarized by the writer in his monograph published as hft. 36 of Engler's "Pflanzenreich." A general description is there given in English on pp. 2–26, while detailed descriptions of the species and hybrids follow in Latin. An interesting account of the group is given by Veitch and Burbidge in Journ. Roy. Hort. Soc., vol. 21 for 1897, on pp. 226–262.

History and distribution.

We owe the first notice of the group to the French botanist Flacourt. In his "History of the Island of Madagascar" (1658) he described the only native pitcher-plant of that region as Anramitico, and inclined to regard the pitcher as a flower or hollow fruit. In 1679 Breyn described the only Ceylon species as *Bandura Zingalensium*, and he justly regarded it as a vegetable wonder. Since that time other forms have been discovered in the Seychelle Islands, in southern China, in northeast India, in the Philippines, the East Indian Islands and in northeast Australia. But the headquarters of the genus extend from the Malay Peninsula—where are ten species—through Borneo and Sumatra, that contain about twenty-four species, to New Guinea and Australia in a southerly and the Philippines in a northerly direction, where are about twenty-six species.

While nearly one-fourth of the species grow in hot reeking swampy situations at or near sea-level in the eastern tropics, the larger number occur in moist ground on the western and northwestern sides of the mountains at elevations of 1,000 to even 10,000 feet. Thus the lone and impressive mountain, Kinabalu in northwestern Borneo, that rises to a height of 13,700 feet, overlooks a tropical shore region that is rich in nepenthes. But, from 3,000 to 10,000 feet, it harbors eight species, some of which are the largest and most gorgeously colored of the genus. The zone of the mountain where the finest are found extends from 6,000 to 10,000 feet and Burbidge has graphically described how this entire belt is almost continuously shrouded in a dense mist, due to moisture precipitation from meeting of the hot lower current of air with the cold currents from the mountain top. This moist dripping climate seems eminently to suit the forms found there, while all of the species flourish best when kept in moist "steamy" surroundings. Repeated attempts were made, from 1750 onward, to introduce and grow a few of the species from Madagascar, Ceylon, India and Borneo. But the type of greenhouse of this earlier period, and the method adopted in their cultivation combined to prevent success. From 1830 to 1860, however, so well had the mode of culture advanced, that seedlings were raised in the Edinburgh, London and Chatsworth gardens, while the Veitch firm that now had collectors like Lobb busy in the native haunts of the genus, imported living plants as well as seeds, both of which they grew successfully. A great impetus was given to the culture of the group when gardeners like Dominy, Taplin, Seden and Court succeeded in crossing some of the species then cultivated, from 1850 to 1870, and in raising hybrids therefrom. These hybrids seemed often to combine good points of both parents, while they, as well as many hybrids since secured, are usually more easy of cultivation, and form a greater showing of the striking pitchers than does either parent. But a new and very lively interest was created in the group after Hooker drew attention to the remarkable structure of the pitchers, and their adaptation to the catching and digestion of insect prey, as set forth in his Belfast address before the British Association in 1874. Collectors like Curtis, Burke, and Burbidge were commissioned by the Veitch firm to secure every available type encountered from Madagascar to Australia. Successful methods of raising, growing and flowering these had been devised; numerous new hybrids appeared in England, America and France from 1875 to 1900, while the scientific interest in the group that was stimulated by the writings of Darwin and Hooker has caused an ever-increasing demand for such plants in every typical collection.



2462. Five distinct types of nepenthes. Beginning from the top they are: *N. villosa*, *N. Lowii*, *N. Rajah*, *N. Hookeriana*, and *N. Rafflesiana*. The first three belong to the famous Kinabalu group. The fourth is the parent of more hybrids than any other kind.

A description of the nepenthes would be very incomplete in such a work as the present, did we not refer again to the history of their hybridization by man, and the resulting production of hothouse types that more than rival in beauty many of the wild species, and which are, as already indicated, more easy of cultivation than are the parent forms.

When Dominy first attempted to cross Nepenthes, few fine forms were in cultivation, *N. Rafflesiana* and *N. Hookeriana* being the best. About 1858 or 1860 he crossed flowers of the former with pollen from what was probably *N. gracilis* from Borneo. The resulting hybrids that were sent out from the Veitch nurseries as *N. Dominii* were at once a success under cultivation, and stimulated further experiment with species of the group. Dominy, Seden, Court and Outram continued this in England from 1860 to 1880, while Taplin, a friend of the two latter, extended the work in Such's collection. By the latter period it had been proved that the species of Nepenthes can be hybridized and rehybridized, at the same time remaining fertile. The varied beauty and easy culture of the hybrids—specially those of Taplin, which were secured and distributed mainly by Williams of London, rendered the group more popular. An added stimulus was given when Court raised *N. Mastersiana* about 1880. But such striking species as *N. Veitchii*, *N. Northiana*, *N. maxima*, (*N. Curtisii*) and *N. sanguinea* were all soon to hand, and so hybridizers like Court, Tivey, Lindsay, and Gautier in Europe, as well as Oliver and Siebrecht in this country, produced novelties in which the "blood" of three to four species was blended. In France, Jarry-Desloges and his gardener have obtained some beautiful and complex hybrids, but they have not as yet been distributed.

The pitchers of some of the above when well grown are magnificent, the plants are in no way more difficult of culture than many of the well-known orchids, while the climatic conditions of America, when modified by moist stovehouse treatment, seem eminently to favor vigorous growth. They have therefore become familiar objects in many American greenhouse collections during the past decade.

All of the species now in cultivation hybridize readily with each other, and produce abundant as well as good seeds. These should be sown on the surface of a seed-pan that is filled with a finely chopped mixture of sphagnum, pot crocks and charcoal. A bell-jar should cover the pan, and it should then be set in a plate of water to ensure a steamy atmosphere. Germination occurs in two to four weeks. The seedlings should be potted off into thumbs when about a month old, and then changed every two months into larger pots. Well-grown year-old plants begin to show adult characters.

Nepenthes culture. (G. W. Oliver.)

Nepenthes are increased by cuttings and by seeds. The ripened shoots, with four or five leaves attached, make the best cuttings. They may be rooted from December till the end of January, but under proper conditions the operation may be performed at any time during the year. Some of the free-rooting kinds, such as *N. Dominii*, *N. gracilis*, *N. Phyllamphora* and *N. Mastersiana*, may be rooted in sand under a glass with a little moss tied around the base of each cutting. Under this treatment the temperature of the sand should be about 80° F. When the roots show through the moss they should be put in small pots and kept close for a couple of weeks. The most satisfactory method of propagation is to put the base of each cutting through the hole of an inverted 2-inch rose pot, plunging the pot in sphagnum moss in a temperature from 80° to 90°. F. (See Fig. 2460.) During the operation of rooting they must be kept in a close propagating-frame and frequently syringed. (See Fig. 2461.) When the roots are about ¾ inch long the cuttings should be potted, using a mixture of finely chopped fibrous peat, moss and sand, with a little finely broken charcoal added. They should be replaced in the moss and kept close until the pots are fairly well filled with roots and then gradually hardened off. All of the kinds do best suspended from the roof of a hothouse, the temperature of which should not fall below 65° F. in winter. The plants may be grown either in orchid-pots or -baskets. In potting or basketing plants from 4-inch pots, large pieces of potsherd and charcoal should be firmly placed here and there among the potting material, which should consist of rough fibrous peat, moss and sand. The plants should not be allowed to grow as vines unless they are intended to produce seed. When large-sized pitchers are wanted, the ends of the shoots should be nipped out after several leaves have been made and the pitchers are in the process of development; this throws strength into the last-formed leaves and produces very large pitchers. When the plants are in active growth they should be well drenched with water at least once each day and syringed frequently, but care should be taken not to overwater newly potted specimens. They should at all times be shaded from bright sunshine, and when a house is devoted to them, or partly occupied with plants requiring similar treatment, it should be shaded with cloth fixed to rollers. Well-pitchered plants may be taken from the growing house and exhibited in good presentation for a long time in a house under conditions which would be unfavorable for their growth. All of the hybrid forms are of easy culture. *N. Mastersiana*, *N. Dominii*, *N. Outramiana* and *N. Henryana* produce pitchers very freely. The species, as a rule, are not quite so free, but some of them thrive equally as well as the garden forms. *N. Rajah*, *N. Northiana*, *N. sanguinea*, *N. albo-marginata* and *N. bicalcarata* are all more or less difficult to manage, as the conditions under which they grow in their native haunts are sometimes not easily imitated. *N. ampullaria*, *N. Rafflesiana*, *N. Phyllamphora*, *N. distillatoria* and *N. Kennedyana* are usually seen well furnished with good pitchers.

INDEX.

alata, 40.
albo-cincta, 2.
albo-marginata, 2.
amabilis, 23.
Amesiana, 23.
ampullaria, 1.
atrosanguinea, 21.
Balfouriana, 49.
bicalcarata, 38.
Burkei, 11.
celebica, 47.
Chelsonii, 28.
cincta, 3.
coccinea, 34.
Curtisii, 47.
cylindrica, 18.
Dicksoniana, 31.
distillatoria, 16.
Dominii, 22.
Dormanniana, 19.
Dyak, 38.
Dyeriana, 43.
edinensis, 32.
Edwardsiana, 9.
excellens, 11, 28.
excelsior, 23.
fallax, 47.
fimbriata, 33.
glabrescens, 16.
gracilis, 13.
hirsuta, 16.
Hookeriana, 24.
Hookeri, 24.
hybrida, 17.
indica, 16.
intermedia, 29.
Kennedyana, 35.
khasiana, 14.
Lawrenciana, 25.
Loddigesii, 24.
Lowii, 50.
Macfarlanei, 51.
macrostachya, 33.
maculata, 17.
madagascariensis, 37.
Mastersiana, 7.
maxima, 47.
Merrilliana, 12.
mixta, 5.
Morganiana, 25.
nigro-purpurea, 30.
nobilis, 42.
Northiana, 4.
O'Brieniana, 33.
Outramiana, 26.
paradisæ, 20.
Phyllamphora, 33.
Rafflesiana, 30.
Rajah, 41.
Rowanæ, 36.
rubra, 2, 16.
Sanderiana, 30.
sanguinea, 6.
Sedenii, 15.
speciosa, 16.
spuria, 4.
stenophylla, 46.
Tiveyi, 48.
truncata, 45.
Veitchii, 39.
ventricosa, 10.
villosa, 8.
Williamsii, 27.
Wittei, 44.
zeylanica, 16.

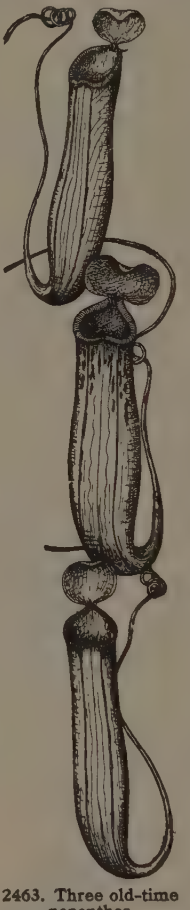
KEY TO THE SPECIES.

A. *Pitcher-lid small, reflexed*.......... 1. **ampullaria**
AA. *Pitcher-lid well developed, inflexed over orifice.*
  B. *Lid devoid of keel, spur, or bristles within.*
    C. *Longitudinal veins of lamina 2–4: lvs. sessile.*
      D. *Collar below peristome white-tomentose*.................. 2. **albomarginata**
      DD. *Collar below peristome brownish tomentose.*
        E. *Lvs. decurrent.*
          F. *Peristome broadly expanded, purplish green or purple striped*...... 3. **cincta**
          FF. *Peristome expanded, green and red-striped*........ 4. **Northiana**
          FFF. *Peristome expanded, purple*.................. 5. **mixta**
        EE. *Lvs. non-decurrent.*
          F. *Peristome red*.......... 6. **sanguinea**
          FF. *Peristome crimson to purple*.................. 7. **Mastersiana**
    CC. *Longitudinal veins of lamina 2–4: lvs. stalked.*
      D. *Peristome deeply ridged; pitchers pyriform*.......... 8. **villosa**
      DD. *Peristome deeply ridged; pitchers elongate-tubular*.... 9. **Edwardsiana**
    CCC. *Longitudinal veins of lamina 5–6: lvs. sessile, non-decurrent.*
      D. *Pitchers strongly constricted in middle, mouth transverse*....10. **ventricosa**
      DD. *Pitchers strongly constricted in middle, mouth oblique*.......11. **Burkei**
      DDD. *Pitchers large, oval*..........12. **Merrilliana**
    CCCC. *Longitudinal veins of lamina 5–6: lvs. sessile, decurrent.*
      D. *St. slender trigonous: peristome narrow-oblique*.......13. **gracilis**
      DD. *St. stout cylindric: peristome rounded, oblique*...........14. **khasiana**
      DDD. *St. stout cylindric: peristome elevated into short neck*......15. **Sedenii**
    CCCCC. *Longitudinal veins of lamina 5–6: lvs. petiolate.*
      D. *Pitchers green, reddish or slightly purple-spotted.*
        E. *Lvs. herbaceous: peristome green, cylindric*.........16. **distillatoria**
        EE. *Lvs. coriaceous: peristome green, cylindric*.........17. **hybrida**
        EEE. *Lvs. coriaceous: peristome expanded*...............18. **cylindrica**
      DD. *Pitchers richly green and purple-blotched; peristome pale green, oblique,*

E. *Color of pitchers throughout purple-blotched*..........19. **Dormanniana**
EE. *Color of pitchers below purple-red, above purple-blotched*................20. **paradisæ**
DDD. *Pitchers green and purple-blotched; peristome oblique, green and purple-striped.*
E. *Color of pitchers red-purple with pale green spots*......21. **atrosanguinea**
EE. *Color of pitchers green with heavy purple marblings.*
F. *Pitcher-wings narrowing from below upward, fringed*...............22. **Dominii**
FF. *Pitcher-wings broad, uniform*.................23. **excelsior**
FFF. *Pitcher-wings broad, doubly fringed*........24. **Hookeriana**
FFFF. *Pitcher-wings of various forms.*
G. *Lf.-margins ciliate-toothed*............25. **Lawrenciana**
GG. *Lf.-margins hairy: pitchers yellow-green with abundant red spots*..............26. **Outramiana**
GGG. *Lf.-margins plain: pitchers yellow-red to red with fine crimson-purple spots*........27. **Williamsii**
DDDD. *Pitchers like* DDD, *but peristome more or less elevated behind into a neck, or widely expanded.*
E. *Peristome elevated into a slight neck behind*........28. **Chelsonii**
EE. *Peristome elevated into a high neck behind*.........29. **intermedia**
EEE. *Peristome elevated into a high widening neck*......30. **Rafflesiana**
EEEE. *Peristome oblique, widely expanded laterally*.......31. **Dicksoniana**
EEEEE. *Peristome expanded, elevated into a neck behind*...32. **edinensis**
CCCCCC. *Longitudinal veins of lamina 7–12: lvs. stalked.*
D. *Lvs. non-decurrent.*
E. *Pitcher-wings narrow or nerved*.................33. **Phyllamphora**
EE. *Pitcher-wings prominent*..34. **coccinea**
DD. *Lvs. slightly decurrent.*
E. *St. finally glabrous: pitcher-wings expanded*.........35. **Kennedyana**
EE. *St. hairy*.................36. **Rowanæ**
DDD. *Lvs. decurrent.*
E. *The lvs. greenish red or red below*..................37. **madagascariensis**
EE. *The lvs. of a peculiar dark green: two strong peristome spines below lid*..........38. **bicalcarata**
BB. *Lid with keel, spur or bristles within*
C. *The lid with basal keel only.*
D. *Lvs. hairy.*
E. *Color of pitchers yellow or greenish red*.............39. **Veitchii**
EE. *Color of pitchers yellowish green with purple spots: lamina usually peltate*....43. **Dyeriana**
DD. *Lvs. glabrous (except margin in N. Wittei).*
E. *Pitchers green, purple-spotted*.................40. **alata**
EE. *Pitchers crimson-purple*....41. **Rajah**
EEE. *Pitchers brownish red, purple-spotted*..............42. **nobilis**
EEEE. *Pitchers tubular, pale green*..44. **Wittei**
EEEEE. *Pitchers crimson: lvs. truncate at both ends*.........45. **truncata**
CC. *The lid with median keel only*....46. **stenophylla**
CCC. *The lid with basal keel and subapical spur.*
D. *St. glabrous*................47. **maxima**
DD. *St. hairy*...................48. **Tiveyi**
CCCC. *The lid with apical spur only*....49. **Balfouriana**
CCCCC. *The lid with long rough bristle hairs within*................50. **Lowii**
CCCCCC. *The lid with shining bristle hairs within*.....................51. **Macfarlanei**

1. **ampullària,** Jack. Bright green, st. and lvs. when young rusty-hairy: pitchers small, green or with few purple spots; peristome broad, obliquely inclined inward; lid small, reflexed. Malaya, Sumatra, Borneo, New Guinea. B.M. 5109. I.H. 24:272. F.S. 22:2325.—An interesting type, easy of growth, and often producing clusters of small pitchers.

2. **álbo-marginàta,** Lobb. St. and lvs. white-tomentose when young: pitchers tubular, dull green with abundant purple blotches or areolations; peristome bounded below externally by a white collar. Malaya, Sumatra, Borneo. G.C. 1872:541. 542. F.S. 22:2343, 2344.—Grows in stiff moist clay in native home (Burbidge), but difficult under cult. A variety with deep purple pitchers is grown as *N. álbocíncta* var. *rùbra.*



2463. Three old-time nepenthes.
Much confused in collections and difficult to distinguish: *N. phyllamphora* above, *N. khasiana* in the middle, *N. distillatoria* below.

3. **cíncta,** Mast. (*N. Northiàna* × *N. álbo-marginàta*). Lvs. thick, deeply amplexicaul, decurrent: pitchers 3–10 x 1–3 in., dimorphic, lower ventricose in inferior, cylindric in superior half, upper cylindric to funnel-shaped, green flushed with red and richly purple-blotched; peristome bounded below by brownish white felted collar. G.C. II. 21: 576. R.B. 21, pp. 268, 269. Gn. W. 4:101.—A vigorous and striking natural hybrid got from seeds collected by Burke. In all characters nearly intermediate between parents.

4. **Northiàna,** Hook. f. (*N. spùria,* Beck). Robust, bright green: lvs. amplexicaul, deeply decurrent, sessile, thick herbaceous, apex peltate: pitchers 3–14 x 1–4 in., dimorphic; lower sub-ovate, pale green with purple spots, upper funnel-shaped with recurved base, richly purple-spotted; peristome widely expanded. Borneo. G.C. II. 16:717. Gn. 23: 492 (as *N. Morganiae*). J.H.S. 21: 236. Gn.W. 4:105. J.H. III. 44:127.—Difficult of growth but with lovely large pitchers. It has been used as parent for some fine hybrids.

5. **míxta,** Mast. (*N. Northiàna* × *N. máxima*). Lvs. amplexicaul, deeply decurrent, petiolate, elliptic with peltate apex: pitchers 3–12 x 1½–3½ in., ventricose-cylindric, yellow-green and sparsely purple-spotted below, abundantly flecked with large spots above; wings narrow, or absent below, expanded and fringed higher; peristome rich purple. G.C. III. 13:47. G.Z. 20:145. G.M. 36:754. F.E. 16:447. G.W. 10:527; 14:293.—One of Tivey's best hybrids that makes a strong growth, flowers readily, and has been a parent for some even finer hybrids.

6. **sanguínea,** Lindl. Lvs. sessile, deeply amplexicaul, thick, herbaceous, oblong-lanceolate: pitchers 3–10 x 2–3 in., ventricose-cylindric to cylindric, bright red to reddish green, wings expanded fringed, or narrow plain; peristome laterally expanded. G.C. 1849:580; 1872:541. F.S. 22:2343. F.M. 1874:128. Gn.W. 24:

504.—Sent about 1849 from Malaya by Lobb to England. but cult. difficult. It yielded the hybrid *N. Mastersiana*, but is now rare in cult.

7. **Mastersiàna,** Veitch (*N. sanguínea* × *N. khasiàna*). Lvs. sessile, slightly decurrent, glabrous, shining: pitchers 5–15 x 1½–3 in., crimson-green with purple spots to uniformly deep crimson; wings fringed or rudimentary; peristome crimson-green to crimson. G.C. 21:248, 249. Gn. 23:492. G.W. 9:285. I.H. 33: 618. J.H.S. 21:237.—A beautiful and easily grown hybrid of Court, but which varies greatly in pitcher-coloring.

8. **villòsa,** Hook. f. Fig. 2462. This is distinct from all other species here described by its rim, which is composed of distant disks that are circular except for teeth which project down into the pitcher.

9. **Edwardsiàna,** Hook. f. This and the last are probably the most striking species of the genus. Both are figured in color by Spencer St. John in Life in Forests of Far East, also by Hooker in Trans. Linn. Soc. 22:69, 70. The former has a short urn-shaped, this a long cylindric pitcher. Neither has as yet been cult. Borneo.

10. **ventricòsa,** Blanco. Terrestrial or epiphytic: lvs. thick, aggregate round st., sessile, shortly decurrent, linear to lanceolate: pitchers in aspect as in *N. Burkei* but mouth elliptic in outline and transverse; lid with 3 to 4 pairs of veins. G.C. III. 23:379. Gn. 74, p. 647. G.M. 44:691. J.H. III. 43:486.—Near to though distinct from *N. Burkei*, but both are native to the Philippines. It flourishes fairly well under cool moist treatment.

11. **Búrkei,** Mast. Lvs. sessile, slightly decurrent, aggregate round st., linear-lanceolate, slightly contracted above insertion: pitchers 3–6 x 1–2½ in., dimorphic, lower cylindric-ventricose, upper constricted in middle, ventricose below, widening above; mouth ovate-oblique, wings absent, surface pale green or with few purple blotches below, heavily blotched above; lid equal to or larger than mouth, with 6–7 pairs of veins. Mindoro in Philippine Isls. Var. **éxcellens,** Veitch, has short wide pitchers richly purple-tinted with dark purple blotches. G.C. III. 6: 493; 8:184, desc. Gn. W. 7:137; 11:153.—This is a species that pitchers abundantly if kept cut back.

12. **Merrilliàna,** Macfarlane. A Philippine species with large crimson-green pitchers, that when intro. may prove valuable for hybridization. Recently described by the author in Bot. Contrib. Univ. Penn. 3:207, pl. 1.

13. **grácilis,** Korthals. Plant slender with green to dull red st.: lvs. sessile, decurrent, elliptic, glabrous, veins 5–7: pitchers 2–4 x ½–1 in., pale green with delicate purple flecks or spots, lower cylindric-ventricose with fringed wings, upper cylindric with narrow wings or ridges; peristome narrow green. G.C. 1872:542, desc.—A weedy species of easy cult., but shy in producing its delicate pitchers. It grows in marshy areas in Malaya, Borneo and Sumatra.

14. **khasiàna,** Hook. f. Fig. 2463. Lvs. sessile, lanceolate: pitchers 3–7 x 1–1½ in., elongate, tubular, green to reddish green with narrow fringed wings; peristome green, cylindric; lid oval, green outside, reddish green inside. B.M. 2629 (as *N. Phyllamphora*); 2798 (as *N. distillatoria*).—Early intro. into cult. from the Khasia Mts. of E. Hindostan, but now rarely seen. It forms shoots 30–40 ft. long with abundant long green pitchers.

15. **Sèdenii,** Mast. (*N.* ? × *N. khasiàna*). Lvs. half-amplexicaul, decurrent, lanceolate, glabrous: pitchers 3–5 x 1–2 in., ventricose below, constricted in middle, cylindric above; wings fringed; peristome cylindric, elevated somewhat into a neck behind. G.C. 1872:542, desc. F.W. 1870:321. F. 1872:54. J.H.S. 21:237.—A hybrid of Seden's that is often and well grown in American greenhouses.

16. **distillatòria,** Linn. (*N. índica,* Poir. *N. zeylánica,* Raf. *N. hirsùta* var. *glabréscens,* Smith. *N. rùbra,* Nichols. *N. zeylánica* var. *rùbra,* Beck. *N. speciòsa,* Hort.). Fig. 2463. Plant bright green, rather slender: lvs. petiolate, half-amplexicaul, glabrous, elliptic-elongate: pitchers 3–5 x 1–1½ in., dimorphic, pale green to dull crimson, lower ventricose below, tubular above; wings wide, fringed, narrowed from below up; mouth nearly transverse; upper cylindric, wings rudimentary, mouth oblique with short posterior neck; peristome cylindric green. P.M. 4:1. L.B.C. 11:1017.—A somewhat unattractive species from Ceylon, that has been a parent of several hybrids.

17. **hýbrida,** Mast. (*N. khasiàna* × *N. grácilis*?). Lvs. amplexicaul, decurrent, semi-petiolate, elongate-lanceolate: pitchers 3–5 x ¾–1 in., cylindric, slightly constricted in middle, green or somewhat purple-spotted (var. *maculàta*); wings shallow ciliate. G.C. 1872:542, desc. J.H.S. 21:1897:238.—A hardy freely pitchering though rather unattractive type that usually catches abundant insect prey in greenhouses. Raised by Dominy about 1863, and sent out by Veitch in 1866.

18. **cylíndrica,** Veitch (*N. distillatòria* × *N. Veìtchii*). St. ascending: lvs. obovate or oblanceolate with reddish midrib: pitchers 5–7 x 1–2 in., ovate-elongate or sub-cylindric, pale green with few small purple spots; wings narrow, interrupted below, fringed above; peristome expanded, yellow-green. G.C III. 2:521.—A rather unattractive hybrid that is now rare in cult.

19. **Dormanniàna,** Williams (? *N. Phyllámphora* × *N. Sédenii*). Lvs. elliptic-lanceolate, margin finely ciliate, veins 5–6: pitchers 4–6 x 2–2½ in., cylindric-ventricose, green and purple-blotched; wings fringed or dentate, narrowed upward; peristome pale green. G.C. II. 17: 525. Gn. 27:496.—A pretty hybrid of doubtful parentage that was raised by Taplin and sent out by Williams.

20. **paradìsæ,** Hort. Parents probably similar to *N. Lawrenciana*, but pitchers richly purple-red below, yellow-spotted above.—Sent out by Williams in 1883.

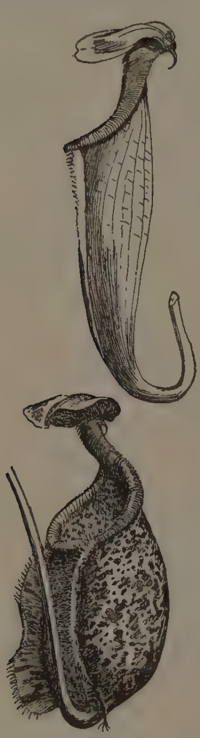
21. **atrosanguínea,** Mast. (? *N. distillatòria* × *N. Sédenii*). Pitchers ventricose below, cylindric above, reddish purple with pale green mottlings; wings fringed wide below, gradually narrowed above; peristome cylindric, oblique, pale green and purple-striped. G.C. II. 17:827.—A Taplin hybrid that grows readily and pitchers freely if kept cut back.

22. **Dóminii,** Veitch (*N. Rafflesiàna* × ? Bornean sp. probably *N. grácilis*). St. dark red: lvs. amplexicaul, decurrent, petiolate, lanceolate: pitchers 3–5 x 1–2 in., ventricose below, contracted toward mouth, mottled green and dark purple; wings narrowing from below upward, fringed; peristome uniform, elevated into a neck behind. J.H.S. 21:238.—This, the first artificial hybrid, was raised by Dominy about 1860, and is still a favorite of easy cult.

23. **excélsior,** Williams (*N. Rafflesiàna* × *N. Hookeriàna*). St. and lvs. at first densely tomentose-pubescent, at length glabrous: lvs. petiolate elliptic: pitchers cylindric-ventricose, pale green with deep purple spots and blotches; wings wide, fringed; peristome cylindric, elevated into a neck behind.—Amongst the best of Taplin's hybrids, as the pitchers are freely produced and are sharply marked, while the plant grows well and prop. readily. *N. amábilis* and *N. Amesiàna* have the same parentage and are nearly related in aspect.

24. **Hookeriàna,** Lindl. (*N. Loddígesii,* Baxter. *N. Hoòkeri,* Alphand). Fig. 2462. Plants strong, young parts covered with brownish white pubescence: lvs. amplexicaul, petiolate, elliptic-lanceolate, veins 5 with

radiating nerves: pitchers 2–5 x 1–3 in., dimorphic; lower subglobose, pale green with extensive purple blotchings; wings ample, doubly fringed; upper funnel-shaped wings narrow not fringed, mouth oblique elevated into a neck behind. G.C. II. 16:813. I.H. 41, p. 145. G.W. 2:151. A.G. 18:877.—A vigorous, attractive and amenable plant that bears abundant pitchers of rich coloring. The writer regards it as a natural hybrid from Borneo between *N. ampullaria* and *N. Rafflesiana*, as it blends parental characters of these.



2464. How the pitchers change their shape.

The earliest and best are mug-shaped ones; the topmost pitchers of old and tall plants are cylindrical. *N. Rafflesiana*, both from same plant. Adapted from B.M. 4285.

25. **Lawrenciàna,** Mast. (? *N. Phyllámphora* × *N. Hookeriàna*). Lvs. lanceolate, margins finely dentate-ciliate: pitchers 3–5 x 1½–2 in., ventricose below, cylindric above, pale green with heavy purple markings; wings expanded, fringed; peristome pale green and red-striped; lid oval. G.C. II. 14:40. I.H. 29:460.—One of Taplin's hybrids, and nearly resembling *N. Morganiana* which seems to have had the same parentage.

26. **Outramiàna,** Williams. One of Taplin's hybrids of doubtful parentage but probably *N. Sedenii* × *N. Hookeriana*, therefore closely like the following hybrid. F.M. 1879:384. F. 1880, p. 156.

27. **Williamsii,** Mast. (? *N. Sédenii* × *N. Hookeriàna*). Lvs. shortly petioled, lanceolate, margin slightly hairy: pitchers yellow-red with numerous and varying bright red spots. G.C. II. 14:40. Gn. 27:496.—Frequent in plant-houses.

28 **Chélsonii,** Veitch (*N. Hookeriàna* × *N. Domínii*). Lvs. petiolate, glabrous, oblong: pitchers 3–4 x 1½–2½ in., broadly ovate, yellowish green with purple spots; wings narrowing from below upward, fringed; peristome oblique, pale green and red-striped, lid green along middle, purple-spotted laterally. G.C. 1872:542 desc. Gn. 23:492. J.H.S. 21:237, 239. G.Z. 23:121.—A very commendable hybrid of Seden's raising. Var. *éxcellens* is the same as *N. edinensis* (No. 32).

29. **intermèdia,** Veitch (? *N. hirsùta* or *N. grácilis* × *N. Rafflesiàna*). Lvs. petiolate, lanceolate: pitchers 5–8 x 2–3 in., ovate, slightly ventricose below, green and abundantly small purple-spotted; wings conspicuous fringed; peristome cylindric, greatly elevated into a neck behind, pale green with purple stripes. G.C. II. 17:179. F. 1875, p. 257. Gn. 11, p. 429. G.Z. 21: 265. J.H.S. 21:237, 238.—A pretty, common, and easily grown hybrid.

30. **Rafflesiàna,** Jack (*N. Sanderiàna*, Burbidge). Figs. 2462, 2464. Lvs. long-petioled oval to lanceolate, like the st. white tomentose when young, at length glabrous: pitchers 3–7 x 2–4 in., dimorphic, lower urn-shaped, upper funnel-shaped, pale green with varied, purple spots and blotches; peristome uniform, much elevated into high neck behind; pitcher within with triangular glaucous conducting and lower shining detentive area. B.M. 4285. F.S. 3:213, 214; 16:1698; 22:2343. F. 1850:77; 1872, p. 221. G.C. 1872:1164. F.S.R. 2:113, desc.; 3:280. G.Z. 30:265.—Native from Malacca to Borneo and Sumatra, it was early brought to Eu., and is a parent of many hybrids. *N. nìgro-purpùrea*, Mast. (G.C. II. 18:429) is a dark purple form with almost white spots.

31. **Dicksoniàna,** Lindsay (*N. Rafflesiàna* × *N. Veìtchii*). Lvs. petiolate, deeply amplexicaul, blade elliptic-obovate, sparsely hairy beneath: pitchers 4–8 x 2–3 in., cylindric-ventricose, somewhat villous, pale green with abundant purple blotchings; peristome oblique, wide, pale green with purple stripes; lid oblong. G.C. III. 4:543, desc. Gt. 38, p. 466. Tr. Bot. Soc. Edin. 18:236. Gn.W. 6:25.—A beautiful hybrid that was raised by Lindsay in the Edinburgh Garden, but which is subject to lf.-spotting and scale.

32. **edinénsis,** Lindsay (*N. Rafflesiàna* × *N. Chélsonii*). Lvs. petiolate, lanceolate: pitchers 3–6 x 2–3 in., ovate, slightly ventricose, yellow-green with dark purple spots; wings expanded, widest below, fringed; peristome wide, subcylindric, slightly elevated into neck behind. A.F. 7:381.—Raised in the Edinburgh Garden by Lindsay, and a pretty hybrid when well grown, but rather difficult of treatment.

33. **Phyllámphora,** Willd. (*N. macrostàchya*, Blume. *N. fimbriàta*, Blume. *N. O'Brieniàna*, Rod. *Phyllámphora mirábilis*, Lour.). Fig. 2463. Lvs. petiolate, light green, herbaceous, glabrous, veins 6–10 pairs, margin dentate-ciliate: pitchers 3–6 x 1–1½ in., subcylindric, slightly inflated in lower half, pale green to red-green or red (*N. O'Brieniana*); wings narrow or as cords; peristome cylindric, transverse, green rarely red; lid orbicular. B.M. 8067. I.H. 37:116. Native from S. China to Borneo, Sumatra and N. Guinea.—It was first cult. nearly a century ago, and has been parent of several hybrids. It varies in shape and color in different localities.

34. **coccínea,** Mast. (*N. Hookeriàna* × *N. Phyllámphora*). This has probably the same parents as *N. Lawrenciana* and *N. Patersonii* and mainly differs in the more generally purple-red surface with yellow-green marblings and spots. G.C. II. 18:169. I.H. 41, p. 143.—It combines very fairly the good points of both parents in being an easily grown, abundantly pitchered and attractively colored type.

35. **Kennedyàna,** F. Muell. An Australian species very near to *N. Phyllamphora* that was grown from 1880 to 1890 and now is rare or lost to cult. G.C. II. 17:257.

36. **Ròwanæ,** F. M. Bailey. Plant stout, erect: pitchers large, dull crimson-green to crimson; peristome cylindric in front, expanded widely behind. G.C. III. 22:338, desc.. J.H.S. 22:192.—An Australian species, first found and illustrated by Mrs. Ellis Rowan, and which may yet be a well-known horticultural form.

37. **madagascariénsis,** Poir. The most outlying species of the genus and native to Madagascar. It forms low upright plants 2–3 ft. high, and bears deep crimson pitchers. It has been intro. repeatedly into French and English stovehouses, but seems to die off rather quickly. G.C. II. 16:685.

38. **bicalcaràta,** Hook. f. (*N. Dỳak*, Moore). Plant tall, stout, yellow-green: lvs. petiolate, large, with 8–14 veins: pitchers goblet-shaped, yellow to brownish or reddish green, rarely almost brick-red; wings conspicuous; peristome with 2 long sharp descending spines behind: fls. in long loose panicles. N. W. Borneo. G.C. II. 13:201. I.H. 28:408. Gn. 33, p. 29.—A remarkable species, but very difficult in cult.

39. **Veìtchii,** Hook. f. Fig. 2465. St. creeping, hairy, epiphytic: lvs. alternate, petiolate, decurrent, elliptic to obovate: pitchers 4–8 x 1½–3 in., yellow-green to reddish hairy; wings expanded and fringed or rudimentary; peristome pale green or red-green, widely expanded behind (Fig. 2465); lid yellow-green with strong basal keel within. B.M. 5080 (as *N. villosa*, in error). G.C.

1872:542, desc.; II. 16:781; 18:808 (as *N. sanguínea*, in error); III. 20:239, desc. F.M. 1877:265. I.H. 23:192. —A unique species from Borneo that has been a parent for many of the best hybrids.

40. **alàta,** Blanco. Plants terrestrial or epiphytic: st. trigonous: lvs. amplexicaul, petiolate, elliptic-lanceolate, nerves 3, rarely 4 pairs: pitchers somewhat dimorphic, cylindric-ventricose to cylindric, finely stellate-pubescent; wings rudimentary below, widening and fringed above; peristome oblique, slightly elevated into a neck behind; lid broadly cordate with internal basal keel. Fl. Filip. ed. 3:III 214; IV. 173.—As yet not intro. from the Philippine Isls., but of bright color and graceful shape; deserving therefore of attention.

41. **Ràjah,** Hook. f. Fig. 2462. St. upright, stout: lvs. large, thick, coriaceous: mature pitchers 5–9 x 3–5 in., red-purple or green-purple; wings widening from below upward, fringed; peristome widely expanded with undulate margin, deep crimson; lid large cordate. Tr. Linn. Soc. 22:421. G.C. II. 16:493. Gn. 22, p. 122. F. 1883:167. B.M. 8017.—A magnificent species from Kinabalu, Borneo, that is difficult under cult. Moore, of Glasnevin, has succeeded well by growing it in a "filmy-fern atmosphere."

42. **nóbilis,** Veitch (*N. sanguínea* × *N. máxima* var. *supérba*). Lvs. slightly stalked, thick, herbaceous, elliptic-oblong, peltate at apex: pitchers 6–9 x 1½–2 in., cylindric, brownish red with scattered purple blotches; wings expanded ciliate; peristome oblique crimson-purple, outer margin wavy; lid with shallow basal crest. G.C. III. 45:25.—A striking hybrid with richly mottled interior to the pitchers.

43. **Dyeriàna,** Macfarlane (*N. míxta* × *N. Dicksoniàna*). Lvs. petiolate amplexicaul, decurrent, oval to elliptic-obovate, apex often peltate: pitchers 5–12 x 2–3½ in., cylindric-ventricose, yellowish green with abundant purple spots and blotches; wings wide, long-ciliate; peristome widely expanded and elongated somewhat into a neck behind; lid with prominent external keel. G.C. III. 28:257; 38:325, desc.—A splendid hybrid that grows readily, and forms large pitchers. It was raised by Tivey and sent out by the Veitch firm in 1900.

44. **Wíttei,** Veitch (*N. stenophýlla* × *N. máxima*). Lvs. deeply amplexicaul, petiolate, with expanded winged base, elliptic-obovate with rounded or peltate apex: pitchers 3–7 x ½–1½ in., tubular with brown pubescent girdle below peristome, pale green with red or purple areolations; wings intermediate between those of parents; lid with basal median-keel within. J.H.S. 21:238.—Raised by M. Witte, curator of Leiden Garden, it is very nearly between the two parents.

45. **truncàta,** Macfarlane. Lvs. large, petiolate, lamina truncate at base and apex: pitchers large, urceolate, crimson; wing narrow or cord-like; peristome widely expanded, undulate without; lid small, keeled at base within. Bot. Contrib. Univ. Penn. 3:207, pl. 2.—A remarkable species collected by W. J. Hutchinson during 1907 in Mindanao, Philippine Isls.

46. **stenophýlla,** Mast. Lvs. petiolate, elliptic-lanceolate, lf.-veins 3: pitchers 3–5 x ½–1 in., tubular, slightly ventricose below, pale green with abundant purple spots and areoles; wings nerve-like below, slightly expanded in middle, fringed toward mouth; lid with internal basal keel. G.C. III. 8:240, desc.; 11:401.—A neat, graceful and richly colored species from Borneo, but hard to grow. It is now rare in cult., but its hybrid *N. Wittei* is fairly easily grown.

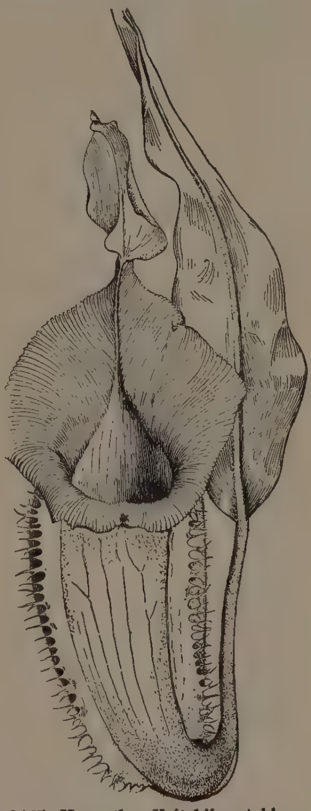
47. **máxima,** Reinw. (*N. celébica,* Hook. f. *N. Cùrtisii,* Mast. *N. fàllax,* G. Beck). Lvs. amplexicaul, petiolate, elliptic with brown ciliate margin: pitchers dimorphic to trimorphic, lower ventricose below, cylindric above; wings expanded, fringed; middle pitchers cylindric with narrow unfringed wings; upper funnel-shaped with wings reduced to cords; all pale green, heavily blotched or overlaid by purple areoles; peristome cylindric in front, expanded and undulate posteriorly, green-purple to dark purple; lid cordate with basal crest and subapical spur within. G.C. III. 2:689; 6:661. B.M. 7138. I.H. 35:59.—A richly colored species that is native to Celebes, Borneo, and N. Guinea, and that was intro. by Curtis from Borneo. It thrives well, flowers freely, and has been a parent of some striking hybrids.

48. **Tíveyi,** Mast. (*N. máxima* × *N. Vèitchii*). Lvs. amplexicaul, decurrent petiolate, elliptic-obovate, apex peltate: pitchers 3–10 x 1½–3 in., cylindric, yellow-green with many large irregular purple blotches; wings imperfect below, expanded and fringed above; peristome widely expanded and undulate laterally, elevated into a neck behind; lid inside with basal keel and subapical spur. G.C. III. 22:200, 201. G.M. 40:599. J.H.S. 21:238.—A large strong and cultivable hybrid that was raised by Tivey. It promises to become a favorite type.

49. **Balfouriàna,** Mast. (*N. míxta* × *N. Mastersiàna*). Pitchers 5–10 x 2–4 in., cylindric-ventricose, green with few large purple spots over surface or mainly toward peristome; wings large, fringed; peristome expanded, purple and green-striped; lid with subapical spur. G.C. III. 26:91.—A striking and fairly easily grown hybrid that was raised by Tivey, and which blends the parental characters of *N. Northiana, N. maxima* (*N. Curtisii*), *N. sanguinea* and *N. khasiana.*

50. **Lòwii,** Hook. f. Fig. 2462. A striking species from Kinabalu that bears large yellow-green leathery pitchers, shaped as in Fig. 2462. It has not been intro. into cult.

51. **Macfárlanei,** Hemsl. A Malayan species with oval or funnel-shaped pitchers that are green, with extensive deep claret areolations. The lid bears long hirsute bristles within.—Not yet in cult., but a promising species for hybridization.



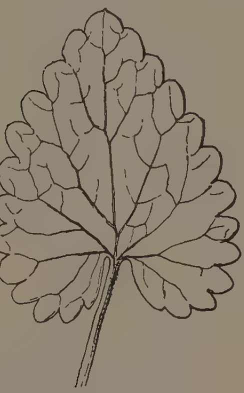
2465. Nepenthes Veitchii, notable for its wide rim.

N. Allióttii=N. Northiana × N. maxima.—*N. atropurpùrea*=N. sanguinea × N. maxima var. superba.—*N. Boisiàna*=N. Tiveyi × N. Morganiæ.—*N. compácta*=N. Hookeriana × N. Phyllamphora.—*N. Còurtii*=N. (?) × N. Dominii. A hybrid of Court that is rare in cult. G. C. II. 16:845.—*N. Deslògei*=N. Tiveyi × N. mixta.—*N. excélsa*=N. Veitchii × N. sanguinea.—*N. Fournièri*=N. Northiana × N. mixta.—*N. Gàmerii*=N. Tiveyi × N. mixta.—*N. Gaùtieri*=N. Northiana × N. mixta.—*N. grándis*=N. maxima var. superba × N. Northiana var. pulchra.—*N. Henryàna*=N. Sedenii × N. Hookeriana. I. H. 4:15; 29:460. G. W. 14:297.—*N. longicaudàta*=N. maxima var. superba × N. Northiana var. pulchra.—*N. Mercièri*=N. Northiana × N. mixta.—*N. Pátersonii*=N. Paradisæ.—*N. Paùllii,* Hort.=?—*N. picturàta*=N. Dyeriana. G. M. 46:677. F.S.R. 2, p. 69.—*N. Ratcliffiàna*=N. Hookeriana × N. Phyllamphora. G.Z. 26:241.—*N. remilliénsis*=N. maxima var. superba × N. Northiana var. pulchra.—*N. robústa*=N. Hookeriana × N. Phyllamphora. G. C. II. 14:41. F. 1880, p. 156.—*N. rufèscens*=N. distillatoria var. rubra × N. Courtii. A rare and rather unattractive hybrid. G. C. III. 4: 669.—*N. Siebrechtiàna*=N. Phyllamphora × N. Sedenii.—*N. Sìmonii*=N. Northiana × N. mixta.—*N. spléndida*=N. Hookeriana × N. Phyllamphora.—*N. Stèwartii*=N. Hookeriana × N. Phyllamphora. F. 1879, p. 157.—*N. supérba*=N. Sedenii × N. Hookeriana. G. Z. 25:145.—*N. Vallièræ*=N. Tiveyi × N. mixta.—*N. Wrigleyana*=N. Hookeriana × N. Phyllamphora. G. C. II. 17:143.

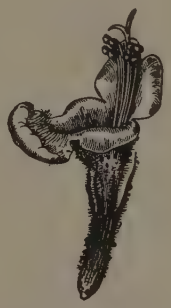
J. M. MACFARLANE.

NÉPETA (Latin, perhaps from Nepete, an Etrurian city). *Labiàtæ.* This group includes catnip, ground ivy and some other hardy perennial herbs of the easiest culture.

Perennial or annual herbs, tall and erect, or dwarf and more or less trailing: lvs. dentate or incised, the floral ones like the rest or reduced to bracts: whorls of fls. crowded in a dense spike, or in a loose cyme, rarely few-fld. and axillary; fls. blue or white, seldom yellow; calyx 15-nerved; corolla somewhat 2-lipped; upper lip straight or erect; lower lip spreading, 3-lobed, with the large center lobe concave; perfect stamens 4, in pairs, the 2 shorter ones in front; ovary 4-parted. The genus is placed near Lopanthus and Dracocephalum, and is characterized as follows: calyx tubular, the mouth straight or oblique, 5-toothed; stamens usually parallel, ascending; anther-cells divergent or divaricate.—About 150 species, mostly in the northern hemisphere outside the Old World tropics.



2466. Leaf of catnip.



2467. Catnip.—Nepeta Cataria. (×3)

Catnip is a familiar weed near dwellings and barns. Cats are fond of it, and catnip tea is a pungent memory with those who have survived the era of homely simples. The seeds of catnip are still offered. Ground ivy (*N. hederacea*) also grows wild in America, and a form of it with variegated foliage is cultivated for edging flower-beds or covering banks and stones. It is hardy in light well-drained soils, but sometimes winter-kills in moist soils. It is also used in vases and baskets. *N. hederacea* is a perennial creeping plant of easy culture in any loose, rich, fairly moist soil in either shade or full sunlight, but to be luxuriant in the open it should have a moist rootage. It is a very rapid grower, and is therefore often troublesome when planted with other low-growing plants. It is very useful as a ground-covering in shrubbery borders and shady places generally, particularly where it can hang over curbs or edgings or where a good sward cannot be secured.

A. *Blossoms small, rather inconspicuous.*

B. *Color of fls. white or nearly so.*

Catària, Linn. CATNIP OR CATNEP. CATMINT. Figs. 2466, 2467. Perennial, densely downy, pale green: st. rather stout, tall and erect: lvs. heart-shaped, green above, whitish below, crenate, stalked: corolla nearly white, or pale purple, dark-dotted. Blooms from July–Nov. Eu., Orient.

BB. *Color of fls. blue.*

hederàcea, Trev. (*N. Glechòma,* Benth. *Glecòma hederàcea,* Linn.). GROUND IVY. GILL-OVER-THE-GROUND. FIELD BALM. Fig. 2468. Perennial, hairy: creeping sts. leafy, making a dense mat: lvs. roundish, more deeply notched at the base than catnip, and green on both sides, the floral ones like the others, not reduced to bracts as in the other kinds here described; lower petioles longer than the lvs.: whorls axillary, few-fld., blue. Nat. from Eu., Asia. C.L.A. 23:57. B.B. 3:87. G.W. 9, pp. 244, 245; 13, p. 558—Other old vernacular names are alehoof, cat's-foot, gill, gill-ale, gill-go-by-the-ground, hayhofe, haymaids, hove, tunhoof, creeping charlie, robin-run-away, gill-runover, crow-vituals, wild snake-root, hedge-maids. March–June.—The green-lvd. form is less cult. than var. **variegàta,** Hort. (*N. hederàcea,* Trev., var. *variegàta,* Hort.).

AA. *Blossoms larger, showy, blue.*

B. *Lvs. not notched at the base.*

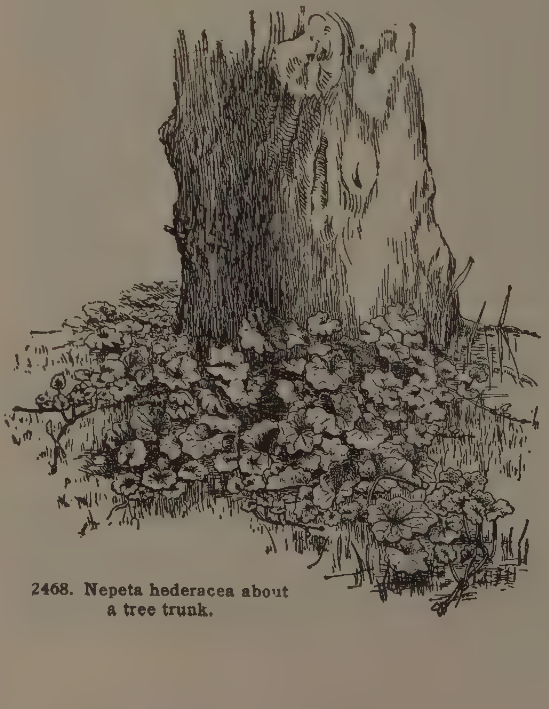
macrántha, Fisch. Erect plant, branching, nearly glabrous: lvs. short-stalked, ovate-lanceolate, green on both sides: cymes peduncled, few-fld.; fls. 1 in. long; bracts minute. Altai. B.M. 2185 (as *Dracocephalum sibiricum*).—Prop. by division of underground sts.

Wìlsonii, Duthie. Allied to *N. macrantha:* herbaceous perennial, 2–2½ ft. high: lvs. shortly stalked, the upper subsessile, ovate-oblong, 2½–3¼ in. long, obtuse, crenate: fls. in distant whorls, short-stalked; corolla violet, about 1 in. long, with a slender tube white at the base, curved and enlarged above. W. China.

BB. *Lvs. notched at base.*

C. *Fls. pedicelled.*

grandiflòra, Bieb. (*N. melissæfòlia,* Pers.). Height 20 in. or more: plant nearly glabrous, green: st. erect and branching: lvs. short-petioled, large, long, heart-shaped, crenate-margined: corolla with upper segm. awl-shaped, much shorter than the violet, hairy lower segm.; calyx-lobes long pointed; fls. beautiful blue. Known in gardens as *N. argéntea,* Hort., *N. grándis,* Hort., *N. incàna,* Hort., *N. teucrioìdes,* Hort. Summer. Caucasus.



2468. Nepeta hederacea about a tree trunk.

betonicæfòlia, C. A. Mey. Upper lvs. green on both sides, notched at base, and cordate: bracts a half shorter than the calyx: fls. pedicelled in dense heads: racemes simple, short; calyx elongate, villous, hardly dilated. Caucasus.

Veìtchii, Duthie. Perennial, herbaceous: whole plant covered with minute rather hispid hairs: st. 1–1½ ft. high: lvs. narrowly oblong, lanceolate, 1–2 in. long, acute, cordate at base, crenate-dentate, rugose; the lower stalked, the upper without petioles: fls. in distant whorls; corolla light blue, about 1½ in. long, with a long narrow deflexed tube. W. China. G.C. III. 40:334.—A recent intro. Handsome.

cc. *Fls. sessile.*

Mussìni, Spreng. Diffuse: branches many, ascending: lvs. green above, whitish below: racemes unbranched; bracts much shorter than the calyx: lvs. small, heart-shaped, blunt, deeply notched: corolla blue, darker spotted. Caucasus, Persia. R.H. 1891: 300. B.M. 923 (*N. longiflora*). Gn. 72, p. 563; 74, p. 413; 78, p. 518.

A. C. Hottes.†

NEPHÈLIUM (an ancient name transferred from the burdock, because of some similarity in the rough fruits). *Sapindàceæ.* Oriental tropical trees, some of them prized for their fr.; species more than 30. Four frs. prized in the Orient have been referred to this genus, the litchi, longan, rambutan and pulassan, the last one not having a general reputation. Recent botanists, however, separate these into the genera Euphoria, Litchi and Nephelium. The characters of separation are: **Euphoria.** Fr. tubercled with rugose, flattened, sometimes indistinct tubercles; aril free; embryo straight, radicle at the base of the seed: petals present; sepals imbricate: includes the longan or longyen (*E. Longana*, Lem. *Nephelium Longana*, Cambess. See *Euphoria*). **Litchi.** Fr. tubercled with angular prominent tubercles; aril free; embryo straight, radicle at the base of the seed: petals wanting; sepals valvate, small: includes the litchi (*Litchi chinensis*, Sonn. *Nephelium Litchi*, Cambess. See *Litchi*). **Nephelium.** Fr. echinate-muricate, sometimes smooth; aril adnate to the seed; embryo curved, the radicle near the apex of the seed: petals wanting, in some species present; sepals valvate, small.

The three species mentioned above may be distinguished by the lvs. as follows: The longan has usually 4 pairs (2–5) of lfts., coriaceous, strongly veined, acuminate but more or less obtuse at point, 2–4 in. or more long; the litchi has usually 3 pairs of lfts., coriaceous, indistinctly veined, glaucous beneath, obtusely acuminate, 2–5 in. long; the rambutan has usually 2–3 or more pairs of lfts., chartaceous, strongly veined, often obtuse, 3½–7 in. long; the midrib is somewhat raised above, impressed in the two preceding species. The longan is offered both in S. Fla. and S. Calif. It is said to have been intro. in Calif. probably 25 years ago; it is also reported that the litchi and *Alectryon excelsum* have been sold for the longan.

L. H. B.

The rambutan, pulassan and longan.

The rambutan (*Nephelium lappaceum*, Linn.) and the pulassan (*N. mutabile*, Blume) are commonly cultivated in the Malay archipelago, where they appear to be indigenous. The longan (*N. Longana* or *Euphoria Longana*), said by De Candolle to be a native of India, is considerably hardier than the first two, and is found as far north as southern China, where it is rather extensively grown.

The rambutan is seen in almost every garden about Singapore and Penang, and its fruit is one of the most delicious of the region. The tree, which grows to a height of 35 or 40 feet, is erect and stately in appearance, with compound leaves composed of five to seven pairs of oblong leaflets about 4 inches long. It is commonly stated that there are eight or ten varieties of the rambutan, but these appear to differ very little from one another, and are rarely propagated by grafting or layering. The fruits are produced in terminal clusters of not more than ten or twelve, and individually are the size of a small hen's egg, oval in form, and covered with soft fleshy spines ½ inch in length. The color is bright crimson, occasionally greenish or shaded with orange. The pericarp is thin and leathery; to eat the fruit the basal end is torn off, exposing the whitish, translucent juicy pulp or aril, which, with a slight pressure on the apical end of the fruit, slides into the mouth. The flavor is acidulous, somewhat suggesting the grape, and generally considered by Europeans very pleasant, though not equal to that of its relative, the litchi. An oblong flattened seed nearly 1 inch in length is inclosed by the aril.

The pulassan is often confused with the rambutan which it greatly resembles, but is distinguished by the shorter blunt spines and the aril separating more readily from the seed. The flavor is sweeter and generally preferred to that of the rambutan.

It is not known that either of these species has ever fruited in tropical America, their culture being limited, practically speaking, to southern Asia. They are usually grown from seed, but layering and grafting are often used to perpetuate choice seedlings. The gootee method, described under Litchi, is successful.

The longan, called by the French "œil de dragon," or dragon's eye, greatly resembles the litchi except in its smaller size and inferior flavor. It ripens later than the litchi and is very popular among the Chinese, quantities of the fruit being sold in Hong Kong and Canton during late summer. It has been introduced to the United States and planted in both Florida and California, where it fruits abundantly and appears to thrive, when grown in locations which are protected from severe frosts. The fruits, which are produced in large terminal clusters, are ½ inch in diameter, spherical, with a thin leathery pericarp and whitish, gelatinous pulp or aril inclosing a shiny brown seed the size of a bean. The flavor is generally considered rather insipid. As a stock on which to bud the more tender litchi the longan may have considerable value, although its growth is rather slow.

F. W. Popenoe.

NEPHRÒDIUM. A name used by some botanists, especially in England, for species of Dryopteris, which see.

NEPHRÓLEPIS (Greek, *kidney scale*, alluding to the shape of the indusia). *Polypodiàceæ.* Sword Fern. A group of tropical and subtropical ferns.

Leaves pinnately divided; pinnæ articulated or jointed, the veins free-forking, the sori on upper forks of the veins and with kidney-shaped indusia which are attached inwardly.—Four species are in more or less common cult. Of these, *N. exaltata* is the most important as it is best adapted to general cult. and also it has given rise to a large number of important horticultural varieties. It is, perhaps, safe to say that this species and its varieties constitute the most important single species of fern in cult. for house purposes. The three other species have each given rise to a few varieties but none of them is well adapted to house conditions, so that they are mainly confined to greenhouses.

In the index that follows most of the names belong to varieties of *N. exaltata*, or more accurately to varieties of *N. exaltata* var. *bostoniensis*, but in the trade they are counted as species and are given specific names. Technically *N. elegantissima* should have a much longer name if its true relationship were to be indicated. To illustrate, *elegantissima* is a variety of *Piersonii*, which is a variety of *bostoniensis* and this a variety of the original species, *N. exaltata*. Thus its scientific name is properly *N. exaltata* var. *bostoniensis* var. *Piersonii* var. *elegantissima*. In the present treatment the trade names are used, but in connection with the descriptions the origin of each form is given when known. The index includes all the names that have been met, although no information has been available regarding some of them. Very few of the English varieties are grown at all in the U. S. English varieties are indicated thus: (E).

Methods of cultivation.

In general, nephrolepis must be propagated entirely by runners. Few if any spores are produced by the varieties. As a plant comes to be a year or so old, the leaves develop the usual fruit-dots or sori, but when examined under the microscope it appears that these consist of abortive sporangia or spore-cases and contain no spores. It is probable that spores are developed occasionally, but so rarely that this method can not be used in propagating new plants commercially. A vigorous plant will, however, produce numerous runners which spread in all directions and take root, starting new plants in this way. It is customary to maintain a number of stock plants planted out in benches from which new runners can be plucked as needed. This also gives a good opportunity for the production of new varieties.

New varieties of commercial value do not appear very frequently in the commoner varieties. Most of the present standard varieties have been propagated from single original plants, although there are cases of a certain type of variation occurring simultaneously with different growers, one of whom might count it worthy of introduction while another would disregard it.

All growers unite in acknowledging the original Boston form as the best grower of all and it appears also that there is a greater demand for this form than for any other. The next most popular form is probably *N. Scottii*, with *N. elegantissima* the third. Teddy Jr., and the large frilled forms, *N. Harrisii* and *N. Rooseveltii*, are also grown by most dealers.

There are two main methods of growing nephrolepis for the market, the pot method and the bench method. In the former, stock plants are grown, planted out in the benches, from which new runners are picked from time to time. These are then potted in 2½-inch pots and transferred to larger pots as becomes necessary. In the bench method, the runners are planted out in the benches and grown to good size when they are put into pots, perhaps 6 inches, and kept till rooted, and then sold.

It would appear that the pot method should produce plants which would be better suited to thrive in house conditions, owing to a better establishment of the roots. Then, too, the leaf-growth should also be better, as the transfer from the bench to the full-sized pot would tend to stop vigorous growth for a while.

Some growers market almost their entire product in the form of the bench runners. This of course is entirely wholesale trade. Such runners bring from 4 to 5 cents in thousand lots. When sold in pots, the price depends on the size of the pot. The various kinds bring in general the same prices. Well-grown plants in 6-inch pots sell wholesale at 50 cents apiece.

These ferns are grown from Maine to Florida. In general, a supply from near at hand is better than one coming from a distance. A lot of Boston runners (5,000) obtained from Florida and grown in Massachusetts were recently seen which were most unsatisfactory. At the end of a month there had been scarcely any growth, while for similar runners obtained nearby three weeks should see them well established and ready for sale. One large grower found another danger in Florida importations in the Florida moth, which nearly cleaned out their supply of ferns before they discovered that sprays of hellebore or pyrethrum destroyed it.

INDEX.

acuminata, 2.
acuta, 3.
Amerpohlii, 29.
Anna Foster, 18.
Barrowsii, 18.
Bausei, 3.
biserrata, 3.
bostoniensis, 5.
canaliculata, 34 (E).
Clarkii, 29.
compacta, 1 (E).
cordata, 1.
cordifolia, 1.
Craigii, 29.
davallioides, 2.
Duffii, 1.
Dwarf Boston, 12.
elegantissima, 19.
elegantissima compacta, 25.
Elmsfordii, 27.
exaltata, 4.
falcata, 10.
furcans, 2, 3.
Giatrasii, 11.
gigantea, 1 (E).
gracillima, 29.
Harrisii, 6,
lycopodioides, 32.
magnifica, 28.
Milleri, 29.
M. P. Mills, 24.
multiceps, 2 (E).
muscosa, 31.
Neubertii, 29.
New York, 8.
pectinata, 1.
Piersonii, 17.
plumosa, 1.
robusta, 22.
Rochfordii, 29 (E).
Rooseveltii, 7.
rufescens, 3.
Scholzelii, 23.
Scottii, 9.
Smithii, 29.
superba, 3, 33 (E).
superbissima, 30.
Teddy, Jr., 13.
tessellata, 1 (E).
todeoides, 21 (E).
tuberosa, 1.
variegata, 1 (E).
viridissima, 15, 30.
Wagneri, 14.
Wanamaker, Boston, 16.
Whitmanii, 20.
Whitmanii compacta, 26.
Wittboldii, 35.
Wm. K. Harris, 6.

A. *Rootstocks with small tubers.*

1. **cordifòlia,** Presl (*N. tuberòsa*, Hook. *N. cordàta*, Hort.). Lvs. numerous, tufted, with stiff petioles, 15–30 in. long, 1½–2 in. wide, with close often overlapping pinnæ, these usually blunt and crenulate. Mex., Japan, and New Zeal.—A rather slow grower. It reproduces by runners but less freely than *N. exaltata*. Commonly known in the trade as *N. cordata* and under this name has several varieties as vars. *compácta*, *gigantèa*, *tessellàta* and *variegàta*. Var. **plumòsa,** common in the trade as *N. tuberosa plumosa*, is a beautiful form with glossy dark lvs. which have the pinnæ once-pinnate in the outer half or two-thirds. Var. **Dúffii** is a remarkable wild variety with the pinnæ reduced to one or two rounded segms. Var. **pectinàta** lacks the tubers and has narrower, more spreading lvs. Probably a distinct species.

AA. *Rootstocks without tubers.*

B. *Sori on special narrow segms. of the fertile lvs.*

2. **acuminàta,** Kuhn (*N. davallioìdes*, Kunze). Lvs. drooping, 2–3 ft. long, 1 ft. or more wide, the lower pinnæ incised crenate, the upper pinnæ narrower, with deeper lobes, each with a single sorus at the apex. Java. —A cult. variety with forked pinnæ is grown, advertised as *N. furcans* and *N. furcans multiceps*.

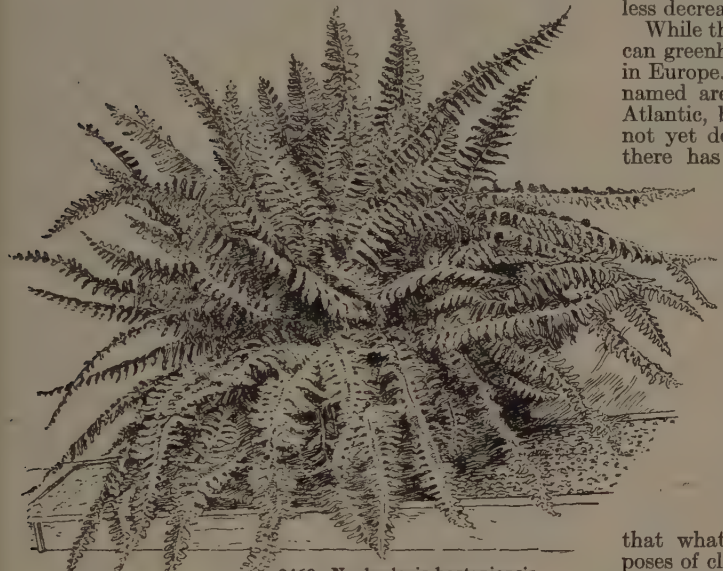
BB. *Sori along margins of ordinary divisions of lvs.*

3. **biserràta,** Schott (*N. acùta*, Presl. *N. Baùsei*, Hort.). Lvs. few, 30–55 in. long, 8–12 wide, drooping, the pinnæ often distant, elongate, narrow, with entire or crenulate margins, rounded in the lower half of the base, auricled in upper half, leathery. Pan-tropic. *N. ruféscens* is a scaly form. Var. **supérba,** usually ascribed to *N. exaltata*, may be a variety of *N. bisserrata*. It is characterized by a crested many-forked apex, and has laciniate-margined pinnæ. Var. **fúrcans** has the pinnæ once or more forked.

4. **exaltàta,** Schott. SWORD-FERN. Lvs. rather rigid and erect, 2–5 ft. long, 3–6 in. wide, oblong, tapering toward the point, the pinnæ rather close, acute, entire or crenulate, the upper side auricled. Fla. to Brazil, Hong-Kong and E. Afr.—This description applies only to the wild species. It is impossible to give a description which will include all the forms which have been derived from this species. Each distinct form needs separate treatment. The varieties of *N. exaltata* have practically all arisen in the last twenty years, since the early nineties. At that time this species was grown to some extent by florists as a house-plant but was not more common than many flowering species. It happened, however, that in a lot of this species of about 200 plants, shipped by Robt. Craig & Co., of Philadelphia, to F. C. Becker of Cambridge, Mass., there was discovered one plant which differed from the ordinary *exaltata* in being more graceful, slightly broader, and a quicker grower. The purchaser identified this plant as the species *acuminata* or, as it was then called, *daval-*

lioides, and proceeded to raise and sell it by the scores of thousands. Later, when a specimen of the fern came into the hands of G. W. Oliver, the latter raised the question of its identification and declared that it was not *davallioides* but *exaltata*, though not the typical form. For some time thereafter Messrs. Becker and Oliver exchanged opinions in the "Florists' Exchange," until Oliver's determination was accepted. The nomenclature commission of The Society of American Florists did not feel competent to give a name to the new variety so it was sent to Kew where it was suggested that the neighborhood of its discovery might well be honored by calling it *bostoniensis*. This name was given in 1896. The fern had been on the market for a year or more previously.

For nearly ten years the Boston fern held undisputed sway. The original species-form was superseded owing to its less graceful stiffer habit. Then in 1903 there appeared a new type of variation in the greenhouses of F. R. Pierson, of Tarrytown, N. Y.


2469. Nephrolepis bostoniensis. (Spread, 7 ft.)

In this new form, the Boston fern departed from its once-pinnate type to give rise to a twice-pinnate form which was introduced as *Piersonii*. But this fern was not consistently once or twice pinnate but both, and after a time it appeared that this unstable condition was not very satisfactory. It was found possible to obtain by careful selection a more fixed type of the twice-pinnate form and when this was introduced it was given the name of *elegantissima*. This was followed by other forms showing the two-pinnate character, and later forms appeared three and even four times divided.

A year or two later, in Brooklyn, another type of variation developed from the Boston fern. This was the dwarf type, with which came some other differences, but with the once-pinnate character retained as in the parent form. John Scott brought out the first of these dwarf types but there are now a half-dozen different dwarf once-pinnate forms.

About this time Harris, of Philadelphia, discovered and introduced a once-pinnate type with beautifully waved pinnæ and called it *Harrisii*. This has since been followed by wavy dwarfs, wavy twice-pinnate forms. Pierson again came to the front with a new type of variation in which the leaves are irregularly curled and twisted so that the resulting leaf becomes a dense thick mass of divided pinnæ, the *superbissima* and *muscosa* forms.

At the present time, with these four main types of variation to start with, and with others, such as thickness of petiole, rapidity of growth, stability of form, and the like, there have come almost all possible combinations and mixtures of these main types so that within certain limits almost anything is possible. Every grower who produces any quantity of these forms is having new types develop in his beds. Many of these are of no commercial value. A few new ones are introduced each year but some which at first appear good prove to have serious defects after testing for a year or two.

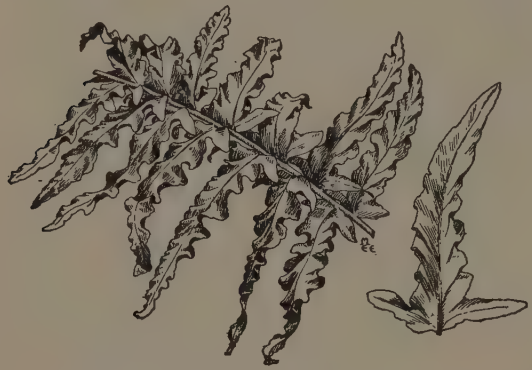
It is an interesting fact that, after ten years of new forms, the old Boston fern still holds its own and sells more readily and in larger amounts than any new form. It appears that with the later variations there has come also less adaptability to house conditions and more or less decrease in the vigor of growth.

While these variations have been appearing in American greenhouses, the same thing has been taking place in Europe. In some cases the new forms produced and named are practically identical on both sides of the Atlantic, but each region has produced distinct types not yet developed by the other. Generally speaking, there has been almost no importation into North America of the new European forms. For this reason little attention is here paid to European forms in this treatment. Not much is known about them by our growers and collectors.

The classification of the forms of *N. exaltata* is a difficult problem on many accounts. In the first place, owing to unscientific horticultural methods of description and publication of names, it is practically impossible to get accurate printed records of the different forms. Some growers have the custom of merely placing a new form on the market without so much as a catalogue or periodical advertisement. At best it is a case of advertising descriptions for the purpose of sale so that what is stated can not be accepted for the purposes of close and accurate description. In the second place, the types of the variations themselves are often of such a character that it is hard to draw up good differential descriptions. Two varieties may vary not at all in the cutting of the leaves but very markedly in the important characters of cultural needs and response. Again, it is usually the case that earlier varieties become superseded by later ones of greater commercial possibilities. The grower then has no sentiment about the original forms but discards them, so that it is practically impossible now to get plants of some of the early stem-varieties from which nearly all of the later have sprung. Added to these difficulties is often indifference on the part of growers to the need of accuracy in naming forms. A single form may be sold by different florists under totally different names.

The descriptions given below of the various forms have been drawn up as far as possible from authentic material obtained from the original producers themselves. Numerous visits have been made to growers in the neighborhood of New York, Boston, and Philadelphia. A collection of living plants has been started at the Brooklyn Botanic Garden, the main object of which is to gather authentic plants of the varieties. It should be noted here that, however careless as to the accuracy of descriptions and names the various growers have been, they have been exceedingly courteous in affording opportunities for study and in giving such information as they possessed.

The varieties chosen for description are those found to be in actual cultivation for the trade in the United States, together with some formerly in the trade but important because the modern varieties have sprung from them. Whenever possible, other varieties have been given incidental description by comparison with the more important forms. In some cases it has not been possible to settle the claims advanced for two or more similar varieties and in such cases the varieties have been given coördinate treatment with a single description. English varieties about which little information has been available have been mentioned where possible in connection with similar American forms.



2470. Nephrolepis Harrisii. (×⅛; pinna ×½)

In the key below dimensions given are for well-grown plants in 6-inch pots. In the smaller varieties, these dimensions are maximum, but some of the larger types may develop leaves as long as 6 feet.

A. *Exaltata forms with lvs. 1-pinnate or sometimes pinnate-pinnatifid.*

B. *Length of lvs. 2½–3 ft.*

C. *Pinnæ plane, the margins straight.*

5. **bostoniénsis.** Fig. 2469. Intro. by F. C. Becker, 1895. Free-growing, the lvs. dark green, spreading or hanging according to the light, the petioles rather succulent, the pinnæ linear-lanceolate, acute, 3–4 in. long, ½–¾ in. wide, entire or crenulate, plane or slightly undulate, herbaceous, less stiff than type form, with more graceful and broader pinnæ. The standard variety and best of all for general purposes. Good as a pot-plant (6 in. or more) or in baskets, on palm trunks or in the rockery. It may be planted out in the southern states.

CC. *Pinnæ wavy.*

6. **Hárrisii.** Fig. 2470. Wm. K. Harris, from *bostoniensis.* **Wm. K. Harris,** Wm. K. Harris, from *Harrisii* is merely *Harrisii* selected for the greater waviness of the pinnæ. See *Rooseveltii.*

7. **Roòseveltii,** Amer. Rose and Plant Co., from *bostoniensis.* Like *bostoniensis,* except for the pinnæ which are beautifully waved and usually auriculate. *Rooseveltii* is exactly like the Harris forms as to the undulation of the pinnæ, but is not quite so large a form and can consequently be better grown in 6-inch pots. Both make beautiful plants when well grown. *Harrisii* and *Rooseveltii* probably represent separate sports of two distinct types of Boston fern which exist in the trade, one taller than the other.

8. **New York,** Giatras, 1913, from *Giatrasii.* Somewhat smaller than *bostoniensis,* the lvs. slender, narrow, the pinnæ somewhat undulate, 2–3 in. long, often blunt, the petiole slender, wiry. Good when well grown but rather slow. Like *Giatrasii* but larger.

BB. *Length of lvs. 15–24 in.*

C. *All the pinnæ entire, not pinnatifid.*

D. *Pinnæ not wavy or twisted.*

9. **Scóttii,** Jno. Scott, from *bostoniensis.* Lvs. spreading, recurved, the pinnæ close, revolute and recurved, the petioles stoutish, rather succulent, strong. This is the commonest of the dwarf varieties. When well grown, it forms a compact dense cluster of lvs. which have good lasting qualities. It is somewhat subject to white scale, and is slower than Teddy Jr.

10. **falcàta,** Wagner, from *Scottii.* Like *Scottii,* except that ends of pinnæ are 1- or 2-forked.

11. **Giatràsii,** Giatras, 1909, from *bostoniensis.* About the same size as *Scottii,* perhaps a little smaller, but different in having more flexible lvs., wiry petioles and midribs, nearly plane pinnæ. Well-grown plants perhaps more graceful than *Scottii* but slower-growing and therefore not so much used.

12. **Dwarf Boston,** F. R. Pierson, from *elegantissima compacta.* A little taller and more free-growing than *Scottii,* lvs. straighter, the pinnæ nearly plane.

DD. *Pinnæ wavy or twisted.*

13. **Teddy Jr.,** Amer. Rose and Plant Co., from *Rooseveltii.* Free-growing, dark green, with wavy pinnæ as in *Harrisii* or *Rooseveltii.* The pinnæ are broader than those of *Scottii,* the color is darker, and the plants quicker-growing. Replacing *Scottii* to some extent.

14. **Wágneri,** Wagner, from *Scottii.* A dwarf sport of *Scottii* with the pinnæ very close and somewhat curved. Resembles *viridissima,* but more regular.

15. **viridíssima,** Pierson, from *superbissima.* Lvs. dark green, rigid, erect, with twisted, closely imbricated pinnæ. Inherits the irregularity of *superbissima* and represents a 1-pinnate reversion. Found to be too slow-growing and too stiff to be valuable for trade.

CC. *All or some of the pinnæ deeply lobed or pinnatifid.*

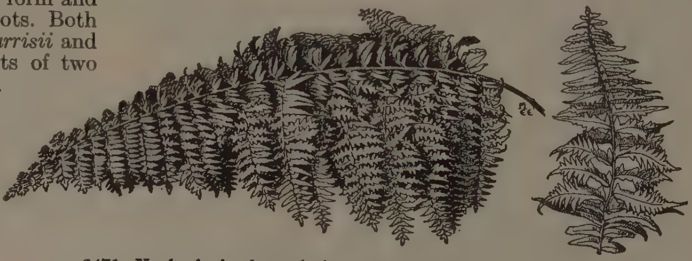
16. **Wanamaker Boston,** Craig, 1915, from *Scholzelii.* Lvs. rather narrow, erect and spreading, the pinnæ wavy, sometimes deeply lobed or pinnatifid in the outer halves, auriculate or with a single separate pinnule at the bases, often bent forward or backward. (This form represents the selection and prop. of the once-pinnate type of lf. often found on *Scholzelii.*)

AA. *Exaltata forms with lvs. 2-pinnate or 2-pinnate-pinnatifid.*

B. *Length of lvs. 2 ft. or more.*

17. **Pièrsonii,** F. R. Pierson, 1902, from *bostoniensis.* The first of the 2-pinnate forms and now discarded. Tall-growing, with the habit of *N. bostoniensis,* the lvs. unevenly divided, some 1-pinnate, some partly once- and partly twice-pinnate, and some entirely 2-pinnate. Important, because nearly all the later 2-pinnate types have come from it, but not itself desirable.

18. **Bàrrowsii,** Barrows, 1905, from *Piersonii.* Much like *Piersonii,* but somewhat differently divided. Another form of this type was called "Anna Foster." From this have come *Whitmanii* and *Magnifica.*



2471. Nephrolepis elegantissima compacta. (×⅛; pinna ×½)

BB. *Length of lvs. about 18 in.*

19. **elegantíssima,** F. R. Pierson, 1904, from *Piersonii.* Lvs. 18–20 in. long, 6–8 in. broad, the pinnæ 3–4 in. long, 1½–2 in. broad, almost completely divided into elongate, acuminate pinnulæ, these 1 in. long, ½in. broad, entire or deeply pinnatifid into linear segms. The most commonly grown of the 2–3-pinnate varieties. It succeeds because of a strong petiole and firm lf.-blade. The lvs. are often thick and dense, due to the broad overlapping pinnæ. A well-grown plant shows a very thick mass of lvs. *Elegantissima* "improved" is the stock grown at present and represents a selected type of *elegantissima* which shows less reversion than the original form. However, when not carefully grown, it will now show strong reversion to the once-pinnate Boston type.

20. **Whítmanii,** Barrows, from *Barrowsii.* In general, similar to *elegantissima* but the lvs. are more open, and the segms. smaller, less elongate than those of the Pierson form. *Whitmanii* "improved" is similar but shows less reversion. The differences in lvs. result in a less dense habit of growth. Reversion is uncommon under good conditions.

21. **todeoìdes,** Rochford (English). Like *elegantissima* but with even more elongate pinnulæ.

22. **robústa,** Craig, 1912, from *elegantissima.* Lvs. 2–2¼ ft. long, 10–12 in. wide, erect, firm, 1–2-pinnate, the pinnæ 4–6 in. long, 1½–2 in. broad when 2-pinnate, lobed at the base, narrower when not divided, the pinnulæ full, entire or crenulate. For the first year or so after its intro. this form showed little reversion but more recently it has begun to throw 1-pinnate lvs. It is a larger more open form than *elegantissima* and consequently more hardy. From *Piersonii* it differs in being broader-lvd. and more erect.

BBB. *Length of lvs. about 15 in. or less.*

23. **Schólzelii,** Scholzel, 1908, from *Scottii.* Lvs. 15 in. long, 4–5 in. broad, erect, simply 2-pinnate, the pinnæ somewhat recurved as in *Scottii,* often revolute, the pinnulæ large, ¼–½ in. long, entire or crenulate. Under the name *Scholzelii,* there is also sold a 3-pinnate form which arose in 1909 at Scholzel's place but which has never been given a separate name. Some of these 3-pinnate plants are erect, some have spreading lvs. Both belong in the next section with the 3-pinnate.

2472. Nephrolepis magnifica. (×⅓)

24. **M. P. Mills,** Harris, from *Scottii.* A twice-pinnate form with small distant segms., characterized by extreme hardiness and by very frequent reversion to the 1-pinnate type. The reverted plants do not appear to be ordinary *Scottii,* but have straight pinnæ and a more open growth. Both are slow.

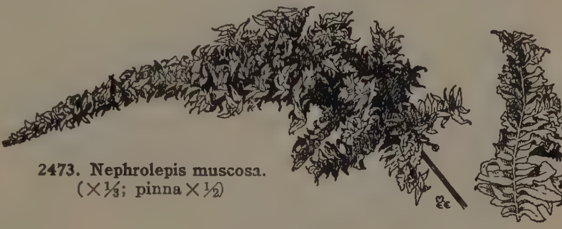
25. **elegantíssima compácta,** Fig. 2471, F. R. Pierson, 1909, from *Piersonii.* Lvs. about 12 in. long, erect, dense, numerous. In cutting like *elegantissima* except that it is often more divided and may be 3-pinnate.

26. **Whítmanii compácta,** Barrows, from *Whitmanii.* Lvs. 15–18 in. long, very full, nearly 3-pinnate. A beautiful form, the lvs. posssibly a little soft.

27. **Elmsfórdii.** Lvs. 12 in. long, 2–3-pinnate, with wiry petioles and a spreading habit. A pretty little form but not well known.

AAA. *Exaltata forms with lvs. regularly 3-pinnate or finer.*

28. **magnífica,** Fig. 2472, Barrows, from *Whitmanii.* Lvs. erect, 15 in. long, 4–5 in. broad, 3-pinnate with small ovate segms., ⅛–¼ in. long. A free grower of open habit, rather light green. More like the forms of the preceding section.


2473. Nephrolepis muscosa. (×⅛; pinna ×½)

29. **Smíthii,** J. C. Clark, from *Amerpohlii.* LACE-FERN. Lvs. 3-pinnate, 8–12 in. long, 6–8 in. broad, divided into very small, close segms. $\frac{1}{16}$in. long. The pinnæ are crowded so that the lvs. become very dense and are thus liable to injury by careless watering. There are a number of named varieties of the same general type but differing in growth characteristics. *Smithii* seems to be the most generally used. Others are as follows: **Amerpòhlii,** Amerpohl; **gracíllima,** *Barrowsii,* from *magnifica;* **Clárkii,** Smith, from *Smithii,* **Mílleri,** Miller; **Neùbertii** (German); **Róchfordii** (English); **Cràigii,** Craig, from *Smithii,* is 4-pinnate, with linear segms., but too soft to be of commercial value.

30. **superbíssima,** Pierson, 1908, from *elegantissima.* Lvs. mainly spreading, the pinnæ closely imbricated and irregularly twisted, firm, dark green, long-pointed, 10–15 in. long, 3–5 in. broad. A very interesting type, though not widely grown owing to its oddity and slowness. A single lf. may be very firm and dense. Throws buds with 1-pinnate lvs. frequently and these selected and grown constitute the var. *viridissima.*

31. **muscòsa,** Fig. 2473, Pierson, 1911, from *superbissima.* Practically dwarf *superbissima,* but makes more symmetrical plants and shows fewer reverting lvs. Lvs. 6–8 in. long, 4–5 in. broad, spreading, very firm and dense with the pinnæ and segms. closely imbricated. Like *superbissima* it is not widely grown. It is slow, and is also liable to injury from water, the lower pinnæ of the lvs. falling off.

32. **lycopodioìdes,** Rochford. Finely divided, irregularly twisted. Apparently like preceding but more finely cut. Probably not yet grown in the U. S.

Additional distinct types not commonly grown in Amer. and which are probably not derived from *exaltata* are:

33. **supérba,** May. Lvs. 20–25 in. long, 4–5 in. broad, the pinnæ deeply laciniately lobed, with the apices forked and crested, more or less recurved. A single lf. simulates well an ostrich plume.

34. **canaliculàta,** May. Has involute lvs. with the tips of the pinnæ laciniate and crested.

35. **Wíttboldii,** (F.R. 5:247) is described as having lvs. 3 times as broad as the typical *bostoniensis.*

Other forms which do not appear to be in the American trade to any extent are: *N. Bátchelori, crispàto-congésta* (E), *Dreỳeri, edmontoniénse* (E), *Faùlkneri* (E), *Fósteri* (E), *grándiceps* (E), *Héstonii* (E), *Márshallii, Márshallii compácta, Màyi* (E), *ornàta* (E), *phillipinénsis, recúrva* (E), *rugòsa* (E), *serrulàta, spléndens* E), *tripinnatífida, washingtoniénsis, Wéstonii* (E), *Wiedei, Wíllmotæ.*

R. C. BENEDICT.

NEPHTHỲTIS (name borrowed from Egyptian mythology; Nephthys, mother of Amibis, wife of Typhon). *Aràceæ.* Tropical African creepers, two of which are cultivated in hothouses for their variegated foliage.

Leaves more or less halberd-shaped or arrow-shaped, with scarcely any sheath on the petiole: infl. terminal; spathe concave-expanded; ovary 1-celled; ovule solitary, pendulous.—About half a dozen species.

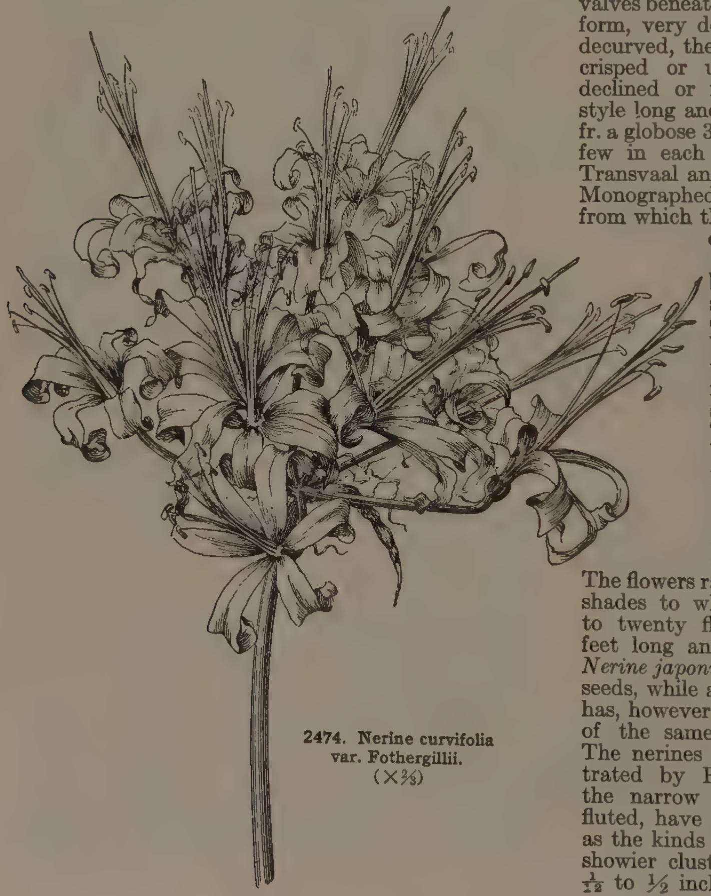
picturàta, N. E. Br. The white markings form a pattern resembling the tips of fern fronds laid between the nerves, with their points all directed toward the base of the midrib: plant stemless, spreading by runners: petioles 10–12 in. long; blade 6–12 in. long, 5–9 in. broad. Congo. Var. **angustàta,** N. E. Br., has smaller and narrower lvs. Figured in catalogues of U. S. Nurseries, 1895.

triphýlla, Hort. "A pretty stove creeper with dark green thrice-divided lvs. marked with greenish white in the exact shape of the lf."

Afzèlii, Schott (*N. libèrica,* N. E. Br.). Lvs. glabrous, the petiole 7–20 in. long, 1–2 in. thick, the blade sagittate, the portion in front of petiole-insertion up to 10 in. long, the basal lobes up to 6 in. long: spathe green, 2–2½ in. long. W. Trop. Afr. George V. Nash.†

NEPTÙNIA (*Neptune,* god of the sea: some of the species are aquatic). *Leguminòsæ.* Perennial herbs, or subshrubs, often floating, one of which is an aquarium plant.

Unarmed, prostrate or diffuse, the branches usually flattened or triquetrous: lvs. bipinnate, sometimes sensitive, the lfts. small: fls. not papilionaceous, perfect or polygamous, in spikes or heads on axillary peduncles; calyx 5-lobed; petals 5, distinct or somewhat cohering; stamens 10 or 5, exserted: pod oblong, oblique, 2-valved, somewhat septate between the ovate compressed seeds.—Species perhaps a dozen, widely spread in the tropics; a few of them are in the extreme southern U. S. and are plants of moist or even dry soil.



2474. Nerine curvifolia var. Fothergillii. (×⅔)

plèna, Benth. (*Mimòsa plèna,* Linn. *Desmánthus plènus,* Willd.). Natant, with prostrate sts., foliage sensitive and much like that of the common sensitive plant, *Mimosa pudica:* the fls. are so odd that one at first sight would not imagine that they belong to the legume family. They are small and collected in an ovoid head, 1½ x 1 in. and borne singly on stalks 6 in. long. These heads or spikes are drooping and have numerous stamens. The singular feature of these fls. is a mass of yellow petalage composed of 6 or more tiers of reflexed narrowly lanceolate bodies, which are really transformed and sterile stamens. The plant floats on pools and has grooved sts., the part under water being white, spongy and full of air-cells. Lvs. alternate and far apart; lfts. many, crowded, linear, obtuse. It is of difficult cult. and can probably not be secured in the trade at present. It grows in the E. Indies and S. Amer., and Mex. and elsewhere. B.M. 4695. B.R. 32:3. L. H. B.

NERÌNE (a nereid of Greek mythology). *Amaryllidàceæ.* Handsome autumn-flowering bulbs from South Africa.

Bulb tunicated, mostly without a neck: lvs. appearing after the fls. or with them, usually strap-shaped: fls. in shades of red and pink (varying to white), in few- or many-fld. umbels on a slender or robust scape; spathe-valves beneath the umbel 2, lanceolate; perianth funnelform, very deeply cut or divided, erect or somewhat decurved, the 6 segms. equal, narrow and more or less crisped or undulate; stamens 6, usually unequal, declined or nearly erect, bearing versatile anthers; style long and slender, straight or somewhat declined: fr. a globose 3-lobed and 3-valved caps., with seeds 1 or few in each cell.—Species 15–18, in Afr. from the Transvaal and Kalahari south to Cape of Good Hope. Monographed by Baker, Flora Capensis, vi (1896–7), from which the following descriptive account is mostly drawn.

Nerine is a remarkable genus of tender bulbous plants, of which the commonest species is *N. sarniensis,* long known as the Guernsey lily from the island where these bulbs are grown to perfection. The winter is their growing season instead of flowering time. They belong to the very small class of autumn-blooming bulbs. The common kinds flower from September to November without any foliage, and the leaves are developed all winter. About May the leaves die down and the bulbs rest from May to August. The leaves appear after the flowers in two or three species, but with the flowers in the others. The flowers range from scarlet through salmon and pink shades to white, and are borne in umbels of four to twenty flowers, on scapes varying from 1 to 3 feet long and averaging 1½ feet. A trade name is *Nerine japonica,* which is really a Lycoris; it has black seeds, while all the true nerines have green seeds. It has, however, the autumn-blooming habit and flowers of the same general appearance as the true nerines. The nerines have two distinct types of beauty, illustrated by Figs. 2474 and 2475. The kinds with the narrow perianth-segments, which are crisped or fluted, have a spidery look and are not so popular as the kinds with broad, flat segments, which make a showier cluster of flowers. The segments vary from $\frac{1}{12}$ to ½ inch in width. The showiest kinds are hybrids or varieties of *N. sarniensis* and *N. curvifolia*, the former species being the most prolific of varieties. In these two species the strong vertical lines of the erect long-protruded stamens make a striking feature. The flowers of the other species have more of a drooping tendency and the stamens are shorter and declinate, as in Fig. 2475. *N. pudica* is perhaps the choicest white-flowered kind. Nerines have bulbs 1 to 2 inches or less in diameter, and about six leaves, varying from 8 to 18 inches in length and 4 to 9 lines in width. Among the uncultivated kinds are some with short stout scapes and others with appendages at the base of the filaments. Nerine is closely related to Brunsvigia, being separated technically on the character of the capsule which is globose and obtusely angled in Nerine as distinguished from turbinate and acutely angled in the other. This distinction, however, seems not always to hold clearly. To the gardener, the differences are largely in relative size, Brunsvigia having larger bulbs, more numerous mostly larger flowers and commonly broader leaves.

The nerines are treated mostly as greenhouse plants. When well established in pots, they bloom year after year. In winter, the foliage is grown, and in spring water is gradually withheld until the bulbs are well ripened, when they remain dormant until August. John Robertson, in "Florists' Review" 1:675, gives advice as follows: the secret of success with nerines is to secure the fullest possible development of the bulbs. This refers to their winter treatment. They enjoy abundance of water at the root and overhead, with occasional applications of liquid manure. This treatment should never cease until the leaves turn yellow, which is a sign that the plants are finishing their growth. Then diminish the water-supply gradually, lay the pots on their sides where they are not likely to get wet, and in full sunlight, so that the bulbs may ripen thoroughly. The plants should not have their roots disturbed, nor do they require much root room: they grow and flower best when hard pot-bound. Three bulbs planted in good fibrous loam with a little sand may remain in a 5-inch pot for five or six years, or even longer, as the offsets can be rubbed off and separately potted while the parent bulbs go on increasing in size. Each year as the flower-scape appears pick off about an inch of the surface soil with a sharp-pointed stick, and give the ball of roots a good soaking and a slight top-dressing.

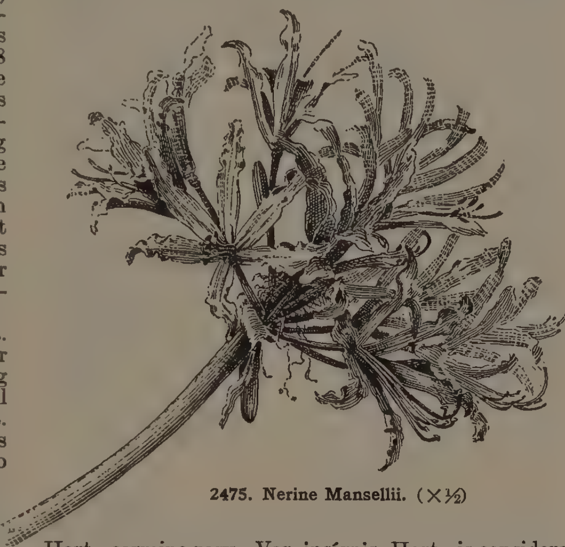
INDEX.

alba, 3, 4.
Bowdenii, 5.
carnosa, 1.
corusca, 1
curvifolia, 2.
Elwesii, 4.
flexuosa, 3.
Fothergillii, 2.
humilis, 7.
insignis, 1.
major, 1, 2, 6.
Mansellii, 3.
pallida, 5.
Plantii, 1.
pudica, 4.
pulchella, 3.
rosea, 1.
Sandersonii, 3.
sarniensis, 1.
splendens, 7.
undulata, 6.
Veitchii, 5.
venusta, 1.

A. *Stamens and style nearly erect.*

B. *Lvs. green, suberect.*

1. **sarniénsis,** Herb. GUERNSEY LILY. Bulb ovoid, to 2 in. diam., the coverings pale brown: lvs. about 6, bright green, developed after the fls., about 1 ft. long, linear, not curved laterally: scape or peduncle 12–18 in. high: fls. bright crimson, 10–12 in an umbel; perianth-segms. oblanceolate, ½in. or less broad, falcate, slightly crisped; filaments suberect, bright red, longer than the segms. Coast region, S. Afr. B.M. 294. R.H. 1912, p. 455; 1913, p. 456. It runs into many forms, as: Var. **Plántii,** Baker (*N. Plántii*, Hort.), has a longer scape, duller fls., and more distinctly clawed segms. Gn. 21:200. Var. **venústa,** Baker (*N. venústa*, Herb.), has bright scarlet fls. produced earlier than any of the other varieties. B.M. 1090 (as *Amaryllis venusta*). Var. **ròsea,** Baker (*N. ròsea*, Herb.), has lvs. darker green than the type: fls. rose-red: seeds oblong instead of globose. B.M. 2124 (as *N. rosea*). Var. **corúsca,** Baker (*N. corúsca*, Herb.), has bulb tunics not chaffy: lvs. broader than in the type, with distinct cross-bars between the main veins: fls. large, bright scarlet. B.M. 1089 (as *Amaryllis humilis*). Gn. 21:200. *N. corusca major* has rich crimson-red fls. Var. **carnòsa,** Hort., carmine rosy. Var. **insígnis,** Hort., is considered by Baker synonymous with the type of the species, but is probably horticulturally distinct. The fls. are said to be rosy.



2475. Nerine Mansellii. (×½)

BB. *Lvs. glaucous, sickle-shaped.*

2. **curvifòlia,** Herb. Bulb ovoid, to 2 in. diam., the coverings pale brown: lvs. 6, appearing after the fls., strap-shaped, curved laterally, thicker than in *N. sarniensis*, about 1 ft. long: scape or peduncle slender and glaucous, 12–18 in. long, the umbel 8–12-fld.: fls. bright scarlet; perianth-segms. hardly crisped, oblanceolate, ¼in. broad, falcate; stamens erect or nearly so, about as long as the perianth-limb. S. Afr. B.M. 725 (as *Amaryllis curvifolia*).—Cult. in the form of var. **Fóthergillii,** Baker (*N. Fóthergillii*, Roem.), which is more robust in all parts (Fig. 2474): fls. more numerous, between crimson and scarlet. R.B. 22:13. Gn. 22, p. 463. G. 3:503; 5:380. Var. **Fóthergillii màjor** (*N. Fóthergillii màjor*, Hort.) is a form with still larger fls. J.H. III. 55:277. F.R. 1:675.

AA. *Stamens and style declined.*

B. *Outer fls. of the umbel opening before the inner ones.*

C. *Segms. distinctly crisped or fluted.*

3. **flexuòsa,** Herb. Bulb subglobose, 1½ in. diam.: lvs. 4–6, appearing with the fls., linear-strap-shaped, arcuate, bright green, ¾in. or less broad, sometimes pustulate: scape flexuous, longer than in the other kinds, sometimes 2–3 ft. long: fls. generally pale pink, the segms. oblanceolate and crisped, ⅙in. broad; stamens declined, the 3 longer ones rather shorter than the segms. Kalahari and central region of S. Afr. B.R. 172. R.H. 1913, p. 456. Var. **pulchélla,** Baker (*N. pulchélla*, Herb.), has glaucous lvs., firmer than in the type: scape not flexuous: fls. pale pink, keeled rose-red. B.M. 2407 and Gn. 21:200. Var. **Sándersonii,** Baker, has peduncle and pedicels more robust and lvs. 1 in. broad: perianth-segms. less crisped, 1¼ in. long, and more distinctly united in cup at base. Var. **álba,** Hort., has white fls. G.C. III. 40:336. **N. Mánsellii,** O'Brien, Fig. 2475, is a fine hybrid between *N. flexuosa* and *N. Fothergillii*. Gn. 56:378. It has very broad fleshy lvs. and bright red slightly irregular fls. This is one of the most interesting kinds.

CC. *Segms. hardly or slightly crisped.*

4. **pùdica,** Hook. f. Bulb globose, about 1 in. diam.: lvs. 4–6, glaucous, 8–9 in. long, suberect, appearing with the fls.: umbels 4–6-fld., the other kinds being 8–20-fld.; fls. white, keeled pink above; segms. oblanceolate, thin, scarcely crisped; stamens declined, the 3 longest a little shorter than the perianth-segms. Original habitat in doubt. B.M. 5901. R.H. 1913, p. 456. F.S. 23:2464. Gn. 21:200. Var. **Élwesii,** Baker (*N. Élwesii*, Leichtl.), has much broader bright green more persistent distinctly veined lvs. with a prominent midrib: fls. more compact and pedicels stouter; segms. pale rose with a darker keel, thicker and more wavy. Var. **álba,** Hort., fls. snow-white.

5. **Bòwdenii,** W. Wats. Bulb variable in size, the largest bottle-shaped and 1½ in. diam. and 2 in. long, freely producing offsets: lvs. ½–1 ft. long and 1 in. or less broad, glossy green, slightly channeled, obtuse: scape nearly cylindrical, 12–18 in. long, bearing a loose 6–12-fld. umbel 9 in. across, the trigonous pedicels 2 in. long; fls. large, rose-pink with keels darker; segms. 2–3 in. long and ½in. wide, recurved and slightly wavy. Cape Colony. B.M. 8117. G.C. III. 36:365. Gn. 77, p. 570. F.S.R. 3:120.—As grown at Kew, the plants are practically leafless when in fl. Var. **pállida,** Hort. (*N. Veìtchii*, Hort.), is pale in color (blush-white): fls. 2¼ in. across, with recurved segms. Gn. 75, p. 484. G.M. 54:742. G.C. III. 58:132.

BB. *Outer fls. opening after the inner ones.*

6. **undulàta,** Herb. Bulb ovoid, to 1 in. diam., the coverings membranaceous and pale: lvs. 4–6, linear, appearing with the fls., bright green, 12–18 in. long and ½in. or less broad: peduncle slender, 12–18 in. long, bearing a centrifugal 8–12-fld. umbel: fls. pale pink, perianth, ¾in. or less long; segms. oblanceolate, very narrow and much crisped. Kalahari region and coast region, S. Afr. B.M. 369 (as *Amaryllis undulata*). Gn. 76, p. 136. Var. **májor,** Tratt. Perianth-limb larger, less crisped.

7. **hùmilis,** Herb. Bulb ovoid, to 1½ in. diam., the coverings membranaceous: lvs. about 6, appearing with the fls., linear, bright green, channeled on the face, about 1 ft. long and ½in. broad: scape or peduncle often smaller than in the other kinds, ½–1½ ft. high: fls. bright pink or rose-red, 10–20 in an umbel, the perianth ¼in. or less long; segms. oblanceolate, acute, crisped; stamens declined, the 3 longer about as long as segms. Coast region, S. Afr. B.M. 726 (as *Amaryllis humilis*). Gn. 21:200. Var. **spléndens,** Hort., is presumably the best form of this species. Fls. purple-crimson.

The following names are mostly important hybrids which in many cases are more popular than the species: *N. amábilis* (N. pudica × N. humilis), rosy, dark-striped. Var. *grandiflòra*, Hort. Van Tubergen, has larger fls.—*N. cándida*, Hort. Pure white, the fls. 15–20, each about 2 in. diam., the segms. undulate: hardly distinguishable from N. flexuosa var. alba. Offered abroad.—*N. críspa*, Hort. Thorburn, scarlet.—*N. élegans* (N. flexuosa × N. sarniensis var. rosea), pink. Var. *carminàta*, cerise. Var. *cærùlea*, shaded blue.—*N. excéllens*, Moore (N. flexuosa × N. humilis var. major), carmine rosy, dark-striped.—*N. excéllens màjor tardiflòra*, Hort.=N. Bowdenii.—*N. Gaìminii*, Hort., is an erect-flowering form of the sarniensis group, with large bright pink fls. "keeled throughout with red:" fls. about 10 in an umbel, each 2 in. across.—*N. Hàylockii* (N. curvifolia × N. flexuosa var. pulchella). One of the oldest hybrids in cult. Raised by Wm. Herbert. The others in this list are more modern.—*N. japónica*, Miq.=Lycoris radiata.—*N. Méadowbankii* (N. sarniensis × N. curvifolia var. Fothergillii).—*N. O'Brìenii* (N. pudica × N. sarniensis var. Plantii). Var. *cærùlea*, Van Tubergen, pale violet, tinged blue.—*N. tardiflòra*, Hort. Van Tubergen, not accounted for by Baker. Fls. bright red in Dec.—*N. Zoroáster*, Hort., is a garden hybrid between N. pudica and N. sarniensis var. corusca.

WILHELM MILLER.
L. H. B.†

NÈRIUM (ancient name for oleander, supposed to be from Greek *neros*, "moist," alluding to the places in which it grows wild). *Apocynàceæ*. The oleander is an old-fashioned evergreen shrub known to everybody, and cultivated everywhere in southern countries. In the North the oleander is a common house plant, being grown in tubs for summer decoration, and ranking in popularity with sweet bay and hydrangea.

Oleanders are erect glabrous shrubs: lvs. in whorls of 3, rarely 4 or 2, narrow, leathery, transversely feather-veined: fls. showy, rose-red, white or yellowish, in terminal cymes; calyx with many glands inside at the base; corolla-tube cylindrical at the base; throat bell-shaped and containing 5 wide or narrow teeth; lobes twisted to the right; anthers 2-tailed at the base and tapering at the apex into a long thread-like appendage; style 1; ovaries 2, forming pods; seeds twisted.—Species probably 3, with varieties. Medit. region to Japan.

The common species, so very widely cultivated, is *N. Oleander*. It attains 7 to 15 feet, and blooms in summer, the flowers being salver-shaped, five-lobed when single, 1½ to 3 inches across, and commonly pink or white, though the colors range from white through creamy white, blush, rose and copper-color, to crimson and dark purple, with variegated forms. It is of easy culture, and is well adapted to city conditions. The chief troubles are scale and mealy-bug. The scale should be sponged off; the mealy-bug is easily dislodged by the hose. Sometimes a plant forms buds which open poorly or not at all. This is often due to the imperfect ripening of the wood. The flowers are borne on the growth of the year, which should be well ripened in June in order to set many strong buds. For this purpose give the plants plenty of light and air, and water more sparingly when the vegetative growth seems to be finished. After flowering, give the plants less water. Protect them from frost in winter; keep them, if necessary, in a light shed. In April, prune back the old wood which has borne flowers and give more warmth and water. The ripened leading shoots can be rooted in a bottle of water. Oleanders are poisonous, and some persons have died from carelessly eating the flowers. Cattle have been killed by eating the foliage. It is said that in California the oleander is immune from the depredations of the gopher.—*Oleanders in the East* (H. A. Siebrecht): The following method of oleander culture has been pursued by the writer with success. Propagation is performed after the flowering period. Good-sized cuttings are taken, and every one grows. When rooted, the cuttings are potted in small pots and kept barely alive over the winter. They will need scarcely more attention than geraniums until February or March, or whenever growth becomes more active. Later in the spring, the young oleanders are planted outdoors in the open ground, in good rich loam or garden soil. (This is sometimes done with ivies or evonymus, but the common method is to plunge the pots outdoors during summer.) Take up the oleanders in September, pot them and bring them indoors for their second winter. The following spring the plants will bloom; but they will not be shapely. The time has now arrived to train them, either as bush plants or crown standards. Top them at whatever height is desired, say 2 or 3 feet, and the plants will make good crowns the same season (i.e., their second summer). Do not allow the plant to bloom the following spring (which is its third spring), and the result will be a fine specimen in full flower for the fourth summer.—*Oleanders in California* (Ernest Braunton): Oleanders are much grown in southern California, and would be extremely popular were it not for black and other scales, which seem to prefer them to everything else. We have five colors here, perhaps all of the same species—white, light pink, dark pink, scarlet and buff. Most of these colors, if not all, can be had in both single and double forms. The writer has never seen an oleander more than 20 feet high, but he thinks they will grow larger. One Los Angeles man planted the red variety twenty-seven years ago for sidewalk trees. (For this purpose, if cleaned of scale when necessary, the oleander is one of the very best.) The trees are heavily pruned and topped every third year. They are now 12 feet high and 6 to 8 inches in diameter at base. Oleanders need no attention here, and are as readily propagated from hardwood cuttings as willow. They are very floriferous, and the inflorescence comes out in large heavy heads, necessitating a close pruning to make them self-supporting.

A. *Fls. not scented.*

Oleánder, Linn. (*N. laurifórme,* Lam.). OLEANDER. ROSE BAY. (Another plant called "Rose Bay" is *Epilobium angustifolium.*) Fig. 2476. Lvs. in 2's or 3's, lanceolate: appendages of the anthers scarcely protruding; segms. of the crown 3–4-toothed. Medit. region, Orient. Gn. 51, p. 81 (fine trees in vases). A.F. 10:265 (Bermuda shrub with a spread of 25 ft.). L.B.C. 7:666 (var. *Loddigesii,* with a variegated fl. and the appendages entire, ovate and obtuse). *N. álbum, N. atropurpùreum, N. cárneum* and *N. ròseum,* Hort., are doubtless varieties. The plant is common in subtropical and tropical countries, sometimes planted in hedges, and sometimes runs wild.

2476. Spray of oleander—Nerium Oleander. (×⅙)

AA. *Fls. scented.*

odòrum, Soland. SWEET-SCENTED OLEANDER. Stout erect shrub: lvs. in 3's, linear-lanceolate: fls. rosy pink, 2 in. across, in clusters of as many as 80, fragrant; appendages of the anthers protruding; segms. of the crown 4–7, long and narrow. Persia, India, Japan. B.R. 74 (fls. double). B.M. 1799 and 2032. G.C. III. 50: suppl. July 8, 1911.—A less robust plant with lvs. commonly narrower and more distant, and angled branches. In wild plants the calyx-lobes of *N. Oleander* are spreading; of *N. odorum* erect. It has the same range of color as the above, and single and double forms. Prop. by layers or cuttings.

WILHELM MILLER.

NERTÈRA (Greek, *lowly;* referring to the habit) *Rubiàceæ.* Creeping herbs, of which one is grown for its handsome profuse berries.

Nerteras are slender perennials, with small opposite lvs. which are stalked or not, ovate or ovate-lanceolate, glabrous or somewhat pilose; stipules present: fls. axillary or terminal, hermaphrodite, inconspicuous, sessile; corolla 4- or 5-lobed; stamens 4 or 5, inserted in base of tube of the tubular or funnel-shaped corolla, the anthers exserted; ovary 2-celled: drupe 2-seeded (two 1-seeded pyrenes), fleshy.—Species about 8, widespread in the southern hemisphere.

depréssa, Banks & Soland. BEAD-PLANT. Glabrous: variable in size, sometimes forming patches: sts. 6–10 in. long, 4-cornered: lvs. 2 lines long, broadly ovate, acute or obtuse, leathery or almost fleshy; petioles about as long as the blades; stipules very small: fls. solitary, greenish. B.M. 5799. F.S. 21:2167 (charming). F.W. 1875:257.—The bead- or coral-bead-plant is a hardy perennial alpine or rock-plant which forms a dense mat of foliage covered with orange-colored translucent berries the size of a pea. It ranges throughout the Andes, from the tropics to Cape Horn. It also inhabits Tristan d'Acunha, and the mountains of New Zeal. and Tasmania. It is prop. by seed or division. The plant needs a sandy soil, with some leaf-mold, and prefers shade in summer and may need some winter covering in the N. It makes a good house plant and well-fruited specimens are occasionally used abroad in fancy bedding as a novelty. The fr. may last from midsummer well into the winter. In S. Calif., *N. depréssa* grows well in the open if it is kept moist and does not receive the direct rays of the sun.

WILHELM MILLER.
L. H. B.†

NERVÍLIA (name refers to the nerved lvs.). *Orchidàceæ.* By some authors made a section of Pogonia with fl.-scape bearing only scales and not lvs., the foliage coming later and separately, stigma broad and lip elongated: the small grayish or reddish fls. are sometimes solitary or twin but usually in a short raceme, nodding: lvs. radical, usually broad, sometimes colored or marked. The species are about 20, from Trop. Afr. to China. They are very little known in cult.

NESÆA: *Decodon.*

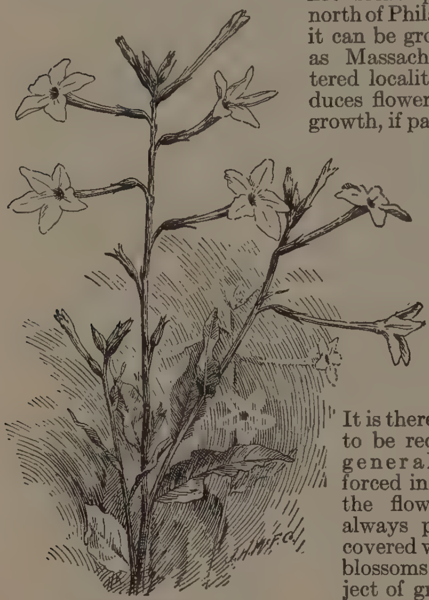
NETTLE: *Urtica.* **Dead N.:** *Lamium.* **False N.:** *Boehmeria.* **Tree N.:** *Celtis.*

NEUWIÈDIA (named for Prince Maximilian von Newied). *Orchidàceæ.* A half-dozen Malayan terrestrial orchids with short caudex and leafy sts.: lvs. lengthened, stalked, strong-nerved: fls. small, mostly white or yellow, sessile or nearly so, in a bracteate terminal raceme or spike; sepals and petals free and mostly similar, connivent or spreading; lip somewhat spatulate, similar to petals; column short. Little cult.; require conditions of warmhouse paphiopedilum. *N. Lindleyi,* Rolfe, has primrose-yellow decurved fls. 1 in. long: 3–4 ft.: lvs. many, 1–2 ft. long, oblanceolate, membranaceous. B.M. 7368. *N. Griffithii,* Reichb. f., has white deflexed pubescent fls. in a short spike; 16 in.: lvs. 4–10 in. long, elliptic-lanceolate, acuminate. B.M. 7425.

NEVIÙSIA (after Rev. R. D. Nevius, who discovered it). *Rosàceæ.* SNOW WREATH. Ornamental shrub sometimes planted for its white flowers.

Deciduous: lvs. alternate, petioled, doubly serrate, stipulate: fls. perfect, in clusters or solitary; calyx-tube flattish; sepals 5, petal-like, spreading, incisely serrate; petals 0; stamens numerous, longer than the sepals, persistent; carpels 2–4, styles slender, curved at the apex, slightly shorter than the stamens: fr. consisting of drupe-like achenes inclosed by the persistent calyx. —One species, found only in Ala. near Tuscaloosa and on Sand Mt. A very distinct genus allied to Kerria and Rubus, well distinguished by its apetalous fls.

The snow wreath is a low or medium-sized shrub with slender wand-like branches, bright green generally ovate leaves and white feathery flowers in clusters arranged wreath-like along the branches. It does not seem perfectly hardy north of Philadelphia though it can be grown as far north as Massachusetts in sheltered localities; and it produces flowers on the young growth, if partly killed back. Even South it does not develop in every situation its full beauty which earned it the name "snow wreath" its flowers are likely to be greenish or dirty white instead of snowy. It is therefore not a plant to be recommended for general planting. If forced in the greenhouse the flowers come out always pure white, and covered with its feathery blossoms it is an object of great beauty. It likes a loamy and well-drained soil and a warm sheltered position.



2477. Nicotiana alata var. grandiflora.

Propagation is by greenwood cuttings under glass, and by seeds.

alabaménsis, Gray. Shrub, 3-6 ft.: branches terete: lvs. ovate to oblong-ovate, acute or acuminate, doubly serrate, minutely pubescent while young, finally nearly glabrous, 1–3 in. long: fls. in clusters of 3–8, rarely solitary, about 1 in. across. June, July. B.M. 6806. G.C. III. 35:229; 41:41. G.M. 53:315. G. 26:135.

Alfred Rehder.

NICÁNDRA (Nicander, poet of Colophon, wrote on plants about 100 B.C.). Syn. *Physalòdes*. *Solanàceæ*. One Peruvian herb differing from Physalis chiefly in the 3–5-loculed ovary and dry rather than fleshy fr., and in the larger and more showy fls., of which the corolla is nearly entire. Lately a second species has been described, perhaps a variant.

Physalòdes, Pers. (*Átropa physalòdes*, Linn. *Physalòdes peruviànum*, Kuntze. *N. physaloìdes*, Gaertn.). Known as Apple-of-Peru, a strong spreading annual, 3–4 ft. high, grown for the showy blue fls. and odd frs.: glabrous: lvs. elliptic or elliptic-ovate, sinuate and toothed, narrowed into a prominent petiole: fls. solitary in the axils, on recurving pedicels, an inch or more across, shaped like a potato flower, the corolla blue or bluish: fr. a thin-walled and nearly or quite dry berry, inclosed in an enlarged, strongly 5-winged calyx. B.M. 2458.—The apple-of-Peru is an old-fashioned garden annual, now rarely seen. It has escaped from cult. in some places in the U. S., and it is now widely distributed in the tropics. It is often confounded with the ground cherry and alkekengi, which are species of Physalis.

N. violàcea, André. Vigorous branched annual, glabrous or sometimes the lvs. hairy on upper side: lvs. subtriangular, the cauline reaching 10 in. long and 5 in. broad, coarsely toothed or lobed: fls. solitary, axillary and short-pedicelled; calyx large, dark violet on lower half, the lobes cordate; corolla violet-blue above and white on lower half, campanulate, to 1½ in. broad. Probably S. Amer. R.H. 1906:208.—Distinguished from *N. Physalodes* particularly by the prominently blue corolla and calyx and similar color on the sts., petioles and peduncles, and the scattered colored hairs on upper surface of lvs.

L. H. B.

NICOTIÀNA (named for Jean Nicot, 1530–1600, of Nismes in Languedoc, consul from the King of France to Lisbon, Portugal, in 1560, who obtained tobacco from a merchant of Flanders, Belgium, which he presented to the court of Portugal and also, on his return to France, to the Queen Catherine de Medici). *Solanàceæ* Herbaceous annuals, perennials or rarely shrubby or arborescent, comprising several stately plants, valued for their rapid growth and large foliage; other species produce showy flowers, and are popular flower-garden subjects; one is the tobacco.

Herbs, mostly viscid-pubescent, of strong odor, possessing narcotic poisonous properties: lvs. alternate, never compound, entire or undulate, mostly sessile or nearly so by a tapering base: fls. hermaphrodite, often regular, long-tubular, mostly opening at night and most fragrant then, in terminal racemes, panicles or thyrses; calyx usually persistent, inclosing the fr., tubular-campanulate or ovoid, 5-parted; corolla salverform, funnelform, or tubular-swollen; limb plicate in the bud, 5-lobed; stamens 5, inserted on the tube, unequal or nearly equal, included; filaments straight, anthers longitudinally dehiscent, ovate or oblong; ovary 2-celled, or 4-celled in one species; ovules many; placenta axillary; style simple; stigma capitate: fr. a 2–4-celled caps., but usually splitting into 4 to several valves; seeds numerous, minute, oblong, somewhat kidney-form, roughened or pitted.—A genus of about 45 species and 54 subspecies, mostly of Trop. Amer., with a few from N. and S. Amer. and 1 from Austral.

Latest publications: Comes, "Monographie du genre Nicotiana," 1899; Splendore, "Sinossi descrittiva ed iconographia dei semi del genrere Nicotiana," 1906; Setchell, "Studies in Nicotiana," 1912; "Tobacco-culture," United States Department of Agriculture, Farmers' Bulletin No. 571, 1914.

Nicotianas are easily cultivated, but in northern latitudes require a hot exposure and a deep rich loose loamy soil, rich in lime and potash, both of which may be supplied from wood-ashes. As the seeds grow slowly in cool weather, they should be started in early spring under glass and kept moist and warm. For tobacco, in districts farther north, hotbeds will secure rapid growth, but in other localities coldframes with a southern exposure should be used. The soil should be a loose loam of high fertility, and thoroughly drained. In the fall, forty pounds of lime and two hundred pounds of stable-manure to 100 square feet of bed should be turned under. In the spring, about two weeks before sowing the seed, twenty pounds of cottonseed-meal or castor pomace, one pound of acid phosphate, and one-half pound of carbonate or sulfate of potash to 100 square feet of bed-area should be

2478. Nicotiana alata var. grandiflora, commonly known as N. affinis. (×⅕) thoroughly spaded into the soil to a depth of 4 or 5 inches, and the bed-surface finely pulverized. If possible, the soil should then be sterilized with steam to prevent fungous diseases and the growth of weed seeds. The seed should be sown at the rate of an even teaspoonful of dry seed to 100 square feet of bed. In order to secure an even distribution of the seed, it is thoroughly mixed into two quarts of land-plaster, finely sifted wood-ashes or bone-meal. Three sowings should be made to insure an even distribution over the bed, the light color of the filler material serving to indicate the evenness of the distribution. The seed must be covered by going over the bed with a roller, or packing with a plank. When young, nicotianas will stand considerable frost, but become more sensitive with age. They are well adapted to pot or tub culture and are fine for summer porch-decoration. *N. alata*, best known in the trade as *N. affinis*, and *N. Sanderæ* are the most popular flower-garden plants. Of the larger species for subtropical bedding, *N. glauca*, *N. tomentosa*, and *N. Tabacum* are best.

INDEX.

acuminata, 5.
affinis, 2.
alata, 2.
albiflora, 7.
angustifolia, 18.
arborea, 10, 11.
atropurpurea, 18.
chinensis, 18.
colossea, 11.
decurrens, 2.
diversifolia, 5.
Forgetiana, 6.
fragrans, 8.
glauca, 10.
glutinosa, 16.
grandiflora, 2, 18.
isodendra, 12.
Langsdorffii, 13.
longiflora, 1, 7.
macrantha, 8.
macrophylla, 18.
multivalvis, 9.
noctiflora, 7.
paniculata, 17.
persica, 2.
quadrivalvis, 9.
rubra, 18.
rustica, 15.
Sanderæ, 4.
semperflorens, 12.
suaveolens, 8.
sylvestris, 3.
Tabacum, 18.
tomentosa, 11.
undulata, 8.
variegata, 11.
wigandioides, 14.

A. *Fls. racemose, paniculate, or axillary, extra-axillary, and solitary; corolla salverform, white or colored, tube long, cylindric; limb-segms. obtuse or acute:* (*Nos. 1–9. Subgenus Petunioides.*)

B. *Ovary 2-celled.*

C. *Lobes of corolla acute.*

D. *Color of corolla greenish to purplish or lobes only white.*

E. *Corolla 6–7 times longer than the calyx.*

1. **longiflòra**, Cav. Erect annual or perennial, 2–3 ft. tall: st. slender, bristly-scabrous: lvs. somewhat clasping, spatulate to lanceolate, prominently undulate, obtuse or acute: fls. 4 in. long, extra-axillary in terminal loose racemes; calyx striate, tubular-campanulate, 5 unequal, erect, linear-lanceolate teeth; corolla villous, salverform, night-opening, fragrant, nearly 7 times longer than the calyx; tube slender, swollen above, green or pale violet; lobes ½in. long, yellowish violet without, white within, nearly equal, ovate-lanceolate, obtuse, often emarginate; filaments adnate, near the throat unequal, 1 shorter; anthers yellowish violet; style shorter than the stamens: caps. nearly equaling the calyx. Texas to Chile and Argentina.—Rare in cult., and inferior to *N. alata*. Becomes annual in northern gardens.

EE. *Corolla 4–5 times longer than the calyx.*

2. **alàta**, Link & Otto (*N. decúrrens*, Agardh). Herbaceous, perennial: st. erect, slender, 2–3½ ft. tall, branching: lvs. sessile, decurrent, oblong-spatulate to ovate-elliptic; apex obtuse, or acute to nearly acuminate; margin entire or distantly repand-dentate: fls. spreading in an open raceme; calyx hirsute, tubular, with 5 unequal subulate teeth; corolla villous, night-opening, fragrant; tube slender, yellowish green, 4–5 times longer than the calyx, swollen above; limb oblique, nearly 2 in. across, pale violet beneath, white within; lobes ovate, acute, often emarginate; stamens unequal, not exserted; style exserted: caps. oblong, shorter than the calyx. Brazil, Uruguay, and Paraguay. Gt. 1010. It is doubtful whether the species *N. alata* is in cult., the garden forms being the varieties. Var. **pérsica**, Comes (*N. pérsica*, Lindl.). Lower lvs. subpetiolate, oblong-spatulate, base often subcordate, repand above, all somewhat clasping and auricled or decurrent: corolla-tube shorter, limb greenish yellow without, lobes slightly unequal, emarginate. Brazil. B.R. 1592.—Intro. into the U. S. as early as 1906. Not much cult. Var. **grandiflòra**, Comes (*N. affinis*, T. Moore, under which name it is universally known in gardens). Figs. 2477, 2478. Fls. very large, and very sweet-scented; tube much dilated, limb yellowish without. G.Z. 1882: 253–5. G.C. II. 16:141. Gn. 34, p. 520; 42, p. 126; 50, p. 212; 56, p. 384. Gng. 5:182. G. 27:323.—Known only in cult. An extremely popular plant, blooming freely throughout the season until killed by frost. On account of its slender habit, it should be planted in a place protected from strong winds. It is apparently perennial, but is treated as a half-hardy annual. It self-sows, and often maintains itself from year to year in the Middle States and the S. In the warmer parts of the S., the roots live over winter with a little protection. Fall-sown seedlings make excellent pot-plants in the winter, the fls. opening in the early evening and closing in the morning, and are very fragrant.

2479. A good border effect with Nicotiana.—N. sylvestris.

DD. *Color of corolla entirely white.*

3. **sylvéstris**, Spegaz. & Comes. Figs. 2479, 2480. Herbaceous, perennial, glandular-pilose throughout: st. tall, leafy below, branching above: lvs. sessile, broad, oblong-spatulate; the lower dilated at the base, half-clasping and auricled, slightly decurrent, the apex, rotund or obtuse; the upper acute, margin reflexed: fls. drooping, in short racemose panicles; pedicels nearly equaling the calyx; calyx 5-angled, somewhat swollen, short and unequally toothed, teeth ovàte-acute; corolla white, fragrant, salverform, pilose; tube 6–7 times longer than the calyx, above somewhat inflated; limb white within; lobes nearly equal, ovate-triangular, often emarginate, becoming reflexed. Argentina. G.C. III. 26:357. G.W. 7:230; 12:318. A.F. 24:600. G.M. 52:48. Gn. 59, p. 186. Gn. W. 15:442.—The lvs. are rugose, veiny, and more attractive than in *A. alata* but the limb of the fl. is less oblique, the tubes more swollen

and does not close in the morning on cloudy days. One of the novelties in 1899 and 1900.

DDD. *Color of corolla rose.*

4. **Sánderæ,** Hort. Sander (*N. alàta* × *N. Forgetiàna*). Herbaceous, annual, viscid-pubescent: sts. 2–3 ft. tall, of bushy habit: basal lvs. large spatulate, undulate; st.-lvs. oblong-lanceolate, short-petioled, acuminate, undulate: fls. bracteolate, in large loose panicles; corolla salverform; tube cylindric, 3 times the length of the calyx, swollen above, greenish yellow tinted with rose; limb oblique; lobes elliptic, acute, often emarginate, carmine-rose. Originated in 1903 by Sander & Sons, St. Albans, England, as a cross between *N. alata* and *N. Forgetiana*. A.G. 25:483. F.S.R. 2:216. F.E. 20:434. G. 26:141; 27:321. G.C. III. 34:256; 39:61. G.M. 47:578; 48:465. Gn. 67:16. G.W. 8:559. R.B. 31:25. R.H. 1905:16.—An attractive and popular garden plant intro. into U. S. in 1904.

CC. *Lobes of corolla obtuse or rounded.*

D. *Lvs. petioled.*

5. **acuminàta,** Hook. (*Petùnia acuminàta*, Graham. *P. viscòsa*, Miers. *N. diversifòlia*, Nees?) Herbaceous, annual, viscid-pubescent: st. slender, branching: lvs. ovate-lanceolate, undulate, sometimes subcordate, narrowed into a short petiole, apex long-acuminate: fls. loose-racemose; calyx glandular-pubescent, membranaceous-scarious, 5 nerves ending in narrow, linear, unequal teeth; corolla white, about 3 in. long; tube green-veined, slightly curved, swollen above, nearly 5 times as long as the calyx; limb 5-parted; lobes small, obtuse, emarginate expanded, green-veined without: caps. nearly equaling the calyx. Chile. B.M. 2919.—Not common in cult., under which it appears to be annual, but in its native habitat it is perennial.

DD. *Lvs. sessile.*

E. *Fls. rose-colored.*

6. **Forgetiàna,** Hort. Sander. Herbaceous, annual: st. 2–3 ft. high, branching from the base: lvs. papery, soft, pubescent; basal lvs. oblong-lanceolate, largest about a foot long, obtuse, tapering to a winged petiole, slightly undulate; st.-lvs. similar, but smaller, ovate, with decurrent blades: fls. in broad loosely branched panicles; branches slender, glandular-pubescent; lower bracts leafy, narrow, acute, becoming smaller upward; pedicels slender, shorter than the fls.; calyx small, 5-toothed, covered with stiff hairs; teeth unequal, very slender, rigid; corolla narrow, funnelform, 1–1¼ in. long, 1 in. diam.; sparsely hairy; lobes of the limb nearly equal, triangular, obtuse; stamens included; filaments hairy at base, jointed above their attachment to the corolla; ovary glabrous. Brazil. B.M. 8006.—Intro. into cult. about 1901 but not much in the trade, being used mostly in hybridizing.

EE. *Fls. greenish.*

F. *St. pubescent throughout.*

7. **noctiflòra,** Hook. (*N. longiflòra noctiflòra*, Voss). Herbaceous, perennial, glandular-viscid, hairs appressed: st. 2–3 ft. tall, slender, branching: lvs. petiolate, oblong-lanceolate, sinuate or undulate-plicate, the lower oblong-obtuse, the upper nearly sessile, linear-lanceolate, acute: fls. pedicellate, horizontal, in terminal panicles; calyx tubular, with 5 unequal, narrow, lanceolate, acute teeth; corolla salverform, night-opening, fragrant, greenish purple without, white within, 3–4 times longer than the calyx; tube cylindric; lobes equal obcordate, emarginate, oblong; nectar-ring orange, thickened: caps. longer than the calyx. Argentina and Chile. B.M. 2785. Var. **albiflòra,** Comes, has the fls. nearly glabrous, glaucous, and greenish white or sometimes pure white without instead of purplish, or sometimes with a purplish vein in each corolla-lobe. Argentina.—Very decorative. Intro. into U. S. from Italy in 1908.

FF. *St. glabrous above.*

8. **suavèolens,** Lehm. Herbaceous, annual or biennial, usually viscid: st. 1–2 ft. tall, densely villous at base, glabrous above: lvs. at base subpetiolate, spatulate, obtuse, above ovate-lanceolate, acute, undulate, petiole decurrent, the uppermost nearly sessile or clasping, acuminate, villous: fls. pedicellate, nodding, distant, bracteolate, in terminal racemes; calyx 5-toothed, striate, tubular, pubescent; teeth linear-lanceolate, narrow, acuminate, unequal; corolla greenish purple, night-opening, fragrant, pubescent, salverform; tube slender, cylindric, striate, 4 times longer than the calyx; limb purplish without, white within; somewhat 2-lipped, the upper lobes very small, all subrotund, obtuse or emarginate: caps. ovate, obtuse, nearly equaling the calyx. Austral.—It is said to grow in moderate shade. Var. **undulàta,** Comes (*N. undulàta*, Vent., not Ruiz & Pav.). The plant is taller: lvs. large, undulate: fls. larger. B.M. 673. Var. **macrántha,** Comes (*N. fràgrans*, Bern.). The st. is glabrous: lvs. oblique, subcordate-ovate, sinuate-repand, acute: corolla large, white, mouth expanded; lobes obtuse. B.M. 4865.

2480. Nicotiana sylvestris. (×¼)

BB. *Ovary 4- to many-celled.*

9. **quadriválvis,** Pursh. Herbaceous, annual, viscid-pubescent: st. erect, or branching: lvs. 4–6 in. long, petiolate, oblong, the upper nearly sessile, entire, lanceolate, acute; margin often somewhat revolute: fls. few on short slender pedicels; calyx-teeth linear, corolla tubular, swollen below, tube about 1 in. long; limb 1½ in. diam.; lobes ovate, obtuse, dark purplish without, white within: caps. 4-celled, subglobose, nearly equaling the calyx.—Formerly cult. by the Indians and still grown by them to a slight extent; probably does not occur outside Indian cult. and gardens; possibly only a cult. mutant of *N. Bigelovii*, as it appeared in Setchell's pedigree cultures of that species. Fresh lvs. said to smell like a goat, but the odor disappears on drying. **N. multiválvis,** Lindl., known only from Indian cult. in Ore. and Wyo., differs in the many-celled indehiscent caps., and many-lobed corolla-limb.

AA. *Fls. racemose or paniculate; corolla salverform; tube relatively broad or swollen, usually yellow or mixed with white or red; limb-segms. obtuse or acute. (Nos. 10–17. Subgenus Rustica.)*

B. *Plants glabrous and glaucous.*

10. **glaùca,** Graham (*N. arbòrea,* Dietr.). Erect, tree-like, up to 20 ft. tall, glaucous-blue all over: st. branching: lvs. long-petioled, unequally subcordate-ovate, acute, somewhat repand: fls. pedicelled, pedicels incurved in fr., in loose, terminal, bracted panicles; calyx tubular, 5-toothed, teeth acute, unequal, somewhat ciliate; corolla yellow, tube scarcely incurved, somewhat swollen above; mouth contracted, softly woolly; limb small, lobes ovate, very short, acute: caps. inclosed in the calyx. Argentina, Paraguay, Bolivia. B.M. 2837. G. 26:571.—Frequently cult. for its stately habit and striking glaucous-blue foliage which sometimes develops purplish tints. It has escaped from cult. and runs wild in Texas and Calif. Usually does not bloom in the northern states. Easily grown from seed.

BB. *Plants pubescent.*

C. *Lvs. sessile.*

D. *Corolla not over 3 times longer than the calyx; stamens much exserted.*

E. *The corolla without a bright red margin.*

11. **tomentòsa,** Ruiz & Pav. (*N. colossèa,* André). Herbaceous or woody, perennial, viscid-pubescent: st. reaching 10 to 20 ft., diffusely branched from the base upward: branches leafy, terete, ascending: lvs. 10–18 in. long by 4–6 in. wide, obovate-oblong, acuminate, narrowing into a very broad undulate, winged petiole with a clasping base, pale green above, paler beneath, with conspicuous midrib and veins: panicle terminal, nearly a foot long and broad, branches ascending, loose-fld., tubercled at the articulations of the pedicels; bracts narrow, caducous; pedicels ½–⅔in. long; fls. inclined, 1½ in. long; calyx broadly terete, ½in. long, smooth, green, base rounded; lobes unequal narrow, obtuse, shorter than the tube; corolla slightly incurved, pale green and pubescent without; tube somewhat exceeding the calyx-lobes; lobes ovate, obtuse, spreading, yellowish tinged with red within; stamens suberect, twice as long as the corolla-lobes; ovary conical, glabrous; style longer than the stamens, reddish; stigma 2-lobed. Brazil. B.M. 7252. G.C. III. 9:83. Gng. 1:97.—A remarkably valuable plant for large and rapid growth. Very useful in making subtropical effects. Re-described by André from plants that came up in soil received with Brazilian orchids which were sent to France. It began to attract attention in France about 1899. It usually has reddish sts. which add to the bold effect. Seeds should be started under glass. Var. **variegàta,** Hort., has mottled and margined foliage. R.H. 1893, p. 9. G.M. 37:61.

EE. *The corolla with a bright red margin.*

12. **isodéndra,** Ricker (*N. arbòrea semperflòrens,* Ament. *N. colossèa variegàta* × *N. macrophýlla*). A tree-like perennial herb, viscid-pubescent throughout: st. erect, 6–18 ft. tall, somewhat branching above: lvs. sessile, ovate to elliptic, acute, undulate: fls. in loose, long-pedicelled, terminal panicles, drooping; tubes greenish, 2 or more times the length of the calyx; corolla broader and whiter than in *N. tomentosa* with a bright red margin. A hybrid between *N. tomentosa variegata* and *N. Tabacum macrophyllum* originated in Germany in 1903 by Franz Ament. It is poorly described and as yet little known in the U. S. M.D.G. 19:208. Gt. 54, p. 43.—Flowers continually throughout the season.

DD. *Corolla 4 times longer than the calyx; stamens slightly or not at all exserted.*

13. **Lángsdorffii,** Weinm. Herbaceous, annual, pilose to downy: st. 2–3 ft. tall, branching: lower lvs. ovate with a short narrow petiole, undulate, obtuse; upper lvs. ovate-elliptic or somewhat lanceolate, sessile, decurrent, acute: fls. paniculate, drooping; calyx 5-toothed, upper teeth longest; corolla greenish yellow, salverform, the tube clavate and swollen above, 3 times longer than the calyx; limb yellow within, obsoletely 5-lobed; lobes obtuse, somewhat emarginate: caps. obtuse, slightly longer than the calyx. Brazil and Chile. B.M. 2221, 2555.

CC. *Lvs. petiolate.*

D. *Corolla 2–3 times longer than the calyx.*

E. *Fls. yellowish or greenish.*

F. *Plants up to 6–7 ft. tall, robust with large heavy lvs.*

14. **wigandioìdes,** Koch. Herbaceous, perennial, of shrubby habit, glandular-pubescent: st. erect, 6–9 ft. tall, somewhat branching below: lvs. petiolate, ovate, acuminate, undulate: infl. paniculate; fls. pedicelled, drooping; calyx campanulate, teeth unequal, acuminate, glandular-pubescent; corolla salverform, yellowish white; limb somewhat reflexed; lobes broadly ovate, cuspidate; stamens included, filaments tomentose at base; style clavate; stigma green; ovary conical, ring fleshy, reddish, surrounding the base. Sent to the Cracow Botanical Garden from Colombia about 1852 by Warscewicz. B.H. 23:331.—A very striking plant for bold tropical effects.

FF. *Plants not over 4 ft. tall, slender and smaller-lvd.*

15. **rústica,** Linn. Herbaceous, annual, sometimes bi- or triennial, somewhat viscous pubescent: st. about 3 ft. tall, branching below: lvs. petiolate, large, thickened, ovate or oblong, cordate or subcordate, entire or rarely undulate, obtuse: fls. day-opening, pedicellate, in terminal racemes, yellowish or greenish, about 1 in. long; tube cylindric, inflated above, contracted at the throat, slightly villous, 2–3 times longer than the calyx; limb glabrous, yellowish; lobes short, rounded: caps. ovate to subglobose, apex often somewhat umbilicate. Mex. and Texas. Barton, Fl. 1:25.—Said to be the first species of tobacco intro. into Eu. Its use was made known by John Nicot for whom the genus was named.

EE. *Fls. reddish yellow.*

16. **glutinòsa,** Linn. Herbaceous, viscid-pubescent throughout: st. angular above: lvs. petiolate, subrotund to ovate, cordate, abruptly acuminate: fls. in terminal racemes, drooping, bracteolate; calyx somewhat 2-lipped, lower lobe 2-parted, upper lobe 3-parted, teeth lanceolate-acuminate, the upper largest, rather long, recurved; corolla reddish yellow, viscid-pubescent without, twice longer than the calyx; tube incurved, swollen above; limb 5-parted; lobes ovate, acute: caps. ovate, obtuse, included within the calyx. Peru and Bolivia. And. Bot. Rep. 484.—Intro. into the U. S. from Italy in 1908.

DD. *Corolla 5–6 times longer than the calyx.*

17. **paniculàta,** Linn. Herbaceous, annual, viscid-pubescent: st. 2–3 ft. tall, simple, angular above, branching: lvs. petiolate, subcordate, ovate or suborbicular, obtuse or abruptly apiculate, the upper ovate, acute: fls. pedicellate, bracteolate, in large terminal panicles; calyx with 5 nearly equal linear teeth; corolla yellowish green, salverform, tube clavate, glabrous, nearly 6 times longer than the calyx, contracted at the throat; limb plicate, green, very short, becoming revolute; lobes acute: caps. ovate, obtuse, slightly longer than the calyx. Peru. R. &. P. Fl. Peruv. 129.—Not much cult.

AAA. *Fls. in panicled corymbs; lobes acute; corolla funnelform, throat more or less inflated, red or rarely white. (Subgenus Tabacum.)*

18. **Tabácum,** Linn. TOBACCO. Herbaceous, annual, sometimes bi- or triennial and somewhat shrubby at

base, viscid-pubescent: lvs. thin, half-clasping, somewhat auricled, sessile, more or less decurrent, ovate, oblong, elliptic or lanceolate: fls. pedicellate in bracted panicles or racemes; calyx oblong, teeth unequal; corolla woolly without, 2–3 times longer than the calyx; tubes white or whitish; limb drooping, rose-colored or red; lobes acute or acuminate: caps. nearly equaling the calyx. Trop. Amer. Nees Fl. Germ. 24:461.—The fls. are diurnal. Cult. from earliest times by the Indians and often runs wild. Its commercial cult. being an agricultural subject is not discussed in this work. It is a striking plant in the garden. Var. **angustifòlia,** Comes (*N. chinénsis,* Fisch.). This is a narrow-lvd. variety from China and Java of which there are several hybrids. Intro. into the U. S. in 1906. Var. **macrophýlla,** Schrank. A large-lvd. variety with large red fls., of which there are several horticultural forms, variously listed in the trade as *N. grandiflòra purpùrea, N. atropurpùrea grandiflòra, N. rùbra.*

N. Bigelòvii, Wats., with sts. 1–2 ft. tall, fls. white 1–2 in. long, is of interest as being the possible origin of N. quadrivalvis and N. multivalvis. Calif.—*N. trigonophýlla,* Dunal, has sts. 15 in. tall: lvs. triangular, sessile, somewhat clasping, 2–2¼ in. long, ½–¾in. wide: corolla yellowish green, ½–⅝in. long: viscous pubescent throughout. Utah to Mex. and Calif.

P. L. Ricker.

NICOTÙNIA is a name given by the undersigned to hybrids of Nicotiana and Petunia offered in 1893. They were originally described as follows: "The plants have slender, drooping or trailing tomentose green, red and purple stalks and lvs. twice or three times as large as the petunia; the fls. are handsome, white, pink, carmine or striped and borne in plenteous profusion. No seed is ever produced, but they are very readily multiplied by cuttings."

These plants have unfortunately vanished from cult. They were, of course, annuals. They were semi-trailing plants, the lvs. covered with abundant short, woolly hairs. The cross was *Petunia hybrida* var. *grandiflora* × *Nicotiana wigandioides* var. *rubra,* the former probably being the seed-parent. The singular thing about the cross was the fact that the root seemed in all cases to be paralyzed and very defective, though the tops in all the many hybrids produced grew with much vigor. The blooms were beautiful, and it is a pity that the plants were not grafted on tobacco roots. Subsequently several parties have reported crosses of the tobacco and petunia and also tobacco and salpiglossis.

Luther Burbank.

NIDULÀRIUM (from Latin *nidus,* a nest). *Bromeliàceæ.* Warmhouse epiphytes, requiring the treatment of billbergia.

Flowers perfect, borne in compound heads, the petals joined at the base and not ligulate (in all the typical species); anthers attached mostly on the back (in some related plants attached mostly at the base): lvs. strap-shaped, ovate or oval, in dense rosettes, the fls. mostly sessile, red, blue, or white; the inner lvs. of the rosette, here called bract-lvs., are usually highly colored and constitute most of the merit of some species.—About 15 Brazilian species, by some referred to Karatas and other genera, but by Mez (DC. Monogr. Phaner. 9) kept distinct.

During the spring and summer nidulariums will require plenty of heat and moisture, this being their growing season. About the middle of January or when they show signs of becoming more active, they may be placed in a house with a night temperature of 65°. Before the plants are started up too much, they should haveany necessary repotting. They do well in either pans, cribs, or wire baskets. The compost should be some light porous material, such as fern fiber, sphagnum moss, or fibrous peat, adding some broken crocks and charcoal for drainage. Gradually increase the temperature at night until by summer they are having 75° with 10° to 15° higher during the day. Dampen the walks and under the benches so as to produce plenty of atmospheric moisture. With the increased temperature, do not allow them to become dry at the root, as they like an abundance of moisture. While nidulariums like plenty of light, they will need some shade when the sun is powerful, so they will not burn. After flowering they should be encouraged to make new growth. During the winter the temperature may be dropped to about 60° at night and the atmosphere should be kept drier. They will need only a very little water during the dark days of winter, just enough to keep them alive. Nidulariums are increased by suckers like many others of the Bromeliaceæ. These may remain on the parent plant until of sufficient size and strength, when they should be taken off and placed in small pots, using the same compost as above. Place these under a frame with bottom heat and a humid atmosphere. In a short time, they begin to make growth, when they may be given the same treatment as the old plants. Sponge often for scale. (J. J. M. Farrell.)

A. *Fls. white.*

Innocéntii, Lem. (*Karàtas Innocéntii,* Ant.). Stemless and stoloniferous: lvs. about 20, in a dense rosette, strap-shaped, about 1 ft. long, broadest near the middle, with many small, spiny teeth, green but more or less tinted brown or red, the oval bract-lvs. bright red: fls. in a dense head, white. I.H. 9:329.—Named for the Marquis de St. Innocent, amateur, of Autun, France. There is a form with yellow-striped lvs. I.H. 41:5. This species is one of the best nidulariums.

striàtum, Baker (*N. Makoyànum,* Morr., not Hort. *Karàtas neglécta,* Baker). Lvs. 8–12 in. long, strap-shaped, fine-toothed, prominently striped with central bands of white and shading to cream-color toward the margin, the body color deep green and not brown-tinted. G.C. III. 8:183 (desc.).—A good species.

AA. *Fls. blue or violet.*

Scheremetiéwii, Regel (*Karàtas Scheremetiéwii,* Ant.). Lvs. 10–15, in a short rosette, lanceolate, 10–18 in. long, with many small but conspicuous spiny teeth, rather firm, bright green above and pale green beneath, the bract-lvs. bright red and showy, the points recurving: fls. blue, in a small head. Brazil. Gt. 1858:224.

fúlgens, Lem. (*N. píctum,* Hort. *Guzmània picta,* Lem.). Lvs. 15–20, in a dense rosette, strap-shaped, with large, strong teeth, mottled with green of different shades, paler and scurfy beneath, the bract-lvs. oval and scarlet: fls. blue. J.F. 4:411.

N. amazónicum, Lind. & Andr.=Canistrum.—*N. Bindòtii,* Morr.=Aregelia.—*N. Carolínæ,* Lem.=Aregelia.—*N. Chantrieri,* André, is a hybrid of N. Innocentii and N. fulgens, with brilliant red bract-lvs., obtained by Chantrier Frères, France. R. H. 1895:452.—*N. Líndenii,* Regel=Canistrum.—*N. mèdeo-píctum,* Hort. Lvs. with dark blotches on a green ground and broad white bands lined with green in the center. Brazil.—*N. Morriniànum,* Makoy=Aregelia.—*N. príniceps,* Morr.=Aregelia.—*N. tríste,* Regel=Aregelia.

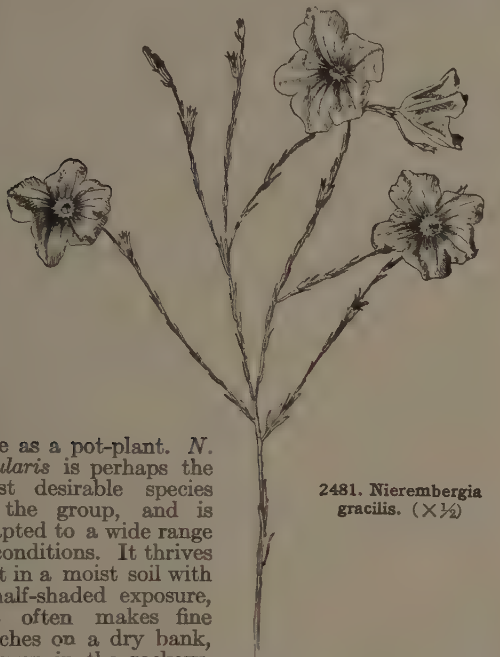
L. H. B.
George V. Nash.†

NIEREMBÉRGIA (for John E. Nieremberg, 1595–1658, a Spanish Jesuit and first professor of natural history at Madrid). *Solanàceæ.* Cup-Flower. Mostly tender perennial herbs valued chiefly for the open border or for pot-plants; they are mostly of prostrate habit, with showy pale violet or white flowers borne freely through the summer and autumn.

Stem decumbent or creeping, rarely suberect, diffusely branched, the branches usually slender and nearly glabrous: lvs. alternate, scattered, entire: fls. borne singly on the tips of young shoots, mostly white with a purple center; calyx 5-parted, tubular or bell-shaped; sepals spreading; tube of corolla long, slender, attenuated below, abruptly expanded above into a broad bell-shaped, saucer-shaped or funnel-shaped limb, which has 5 broad, obtuse lobes: caps. 2-valved.—About 25 species from Trop. and Subtrop. Amer., allied to

Petunia and characterized by the long and very slender tube of the corolla.

Several species of Nierembergia have distinct value for certain purposes. *N. gracilis* makes an excellent pot- or basket-plant, and is also popular for the border. *N. frutescens* does well in the open, but is more desirable as a pot-plant. *N. rivularis* is perhaps the most desirable species of the group, and is adapted to a wide range of conditions. It thrives best in a moist soil with a half-shaded exposure, but often makes fine patches on a dry bank, or even in the rockery. Both *N. gracilis* and *N. frutescens* thrive in a loose, rather moist soil, but are not impatient of dryness. These three species endure winters without protection in the latitude of New York.


2481. Nierembergia gracilis. (×½)

Nierembergias are propagated chiefly by cuttings taken in the fall, or by seeds. *N. rivularis* is most readily increased by dividing the creeping stem where it has rooted at the nodes. As most species are tender, they are best stored indoors, a cool greenhouse being best, where they may receive plenty of light and air. It is best to cut them down almost to the soil when setting them away for the winter.

A. *St. prostrate or creeping: branches ascending.*

B. *Fls. creamy white, sometimes slightly tinted with rose or blue.*

rivulàris, Miers. WHITE-CUP. Whole plant glabrous: st. slender, creeping, rooting freely at the nodes, forming a dense mat, the branches seldom rising over 6 in. high: lvs. oblong to oblong-spatulate, obtuse membranaceous, variable in size, with a long, slender petiole: fls. sessile or short-peduncled; calyx cylindrical, the lobes oblong-lanceolate, slightly spreading; corolla-limb broadly bell-shaped, 1–2 in. broad; throat golden yellow. La Platte River, S. Amer. B.M. 5608. J.H. III. 31:311. Gn. 23, p. 188; 25, p. 145; 64, p. 113; 66, p. 431. G. 19:33.—A very adaptable and desirable species for a stream bank, dry border or alpine garden. The fls. are large and beautiful. It is difficult to eradicate after once established, as small pieces of the st. will take root and grow.

BB. *Fls. white, with purple center.*

gràcilis, Hook. (*N. filicaùlis*, Hort.). Fig. 2481. Branches very slender, ascending 6–8 in., slightly downy: lvs. scarcely ½in. long, linear or slightly spatulate, those on the younger branches somewhat hairy: limb of corolla spreading, convex, white tinged and veined with purple toward the center, throat yellow. Argentina. B.M. 3108. G. 29:255.—A charming little plant for the hanging-basket. A garden form, var. **Crozyàna**, Hort., has fls. tinted lilac and appears to be more floriferous than the type. F.S. 14:1410.

BBB. *Fls. pale lilac.*

Veìtchii, Berkeley. St. 8–12 in. long, with slender, glabrous or slightly pubescent branches: lvs. ½–1 in. long, short-petioled or sessile, the upper linear, the lower broadly spatulate: calyx-lobes linear-oblong, recurved; corolla-tube ½–¾in. long, white, the limb broadly bell-shaped, pale lilac. Trop. Amer. B.M. 5599. F. 1872, p. 141.

AA. *St. nearly erect.*

frutéscens, Dur. (*N. fruticòsa*, Hort.). TALL CUP-FLOWER. St. 1–3 ft. high, much branched, shrubby: lvs. scattered, linear: fls. about 1 in. broad, the limb saucer-shaped, white tinted with lilac or blue; throat yellow; handsome. Chile.—The fls. resemble *N. gracilis* in color, but are much larger. Valuable in the greenhouse or for the border. As a pot-plant it makes a fine bush and bears fls. almost continuously. It can be used as a bedding plant with excellent results if started under glass and transplanted. G. 33:109, 595. H.F. II. 10:9.—A garden form, var. **grandiflòra**, Hort. (*N. grandiflòra*, Hort.) has somewhat larger fls. than the type. Var. **albiflòra**, Hort. Fls. white, appearing well with the foliage. Var. **atro-violàcea**, Hort. Pretty plants, very compact, with dark violet fls. Reproduces well from seed.

S. W. FLETCHER.
A. C. HOTTES.†

NIGÉLLA (diminutive of *niger*, black; referring to the color of the seeds). *Ranunculàceæ.* LOVE-IN-A-MIST. DEVIL-IN-A-BUSH. FENNEL-FLOWER. Hardy annuals grown for their interesting flowers and seed-pods which are often surrounded by the much-divided involucre.

2482. Nigella damascena.

Stems erect: lvs. finely divided, alternate: fls. showy, white, blue or yellow; sepals 5, regular, petal-like, deciduous; petals 5, with hollow claws, notched or 2-lobed: carpels 3–10, fusing at the base into 1 cavity, cells opening at the top when mature; seeds many, black and hard.—About 12 species, including Garidella; mostly natives of the Medit. region. Following 3 are the only species now used in Amer.

Nigellas require little care. The seed should be sown in the open border in good soil any time after the land is fit to work in early spring, as the plants are entirely hardy. The seedlings should be thinned, if necessary, to a distance of about 8 inches. They seldom succeed well if transplanted. If the seeds are sown in early autumn, the plants may withstand a mild winter and be ready to flower earlier the next summer. By planting at different seasons the plants may be continued in beauty nearly throughout the summer. The seeds of *N. sativa*, Linn., or black cummin, are sometimes used as seasoning in the Old World.

damascèna, Linn. Fig. 2482. Height 1–2 ft.: lvs. bright green, very finely cut: fls. white or blue, large; involucre very dense and fine; styles erect in the fr., nearly as long as the caps.: fr. not divergent at top. Summer. S. Eu. B.M. 22. Gn. 37, p. 130; 63, p. 165. J.H. III. 51:61. Gn.M. 5:296. Var. **nàna,** Hort. A dwarf form with very large fls.

hispánica, Linn. Lvs. much divided, but less so than in the preceding: fls. deeper blue than the last, with deep red stamens; involucre absent; styles rather spreading: fr. divergent at top. July. Spain and N. Afr. B.M. 1265. Gn. 37:130. Var. **Fontanesiàna,** Hort. (*N. Fontanesiàna*, Hort.). Much like the type, but said to flower 2 weeks earlier. Var. **álba,** Hort. Plant 18 in. tall: fls. white. Var. **atropurpùrea,** Hort. Fls. purple.

integrifòlia, Regel. Lvs. less divided than either of the above species: fls. differing in being bell-shaped. Cent. Asia. B.M. 8245. G.C. III. 44:227.

K. C. Davis.

NIGGER-TOE: Nuts of *Bertholletia*.

NIGHT-BLOOMING CEREUS: *Cereus*, and other genera mentioned on p. 721.

NIGHTSHADE: *Solanum nigrum*. **Deadly N.:** *Atropa Belladonna*. **Enchanter's N.:** *Circæa*. **Three-leaved N.:** *Trillium*.

NINE-BARK: *Physocarpus*.

NINTOÒA (East Indian name). A name proposed in 1830 by Robert Sweet for certain species of Lonicera (see page 1910). *N. japonica*, Sweet=*Lonicera japonica*.

NÌPA (native name in Molucca). *Palmàceæ*. One species of palm widespread along tidal rivers and estuaries, Ceylon to the Philippines and Australia, the great leaves much used in thatching, and the fruit edible.

Trunks or rootstocks prostrate, gregarious: lvs. pinnatisect, 10–30 ft. long, from the ends of the rootstocks; lfts. numerous, rigid, plicate, lanceolate, long-acuminate, 2–3 ft. long: fls. monœcious, in an erect infl. springing from the rootstock; male fls. small, in catkin-like lateral branches of the spadix, stamens 3; female fls. larger, in terminal globose heads, the carpels 3: fr. large and spherical (as large as a man's head), comprised of many carpels or drupes 4–6 in. long. Toddy is extracted from the spadix, and from this product other materials (as sirup, sugar and vinegar) are made. Kernel hard and white, edible. *N. frùticans*, Wurmb., is a most useful plant in the thatch-making in the Philippines (Figs. 1993, 1994, Vol. III), but it is probably not cult. to any extent. It has been intro. in S. Fla.

L. H. B.

2483. Nolana paradoxa. (×½)

NIPHÆA (Greek, *niphos*, snow; alluding to the white color of the fls., which is not usual in this family). *Gesneràceæ*. Tropical American stemless or dwarf soft-villous herbs, with cordate, coarsely serrate lvs. and clusters of about a dozen fls. an inch or so across, borne singly on reddish stalks. For general cult. they are inferior to gloxinia and achimenes, but they are desirable for botanical collections. They have a creeping root, and no tubers: lvs. wrinkled, petiolate, opposite: corolla nearly wheel-shaped; disk absent; stamens 4 or 5; filaments short, straight; anthers erect, free, the cells facing inward, parallel, confluent at the apex.—Species 2, Guatemala and Cuba.

oblónga, Lindl. Height 1 ft.: lvs. heart-shaped or perhaps somewhat oblong, more or less whorled, petioled and cordate at base, strongly serrate, hirsute and rugose: fls. drooping, winter; corolla about 1½ in. across, pure white, on slender reddish peduncles; lobes roundish, concave at first, then revolute. Guatemala. B.R. 28:5. H.U. 5, p. 301.

L. H. B.

NIPHÓBOLUS. A name once in rather general use but now replaced by *Cyclophorus*, which see.

NITRÀRIA (Latin *nitrum*, natron; in reference to its habitat in nitrous soil). *Zygophyllàceæ*. Niterbush. Four low rigid shrubs distributed from S. Russia to Mongolia, W. China and Persia and through Asia Minor to Arabia and N. Afr., with alternate small fleshy, entire or dentate, stipulate lvs. and with small white or yellowish green fls. in terminal cymes followed by berry-like drupes: calyx 5-parted, fleshy; petals 5, concave; stamens 15; ovary superior, conic-oblong, attenuated into a very short style with 3 connivent stigmas, 2–6-celled: fr. an ovoid drupe with a sculptured 1-seeded stone dehiscent at the apex; cotyledons often 3. The following species is sometimes cult. in European botanic gardens and has been intro. recently by the Dept. of Agric. into this country and recommended as a sand-binder for cooler semi-arid regions; its fleshy fr. is edible. Prop. by seeds and by layers. It is of difficult cult. under ordinary conditions, as it is, like most desert plants, impatient of too much moisture and seedlings particularly are liable to damp off. It grows well in saline and alkaline soils; in ordinary soil an application of salt is recommended to grow it successfully.

Schòberi, Gmel. Spiny rigid shrub, to 6 ft., with whitish branches: lvs. obovate-oblong to linear-spatulate, obtuse or sometimes acutish, entire, thickish, silky while young, finally usually glabrous, ⅓–¾in. long: fls. white, about ⅓in. across, in stalked terminal cymes about 1 in. across; petals spatulate-oblong; stamens about as long as petals: fr. purple or blackish violet, rarely yellow, about ⅓in. long. June; fr. in Sept. and Oct. From S. Russia to Mongolia, W. China and Persia. L.B.C. 14:1395.—By the Dept. of Agric. the plant was intro. from Turkestan as *N. retusa*, but *N. retusa*, Aschers., is a native of Syria, Arabia and N. Afr. and easily distinguished by its broadly obovate lvs. usually 3-toothed at the apex.

Alfred Rehder.

NITROGEN. The rôle of nitrogen in horticulture is discussed under *Fertility, Fertilizers, Legumes, Lime* and *Manures*.

NOLÀNA (from *nola*, a little bell; referring to the shape of the corolla). *Nolanàceæ*. Prostrate annual herbs with showy blue flowers opening only in sunshine, valued chiefly for covering poor or rocky places.

Stem often slightly angulate, usually spotted and streaked with purple above glabrous or viscid-pubescent, much branched, the ends of the branches ascending several inches: lvs. solitary or in pairs, entire, usually fleshy, the lower long-petioled; the upper short-petioled, sessile or attenuated into a winged petiole: fls. borne singly in the axils of the lvs., mostly short-peduncled, commonly blue or purple, rarely white or rose; calyx 5-parted; corolla short funnel-shaped or bell-shaped, as in Convolvulus, entire, 5-angled or 5–10-lobed; ovaries 5 to many, 1–5-seeded, arranged in 1–2 series or clustered irregularly around the base of the style.—About 20 species, all native in Chile and Peru, mostly seacoast plants.

The characters by which several species of Nolana have been separated are not well defined. It is probable that *N. prostrata* and *N. paradoxa* should be considered as one species. The chief characters which have been used to distinguish them are the number of ovaries in each flower and the number of seeds in each ovary; but these characters vary in different plants of these and other species of Nolana.

Nolanas grow readily from seeds sown in the open in May. For early blooming and for seed-production they should be started under glass in March and transplanted in May. *N. paradoxa* is used with fine effect when planted in large patches in the border or on rocky hillsides. All of the species do well in pots. They prefer a light soil and sunny situation. *N. paradoxa* is well suited for use in vases and baskets.

A. *St. smooth or sparsely hairy.*

B. *Fls. large (1–2 in.), dark blue, not striped.*

paradóxa, Lindl. (*N. atriplicifòlia*, Hort.? *N. grandiflòra*, Lehm.). Fig. 2483. Seven to 10 in. tall: root-lvs. very long-petioled, ovate; st.-lvs. ovate, mostly sessile or with winged petiole, fleshy: fls. large, 1–2 in.; sepals ovate-lanceolate; limb of corolla blue; throat white, inside of tube light yellow; ovaries commonly many, 1-seeded. Chile. B.R. 865. Not B.M. 2604, which is *N. tenella.*—This is the most common species in cult. Var. **álba,** Hort., has white fls. Var. **violàcea,** Hort., has violet fls. F.S. 13:1294. H.F. II. 1:60.

BB. *Fls. small (¾in.), light blue, striped with dark purple.*

prostràta, Linn., not Hook. Resembles *N. paradoxa* but is distinguished by the st. being more reclining, the fl. is smaller and the throat of corolla marked with violet-purple veins: calyx pyramidal with triangular lobes: ovaries commonly few, 2–4-seeded. Perhaps this should be united with the preceding; it is native to Peru. B.M. 731.

AA. *St. densely hairy.*

B. *St.-lvs. lanceolate, thick: plant hoary-pubescent.*

lanceolàta, Miers. St.-lvs. rather narrow, mostly in pairs, 2–6 in. long, the base obliquely clasping or slightly decurrent on the outer side: sts. hairy: fls. 1–2 in. broad, with a spreading 5-lobed limb, each lobe deeply notched; limb of corolla azure-blue, throat yellowish white, marked at the base with a line of purplish blue and spotted yellowish green. Chile. B.M. 5327. H.F. II. 5:55.

BB. *St.-lvs. ovate, membranaceous: plant viscid-hairy.*

tenélla, Lindl. St. and whole plant viscid-hairy: st. slender: upper lvs. ovate, membranous, obtuse, with rounded base and winged petiole: peduncle long-hairy: fls. violet-blue, with a white throat; limb 5-lobed, each lobe tipped with a broad point. Chile. B.M. 2604 (erroneously as *N. paradoxa*, but poorly shown as no hairiness is indicated).—Not advertised in Amer.

S. W. Fletcher.
A. C. Hottes.†

NOLÌNA (C. P. Nolin, joint author of an essay on agriculture, Paris, 1755). *Liliàceæ*, tribe *Nolìneæ*. Sub-acaulescent, or small trees, with dracena-like leaves, little cultivated except under glass, and sometimes in open grounds in southern California and comparable regions.

The liliaceous tribe Nolineæ, in addition to Dasylirion, contains 3 genera with unarmed lvs., so closely related that they have been united by excellent botanists under the genus Nolina. As now limited, however, Nolina has panicled small polygamo-diœcious fls. and wingless 3-lobed 1–3-seeded often inflated fr.; Calibanus differs from it in the fr. being neither lobed nor inflated; Beaucarnea, like Dasylirion, has 3-winged fr., neither lobed nor inflated, and its trunk differs from that of Nolina in being more swollen at base. S. U. S. to Cent. Amer. Monograph in Proc. Amer. Phil. Soc. 50 (1911), by Trelease; species 24. Other species than those enumerated below may be expected in the collections of amateurs. Treatment in cult. as for yuccas.

2484. Beaucarnea guatemalensis.

longifòlia, Hemsl. (*Yúcca longifòlia*, Schult. *Y. Barrancasécca*, Pasquale. *Dasylírion longifòlium*, Zucc. *Roulínia Karwinskiàna*, Brongn. *Beaucárnea longifòlia*, Baker). Rough-barked small tree 5–10 ft. high, with somewhat swollen base and few short branches crowded at top: lvs. thin, green, rough-edged, more or less frayed at tip, 1 in. x 3 ft. or more, gracefully pendent: infl. nearly sessile; fls. $\frac{1}{16}$in. long: fr. ¼in. long, ½in. wide, inflated; seed roundish, ⅛in. diam. S. Mex. Abhandl. Akad. Muenchen. Cl. 2. 3:1. R.B. 1865:20; 31, p. 230. Gn. 24:433. G.C. II. 7:493, 567. Bull. Soc. Ort. Tosc. 1890:6. G.W. 11, p. 14; 14, p. 199. G.Z. 3:20. Natur, 34:340. Gt. 29:117; 33:68. R.H. 1911, p. 206. Proc. Amer. Phil. Soc. 50:3, 8, 13, and p. 426.

The following species are given the nomenclature under Beaucarnea:

B. recurvàta, Lem. (*B. tuberculàta*, Roezl, *Nolìna recurvàta*, Hemsl. *N. tuberculàta*, Hort. *Pincenectítia tuberculàta*, Lem.). Becoming 30 ft. high, slender-branched above, swollen at base: lvs. green, thin, smooth-edged, recurving, ¾in. x 3–6 ft.: infl. nearly sessile; fls. $\frac{1}{16}$in. long: fr. unknown. S. E. Mex. I. H. 8, p. 58. G.C. 1870:1445; III. 46:4. D.G. Mag. 1871:288. Gt. 28:210. Gn. 19, p. 372. R.H. 1911, p. 207.—Tender in Cent. Fla.

B. guatemalénsis, Rose. Fig. 2484. Slender, sometimes much-branched tree, 20 ft. high: lvs. green, thin, smooth-edged, recurving, 1 in. x 3 ft.: infl. short-stalked; fls. ⅛in. long: fr. ½ x ⅝in. Guatemala. Contr. U. S. Nat. Herb. 10, p. 88.—Tender in Cent. Fla.

B. strícta, Lem. (*B. recurvàta strícta*, Baker. *B. glaùca*, Roezl. *B. Purpùsi*, Rose. *Pincenectítia glaùca*, Lem.). Becoming 30 ft. high, somewhat branched: lvs. pale, slightly rough-edged, straight, ¼–½ in. x 2–3 ft.: infl. short-stalked; fls. $\frac{1}{16}$in. long: fr. ¼ x ½in. S. Mex. D.G. Zeit. 28:223. Proc. Amer. Phil. Soc. 50:8, 14.

B. grácilis, Lem. (*B. oèdipus*, Rose. *Nolìna hístrix*, Hort.). Becoming 30 ft. high, greatly swollen at base variously branched: lvs. very glaucous, rough-edged, straight, ¼ x 18–20 in.: infl. short-stalked; fls. $\frac{1}{16}$in.

long: fr. ⅜in. long and broad. S. Mex. Contr. U. S. Nat. Herb. 10:23. Publ. Carnegie Inst. No. 99:19. Proc. Amer. Phil. Soc. 50: 4, 11.

N. Hartwegiàna, of gardens—but not the species properly so-called—a plant with round rough-barked st. about as large as a coconut and narrowly linear tufted lvs., is the type of a related genus, Calibanus, which differs in its rounded 3-celled fr. neither inflated, lobed nor winged, and is known as *Calibànus Hoòkerii*, Trel. (C. cæspitosus, Rose. Dasylirion Hookerii and D. Hookeri, Lem. D. cæspitosum Scheidw. D. flexile, Koch. Beaucarnea Hookeri, Baker). E. Cent. Mex. B. M. 5099. Contr. U. S. Nat. Herb. 10:24, 25, and p. 90, fig. 4. Proc. Amer. Phil. Soc. 50:6, 8, 9, 11, 14.—The most beautiful of all this group is *N. longifolia*, when young, with its crown of drooping leaves 6 feet or more long, reaching to the ground. Few other true nolinas possess much beauty, but the caulescent species are odd and rather graceful, and Lower Californian forms like *N. Bigelovii*, Wats., *N. Beldingii*, Brandegee (G.C. III. 34:43) and *N. Parryi*, Wats., may succeed in the warmer parts of California.

William Trelease.

NÓLTEA (after E. F. Nolte, professor of botany at Kiel; born 1791). *Rhamnàceæ.* Soapbush. An evergreen glabrous shrub from S. Afr., with alternate short-petioled serrate lvs., small deciduous stipules and with small white polygamous fls. in terminal and axillary panicles: calyx campanulate, 5-lobed; petals 5, small, shorter than sepals, cucullate; the 5 stamens opposite the petals; ovary half-inferior, 3-celled; style rather short, with slightly 3-lobed stigma: fr. a caps., 3-valved, septicidal with 3 erect compressed seeds. The whole plant is saponaceous and the macerated foliage is used by the natives in washing. Sometimes used as a hedge plant in S. Afr. Cult. occasionally in S. Calif., though it has scarcely any particular ornamental quality. Prop. is by hardwood or greenwood cuttings and also by seeds. **N. africàna,** Reichb. (*Ceanòthus africànus*, Linn.). Upright shrub with virgate branches, to 12 ft.: lvs. oblong-lanceolate, serrate, obtuse, pale green below, 1–2 in. long; stipules small, roundish, thickish: fls. whitish, ⅙in. across in short axillary and terminal panicles crowded at the end of the branches into leafy panicles several inches long: caps. ⅙in. across. S. Afr. Sim, Forests and For. Fl. Cape of Good Hope, 37.

Alfred Rehder.

NOPÀLEA (from the Mexican name of the cochineal cactus). *Cactàceæ.* A genus of 4 or 5 species, often placed with the opuntias, but differing from the latter in having erect petals, and stamens and style exsert beyond the perianth, as well as in some minor details. Natives of Trop. Amer. **N. coccinellífera,** Salm-Dyck (*N. inapérta*, Schott). An arborescent, flat-stemmed plant, with a somewhat cylindrical trunk 6–10 in. diam., widely grown in semi-tropical countries, but rarely found in the U. S., and then only in the largest collections of cacti. It is chiefly interesting in being one of the important food-plants of the cochineal insect. B.M. 2741, 2742 (as *Cactus cochinellifer*). *N. guatemalénsis* and *N. lùtea* are 2 recently described species from Guatemala which have been intro. into cult.

J. N. Rose.

NORÒNHIA (after Ferd. de Noronha, Spanish naturalist and traveler: died 1787). *Oleàceæ.* One tree or large bush, differing from Olea in having separate petals and in other characters. *N. emarginàta*, Poir. (*Òlea emarginàta*, Lam.), is native in Madagascar and other islands, and is planted somewhat in Hawaii. Lvs. opposite, evergreen, short-stalked, coriaceous, cuneate-oblong and more or less retuse, entire: fls. yellowish, fragrant, in axillary clusters; calyx small, 4-toothed or -cut; petals 4, sometimes somewhat coherent at base: fr. an edible drupe, purple when ripe, globular, about 1 in. diam.; seed usually 1 (ovary 2-celled), in the sweet pulp.

NORTH AMERICAN STATES, Horticulture in. The descriptive articles on the horticultural resources of the North American continent are comprised in two parts: the symposium on British North America in Volume I, and the present assembly. These together give a comprehensive view, and yet in some detail, of the present state of development in fruit-growing, vegetable-growing, flower-growing, and related activities in this vast area. Inasmuch as the statistical information is not comparable as between the British and the American parts of the continent, and as the markets and governmental control are different, as well as for other reasons, it has seemed best to treat the two parts separately, although the reader will want to consult them both to secure his view of the continent as a whole.

The article on Alaska naturally attaches itself to the present account. It is desirable, also, to present here an account of the horticultural possibilities of the Canal Zone (with its ten-mile strip across the Isthmus of Panama), although that region is not correctly a part of North America; but it belongs with the same governmental administration as the continental states of the Union, and the trade relations will naturally be close.

A third group of descriptive articles is found in Volume III, under the title "Island Dependencies." These insular areas are all tropical and therefore have a more or less common interest. The islands are Porto Rico, page 1689; Hawaii, page 1692; Guam, page 1696; Tutuila, page 1699; Philippines, page 1702.

In percentage of total value of all crops in the United States, the horticultural products reach not more than 13 per cent, even counting potatoes and sweet potatoes as within the definition. The census figures for the year 1909 give the percentage of value of vegetables (including potatoes, sweet potatoes and yams, and other vegetables) to be 7.6 per cent of the total value of all crops; of fruits and nuts to be 4 per cent; of flowers and plants to be .6 per cent; of nursery products to be .4 per cent. In average value to the acre in 1909, "flowers and plants" lead all crops, with $1,911.02; small-fruits $110.01 to the acre; potatoes, $45.36; sweet potatoes and yams, $55.25; "other vegetables," $78.26. This may be compared with the acre-value of staple field crops, as cereals $13.93; hay and forage, $11.40; tobacco, $80.55; cotton (including seed), $25.74; sugar-beets, $54.60; sugar-canes, $55.40.

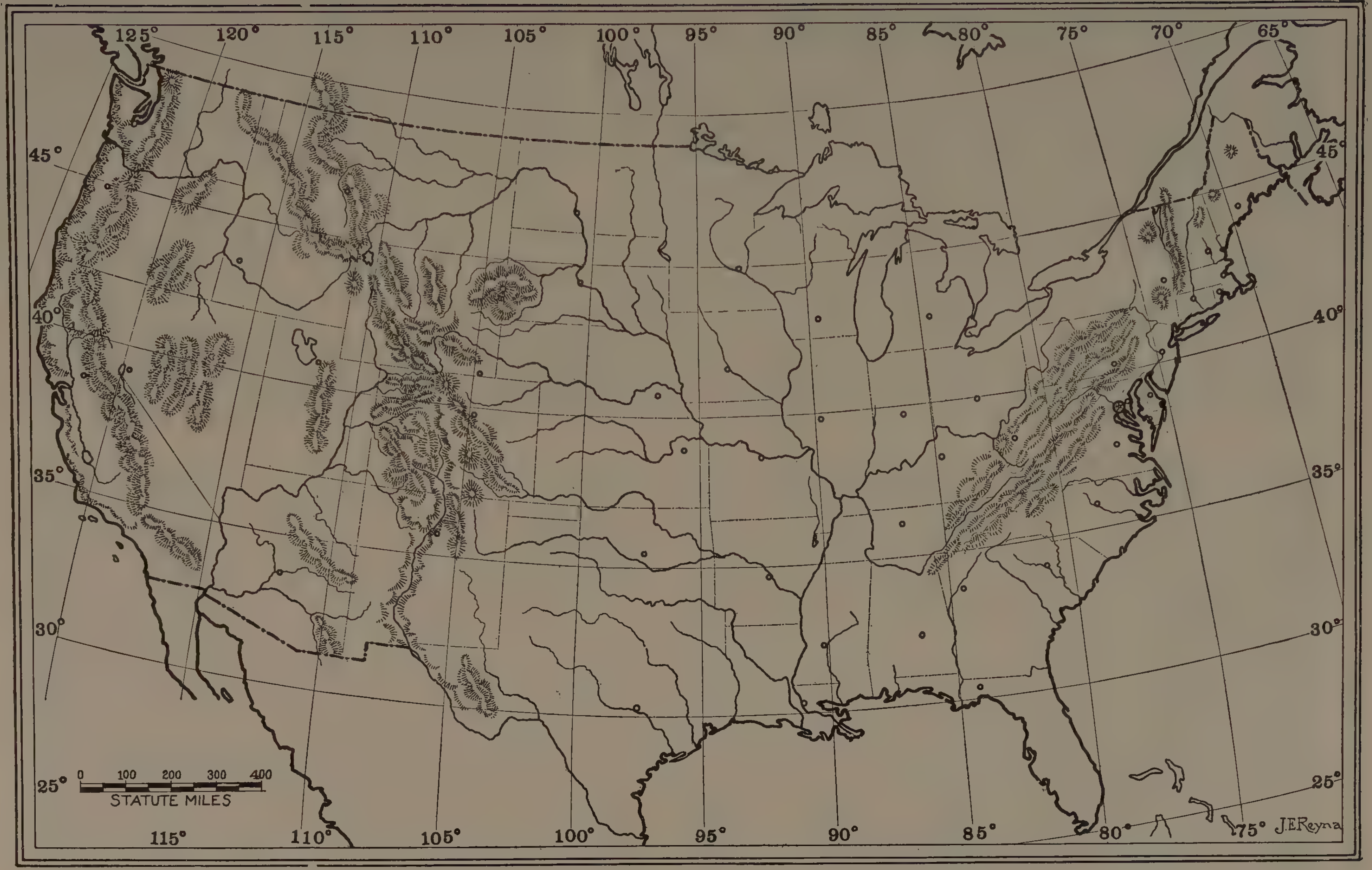
The territory of the continental United States comprises practically the whole range of climate. While none of it is within the tropics, the southern end of Florida is essentially tropical; the Gulf coast, southern Texas, southern California and the less elevated regions between are subtropical; and Alaska is partly within the arctic. There are long ranges of seacoast climates, and vast areas of midcontinental conditions. There are regions of unusually heavy rainfall, and others of very deficient precipitation and with desert conditions. There are widely different drainage systems, elevations from perpetual snow to depressions below sea-level, and the widest variations in soils and exposures. These wide ranges of conditions provide the physical basis for the most diverse horticultural pursuits. The mountain barriers and main drainage basins, as well as the seacoasts, are shown in Fig. 2485. This map may be joined to that of the British possessions, Fig. 652, on page 560.

The present symposium on the horticulture of the United States takes the form of an account by states; and these states are assembled in groups to represent geographical regions, as follows:

New England States.—Maine, page 2152; New Hampshire, page 2154; Vermont, page 2157; Massachusetts, page 2159; Rhode Island, page 2162; Connecticut, page 2164.

Middle Atlantic States.—New York, page 2167; New Jersey, page 2170; Pennsylvania, page 2173.

East North Central States.—Ohio, page 2176; Indiana, page 2179; Illinois, page 2182; Michigan, page 2184; Wisconsin, page 2187.



2485. Outline map of the United States, showing great drainage basins and some of the mountain masses.

West North Central States.—Minnesota, page 2190; Iowa, page 2193; Missouri, page 2196; North Dakota, page 2199; South Dakota, page 2202; Nebraska, page 2205; Kansas, page 2207.

South Atlantic States.—Delaware, page 2210; Maryland, page 2212; Virginia, page 2215; West Virginia, page 2218; North Carolina, page 2220; South Carolina, page 2223; Georgia, page 2226; Florida, page 2229.

East South Central States.—Kentucky, page 2232; Tennessee, page 2235; Alabama, page 2237; Mississippi, page 2240.

West South Central States.—Arkansas, page 2243; Louisiana, page 2246; Oklahoma, page 2249; Texas, page 2251.

Mountain States.—Montana, page 2255; Idaho, page 2257; Wyoming, page 2260; Colorado, page 2263; New Mexico, page 2266; Arizona, page 2269; Utah, page 2272; Nevada, page 2275.

Pacific States.—Washington, page 2278; Oregon, page 2281; California, page 2284.

Alaska, page 2287.

The statistics concluding the articles, compiled by Editor, are taken from the Thirteenth Census, 1910 (products of 1909). This is with the purpose not only to give the statistics of each state but to afford a basis of comparison between the states and to present the facts for the Union. As a basis of comparison, the main agricultural products are also given. The categories of fruits are those used in the Census classifications. It does not necessarily follow that "peaches and nectarines" means that there are nectarines growing in commercial quantities in the given state, or that loganberries are grown when the category is "raspberries and loganberries." In some cases in which these and other incidental fruits are known not to be grown, the names have been eliminated, but not always so. The statements are classificatory.

The Canal Zone (Fig. 2486).

When Balboa followed the narrow jungle trails of the Indians from one rambling settlement to another across the Isthmus, he probably noted, if he took any horticultural notes at all, that the economic flora was deplorably meager. The palm-thatched "bohios," as they called their one-room dwellings, were scattered along the high banks of the rivers, just above flood-mark; and the patches of root-crops and grains were massed close up under the watchful eye and ear of the planter,—to avoid depredations by the plentiful game animals, the deer, tapirs, agoutis, pacas, and their kind. This sort of make-believe horticulture, however, had been improving very slowly for thousands of years when the first Spaniard appeared on the scene.

If we hold, with O. F. Cook, that the first ideas of agriculture originated in the old Caribbean region, if we place the birth of the science back to the first purposeful covering of an otó tuber in a half-cleared plat somewhere about here some 50,000 years ago, then we must needs offer some explanation for the undeniable backwardness of tropical American horticulture at the beginning of the sixteenth century. We may rightly ignore all ethnological points in the case and assert that in this region a little more than anywhere else on the earth's surface did the food-plant growers have a pitiably laborious and precarious struggle with the primeval jungle. Indeed, it is doubtful whether even the present inhabitants of the Chagres Valley could eke out enough to live on from their little semi-cultivated patches if they were deprived of the machete and their few other "civilized inventions."

In point of fact, however, the indigenes of this region had a fairly large number of quasi-economics in use, not to say in cultivation. They probably depended upon the larger game animals to a great extent, with fish, snakes, and iguanas also *en mênu;* their main root-crop was "yuca," or cassava (*Manihot dulcis* var. *Aipi, M. utilissima*), and to this day the "small farmer" of the interior of the Isthmus sets great store on "farina," the artificially dried, grated, peeled root. Otó, or Yautia (Xanthosoma spp.) was probably second in importance as a vegetable food and undoubtedly existed then in many forms. Of yams there were probably several species, all inferior to those now in evidence. The malanga, or taro (Colocasia), probably arrived with the Spaniards. The sweet potato may have been in evidence, but the present dialects of the Panamanian Indians (according to Pittier) contain no word for this root. And the "cacahuate," or peanut, was a prominent prehistoric crop from Mexico to Peru.

Among the fruits, the avocado, indigenous from Peru to Mexico (but not in the West Indies), demonstrates its nativeness by attaining a greater size here than elsewhere—2 feet in diameter, with a height of 65 feet or more, and fruits in proportion; the Mexican black-skinned and the Guatemalan hard-skinned varieties are unfortunately absent. The cashew (*Anacardium occidentale*) is and probably was common everywhere outside of the forests; the sister species, the espavé (*A. rhinocarpus*) is a conspicuous jungle giant. The guavas, though unable to compete with the forest species, are among the first to occupy cleared ground. The annonas were probably common; three forest species bear edible fruit. Two caimitos, or star-apples (Chrysophyllum spp.) are half or wholly wild. The calabash (*Crescentia Cujete*) was probably semi-cultivated for the sake of its fruit-rinds, used in lieu of crockery.

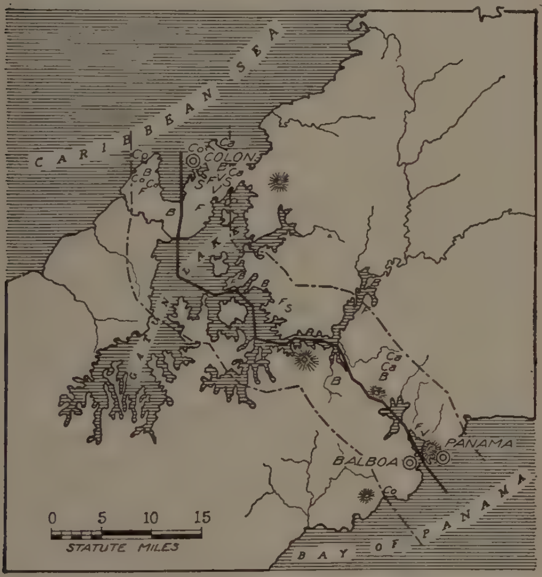
The pineapple probably made its first appearance to the public somewhere in this region. As to the bananas and plantains, it will probably never be known just how or when they were introduced (from Africa or, more probably, from the Orient); it seems certain, however, that there were a few varieties (out of the 300 or more) under cultivation when Balboa came. The anotto (*Bixa Orellana*) was doubtless used then, as now, for decorating the body and, mixed with palm-oil, to keep away mosquitos and the terrible "sand-flies" and ticks.

There were probably also peppers, ginger, papayas, maize, and beans in those plantations of 4,000 years ago; but unlike their distant neighbors, the Incas and Aztecs, the Isthmian planters neglected to set it down on stone records.

The first two centuries of civilization brought but little to this region in the way of new economic plants; but as soon as travel across the Isthmus became a real movement, and with pirates and brigands becoming unpopular, Panama horticulture began to improve. The Indian mango and the Polynesian bread-fruit arrived and soon assumed a permanent predominance over all other fruits, except the avocado and the musas. The citrous fruits, various vegetables, rice, sugar-cane, the akee (brought in with the slaves) and, of course, the ubiquitous tropical ornamentals (Aralia, Hibiscus, Acalypha, Codiæum, Jasminum, and others) came in due time. Many first-class economics, however, such as sapodillas, star-apples, sweetsops, tamarinds, mammee apples, and mammee sapotas, are still nearly or quite absent within the Zone boundaries. The French brought in a few good things. In 1906 to 1908, H. F. Schultz, as horticulturist, began the propagation of ornamentals and vegetables; through the auspices of David Fairchild and the writer, a good collection of economics was sent from the propagating-houses of the United States Department of Agriculture, at Washington, D. C., to the Zone, with partial success. About 1908–9, it was considered impracticable to raise fresh vegetables and fruits for the Canal Commissary, and until the native plantations began to be "bought in" by the Land Office, January 1, 1913 (by Presidential Order of December 5, 1912), Zone horticulture was in a state of desuetude. Oranges, bananas, avocados, and the like, were sometimes gathered wherever it seemed expedient, without a definite policy of management, till October, 1914.

At present (1915), even, it is uncertain how far the Supply Department is warranted in going with the upkeep of the hundreds of small and large plantations expropriated from the Panamanian and West Indian settlers, and how many new plantations are actually required, first, in the interest of financial economy, and, second, as a safeguard measure: i.e., a meat, fruit and vegetable supply *in loco* in case of a sudden isolation of the Zone. (In fiscal year ended June 30, 1914, the Land Office settled 1,903 claims of squatters, aggregating $147,452.50).

Corregidor Island, at the entrance to Manila Bay, according to report, has enough food-supplies in store in dry and refrigerated vaults to last the entire American population of the archipelago for more than one year; a week's blockade of the Canal Zone would, under present conditions, cause considerable trouble, and three weeks with no commissary stock from oversea might be disastrous, since the contiguous Panama territory could supply only the cities of Colon and Panama, and then only a few things. Theoretically, nearly all the food required by the 30,000 or more employees and their families, who are almost entirely dependent upon the Supply Department for their daily food, may be produced in the Zone; practically, however, the daily quotum of 92 to 108 barrels of flour, about 285 bushels of potatoes, and the temperate fruits and some of the vegetables in like proportion, will always have to be imported.



2486. The Canal Zone. *B,* Bananas; *Ca,* Cacao; *Co,* Coconuts; *F,* Fruits; *S,* Sugar-cane; *V,* Vegetables.

At the beginning of 1915, there were practically no vegetables or fruits (except bananas and plantains) raised in the Zone, with the exception of a square mile or more of native fields near Colon which have not yet been expropriated, and the Hospital Farm at Corozal; the latter institution produces fresh eggs, milk, and a fair supply of radishes, okra, lettuce, papayas, and other things for Ancon Hospital.

At Las Guacas, 12 miles up the Chagres River from the lake,—i. e., some 6 miles beyond the east boundary of the Zone, but below the "100-foot level" (land along water-courses leading into the lake, up to 13 feet above its mean water-level is also by treaty included in Zone territory)—there are two small banana and plantain "walks," which, when fully under cultivation, will turn out not only all of these fruits required by the local commissary stores, but will also supply, nearly at cost, all the steamers in port and in transit through the Canal, a very considerable demand.

At Juan Mina, also on the Chagres, just within the Zone limits, a citrous grove is now being established; with water transportation (forty minutes by launch to Gamboa railway station), good soil, and phenological suitability, as demonstrated by the few scores of very prolific native orange (seedling, of course) trees now in evidence there, it is thought that by 1918 or 1919 the absurd necessity of importing thousands of dollars' worth of pomelos, oranges, mandarins, limes, and other fruits from Florida, Costa Rica and Jamaica will be absolutely and permanently removed.

At Chocolate (formerly the Las Cascadas Plantation Co., Ltd., a British-capital concern), on the continental divide 5 miles from Culebra Cut, over six tons of dry cacao "beans" from only about 15,000 trees in "run-down" condition have been turned out in the first ten weeks of operation by the Supply Department. This estate boasts of having the oldest Castilla trees, planted as a crop, in the world. The unfortunate Castilla boom actually started, it is said, from these now 30-centimeter to 40-centimeter, moribund, worthless specimens, and an optimistic German scientist who happened to come by a dozen years or so since. The semi-abandoned cacao trees here broke the world's record, perhaps, for rapid maturing of the year end crop; six heavy pickings had to be made the first six weeks, instead of the two or three normal ones.

A grove of over 500 avocado seedlings, one of the largest in the world, has been set out at Frijoles; and mangoes, citrous fruits, pineapples, yams, sweet potatoes, and maize (for table ears) are going in, bananas and sugar-cane are also in evidence.

At Manawá and Puerto Escondido ("Condio," in local dialect), two native villages some 3 miles to the east of Colon, there are endless problems for the investigating horticulturist;—from major crops, like sugar-cane and cacao, through hundreds of acres of half-tilled patches of bananas, yams, and cassava, to fussy little questions of economy regarding the rejection or retention of small lots of coconuts, bread-fruits, avocados, limes, roselle, guavas, native squashes, ginger, and even cola.

At Venado, there are 20,000 non-bearing coconuts mostly in good condition. This plantation, if kept up under modern methods, will yield annually by 1925 sufficient oil to make some 300 tons of soap, enough to last the War Department a long time. At Sweetwater, there are several thousand coconuts in bearing, but in heavy bush and consequently in unprolific condition. In all there are twelve plantations now under some form of management by the Chief Quartermaster's Supply Department; the condition of these will be improved as rapidly as circumstances will permit; some may be extended, and a few more will probably be added.

As to the jungle: near the Canal there is no virgin forest left intact and, in fact, the better timbers have been culled out all along the Panama Railroad. The forest within sight of the steamers and trains is mostly second growth; this, however, is usually more dense than the old stand. Here is an opportunity for the Government to practise modern forestry and develop, say, 100 square miles of timber reserve.

As everywhere in Central America and the West Indies, the silver-lined leaves of the trumpet-wood (Cecropia) and the crumpled leaves of the also ugly companion Didymopanax are ever before the eye, just as some one of the four or five Heliconias is always in the way. Numerous Bombaceæ are to be found in or around every forest area; their interesting bolls, if one may so term them, are as remarkable as their trunks; the trunk of one, *Bombax Barrigon*, is true to its vulgar Spanish specific name, in having a very "aldermanic rotundity" just above its base. The lofty but proportionately small crowns of the giant "Cuipo" (Cavanillesia) are a feature of the landscape near Pedro Miguel, which happens to be about the northernmost limit of this striking South American tree. There are, as everywhere in the tropics, many Ficus species, to puzzle future botanists. Mahogany and cedar are scarce, except near the Zone limits; however, the cutters' axes of a concessionnaire can be heard from the orange plantation at Juan Mina. Some new Lecythaceæ have recently been discovered by Pittier of the United States Department of Agriculture; some of the nuts rival the Brazil and Paradise nuts. Many excellent hardwoods are also in evidence.

The branches and trunks of the rough-barked trees usually support a varied flora of bromeliads, aroids, and orchids. On the Atlantic slope, where the rainfall averages around 125 inches a year, the orchids revel in a droughtless climate; the dry season—December to April, or longer—of the south or so-called west side of the Isthmus, the precipitation of which is just about one-half that of the Colon region, makes for a different flora. The most famous orchid here is the "Holy Ghost," or "Dove" (*Peristeria elata*); a coryanthes is more interesting, however, and makes up in number of flowers what they lack in size as compared with its bizarre sister species, *C. macrantha* of the Trinidad "high bush." The deep purple sobralias are striking; the butterfly orchids (Oncidium spp.) are everywhere, and range from buttonhole size (meaning the entire plant with its two bright yellow flowers) to the one with an 8-foot peduncle.

Several fine marantas and costus spp. and rank Zingiberaceæ and Araceæ encumber the ground wherever they can find plenty of shade and moisture. The carludovicas, that made Ecuador hats world-famous, abound in the denser jungles and are one of the worst sorts of weeds on the Manawá cacao plantations; in one ravine the petioles attain a length of 6 meters (20 feet)! Tagua (Phytelephas sp.) barely enters the Zone from the south. But the true palms are everywhere: Acrocomia, Attalea, Bactris, Elæis, Iriartea, Hyospathe, even the terrible desmoncus (worse than the calamus of the Philippines). Four species, at least, yield oil for the native table and two might prove of commercial importance, the corozo (Acrocomia) and the elæis, for their kernels. Nuts of a small-fruited species of Attalea, the commonest large forest palm, may also through their great abundance be of value.

Most of the still-water reaches of the "3,000-mile coast-line" of Gatun Lake are more or less filled with luxuriant water lettuce and lesser evils in the way of aquatics; the Dredging Division is only now getting the two water hyacinths under control, after a strenuous fight with arsenical sprays by the hundred barrels. The shallow bays teem with micro-organisms; the many square miles of submerged forest furnish an excessive amount of decaying vegetable matter to feed the subaquatic life; billions of fish-fry are appearing now,—so thick in places that they may be scooped out with the hand. Pará grass and a papyrus-like rush are preëmpting the margin—an ideal habitat for the hippopotamus, which should be introduced as a margin-mower and aquatic-consumer to help out the Health Department in destroying mosquito breeding-grounds, and incidentally to furnish the Supply Department with the same kind of wholesome meat that South Africa once depended on.

In a word, then, here in the most important country of its size in the world, the Panama Canal is meeting an unprecedented problem: in 325 square miles of moderately suitable territory, more or less isolated, how nearly self-supporting shall this area be made,—what sort of horticultural development should it have, and how much? The foreground is somewhat out of focus at present, but there are certainly some very interesting possibilities in the perspective.

O. W. Barrett.

NEW ENGLAND STATES.

Maine.

Maine (Fig. 2487), the most easterly state in the Union, lies between latitude 43° 6′ and 47° 27′ north, and longitude 66° 56′ and 71° 26′ west. It has a very irregular coast-line, extending from Kittery on the south to Eastport on the extreme east, so broken by river and bay indentations as to measure about 2,500 miles in extent. About one-tenth of the area of Maine is water. There are about 2,200 lakes and ponds which act as reservoirs to hold in reserve the vast water-power of the state. It has three large river systems extending well into the interior, along whose courses are found the most fertile farms in the state. A central elevated plain extends across the state from west to east, at an elevation of 1,000 to 2,000 feet, near the center of which is Mount Katahdin, which has an altitude of 5,385 feet. A considerable part of the five most northern counties of the state are still covered with a heavy forest growth. In the northwestern section, this consists of pine, spruce, fir, hemlock and cedar; while farther south the conifers are replaced by birch, beech, oak, ash, maple, and the like. About three-fourths of the land area is classed as forest land. Maine ranks first among the states in its annual cut of spruce and fir, and third in white pine and birch. The annual cut of all timber is about 1,000,000,000 feet. The forest interests of the state are separated into two classes, viz., the Maine forest district of about 9,500,000 acres, and the forested area of towns and plantations of 4,500,000 acres.

A large part of the state is especially adapted to the growing of fruit of exceptionally high quality. It is true that the fruit-growing industry in Maine is in its infancy so far as modern methods are concerned. Local conditions are such that the most favorable opportunities exist for the development of this industry. Portland is one of the most convenient ports for the shipping of apples to foreign markets, and large quantities are sent each year. The natural fruit-belt of the state embraces the section south of latitude 44° 30′, although some fine orchards are found in the center of the state extended to latitude 45° 10′. Latitude 45° north is regarded as the northern limit of profitable fruit-production, yet even in Aroostook County many orchards are yielding good returns, especially of such varieties as the Wealthy, Fameuse and Dudley Winter. The leading commercial fruit is the apple, the normal crop being about 1,000,000 barrels. The leading counties in the state in apple-production are Oxford, Cumberland, Androscoggin, Kennebec, Waldo and southern Franklin, Somerset, Piscataquis and Penobscot.

In York County, thrifty apple trees, over one hundred years old, are still bearing. These probably came from the famous Vaughan Nursery, in Hallowell, which was established about 1800. The Bowman Brothers, of Sidney, conducted an extensive nursery for a number of years, growing their stock from seeds taken from apple pomace at the cider-mill. The seedling trees were grafted to Baldwins, Rhode Island Greenings, Spy and other leading varieties. Remnants of the orchards set from this stock are still to be found in almost every section of the state. Many old seedling orchards, which yielded the once-famous "hard cider" for the Andrew Jackson political campaign, are still in existence, but these are rapidly passing with the coming of the movement for better fruit, and their places are being filled with the best commercial varieties. In 1910, about 1,000,000 apple trees were set. This was probably the largest number ever planted in one year. There are four leading nurseries selling fruit stock, but only two that make a business of budding their own stock on to French seedlings. Many orchardists are top-working over their Ben Davis trees to such varieties as Baldwin, Spy, Rhode Island Greening, while Delicious and Opalescent are gaining favor.

The following varieties of apples originated in the state: Wealthy, from seed obtained in Bangor in 1860; Rolfe, in town of Guilford, about 1820; Starkey, in North Vassalboro; Dudley Winter, seedling of Oldenburg, originated at Castle Hill, Aroostook County; Winthrop Greening, Winthrop, about 1800; Quince, at Cornish, about 1850; Parlin, Norridgewock, about 1840; Stowe, Perham, Aroostook County, 1862, and Hayford Sweet, at Maysville, Aroostook County.

Fine peaches are grown in Oxford and Androscoggin counties, in the southwestern part of the state.

Fifty years ago large quantities of the finest Black Oxheart cherries were grown and shipped from Hallowell in Kennebec County, but the orchards have become neglected so that but few old trees remain.

Plums, pears, sour cherries and grapes are grown throughout the southern half of the state, as far north as latitude 45°.

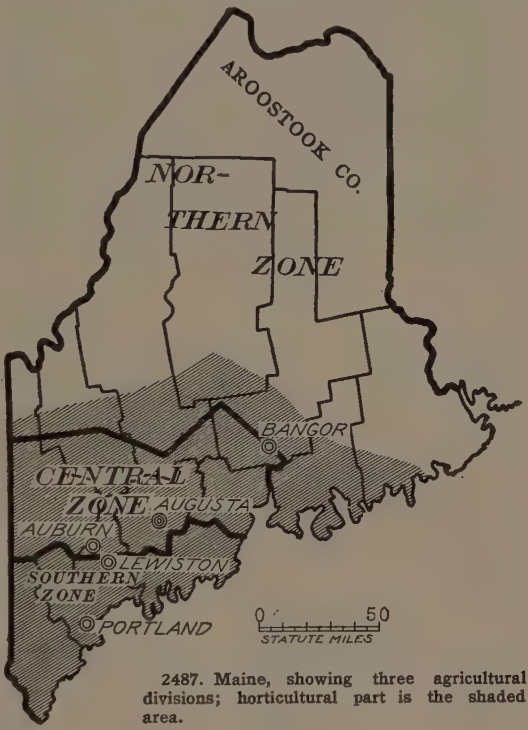
Small-fruits of all kinds grow wild in lavish abundance, especially strawberries, raspberries, blackberries, blueberries and cranberries. For cultivated berries, strawberries easily take the lead and are grown very extensively for local markets and to ship to Boston. The small-fruit industry is a profitable one and is being extended each year. The conditions are ideal, as the fruit comes on the market after fruits from other states have disappeared, thus bringing good prices with a large market demand. In Washington County is a large tract of about 150,000 acres, called the "Blueberry Barrens," which brings in a big revenue to the owners. Several thousand bushels of the berries are sold as fresh fruit, but the large bulk goes to the canning industry, yielding an income of several hundred thousand dollars. Cranberries are found to some extent along the coast and also in inland sections.

Potatoes stand second in crop-production. The starch industry is an important one for Aroostook County, yielding in 1914 about 20,000,000 pounds. Aroostook County far exceeds any other county in the United States in potato-production. There is a larger output from this county than from all the other counties in the state combined. The leading varieties are the Green Mountain and Irish Cobbler, although a large number of other varieties are grown. Under trial tests over 700 bushels have been grown on an acre; six-acre lots have given an average of 460 bushels; ten-acre lots, 350 bushels. Farmers who adopt up-to-date methods average 300 bushels an acre. This can be done in any part of the state. The town of Presque Isle, the garden of Aroostook County, has potato farms valued at $40,000. Contracts are made with growers in the southern states to supply Aroostook-grown potatoes for seed at $1 a bushel for a term of five or ten years. The variety most grown for this purpose is the Irish Cobbler.

The leading vegetables grown, as market-garden produce, include snap beans, beets, cabbage, cucumbers, lettuce, peas, squash, sweet corn and tomatoes. Of the above crops, large quantities of beans, corn, peas and squash are used in the canning industry of the state. Although Cape Elizabeth is the leading market-garden center, there are many other sections largely engaged in this industry, notably the towns around Lewiston and Auburn in Androscoggin County; Saco and Biddeford in York County; Augusta and Waterville in Kennebec County; Bangor in Penobscot County, and Elsworth and Mt. Desert, in Hancock County. Maine offers great inducement for market-gardening, cheap lands are available, fine shipping facilities are offered, both by boat and train, while electric lines are being extended so as to reach and open up large areas not previously available.

The first regular Maine nursery was probably located in the town of Orrington, then a part of Buckstown, between 1804 and 1812, by Ephraim Goodale.

Among those who were influential in the development of Maine horticulture may be mentioned the following: Benjamin and Charles Vaughan, pioneer nurserymen; Ezekial Holmes, the "Father of Aroostook;" Z. A. Gilbert; S. L. Goodale, nurseryman at Saco; D. H. Knowlton, authority on fruits; W. M. Munson, professor of horticulture; Phineas Whittier, the "apple king of Maine;" H. L. Deland, fruit-grower; James Nutting, fruit-grower; Captain Elijah Low, plum-grower; G. B. Sawyer, one of the pioneers for better fruit in Maine; E. K. Whitney, expert at grafting; Solon Chase, "the Spy king;" Frederick Hobbs, grape specialist.



2487. Maine, showing three agricultural divisions; horticultural part is the shaded area.

Public-service agencies for horticulture

The first agricultural school in the United States was established in Gardiner, Maine, in 1821, called the "Gardiner Lyceum." This institution flourished until state aid was withdrawn in 1835.

The land-grant college was established in Orono in 1864 as "The State College of Agriculture and Mechanic Arts." The name was changed in 1897 to the "University of Maine." There are three members of the horticultural staff.

The Experiment Station was established in 1885 as a department of the University. The state owns two experimental farms, one situated in the town of Monmouth in Kennebec County, used particularly for work with apples, corn, and small grains. The other is situated in the town of Presque Isle, in Aroostook County, used especially for studies with potatoes, small grains and grasses. These are under the supervision of the Experiment Station. The staff of the Experiment

Station is a strong factor in the line of horticultural progress in the state, especially in plant-breeding, with such crops as potatoes, corn, oats, beans and fruits; plant pathology, rendering great aid in identifying plant diseases and giving directions for their control; entomology, where expert advice is given, by means of bulletins on insect pests of the farm, garden and orchard.

About fifteen of the secondary schools in the state are offering courses in horticulture.

The State Department of Agriculture at Augusta has charge of all the nursery inspection work of the state and also holds orchard demonstrations.

The Extension Department of the University was organized in 1907, and work is now being carried on in nine out of the sixteen counties. Farmers' institutes are also held by the Department of Agriculture.

The Maine State Pomological Society was organized in 1873 and has had a great influence on the horticulture of the state. There are nine local fruit-growers' associations which are doing good work for better fruit for Maine. The Maine Seed Improvement Association was organized in 1910. The Gardeners' Union of Lewiston and Auburn was organized in 1914 to promote horticultural interests. The Maine State Florists' Society was organized in March, 1915. The leading establishments in the state are located at Portland, Bar Harbor, Lewiston, Augusta, Bath, Bangor, Biddeford, Waterville, Freeport, Yarmouth, and Houlton.

Statistics (*Thirteenth Census*).

The approximate land area in 1909 was 19,132,800 acres. The land in farms was 6,296,859 acres or 32.9 per cent of the land area. The improved acreage in farms in 1909 was 2,360,657; the woodland in farms, 2,775,621; and other unimproved land in farms, 1,160,581. The total number of farms in 1910 was 60,016, the average acreage a farm being 104.9. [The total area of Maine is 33,040 square miles.]

The leading agricultural crops are hay and forage, forest products of the farms, and cereals. In 1909 hay and forage occupied 1,255,011 acres, or 53.2 per cent of the improved land area. The value of the products in 1909 was $15,115,821, which was 38.4 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was $5,573,763, as compared with $2,652,252, their value in 1899. Cereals occupied 159,616 acres in 1909, the value of the production being $3,100,902.

Horticultural products grown are tree-fruits and nuts, small-fruits, potatoes and other vegetables, and flower and nursery products. The value of the fruits and nuts in 1909 was $2,215,116, as compared with $841,811 in 1899, an increase of 163.1 per cent. Small-fruits decreased in acreage from 1,585 in 1899 to 1,260 in 1909, when the value of the products was $233,124. The total acreage of vegetables, including potatoes, was 161,087, and their value $12,377,717. This was a marked increase over the acreage in 1899 when it was 91,777. The acreage of flowers and plants and nursery products decreased from 178 in 1899 to 169 in 1909, when the value of the production was $324,249.

The total quantity of orchard fruits produced in 1909 was 3,694,251 bushels, valued at $2,207,748. This was a marked increase over 1899, when the value of orchard fruits was $834,000. In 1909 apples contributed over 98 per cent of the total quantity; pears and plums and prunes most of the remainder. The number of bearing apple trees in 1910 was 3,476,616; those not of bearing age 1,045,123. The production in 1909 was 3,636,181 bushels of apples, valued at $2,121,816. The number of pear trees of bearing age in 1910 was 46,683; those not of bearing age, 13,013. The production in 1909 was 38,964 bushels, valued at $43,524. The plum and prune trees of bearing age in 1910 numbered 43,576; those not of bearing age, 22,491. The production in 1909 was 14,637 bushels, valued at $31,954. The more important of the other orchard fruits were 2,403 bushels of cherries, valued at $7,164; 2,014 bushels of peaches and nectarines, valued at $3,205; and small quantities of apricots and quinces, valued at less than $100.

The production of grapes is relatively unimportant in Maine. The total production in 1909 was 231,529 pounds, valued at $6,954. The vines of bearing age in 1910 numbered 9,731; and those not of bearing age 1,944.

Few nuts are grown in Maine. The total production of nuts in 1909 was 12,922 pounds, valued at $414. The value of the different nuts were as follows: butternuts, $152; chestnuts, $100; oil-nuts, $60; and black walnuts, $50.

Strawberries are by far the most important of the small-fruits grown in Maine, with raspberries and loganberries second in importance, closely followed by blackberries and dewberries. The acreage of strawberries increased from 512 in 1899 to 698 in 1909, when the production was 1,626,250 quarts, valued at $168,847. The acreage of raspberries and loganberries decreased from 131 in 1899 to 127 in 1909, when the production was 154,121 quarts, valued at $20,657. The acreage of blackberries and dewberries increased from 123 acres in 1899 to 145 in 1909, when the production was 153,816 quarts, valued at $15,931. The production of cranberries in 1909 was 100,192 quarts, valued at $7,957; that of currants, 76,031 quarts, valued at $6,986; and that of gooseberries, 65,867 quarts, valued at $5,881.

The potatoes are by far the most important of the vegetables. The acreage increased from 71,765 in 1899 to 135,799 in 1909, an increased acreage of 89.2 per cent. The production in 1909 was 28,556,837 bushels, valued at $10,224,714, which was 26 per cent of the total value of all crops. Other vegetables increased in acreage from 20,012 in 1899 to 25,288 in 1909, when the value of the products was $2,153,003. The more important of these vegetables were: 8,693 acres of sweet corn, valued at $272,614; 353 acres of cabbage, valued at $71,434; 472 acres of turnips, valued at $42,585; 257 acres of green peas, valued at $29,747; 201 acres of squash valued at $22,460; 60 acres of tomatoes, valued at $9,728; and 31 acres of cucumbers, valued at $8,185. Other vegetables grown were green beans, beets, carrots, cauliflower, celery, lettuce, onions, radishes.

The acreage devoted to the growing of flowers and plants increased from 71 in 1899 to 112 in 1909. The total area under glass at this time was 706,917 square feet, of which 624,472 were covered by greenhouses, and 82,445 by sashes and frames. The total value of the flowers and plants produced in 1909 was $301,005.

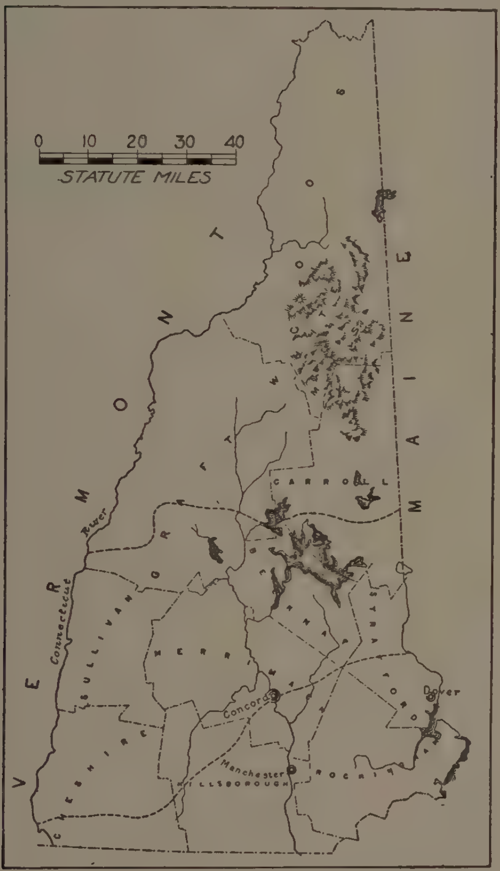
The acreage of nursery products, on the other hand, decreased from 107 in 1899 to 57 in 1909, a decrease of 46.7 per cent. The value of the nursery products in 1909 was $23,244, as compared with $46,207 in 1899.

E. F. Hitchings.

New Hampshire.

The soil of New Hampshire (Fig. 2488) is very variable. In fact there are practically no large continuous areas of any single type, and nearly every farm has several soil-types on it. In the main the soils are of granitic origin, being the result of glacial action together with a partial reworking of the glacial deposits by rivers and streams. Within narrow limits can be found all gradations of soil from sand to pure boulder clay, and they mostly carry a relatively high percentage of potash. In only a few sections of the state is any limestone soil found and the areas are rather limited. The soils of the valleys, coastal plains, and rounded hills are relatively fertile, but the highlands are rough, rocky, and mountainous and become more rugged as they extend northward until the White Mountains are reached. Roughly speaking, there is a high ridge, mountainous in parts, extending from the Massachusetts line on the south to the White Mountains on the north and which lies a little west of the central part of the state. This ridge is the watershed between the Connecticut River on the west and the Merrimac River to the east. It is on the east and south sides of this ridge that many of the best orchards of the state are located and an exceptionally fine type of apple, especially Baldwin, is grown in these locations.

The state may be divided into three sections, horticulturally, as shown in the accompanying map. In the lower section are found by far the largest fruit interests and north of this line there is practically none of the so-called tender fruits, such as peaches. In the central section, the apple and pear thrive and the opportunities for further development of the industry are excellent. The price of good apple land is reasonable and by means of the higher land a long-keeping, high-colored apple is produced. North of this central section there is little development of horticultural interests, although along the Connecticut River on the west and in northern Coos County to the north of the White Mountains, the hardier varieties of apples and small-fruits may be grown.



2488. New Hampshire, showing three agricultural divisions.

While the average rainfall for the state is 40 inches, the past few seasons have been much below this figure as recorded at Durham. In 1913, the rainfall for the year was 30 inches and in 1914, 31 inches.

The apple is the principal fruit grown in the state and may be said to be the leading horticultural product. The fruit thrives naturally throughout the southern half of the state as indicated by the large number of seedling trees that spring up through the open fields and along the fences. In fact, many of the bearing trees (especially the older orchards) are these seedling trees top-grafted to desirable varieties. It is a common sight in New Hampshire to see the apple trees planted along the stone walls or as scattered trees about the farms, rather than planted in orchards. This, however, is not true of the younger plantings.

Like most other sections of the country, there is a greatly renewed interest in the fruit business and a large number of trees have been planted in the past ten years. Also, many non-residents are planting a part of the farms about their summer homes to apples. In 1913, New Hampshire was awarded the first prize on her state exhibit of apples in competition with the other New England states, and several times New Hampshire Baldwins have won the sweepstakes prize at the New England Fruit Show. The commercial outlook for fruit-growing in the state is bright and the fact that some of the best markets in the country are practically at its door has stimulated much of the planting. Many growers ship exclusively to foreign markets and it is a short haul to place the fruit on the steamship pier at either Boston or Portland.

Modern methods of orchard management are being used by the progressive growers, a number are packing their apples in boxes and realizing the highest prices for them; power spray outfits are in use in a number of sections and proper cultural methods are being practised by more growers each year. But, notwithstanding this renewed interest, in many sections it must be noted that the older orchards are dying at an alarming rate; especially is this true in the southeastern part of the state. Many are cutting out their trees, deeming them worthless and impossible of renovation. The primary causes of this general dying of the old trees are the insect pests which have been defoliating the trees year after year and the fact that they are standing in sod and receive no stimulation of any kind. The brown-tail and gypsy moths are the most serious insects in the state and both feed freely on the apple trees. It is not difficult to control them in the orchard, and continued education and demonstration should do much to check their ravages. It is a more difficult matter to introduce tillage methods for the apple, partly because the growers fear the lack of color which commonly results and also because the trees are often scattered or along fences as above mentioned. Several notable examples in the state of the good results of orchard cultivation are having their effect and many of the young orchards are being tilled.

The varieties most commonly grown are Baldwin, Rhode Island Greening, Northern Spy, Fameuse, Blue Pearmain, King, and McIntosh. The last-named variety has been more largely planted than any other in recent years. In some sections the Nodhead or Jewetts Red is grown largely, also the Roxbury Russet, Gravenstein, Hubbardston, Wealthy, Porter, Tolman Sweet, Bethel, Twenty Ounce, and many of the older varieties. Among the newer plantings are found considerable numbers of Delicious, Stayman and Winter Banana, but their adaptability to this section has not been established.

Plums are grown only in a limited way and they are mostly of the Japanese varieties. The domesticas have been abandoned largely because of the prevalence of black-knot. The Abundance, Burbank, Chabot, and Red June are the varieties commonly grown and they are able to withstand the winters to a sufficient degree to warrant their recommendation.

Peaches are successfully grown in several sections, notably about Portsmouth, Rochester, Derry, Wilton, Lyndeboro, and Milford. Instances are reported on good authority of obtaining nineteen successive crops, but this is quite unusual, possibly three out of five being nearer the average of the more favored regions. Practically all the peach orchards are cultivated, and crim son clover and buckwheat are favored cover-crops. Peach-leaf curl is found to a sufficient extent to necessitate spraying for its control, but peach "yellows" is not known to exist and brown-rot causes very little trouble. San José scale is found in a few places. The varieties commonly grown are Greensboro, Carman, Mountain Rose, Early Crawford, Champion, Belle of Georgia, Elberta and Late Crawford. The Elberta is more largely grown than any other.

Cherries are grown in a very limited way, there being no orchard of any size, although both the Early Richmond and Montmorency do well. Pears are receiving very little attention at present.

The grape is planted in a few sections but the season is rather short to insure their proper maturity. The Concord, Worden, Delaware, Brighton, and Niagara are mostly grown.

Of the cultivated small-fruits, the strawberry and red raspberry are grown more largely than the others. There is an increasing demand for small-fruits throughout the state as a result of the ever-increasing number of tourists and summer residents. This phase of horticultural development offers good returns, especially where it is possible to practise irrigation.

By far the most important small-fruit, however, is the blueberry. The season extends from early July until mid-September. There are no statistics as to the actual quantity of blueberries produced in the state, but it is safe to say that it is several times greater than the quantity of strawberries. The low-bush blueberry is the earliest in ripening its fruit, followed by the medium and high-bush types. Probably two-thirds of the total crop are from the low-bush plants. New Hampshire and Massachusetts blueberries bring the highest prices on the Boston market. This is due to the fact that the berries are largely of the high-quality low-bush type and are almost all hand-picked. The low-bush blueberries are found mostly on fine, sandy, peaty soils on high lands. In many instances, the sides and rounded tops of hills in the southern and central parts of the state are covered with practically a pure stand of low-bush blueberries; on other hills it occurs in open spaces between clumps of the wild ground juniper and native wild spireas. The high and intermediate bush types are also found on high land but are more common on lower areas and on soils containing more moisture. A very limited start has been made in the cultivation of the high-bush blueberry. The low-bush type produces its finest fruit most abundantly on plants two and three years old, hence it is a common practice among owners of low-bush pastures to burn over a portion of the bushes each spring. Large shipping centers are the towns of South Lyndeboro, Greenfield, Alton and Milton, but almost all towns in the southern and central parts of the state ship at least in small quantities. They are usually marketed in the thirty-two-quart strawberry crates. The Boston dealers make a uniform charge of 2 cents a quart for selling, and the freight to Boston from most points in New Hampshire is 15 to 20 cents a crate. As a rule, the average price nets from 12 to 16 cents a quart at the first of the season and 8 to 10 cents a quart at the end of the season.

Market-gardening has been neglected in the past few years and as a result a large percentage of green stuff is shipped in from Boston, except in the height of the season. However, about Portsmouth and Dover and in the Merrimac Valley, considerable trucking is carried on. The Skinner system of irrigation is used in these sections and auto-trucks are used to some extent to market their product. Very little is done in growing vegetables under glass to supply the winter demands and most of the greenhouse vegetables are shipped in from Massachusetts.

Most of the greenhouses are found near the larger towns and cities and are mostly devoted to the growing of flowers. Roses are grown in a large way near Exeter and Dover. The growers attribute their success to the type of soil in these sections. One grower at Exeter has 96,000 feet of glass and another near Dover has 153,000 feet, all of which is devoted exclusively to the growing of roses for the Boston trade. The varieties grown are White and Pink Killarney, Killarney Brilliant, Ward, Richmond, and Sunburst.

Some very good examples of landscape gardening are to be found about Dublin and Peterborough. Most of the estates are owned by summer residents. In many other sections of the state this art is being manifested and considerable money has been expended in beautifying the estates. About the numerous summer hotels through the mountains may be seen some good examples of the landscape art. The farm homes are kept up unusually well. Most of the houses are large and the buildings are kept well painted. Many artistic libraries and churches are to be found in the rural districts.

A few varieties of apples have originated in New Hampshire which have become distributed to some extent throughout eastern United States. Among the best known of these are the Granite Beauty, Milden, Piper, and Red Russet.

Historically, New Hampshire can lay claim to an early recognition of the possibilities of growing fruit-trees and vines. In 1623, Ambrose Gibbons set the first vineyard, together with other fruits, near the mouth of the Piscataqua river near Portsmouth. There are many such old horticultural landmarks.

Many of the early settlers came from the southwestern counties of England. To them cider and perry seemed almost as necessary as food, and very soon after their arrival they began to set orchards of apples and pears. Their particular object was not the fruit itself, but the beverages made from it. The following item is taken from one of the many town histories that have been published in New Hampshire, and although it may be slightly exaggerated, it gives some idea of the apple industry one hundred years ago:

"About this time—1800 to 1810—the apple orchards in town which had been early set out, produced apples in abundance, which were made into cider. Every man had his orchard, and every tenth man his cider-mill. Every well-to-do farmer put into his cellar yearly from twenty to fifty barrels of cider which was all drunk on the premises. Col. John Bellows had an orchard of 30 acres, the largest in town. In 1805 there were 4,800 barrels of cider made and every drop drunk in town."

Public-service agencies for horticulture.

The New Hampshire College of Agriculture and the Mechanic Arts was created by an act of the Legislature in 1866 and was established at Hanover as a state institution, in connection with Dartmouth College. In 1893 the College was moved from Hanover to Durham. This action followed the death of Benjamin Thompson, of Durham, a farmer, who died January 30, 1890, and left his entire estate, with a few minor reservations, to the college. A department of horticulture was established in 1895, and at the present time there are five members of the horticultural staff, which includes one instructor who devotes his entire time to extension work.

The Experiment Station is located at Durham in connection with the Agricultural College. It was established in 1887. There are sixteen members of the staff at the present time, representing nine departments. The horticultural department has leased a Baldwin apple orchard near Durham for experimental purposes. There have been issued twenty-five bulletins on horticultural subjects.

The extension work in New Hampshire may be said to have had its real beginning in September, 1911. Among the activities of the extension service, the horticultural department has been carrying on some special demonstration work in several orchards.

The New Hampshire Horticultural Society was organized in 1893. It is in a prosperous condition.

There is a law in the state providing for the inspection of nursery stock, also a State Moth Department which has under its control the state and federal activities in the control of the gypsy and brown-tail moths.

Statistics (Thirteenth Census).

The approximate land area of New Hampshire in 1910 was 5,779,840 acres. The land in farms was 3,249,458 acres, or 56.2 per cent of the land area. Of this land in farms, 929,185 acres were improved; 1,502,389 were in woodland; and 817,884 acres other unimproved land in farms. The number of all the farms in 1910 was 27,053, and the average acreage to the farm 120.1. [The total area of the state is 9,341 square miles.]

The leading agricultural crops of the state are hay and forage, and cereals. The acreage occupied by hay and forage decreased from 615,042 in 1899 to 529,817 in 1909, when the value of the production was $7,846,143. Cereals decreased in acreage for the same period from 42,335 in 1899 to 32,928 in 1909, when their value was $879,631. The value of forest products of the farms in 1909 was $3,610,178, as compared with $2,296,265 in 1899.

Horticultural crops grown in New Hampshire are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $734,387 as compared with $728,520 in 1899. Small-fruits decreased in acreage from 730 in 1899 to 618 in 1909, when the production was 998,244 quarts, valued at $107,365. In 1909 the total acreage of potatoes and other vegetables was 26,225 and their value $2,276,177. Excluding potatoes, the acreage of other vegetables increased from 7,357 in 1899 to 8,855 in 1909 when the production was valued at $1,071,551. The acreage devoted to flowers and plants and nursery products increased from 72 in 1899 to 117 in 1909, when the production was valued at $248,041.

The production of all the orchard fruits in 1909 was 1,165,044 bushels, a decrease of 42.3 per cent from the production in 1899. In 1909 apples constituted more than 95 per cent of the total production, and peaches and nectarines and pears most of the remainder. The production of apples in 1909 was 1,108,424 bushels, valued at $637,990. The number of apple trees of bearing age in 1910 was 1,240,885; those not of bearing age 207,289. The production of peaches and nectarines in 1909 was 23,218 bushels, valued at $37,884. The peach and nectarine trees of bearing age in 1910 numbered 57,571; those not of bearing age 35,213. The production of pears in 1909 was 24,224 bushels, valued at $25,206. The number of pear trees of bearing age was 36,816 and those not of bearing age 9,397. There were also produced in 1909: 7,542 bushels of plums and prunes, valued at $14,039; 1,403 bushels of cherries, valued at $4,133; quinces, to the value of $456; and apricots, to the value of $68.

The production of grapes and nuts in New Hampshire in 1909 was relatively unimportant. Grapes produced 375,164 pounds, as compared with 487,500 pounds in 1899. Their value in 1909 was $10,926. The production of nuts in 1909 amounted to 254,521 pounds, valued at $3,684. The nuts produced were 217,431 pounds of butternuts, valued at $2,597; 13,330 pounds of black walnuts, valued at $375; 8,446 pounds of hickory-nuts, valued at $303; and 5,479 pounds of chestnuts, valued at $242.

Of the small-fruits grown in New Hampshire, strawberries are the most important, with raspberries and loganberries ranking next. Strawberries increased in acreage from 307 in 1899 to 310 in 1909 when the production was 638,057 quarts, valued at $68,552. Raspberries and loganberries increased in acreage from 80 in 1899 to 85 in 1909, when the production was 86,558 quarts, valued at $11,821. Other berries produced in 1909 were 75,913 quarts of blackberries and dewberries, valued at $7,793; 43,319 quarts of currants, valued at $4,587; 30,304 quarts of cranberries, valued at $2,686; and 5,841 quarts of gooseberries, valued at $683.

The acreage devoted to potatoes in New Hampshire decreased from 19,422 in 1899 to 17,370 in 1909, when the production was 2,360,241 bushels, valued at $1,204,626. Excluding potatoes, the more important of the other vegetables produced in 1909 were 589 acres of sweet corn, valued at $28,835; 163 acres of cabbage, valued at $21,184; 51 acres of tomatoes, valued at $7,143; 68 acres of turnips, valued at $6,832; and 29 acres of onions, valued at $6,560. Vegetables of minor importance in 1909 were asparagus, green beans, beets, carrots, celery, cucumbers, green peas, squashes.

The raising of flowers and plant and nursery products is of little importance in New Hampshire. The acreage devoted to flowers and plants in 1909 was 93, as compared with 38 in 1899. The total area under glass in 1909 was 752,313 square feet, of which 719,848 were covered by greenhouses and 32,465 by sashes and frames. The value of flowers and plants produced in 1909 was $236,144. The acreage devoted to nursery products decreased from 34 in 1899 to 24 in 1909, when the production was valued at $11,897, as compared with $7,012 in 1899.

J. H. Gourley.

Vermont.

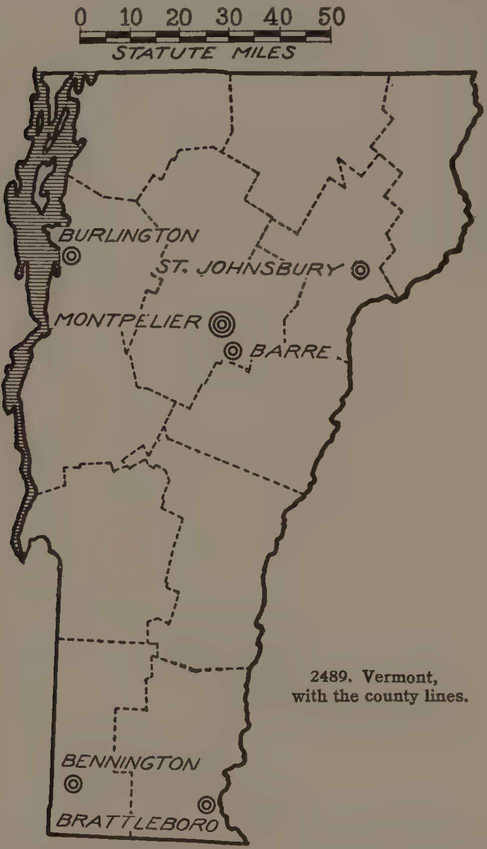
Vermont (Fig. 2489) is not and never will be a great horticultural state. Aside from the apple, strawberry, onion, and potato, the cultivable land is largely devoted to farm crops and dairying. The Champlain and Connecticut valleys are well adapted to fruit and vegetable crops. Apple orcharding throughout the state, but especially in sections noted above, offers the best opportunity. Much of the hill-town land should revert to forests.

In general, the soils of Vermont are well adapted to the culture of orchard-fruits. The limestone and granitic soils, especially on the west side, seem particularly fitted to the development of a thrifty long-lived tree. With but few exceptions, the soil is deep and retentive of moisture. The necessity for irrigation is the exception rather than the rule. Drainage is seldom necessary for orchard plantations; although for small-fruits and vegetables, tiling is desirable. Cover-crops are not used to the extent which their merit justifies.

The home markets for fruit and vegetables are unusually good. Strawberries rarely sell for less than 12½ cents a quart, and the average price for good fruit is probably nearer 15 cents. Blackberries usually bring 10 cents, and raspberries 10 to 20 cents. Cherries can generally be bought, the price being $3 to $4 a bushel. Good vegetables sell equally well. With such favorable markets, supported by numerous small manufacturing villages and a horde of summer boarders, horticultural industries certainly ought to thrive.

The horticultural regions of Vermont are, roughly, three. The first and most important is the Champlain Valley district, including several large islands in Lake Champlain. This region reaches toward Montreal on the north; and the general character of its horticulture is much like that in the St. Lawrence Valley between Montreal and Lake Ontario. Winter apples are the most important crop in this section. The second region lies in the southwestern part of the state and belongs to the upper Hudson Valley. Apples will grow readily when properly attended, but they are seldom cared for. Greater success is secured with small-fruits, the growing of which is greatly encouraged by the large annual immigration of summer residents. The third district comprises the valley of the Connecticut. It is the least developed of the three, horticulturally. The reason for this is not plain. Soil and climate are admirably adapted to all sorts of fruits. Even peaches are successfully grown in orchards. The few men who grow plums, cherries, strawberries, and so on, are proving every year that the Connecticut Valley in Vermont is naturally as much a fruit region as any other.

The apple crop in Vermont is fast assuming commercial proportions. There are many large orchards in every county, and in almost every town. Commercial orcharding is best developed on the western border, including the Champlain Valley, and extending southward to Bennington, where there is a 300-acre orchard. The market varieties are Rhode Island Greening, Northern Spy, Baldwin, Wealthy, Fameuse and McIntosh. The old family orchards of innumerable inferior varieties are rapidly disappearing through old age and neglect. The greatest plantings of apple trees in a generation have been made since 1910. Vermont has had experience with the Russian apples, T. H. Hoskins, of Newport, on the northern boundary of the state, having been one of the most famous experimenters. Nevertheless, the Russian varieties have made small impression on the pomology of the state.



2489. Vermont, with the county lines.

In all probability there are more extensive orchards in Vermont than in any other New England state. In 1870, the notable orchard of C. T. Holmes, of Charlotte, which embraces 105 acres, was set mostly to Rhode Island Greenings. In 1880, the famous Richford orchard in Highgate was set to a single variety,—Fameuse. Within a few years other orchards of similar proportions have been set. The most famous apple section of Vermont is in Grand Isle County, known to commercial men as the "Island Apple County." Grand Isle, which is the smallest county in the state, is the most important commercial apple section by reason of the small population and the relatively large proportion of the crop that is shipped out of the state. Each of the three separate islands of the county are entirely surrounded by the waters of Lake Champlain and enjoy thereby greater immunity from frost than other sections of the state. The first large orchard in the county (also in the state) was set in 1819, and embraced 20 acres, all of cider-apple stock which sold for 10 cents a bushel to French people from Canada. In 1848 and 1864 other large orchards were set, and in 1870 the work of planting trees was widespread. In 1912, the Eastern Fruit and Nut Orchard Company started its 215-acre orchard, which is interplanted with plums, cherries, and fillers. It is doubtful whether any region can produce apples of finer appearance, better quality or greater durability, than can be produced in Grand Isle, Vermont.

Plums are grown just enough to prove that they will succeed admirably. Lombard, Green Gage, Bradshaw, the Damsons and other old-fashioned sorts still retain preference of conservative Vermonters, although other growers are planting chiefly of the Japanese varieties, especially Burbank and Abundance. In the northern and mountain towns, only the americana and nigra types are hardy; but even these are seldom grown.

Pears have no commercial importance in the state. The localized orchards of a generation ago were swept out by the pear-blight, and the plantings replaced with apples. With proper care, the hardy varieties succeed.

Among cherries, Morello, Montmorency and Richmond are favorites. Raspberries are mostly red, the black berries being seldom grown. Cuthbert is the leading variety, though Schaffer and Columbian are gaining rapidly. Blackberries are carefully grown usually. Fine blueberries are picked from the fields in considerable quantities. Early varieties of grapes can be ripened for home use, Concord, Worden, Moore Early, Green Mountain and Delaware being leading varieties.

Vermont is remarkably free from many noxious insects and serious diseases. The area infected with San José scale is confined to a few towns in a single county in southeastern Vermont. The gypsy moth does not as yet occur in the state; and the brown-tail moth area is restricted to the southern and eastern borders, and further extension is being combated with vigor. Apple blotch and bitter-rot are not known to occur in the state. Crown-gall and hairy-root diseases are rare.

Truck-gardening is practised in the neighborhood of all the principal cities; but it cannot be said to be a well-managed business. Those crops which grow in special perfection are beans, potatoes, peas and tomatoes, salsify and parsnip. Those which cannot be grown, or which are, as a rule, unsuccessful, are melons, okra, sweet potatoes, and lima beans. Special crops which are sometimes grown in quantities for export are seed peas, white beans and onions.

On account of the long cold winter and the short and cloudy days of that season, the greenhouse industries have developed slowly. Notwithstanding this fact, many towns make demands for greenhouse products and every city in the state supports two or more greenhouses, devoted mostly to carnations, roses, chrysanthemums, lilies, and pot-plants.

There are three commercial nurseries in Vermont. One at Charlotte specializes in hardy ornamental shrubbery, and those at Waterville and Beebe Plains are apple nurseries.

Some very good examples of landscape gardening may be found about Bennington, Manchester, Shelburne, Burlington, and Woodstock, many of which are summer homes of city people. Island and shore camps in the Champlain district are especially attractive.

Several Vermonters of an earlier generation who were influential in either developing new horticultural varieties or testing the adaptability of varieties from other countries, were: C. E. Goodrich, originator of the Garnet Chile potato, and introducer of the Amazon, Calico, Cuzco, Central City, Rust Coat, and Pink

Eye potatoes; Albert Breese, of Hubbardston, originator of the Early Rose potato; Cyrus Pringle, of Charlotte, a scientific plant-breeder and eminent botanist (see Volume III, page 1591); E. C. Brownell, originator of the Brownell Best, Beauty, Eureka, Superior, and Winner varieties of potato; Albert Rand, originator of the Rand Peachblow potato, thought by some to be the Perfect or Improved Peachblow; and T. H. Hoskins, Newport, in the northern part of the state.

Public-service agencies for horticulture.

The Agricultural College of Vermont is located in Burlington, and is an integral part of the University of Vermont. In 1862 the Legislature chartered the Vermont Agricultural College, but it was not until 1865 that it was incorporated with the University. Instruction in horticulture was not begun until 1874, and in 1890 the department was established for instruction to students in the four-year course. The teaching is carried by one professor.

The Experiment Station is a part of the University and is coördinate with the College of Agriculture. There are three members of the horticultural staff. Twelve bulletins have been published on horticultural subjects, aside from annual report articles.

There are two state schools of agriculture, located at Randolph and Lyndon Center, where courses in horticulture are given. As a separate subject, horticulture is not taught in the public schools, although it receives some attention in a general agricultural course which is now offered in six public schools.

There is no state department of horticulture, although the State Commissioner of Agriculture devotes some time to horticultural welfare work. The inspector of nurseries is appointed by the Commissioner of Agriculture. An expert entomologist, similarly appointed has charge of the suppression of especially noxious insects.

Extension work in horticulture is carried on in connection with the College of Agriculture. The Vermont State Horticultural Society, organized in 1896, is also furthering the horticultural interests in the state.

Statistics (*Thirteenth Census*).

The approximate land area of Vermont in 1910 was 5,839,360 acres. The land in farms was 79.9 per cent of this area or 4,663,577 acres. Of this land in farms, the improved land numbered 1,633,965 acres; the woodland, 1,566,698 acres; and other unimproved land in farms, 1,462,914 acres. The total number of farms in Vermont in 1910 was 32,709, and the average acreage to the farm, 142.6. [The total area is 9,564 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage devoted to the production of hay and forage increased from 1,006,375 in 1899 to 1,030,618 in 1909, when the production was valued at $16,335,530, which was 54.9 per cent of the total value of all crops. Cereals decreased in acreage from 160,127 in 1899 to 134,611 in 1909, when the production was valued at $2,651,877. Forest products of the farms in 1909 were valued at $3,638,537, as compared with $2,108,518 in 1899.

Horticultural crops grown in Vermont are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $818,851, as compared with $459,508, in 1899. Small-fruits increased in acreage from 418 in 1899 to 469 in 1909, when the production was 826,122 quarts, valued at $92,030. The total acreage of potatoes and other vegetables grown in 1909 was 35,408, and their value, $2,615,299. Excluding potatoes, the acreage of the other vegetables increased from 5,131 in 1899 to 8,548 in 1909, when the value of the production was $872,183. Flowers and plants and nursery products decreased in acreage from 112 in 1899 to 60 in 1909, when the production was valued at $89,740.

The total quantity of orchard-fruits produced in 1909 was 1,492,499 bushels, valued at $801,365. Apples contributed nearly all this quantity, and pears most of the remainder. Apple trees of bearing age in 1910 numbered 1,183,529; those not of bearing age, 219,833. The production in 1909 was 1,459,689 bushels, valued at $752,337. Pear trees of bearing age in 1910 numbered 26,315; those not of bearing age, 7,726. The production of pears in 1909 was 20,763 bushels, valued at $23,788. Other orchard-fruits produced in 1909 were: 7,205 bushels of plums and prunes, valued at $12,927; 2,506 bushels of cherries, valued at $7,651; 2,221 bushels of peaches and nectarines, valued at $4,399; and minor quantities of quinces and apricots.

The grape-production in 1909 was 203,011 pounds, valued at $6,328. The grape-vines of bearing age in 1910 numbered 9,318; those not of bearing age, 1,845.

The production of nuts in 1909 was 891,825 pounds, valued at $11,158. Butternuts were the most important of the nuts in 1909, the production being 845,899 pounds, valued at $9,872. Other nuts produced were: 32,910 pounds of black walnuts, valued at $725; 9,516 pounds of hickory-nuts, valued at $410; and 3,350 pounds of chestnuts, valued at $149.

Of the small-fruits grown in Vermont, strawberries are the most important, with raspberries and loganberries ranking next. The acreage devoted to the production of strawberries increased from 232 in 1899 to 276 in 1909, when the production was 615,820 quarts, valued at $68,690. Raspberries and loganberries decreased in acreage from 92 in 1899 to 80 in 1909, when the production was 85,065 quarts, valued at $10,596. Blackberries and dewberries decreased in acreage from 48 in 1899 to 47 in 1909, when the production was 56,252 quarts, valued at $6,032. Currants increased in acreage from 30 in 1899 to 58 in 1909, when the production was 58,533 quarts, valued at $5,684. In addition, there were produced in 1909, 7,424 quarts of gooseberries, valued at $728, and 1,120 quarts of cranberries, valued at $110.

Potatoes, the most important of the vegetables grown in Vermont, decreased in acreage from 28,353 in 1899 to 26,859 in 1909, when the production was 4,145,630 bushels, valued at $1,743,049. The more important of the other vegetables produced in 1909 were: 1,110 acres of sweet corn, valued at $35,650; 98 acres of cabbage, valued at $16,263; 29 acres of onions, valued at $6,780; 64 acres of turnips, valued at $6,543; 18 acres of tomatoes, valued at $4,236; 31 acres of cantaloupes and muskmelons, valued at $4,082; 39 acres of green peas, at $2,615; and 24 acres of beans, valued at $1,587.

The acreage devoted to the production of flowers and plants, decreased from 38 in 1899 to 23 in 1909. The area under glass in 1909 was 178,199 square feet, of which 162,339 were covered by greenhouses, and 15,860 by sashes and frames. The value of the flowers and plants produced in 1909 was $78,726, as compared with $58,575 in 1899.

Nursery products decreased in acreage from 74 in 1899 to 37 in 1909. The value of the nursery products in 1909 was $11,014, while their value in 1899 was $49,625.

M. B. Cummings.

Massachusetts.

The horticultural interests of Massachusetts (Fig. 2490) are fully equal to those of agriculture proper, when one considers the production of fruits, vegetables, flowers, and the labor and expense applied to the growth of ornamental trees, shrubs and plants and their use in decorating the homes, among which there are probably more comfortable, well-kept and beautiful homes than can be found in any similar area in the world. The people of this state probably consume more of the luxuries of life than any other people on the same area, and among the so-called luxuries may be classed fruits, fancy vegetables, and flowers.

The soil of Massachusetts is generally considered unproductive and poorly adapted to horticultural pursuits, and this is true in so far as it refers to large areas of exceptionally fertile land, of which that in the Connecticut Valley is the only section of more than a few acres in extent. Everywhere about the state, however, there are small areas of land suited to the growth of almost every crop succeeding in similar latitudes. By business enterprise, persistent effort, and skill, profitable horticultural crops can be grown. The local products largely supply the markets in their season. Apples are also exported.

There are no large areas devoted to the growth of either orchard- or small-fruits in Massachusetts, but small areas of nearly all these fruits are very profitably grown in most sections of the state. The amount of fruit produced within the limits of the state is not nearly up to the home consumption, except cranberries, and possibly the apple in some seasons. Even in seasons of an unusual crop in the state, large quantities of apples from other states are shipped into our markets, because in many cases they are of superior size and beauty.

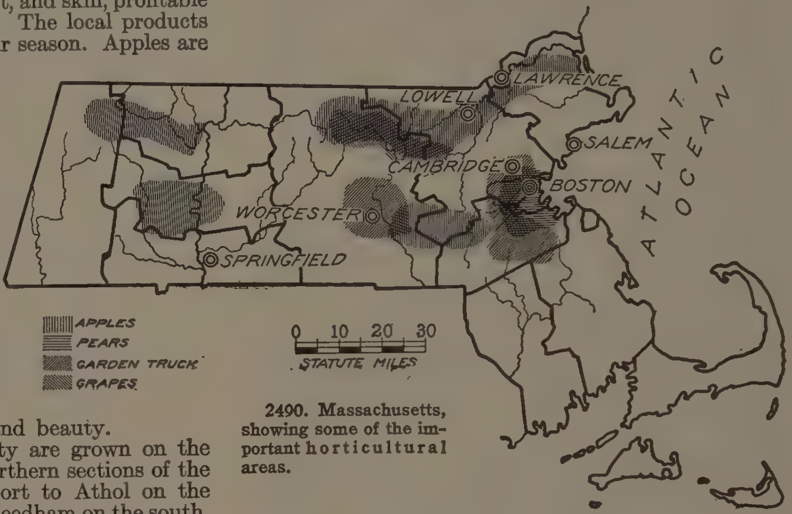
Apples of especially fine quality are grown on the granite soils of the middle and northern sections of the state, extending from Newburyport to Athol on the north, and from Northbridge to Needham on the south, and a small area in the Connecticut Valley.

Pears are grown in small areas within a short radius of most of the cities and large towns, eastern Massachusetts being particularly adapted to this fruit. Pears are also shipped into our markets from the southern states and California, and as the market for this fruit is limited, prices often rule very low.

Peaches of the finest quality are profitably grown more or less over the entire state on elevated land with a northern, northwestern, or northeastern exposure. On low land and that with a southern exposure the fruit-buds are winter-killed three years out of five. However, even under these conditions, when the trees are planted on rather light high land and well cared for, one crop in three years is often more profitable than most other fruit or vegetable crops. The fruit on trees well grown is large, of the finest color and quality, and the fresh, ripe condition in which the grower can put it into the local markets makes it quickly salable at the highest prices. The peach-belt may be included in that of the apple.

Plums are not grown to a great extent, the larger markets being supplied largely by New York and California. Few orchards remain productive longer than ten or twelve years, on account of the black-knot, leaf-blight and brown-rot. Within the past ten or fifteen years both European and Japanese plums have been largely planted, but they succeed only for a short time, except with the best care. They are planted in small numbers in poultry-yards and gardens.

The cherry, owing to the attack of the black aphis, the plum-curculio and brown-rot, is very little grown as an orchard-fruit. A few vigorous and productive trees may be seen here and there by the roadside, about old homesteads or on the lawn, where they live longer and attain greater size than when grown under a high state of cultivation in the garden or orchard, because of the fact that when grown too rapidly the trunks crack on the south side and the trees soon die. Our markets are largely supplied with cherries from California, New York, and other states.



2490. Massachusetts, showing some of the important horticultural areas.

Grapes have been more or less planted from Fitchburg on the north to Concord and Lexington on the south, but succeed only on elevated land with a southern exposure. Only the earliest varieties can be grown unless the fruiting canes are girdled.

Small-fruits are more grown and more nearly supply local markets than do the large fruits, but are grown only on small areas. The supply of very early fruit comes from the southern states of the country, but home-grown fruit is so much superior in quality that it sells at reasonable prices, notwithstanding prices may have been very much reduced by an over-supply of the southern product. Of the small-fruits, the strawberry is the most widely grown. There are no large areas especially devoted to strawberries, but most homes have strawberry-beds of good size. Currants are grown to a considerable extent, almost every garden containing more or less currant bushes for home supply, while many large plantations may be found near every large town or city. The conditions of success are a rather moist, rich soil, with the bushes trained into a very compact form and pruned so that the fruit will be borne on wood that is not over three or four years old. Gooseberries are little grown, although the demand is rather on the increase. The more hardy kinds can be as easily grown as the currant, while the European sorts and their hybrids, many of them, require much care and skill. Like the currant, the blackberry is largely grown for home use, and also for market. It succeeds upon a great variety of soils, can be grown cheaply and sells at good prices. Few plantations will be profitable on the same land more than from five to seven years unless the soil is strong and rich. It is the practice of most growers to plant a new lot every six or seven years. The red raspberry is the most popular of the bush-fruits, and when successfully grown is the most profitable. For success it requires a deep sandy loam, retentive of moisture, but plantations must be renewed after six or eight years' growth on one piece of land. The blackcap raspberry has found less and less favor each year, and can only be sold at very low prices in the city markets.

The business of market-gardening has made rapid strides in the state in the past ten years, and the demand for choice vegetables continues more or less the year round. Even in the matter of competition with vegetables from the South during the winter, the local growers have reached a good degree of success. The truck-gardens are mostly located near large cities where products can be shipped by freight or express. In almost every part of the state may be found forcing-houses for the growth of lettuce, tomatoes, cucumbers, rhubarb, asparagus, and the like, and notwithstanding the cost of such structures and the fuel to keep up the necessary heat, the increase in the number of forcing-houses in the state within the past few years is a certain indication that the business is profitable.

It is perhaps in the growth of cut-flowers and house and decorative plants that Massachusetts excels in horticulture. As a rule, the largest establishments of this kind are located near the large cities, though in some cases they may be found in some of the more rural towns. The horticulturists of Massachusetts understand their advantages in having the best markets in the world at their doors, and a great variety of the soils suitable for the growth of many of the varied crops. By persistent effort and superior skill they could supply these markets largely, and thus retain within the state much of the wealth that now goes outside to pay for the produce that could be raised at home.

In commercial horticulture, Massachusetts is not the equal of some other states, although its market-gardening and floricultural interests are large, but its influence on the horticulture of the country is more important than acres and tonnage. The best horticulture is that which develops under difficulties, because it develops the man. The love of the country and attachment to its own soil are strong in Massachusetts. Individuality has full course. It is a land of home-loving people. It has developed the amateur horticulturist to perfection,—the person who grows the plant and dresses the soil for the very love of it. There are many large collections of choice plants, and great numbers of artistic, compact and tidy garden-homes. There is keen appreciation of the merit of well-grown things. The influence of the Massachusetts Horticultural Society has been incalculable. It is our oldest and strongest geographical organization. Since 1829 it has had its stated discussions, held its periodical shows, collected its library and records. It is a center of education and culture. The establishment of Mt. Auburn Cemetery, Cambridge, in 1831 was the beginning of the movement in this country for cemeteries in the open as distinguished from the churchyard.

A list of persons influential in developing the horticulture of Massachusetts must necessarily be incomplete, as so much amateur and professional interest in horticulture has developed in this state. The following persons, however, may be mentioned: Marshall P. Wilder (see Volume III, page 1603); Robert Manning (page 1587); C. M. Hovey (page 1580); W. C. Strong (page 1598); O. B. Hadwin. W. W. Rawson (page 1593); Jabez Fisher, and many others. "The History of the Massachusetts Horticultural Society," published in 1880, should be consulted for many other personalities.

Public-service agencies for horticulture.

The land-grant college of Massachusetts was established at Amherst in 1865, and opened for work in 1867. There are at present seven members of the horticultural staff.

The Experiment Station is also located at Amherst, being established in 1882. Its horticultural staff numbers fifteen members.

Extension work is also carried on throughout the state. Bureaus are being established in each county, which are giving invaluable aid to the horticulturist.

The State Board of Agriculture supports a series of lectures upon agricultural and horticultural subjects.

Several counties have established agricultural and horticultural schools, and a few of the high-schools are introducing these courses.

Special inspectors are appointed for nursery inspection and the control of insect pests and diseases. There are also special bee inspectors.

Statistics (*Thirteenth Census*).

The approximate land area of Massachusetts in 1910 was 5,144,960 acres. The land in farms numbered 2,875,941 acres, or 55.9 per cent of the land area. The improved land in farms numbered 1,164,501 acres; the woodland in farms 1,064,553; and other unimproved land in farms 646,887. The number of all the farms in 1910 was 36,917; the average acreage to a farm being 77.9. [The total area is 8,266 square miles.]

The leading agricultural crops are cereals, hay and forage, and tobacco. There was a slight increase in the acreage occupied by cereals from 53,385 in 1899 to 55,267 in 1909, when the value of the products from cereals was $1,617,131, or 5.1 per cent of the total value of all crops. The acreage devoted to hay and forage decreased from 610,023 in 1899 to 519,503 in 1909, when the value of the production was $11,280,989, or 35.3 per cent of the total value of all crops. The acreage of tobacco increased from 3,826 acres in 1899 to 5,521 acres in 1909, when the value of the production was $1,218,060. The value of forest products produced on the farms in 1909 was $2,668,410, as compared with $1,944,714, their value in 1899.

Horticultural crops are the fruits and nuts; small-fruits; vegetables, including potatoes; and flowers and plants and nursery products. In 1909 the value of the fruits and nuts produced was $2,108,799, as compared with $1,218,659, the value in 1899. The acreage of small-fruits increased from 8,346 in 1899 to 9,552 in 1909, when the value of the small-fruits was $1,676,790, or 5.2 per cent of the total value of all crops. In 1909 the total acreage of potatoes and other vegetables was 61,686, and their value $8,184,213. The acreage of vegetables, excluding the potato, was 37,220 and their value $6,189,857, both acreage and value being decidedly greater than in 1899. The raising of flowers and plants and nursery products is of relative importance. The acreage increased from 1,478 in 1899 to 2,750 in 1909, when the value of the products was $3,061,342, which was 9.6 per cent of the total value of all crops.

The total quantity of orchard-fruits produced in 1909 was 2,763,679 bushels, valued at $2,074,270. Apples contributed more than nine-tenths of this quantity; peaches and pears most of the remainder. The number of apple trees of bearing age in 1910 was 1,367,379; those not of bearing age, 355,868. The production in 1909 was 2,550,259 bushels, valued at $1,780,290. The number of peach and nectarine trees of bearing age in 1910 was 154,592; those not of bearing age, 162,114. The production in 1909 was 91,756 bushels, valued at $138,716. The number of pear trees of bearing age in 1910 was 113,365; those not of bearing age, 38,378. The production in 1909 was 96,071 bushels, valued at $110,069. In addition, 17,814 bushels of plums and prunes were produced in 1909, valued at $28,253; 4,761 bushels of cherries, valued at $10,848; 2,863 bushels of quinces, valued at $5,754; and minor quantities of apricots and mulberries.

Grape-growing has little significance in Massachusetts. In 1910 the grape-vines of bearing age numbered 58,277; those not of bearing age, 14,261. The production in 1909 was 1,132,838 pounds, valued at $30,858.

Nuts are of less importance than grapes. The total production in 1909 was 134,920 pounds, valued at $3,671. The leading nuts were: 40,064 pounds of black walnuts, valued at $1,219; 60,151 pounds of butternuts, valued at $984; and 23,834 pounds of hickory-nuts, valued at $904.

Cranberries are by far the most important of the small-fruits grown in Massachusetts, with strawberries second in importance. The acreage of cranberries increased from 5,128 in 1899 to 6,577 in 1909, when the production was 22,714,496 quarts, valued at $1,062,205. The acreage of strawberries for the same period decreased from 2,027 in 1899 to 2,015 in 1909, when the production was 5,518,867 quarts, valued at $495,438

The more important of the other small-fruits produced in 1909 were 376,136 quarts of raspberries and loganberries, valued at $55,757; 307,987 quarts of blackberries and dewberries, valued at $31,454; 213,810 quarts of currants, valued at $19,904; and 57,827 quarts of gooseberries, valued at $5,007.

The potato is by far the most important of the vegetables. The acreage decreased from 27,521 in 1899 to 24,459 in 1909 when 2,946,178 bushels were produced, valued at $1,993,923. Among the leading vegetables grown in 1909, excluding potatoes, were: 2,493 acres of onions, valued at $624,630; 2,442 acres of cabbage, valued at $426,586; 1,187 acres of celery, valued at $368,854; 4,942 acres of sweet corn, valued at $355,953; 1,228 acres of tomatoes, valued at $268,380; 372 acres of cucumbers, valued at $179,084; 776 acres of asparagus, valued at $116,622; 1,068 acres of turnips, valued at $95,754; and 555 acres of squash, valued at $91,388. Vegetables of minor importance in 1909 were green beans, beets, carrots, cauliflower, eggplant, parsnips, green peas, green peppers, radishes, rhubarb and spinach.

The acreage devoted to the production of flowers and plants increased from 584 in 1899 to 1,203 in 1909, an increase of 106 per cent. The total area under glass in 1909 was 7,382,009 square feet, of which 6,817,585 were covered by greenhouses, and 564,424 by sashes and frames. The value of the flowers and plants produced in 1909 was $2,455,467, as compared with $1,639,760 in 1899.

The acreage devoted to nursery products increased from 894 in 1899 to 1,547 in 1909, an increase of 73 per cent. In 1909 the value of nursery products was $605,875, as compared with $260,069 in 1899.

S. T. Maynard.

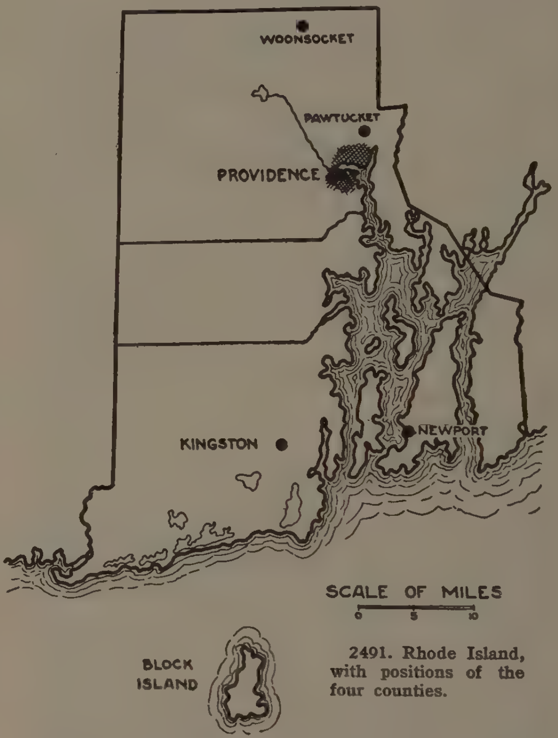
Rhode Island.

The general topography of Rhode Island (Fig. 2491), is of a hilly nature, tending to become more broken after leaving the ocean shores of the southern part of the state and of Narragansett Bay, which extends as a triangular body of water from Long Island Sound to Providence. This bay with its numerous islands and fine shores has resulted in the development of a number of summer resorts which furnish an excellent market for locally grown horticultural products.

Geologically there are within the state two distinct physiographic provinces, the eastern or Narragansett basin area, which comprises the eastern third of the state, and the western or more mountainous area of hill remnants from one of the ancient east Appalachian mountain ranges. Included within the Narragansett area are the islands of the bay and an area which follows the western shore of the bay, extending at no point more than 3 miles inland, and from the head of the bay, it extends northward across the boundary of the state. Topographically, this region consists of smoothly rounded hills, not exceeding 250 feet in height, and of gently rolling glacial plains. The inland or rougher area consists of rough and stony hills. Considerable areas of fresh-water swamps are found within this province; there are also many small lakes. The state lies wholly within the glaciated area.

The average annual rainfall for the state is approximately 48 inches, being somewhat greater than this in the southern section of the state which is locally influenced by proximity to tidewater.

With a population of 508.5 to the square mile, there is furnished a market for horticultural produce which is far in excess of the ability of the state to supply. This condition, together with the close proximity of both the Boston and New York markets, affords market conditions most favorable for an intensive horticultural development in the future. With 96.7 per cent of this population classed as urban, the demand created for perishable food-products has resulted in the development of vegetable-gardening as one of the most specialized horticultural industries of the state. The regions where this specialization has been most largely developed have the cities of Providence and Newport as their centers. In addition to the cities, the many villages devoted to manufactures and the summer resorts furnish markets that are supplied by producers who cannot be classified as market-gardeners, yet who derive a very substantial proportion of their cash income from the growing of vegetables and fruits. It is this class of growers which exert a very marked influence upon the agricultural prosperity of the state



2491. Rhode Island, with positions of the four counties.

The sandy soil types of the state, when abundantly supplied with water, are well suited to the growing of high-quality vegetable products. Although all of the different vegetables are grown in abundance, the following may be mentioned as of special importance: lettuce of the hard-headed Boston market type, the loose-leaf varieties being practically unknown in the wholesale markets; tomatoes are produced in large quantities, the larger growers relying almost entirely upon the Stone or some improved strain thereof; green corn is a profitable crop, large quantities of which are used for roasting with clam dinners served daily at many of the shore resorts throughout the season. The standard variety for this trade is the Potter's Excelsior corn. Vegetable-growing will be the most important commercially of any horticultural enterprise for many years to come.

Building of improved roads by the state, together with the development of the automobile as a means of getting farm produce to market, is beginning to exert a marked influence upon the areas devoted to horticultural products. This is shown most conclusively in the areas which are being planted to the tree-fruits in the northwestern section of the state. The rough land in this section which has heretofore been inaccessible to market, on account of lack of transportation facilities, is capable of producing fruit of high color and quality. Varieties of fall apples, such as the Gravenstein, find a ready market at remunerative prices, while for the main crop, the standard varieties are Rhode Island Greening, Baldwin, McIntosh and Spy. Of the stone-fruits, the peach is the most largely grown, orchards being found in all sections of the state. Those growers whose orchards are situated on the higher slopes along the shores of Narragansett Bay and upon the island of Rhode Island suffer much less injury from winter-killing of the buds and frost-injury in the spring than do those growers whose orchards are located farther inland; the latter, however, have less trouble with the various fungous diseases. The area devoted to the peach is being extended each season, particularly in the counties of Bristol and Newport. Cherries and plums are grown only in very limited quantities, the local markets being supplied almost entirely by shipments from other states. The plum is being grown profitably in those sections removed from the seashore. Of the cherries, the sour varieties are the most profitable, on account of the great difficulty in growing the sweet varieties in many sections, and are now being planted more than formerly.

Pears are not produced in large quantities for market, although the total number of trees of this fruit is large, as it is more commonly grown in the small house-lot than any other fruit. To such an extent is it produced upon these small holdings that the market demand for the summer and early fall varieties is very limited while for the later varieties, such as Bosc, Lawrence and Sheldon, there is an unsupplied demand in the city markets which would probably justify the commercial planting of this fruit.

In the production of varieties of fruit the state has played little part, its most important contributions being the Rhode Island Greening apple and the Buffum pear.

Of the small-fruits, strawberries and cranberries are of the most importance commercially. The acreage devoted to the small-fruits has shown a very material decrease in recent years. The largest production of strawberries is in Providence and Newport counties, the crop being grown almost entirely in wide matted rows. Cranberries are most largely produced in Providence and Washington counties. When proper attention is given to the bogs, they are the most profitable of the farm areas; the bulk of the crop is produced upon natural bogs which are overflowed during the winter months by adjacent streams. The prices received are such as to justify the paying of more attention to this crop, as many of the natural bogs are so located as to be easily flooded at a comparatively small expenditure.

Currants, raspberries and gooseberries are mostly grown for home consumption with the result that the markets are never properly supplied. The prices received for these fruits are such as to make them profitable when grown under commercial conditions. Blackberries are not profitable as a rule, owing to the extensive areas of the wild fruit throughout the state.

Of the horticultural changes during the past decade, the most marked has been the decrease in the production of vegetables under glass and the increase in floricultural products. Many large ranges of glass which were formerly wholly or in part devoted to the production of lettuce, tomatoes and cucumbers, are now being used for the growing of roses, carnations and lily-of-the-valley. The area under glass devoted to the production of flowers has more than doubled in the past decade. Where formerly the trade was confined almost entirely to cut-flowers, now much attention is being given to the production of potted plants for home-decoration. Vegetable-forcing at present is being conducted, in most cases, as an adjunct to the general market-gardening business, forcing vegetables to maturity only at those seasons of the year when the houses and hotbeds are not needed for growing of stock for transplanting to the fields.

Nursery stock is receiving much more attention than formerly, the area devoted to the growing of nursery stock having been increased two and one-half times during the past ten years. The business is confined almost entirely to the growing of ornamental trees and shrubs. On the island of Rhode Island are several nurseries which make a speciality of those plants best suited for planting near the seashore. Stock from these nurseries, while not making so large a growth of tops as that produced farther inland, has a root-system which is unexcelled.

Throughout the state are many fine estates, among which may be mentioned the many summer homes in the vicinity of Newport, where the famous cliff walk is lined for several miles with beautiful lawns and grounds, some of which are noted for the fine collections of ornamental trees and shrubs. While one is constantly reminded that Rhode Island is primarily a manufacturing state, yet the large number of fine suburban homes, the small grounds of which are planted with most excellent taste and upon which are found growing collections of fruits which furnish a succession throughout the entire season, shows a high appreciation of nature upon the part of many of her inhabitants.

The metropolitan park system of the state centered at Providence, which has for its object the development of pleasure-grounds and the conservation of historical sites, is receiving liberal support and the commission in charge of the work is rendering a most valuable service to the state in the development of love for the beautiful in nature.

Throughout the state many farms which have been neglected by their former owners are passing into the hands of foreigners, especially Italians and Portuguese, who are clearing much of the rough land of rocks and brush and using the land for the growing of truck and fruit. The immediate development of the state will be away from the general farm crops and toward the growing of the more perishable crops. There are within the state most excellent opportunities for the development of horticultural enterprises, either along the fruit or vegetable lines, as the urban population is increasing much more rapidly than the population engaged in the production of foodstuffs.

Among those individuals who have exerted a marked influence upon the horticultural development of the state, the following may be mentioned: Solomon Drowne, M.D. (1753–1834), who was professor of botany in Brown University, and in 1824 published "The Farmer's Guide, a Comprehensive Work on Husbandry and Gardening;" the Moore family for many years were very active in the development of fruit-growing and ornamental horticulture in the state, especially Silas Moore (1818–1879), nurseryman; Robert E. Moore (1820–1902), orchardist; Robert I. Moore, (1835–1899), landscape gardener; James Nesbit, landscape gardener; and James A. Budlong (1823–1895), market-gardener.

Public-service agencies for horticulture.

The leading agency in the dissemination of horticultural information throughout the state is the Rhode Island State College located at Kingston. This institution was established by act of the state legislature, March 23, 1888, as the Rhode Island State Agricultural School, the first class entering in September, 1890. On May 19, 1892, the institution was incorporated by the state legislature and its name changed to the Rhode Island College of Agriculture and Mechanic Arts. Again, after the passage of the Adams Act by Congress, the name was changed to the Rhode Island State College, this change occurring May 4, 1909. There are two teaching members of the horticultural staff.

The Rhode Island Experiment Station, located at Kingston, is a department of the State College, its work being conducted by a staff of seventeen. At present there is no horticulturist upon the staff. There have been published nineteen horticultural bulletins, besides numerous horticultural articles in the annual reports.

Horticulture is not taught in any of the public schools of the state as a text-book subject. School-gardens were established by the Extension Department of the State College in 1905, which work has developed very rapidly since 1908, the coöperation of the State Board of Agriculture and school authorities of the various cities and towns having been secured at that time. In addition to the school-garden work, the Extension Service conducts orchard demonstrations in spraying and pruning.

The State Board of Agriculture is by law empowered to employ an entomologist who has charge of all nursery inspection work in connection with insect pests and diseases.

The most important societies of horticultural interest in the state are the Rhode Island Horticultural Society of Providence, Newport Horticultural Society, Florists' and Gardeners' Club of Providence and the Providence Market-Gardeners' Association. The latter society has for its object the betterment of conditions under which the growers for the Providence market dispose of their produce.

Statistics (*Thirteenth Census*).

The approximate land area in 1910 was 682,880 acres. The land in farms was 64.9 per cent of the land area, or 443,308 acres. Of this land in farms, the improved land numbered 178,344 acres; the woodland, 185,909 acres; and other unimproved land in farms 79,055 acres. The number of all the farms in 1910 was 5,292, and the average acreage was 83.8. [The total area of Rhode Island is 1,248 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage devoted to hay and forage decreased from 69,776 in 1899 to 61,327 in 1909, when the production was valued at $1,309,717, which was 33.3 per cent of the total value of all crops. Cereals increased in acreage from 10,552 in 1899 to 12,112 in 1909, when the production was valued at $376,097. The value of the forest products of the farms was $312,022 in 1909, as compared with $195,472 in 1899.

Horticultural crops produced in Rhode Island are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of fruits and nuts produced in 1909 was $207,844, as compared with $160,411 in 1899. Small-fruits decreased in acreage from 581 in 1899 to 281 in 1909 when the production was 437,560 quarts, valued at $43,033. The total acreage of potatoes and other vegetables in 1909 was 9,924, and their value $1,045,093. Excluding potatoes, the other vegetables increased from 5,165 in 1899 to 5,275 in 1909, when the production was valued at $636,656. Flowers and plants and nursery products increased in acreage from 263 in 1899 to 502 in 1909, when the production was valued at $634,087.

The production of orchard fruits in 1909 was 245,822 bushels, valued at $197,639. Apples produced most of this quantity, and peaches and nectarines and pears most of the remainder. The number of apple trees of bearing age in 1910 was 152,009; those not of bearing age 54,560, and the production in 1909 was 212,908 bushels, valued at $147,125. Peach and nectarine trees of bearing age in 1910 numbered 39,342; those not of bearing age 30,795, and the production in 1909 was 17,704 bushels, valued at $30,609. Pear trees of bearing age in 1910 numbered 16,907; those not of bearing age 5,405 and the production in 1909 was 12,501 bushels, valued at $14,577. Other orchard fruits produced were: 1,872 bushels of plums and prunes, valued at $3,586; 618 bushels of quinces, valued at $1,267; and 214 bushels of cherries, valued at $464.

The production of grapes in 1909 was 152,937 pounds, valued at $9,759. The grape-vines of bearing age in 1910 numbered 7,662; those not of bearing age, 9,634. Nuts are of little importance, the production in 1909 being valued at $49.

Strawberries are the most important of the small-fruits grown in Rhode Island. The acreage of strawberries decreased from 154 in 1899 to 140 in 1909, when the production was 326,540 quarts, valued at $31,712. Cranberries decreased in acreage from 300 in 1899 to 70 in 1909, when the production was 34,688 quarts valued at $2,734. Raspberries and loganberries decreased in acreage from 57 in 1899 to 34 in 1909, when the production was 32,871 quarts, valued at $4,197. Other small-fruits produced in 1909 were: 17,875 quarts of blackberries and dewberries, valued at $1,927; 17,110 quarts of currants, valued at $1,564 and 8,251 quarts of gooseberries, valued at $852.

Potatoes in Rhode Island decreased in acreage from 5,816 in 1899 to 4,649 in 1909 when the production was 552,677 bushels, valued at $408,429. The more important of the other vegetables produced were: 790 acres of sweet corn, valued at $49,440; 37 acres of celery, valued at $26,880; 192 acres of cabbage, valued at $25,818; 152 acres of onions, valued at $23,828; 187 acres of tomatoes, valued at $22,898; 196 acres of turnips, valued at $21,050; 199 acres of cucumbers valued at $18,330; 93 acres of asparagus, valued at $17,504; 154 acres of beans, valued at $13,305; 11 acres of lettuce, valued at $14,670; 205 acres of peas, valued at 12,790; and 8 acres of radishes, valued at $10,269. Vegetables valued at less than $10,000 were beets, cantaloupes and muskmelons, carrots, cauliflower, eggplant, parsnips, green peppers, pumpkins, rhubarb, spinach, and watermelons.

The acreage devoted to the production of flowers and plants increased from 177 in 1899 to 290 in 1909. The total area under glass in 1909 was 2,027,643 square feet. Of this area 1,882,314 square feet were covered by greenhouses, and 145,329 by sashes and frames. The value of the flowers and plants produced in 1909 was $558,543, as compared with $314,806 in 1899.

The acreage devoted to nursery products increased from 86 in 1899 to 212 in 1909, when the value of the products was $75,544, as compared with $42,295, the value of the nursery products produced in 1899.

George E. Adams.

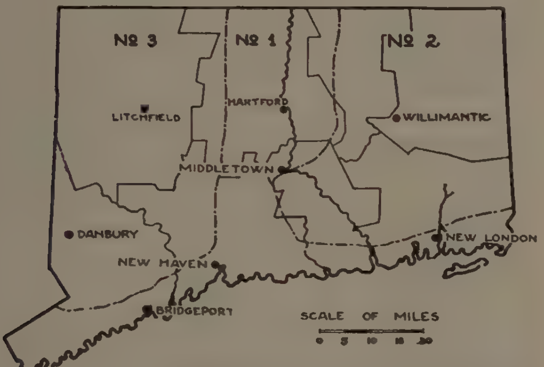
Connecticut.

While Connecticut (Fig. 2492) is one of the smallest states, covering but one degree of latitude (41° to 42°), it is adapted to as wide a range of horticultural productions as any state outside of the semi-tropic fruit-belt, owing to the great diversity of soil and varying elevations, from the sea-level along the whole southern border, to 900 and 1,200 feet in sections of Tolland County, and 1,200 and 1,500 in parts of Litchfield. The "season" of many of the quick-maturing species and varieties of fruits, flowers and vegetables is often entirely over on the light soil in the Connecticut Valley and along the Sound shore when like species and varieties are but just beginning to ripen on the cooler, moist soils of the hills of Tolland and Litchfield counties.

Strawberries and green peas from East Hartford and Glastonbury supply the Hartford market, while on the Bolton hills, only 12 miles away, the blooming vines give promise of the crop that is to come after the valley season is entirely over; so that "home-grown" strawberries are usually to be had in the Hartford market for a period of six or seven weeks. The Sound shore, Housatonic Valley and Litchfield hills supply

New Haven, Bridgeport and other cities of the state through equally long seasons.

From the earliest settlement of the state, fruit-growing for the family home-supply has been a prominent feature of Connecticut agriculture, the apple being a main reliance. The old seedling trees scattered over all our farms today are plain evidence that our ancestors took their apple-juice through the spigot of the cider-barrel rather than fresh from the pulp of the ripe fruit of some finer variety. A hundred years ago every farmhouse cellar wintered from thirty to fifty barrels of cider, while today it is hardly respectable to have any, and probably not one family in ten now has even one single barrel on tap as a beverage. Yet in quantity and variety the family fruit-supply has wonderfully increased and a daily supply of fresh home-grown fruit is the rule rather than the exception in most farm homes,—small-fruits in variety, apples, pears, peaches, plums (both European and Japan), cherries and quinces, in all the best standard varieties, coming to their highest perfection in every section of the state when rational methods of culture are followed.



2492. Connecticut, marking the three main horticultural districts.

Natural timber and semi-abandoned farm- and pasture-lands, growing up to brush and timber, with increasing acreage yearly up to the beginning of the twentieth century, are now furnishing the "new lands" for extensive horticultural enterprises and many thousands of acres of these lands have been cleared and planted to peaches, apples and grapes within the past fifteen years, particularly in Hartford, Tolland, Middlesex and New Haven counties, mostly by newcomers from the north of Italy, although a few of the large developments have been made by old-time pioneer orchardists. Lying midway between New York and Boston, the greatest horticultural markets of America, Connecticut is better situated than any other state in the Union to realize quick cash returns from her horticulture. Every farm is within driving distance of some one or more of the busy manufacturing towns and villages, whose people are appreciative of choice fruits and are able to pay for them.

District No. 1 comprises the Connecticut River valley and adjacent hills, along the Northampton branch and the main line of railroad from Hartford to New Haven, and all of the shore towns. This region contains most of the sandy plain lands of the state, and the loams and clay most free from rocks and stones. On the hills back from the river, on the ridges either side of the railroads, and a few miles back from the Sound shore, there are many places where soil and topographical conditions are much the same as in districts Nos. 2 and 3; but, having much larger tracts of easily cultivated lands, and being better located as to market conditions, this district is more highly developed horticulturally than either of the others. Here are the great market-gardens and small-fruit farms, peach-orchards, vineyards and melon-fields.

District No. 2 comprises Tolland and Windham counties and all of the Middlesex and New London counties, except Cromwell and the shore towns, and is particularly well suited to apple- and peach-culture, owing to the rolling condition of the country and natural fertility of many of the hills. Every few miles are little valleys and pockets suited to the production of small-fruits and vegetables in variety. A few townships in the northeast grow apples rather extensively, while in the west and southwest commercial peach-orchards are found to considerable extent.

District No. 3 comprises western Hartford, northwestern New Haven, northern Fairfield, and all of Litchfield counties, and is somewhat similar to district No. 2, except that the soil is generally heavier, with rather more mixture of clay and the hills are more abrupt and rocky. Some sections of Litchfield County are too cold and bleak for any but the most hardy fruits. Apples grow freely everywhere, and, while always of good quality, the brightest colors, firmest texture and highest quality of fruit is produced on the rocky hills, at an elevation of 300 to 1,000 feet. Baldwin, Rhode Island Greening, Roxbury Russet and Spy are the leading varieties, although all the varieties that thrive well in the northeastern United States grow to perfection here when properly cared for, and in the new orchard developments of the past ten years, Wealthy, McIntosh, Banana and Delicious have been very extensively planted.

Peach-culture on an extended scale is a recent development. Thirty-five years ago the only commercial orchard in the state contained about 2,000 trees, and probably 5,000 trees would be a liberal estimate for the state at that time; now upward of 1,000,000 peach trees are grown in the state. While many varieties are grown, the main plantings are of Greensboro, Carman, Hiley, Champion, Belle of Georgia and Elberta, of the North China type, an almost entire abandonment of the older Persian types as formerly grown, such as Mountain Rose, Oldmixon and the Crawfords. High culture, close pruning, spraying and a thinning of the fruit are generally practised, and fruit of brightest color, largest size and high quality is thus secured. In the markets of this and neighboring states, "Connecticut peaches" usually sell at a much higher price than those from any other section. The only serious drawback is the winter-killing of the fruit-buds in the valleys when temperature drops to 10° to 20° below zero, this happening probably two years out of five, while on many hillsides and hilltops at least four crops out of five are assured; but there are many favorable localities where annual crops are almost a certainty.

Japanese plums, largely planted from 1895 to about 1905, were for a few years very vigorous, productive and profitable, Abundance, Burbank, and Red June being the most acceptable varieties. Of recent years, however, the trees have become very short-lived and their commercial planting has been almost entirely abandoned.

Raspberries, blackberries, currants and gooseberries grow and produce freely all over the state, and all local markets are abundantly supplied in season.

Grapes are grown successfully all over the state, except on the highest and coldest hills; and on the sandy plains and warm, rocky hillsides all the best standard varieties can be produced in perfection. There are a number of small vineyards in every county. There are many vineyards of three to ten acres in Hartford, Middlesex, New Haven and Fairfield counties, mostly owned by Italians, and grown for wine-making purposes, although in recent years many of the selected grapes from these vineyards find their way into market, where they sell at much higher prices than any from outside the state. Concord, Worden and Niagara are varieties mostly grown for commercial and wine-making purposes, while almost the entire list of standard varieties can be and are grown in family vineyards.

Pears thrive and fruit well except on the lighter lands, and nearly every home-garden has from one to half a dozen trees. There are a few small commercial orchards in district No. 1, Bartlett and Clapp being most largely grown. At Hartford and the adjoining towns on the west side of the Connecticut River, the Bosc is produced in its highest perfection.

Cherries have been steadily failing in the state for twenty-five years. Not enough are grown for home supply. Newly planted trees soon die out, and there is a general discouragement. They seem to do best in the vicinity of Middletown and Meriden, and the few commercial plantings there are quite profitable.

Quinces are grown all over the state for home supply, but thrive best along the Sound shore, where there are a large number of small commercial orchards.

Strawberries are very largely grown, both for home and outside markets, mostly in medium matted rows, with an average yield of eighty to ninety bushels an acre. Some cultivators, who follow the hill system or grow in narrow, thinly matted rows, secure 150 or more bushels an acre. In recent years some of the heavy wet hilltop lands in Hartford and Tolland counties have been cleared of stones and are producing late in the season heavy crops of extra-fine strawberries that in 1914 supplied the Hartford market with the very best of the whole year and it is reported that the returns to the growers were from $600 to $800 an acre.

A number of the berry farmers have systems of irrigation which add greatly to the surety of the crop, besides increasing the size and appearance of the fruit. The rolling character of the country and vast number of small streams abundantly supplied with water make it possible, at moderate expense, to irrigate many thousands of acres in this state, and the time is not far distant when the streams of Connecticut will be more valuable to her horticulturists than they ever were to her manufacturers in the old days of many small factories and water-wheels.

Almost from the earliest settlement, small local nurseries have abounded in the state and today number forty-one, with three quite extensive ones in Hartford, New Haven and Fairfield counties. At Cromwell, Middlesex County, is a floricultural establishment which, with one exception, has the largest area under glass of any such establishment in America, —some thirty acres,—and surpasses all others in the annual production of superb roses.

The late Judge A. J. Coe, of Meriden, was one of the first men in America to take up the new chestnut culture by the importation of the best foreign varieties and the selection of the best natives and their crosses. He began the grafting on native sprouts and seedlings, and fifteen to twenty years ago stimulated a general chestnut grafting, so that a number of chestnut orchards were being established on land too rough for cultivation, yet strong in its ability to grow the chestnut tree and nuts to perfection; but the chestnut blight of recent years is playing such havoc with all chestnut trees that for the present no further developments can be expected.

At Wethersfield, in Hartford County, Orange and Milford, in New Haven County, and Southport, in Fairfield County, are many farms devoted to seed-growing. Onion seed and sweet corn are the great specialities, but a great variety of other seeds are also grown, especially at Wethersfield and Orange.

Market-gardening is conducted extensively by specialists near all large towns and cities, while, with so many markets always close at hand, vegetables and fruits are sold in moderate quantities from nearly every farm. The largest market-garden farm is at New Haven, where over 400 acres are under annual cultivation with vegetables and small-fruits. Twenty years ago at Southport, Fairfield and Westport, there were many farms, both large and small, devoted entirely to the production of onions. "Southport onions" were famous for fine appearance and quality, and nowhere in America was the annual yield so great or price received so high as in this district. Marketing was done in sailing vessels, direct from the farms to the dock markets in New York, where the onions were sold direct to retail dealers, boat captains acting as salesmen without commission for the sake of carrying the freight. For many years the net returns an acre were the greatest of any in the state. Being along the Sound shore and only fifty miles from New York, these valuable farm lands have in recent years been bought up for summer residents' property at $2,000 to $8,000 an acre, causing an entire abandonment of the once-prosperous onion business.

Trolley freight lines are widely extended through many farming sections of the state, and, running express cars at certain hours of the day with freight movements at night, they are growing to be a factor in the distribution of horticultural products.

Of the persons not now living who have had marked influence on the development of Connecticut horticulture may be mentioned: Theodore S. Gold, of West Cornwall; P. M. Augur, of Middlefield; Edwin Hoyt, of New Canaan; Richard Van Densen, of Enfield; A. J. Coe, of Meriden; Dr. Gurdon Russell, of Hartford; Albert Day, of Brooklyn; J. M. Hubbard, of Middletown; A. C. Sternburg, of West Hartford; John B. Smith, of New Britain; James B. Olcott, of Manchester; Miss Emily Moseley, of Glastonbury; and Mrs. John P. Bacon, of Danbury. Gold, Augur, Hoyt, Coe and Van Deusen were fountain-heads of horticultural knowledge in regard to varieties of fruits and their adaptability to different sections at the time of the commercial awakening in the seventies and early eighties of the last century; while Miss Moseley might be said to have been the mother of the great commercial horticultural industries that center about Glastonbury, in Hartford County, and reaching out into Tolland and Middlesex counties, while the influence of Augur, Coe and Hubbard are clearly shown in the large orchard interests now centered about Middlefield and Wallingford. Gold and Hoyt had a wider influence the whole state over, and their works live after them in nearly every rural home at the present time.

Public-service agencies for horticulture.

The State Agricultural College at Storrs, in Tolland County, and the Connecticut Agricultural Experiment Station at New Haven, are the only two public-service agencies doing any work along horticultural lines. While the Experiment Station at New Haven has no horticulturist under that name, it has a botanist who devotes his time to a study of the diseases of all farm crops and the means of combating them, and can also give advice regarding the pruning, grafting and general care of orchards. An entomologist does the same work for insect pests that the botanist does for fungous diseases. The Station inspects yearly all nurseries in the state. There is a specialist on market-gardening and a plant-breeder. There have recently been issued three or four horticultural bulletins, a spray calendar and a short bulletin of specific directions for treatment of orchards, and two or more within the year on insect pests.

There is a school of horticulture at Hartford, and horticulture is taught in connection with agriculture in many of the high-schools.

The Connecticut Pomological Society, organized some thirty years ago, is a prominent feature in the lively fruit interests of the state, and at the present time has a paying membership of nearly a thousand members, making it the largest society in proportion to population of any state in the Union.

Statistics (*Thirteenth Census*).

The approximate land area according to the 1910 census is 3,084,800 acres. Of this, 70.9 per cent or 2,185,788 acres are in farms. The land in farms that is improved is 988,252 acres, or 45.2 per cent; the land that is in woodland, 757,743 acres, and other unimproved land in farms, 439,793 acres. The number of all the farms in the state in 1910 was 26,815. Their average acreage at that time was 81.5. [The total area of Connecticut is 4,965 square miles.]

The leading agricultural crops are cereals, hay and forage, tobacco, and forest products of the farms. The acreage in cereals in 1909 was 74,083, showing an increase of only 2,051 acres over that of 1899. The value of the cereals in 1909 was $2,039,211 which was 9.1 per cent of the total value of all crops. The acreage of hay and forage in 1909 was 401,322, a decrease of 16.1 per cent from the acreage in 1899. The value of the hay and forage in 1909 was $7,224,500, which was 32.1 per cent of the total value of all crops. Tobacco increased in acreage 58.5 per cent during the ten-year period. The acreage in 1899 was 10,119; in 1909, 16,042. The value of the tobacco products in 1909 was $4,415,948 or 19.6 per cent of the total value of all crops. The value of the forest products from the farms in 1909 was $1,861,853; in 1899, $1,275,720.

The leading horticultural crops are potatoes and other vegetables, fruits and nuts, and flowers and plants and nursery products. Small-fruits are also of considerable importance. The acreage in potatoes has been changing constantly. In 1879 there were nearly 28,000 acres; there was a decrease of nearly 5,000 acres in 1889; an increase during the next decade, and a decline of over 3,000 acres between 1889 and 1909, leaving the acreage for 1909, 23,959. This acreage produced 2,684,414 bushels of potatoes, valued at $1,882,197. Other vegetables increased in acreage 31.6 per cent from 1889 to 1909. The acreage in 1889 was 12,349; in 1909, 16,250. The value of these vegetable products in 1909 was $1,965,635. The total value of fruits and nuts in 1909 was $1,375,699; that of flowers, plants and nursery products, $1,308,937. Small-fruits were also produced to the value of $316,752, although the acreage decreased from 1,987 in 1899 to 1,597 in 1910.

More than four-fifths of the quantity of orchard fruits produced in 1909 were contributed by the apple. Peaches, nectarines and pears produced most of the remainder. The production of apples in 1909 was 1,540,996 bushels, valued at $833,168; that of peaches and nectarines 269,900 bushels, valued at $417,598; that of pears 41,322 bushels, valued at $41,652. The other orchard fruits of lesser importance, their production and value in 1909 follow: plums and prunes, 13,663 bushels, valued at $19,419; cherries, 3,617 bushels, valued at $8,164; quinces, 4,627 bushels, valued at $7,027.

In 1910, there were 107,054 grape-vines of bearing age in Connecticut and 61,670 vines not of bearing age. The grapes produced amounted to 1,317,682 pounds, valued at $43,523.

The nuts of most importance in 1909 were the hickory-nuts and black walnuts. The number of hickory-nut trees of bearing age in 1910 was 3,792; those not of bearing age 5,385. The production was 64,124 pounds, valued at $2,656. The number of black walnut trees of bearing age in 1910 was 3,188; those not of bearing age 2,636. The quantity produced was 45,304 pounds, valued at $1,856.

Strawberries were by far the most important of the small-fruits grown in Connecticut, with raspberries and loganberries ranking next. The acreage of strawberries in 1909 was 993, as compared with 971 in 1899. The production was 3,016,295 quarts, valued at $235,648. The acreage of raspberries and loganberries in 1909 was 289 acres and the production 384,256 quarts, valued at $46,618. The acreage, production, and value of the other small-fruits follow: 128 acres of blackberries and dewberries, producing 192,752 quarts, valued at $16,869; 123 acres of cranberries, producing 145,408 quarts, valued at $9,555; 54 acres of currants, producing 74,488 quarts, valued at $7,056, and 9 acres of gooseberries, producing 9,023 quarts, valued at $878.

Aside from potatoes, discussed above, the more important vegetables, their acreage, and value in 1909 were as follows: 165 acres of asparagus, valued at $31,685; 167 acres of green beans, valued at $21,426; 733 acres of cabbage, value of which was $93,796; 159 acres of cantaloupes and muskmelons, the value of whose product was $25,898; 185 acres of celery, the value of the product being $55,142; 2,142 acres of sweet corn, the product valued at $137,083; 282 acres of onions, the value of the product being $38,156; 232 acres of green peas, the product valued at $24,382; 85 acres of spinach, the product being valued at $11,270; 621 acres of tomatoes, the product valued at $115,654; and 742 acres of turnips, whose product was valued at $40,968. Other vegetables grown were carrots, cauliflower, cucumbers, lettuce, green peppers, and watermelons.

In 1909, there were 560 acres occupied by flower and plant establishments as compared with 187 acres in 1899, an increase of 199.5 per cent. The area under glass in 1909 was 2,849,481 square feet, of which 2,636,063 were covered by greenhouses and 213,418 by sashes and frames. The total value of the flowers and plants in 1909 was $1,047,431.

The acreage occupied by nursery establishments increased from 605 acres in 1899 to 770 in 1909, an increase of 27.3 per cent. The total value of the nursery products in 1909 was $261,506. J. H. Hale.

MIDDLE ATLANTIC STATES.

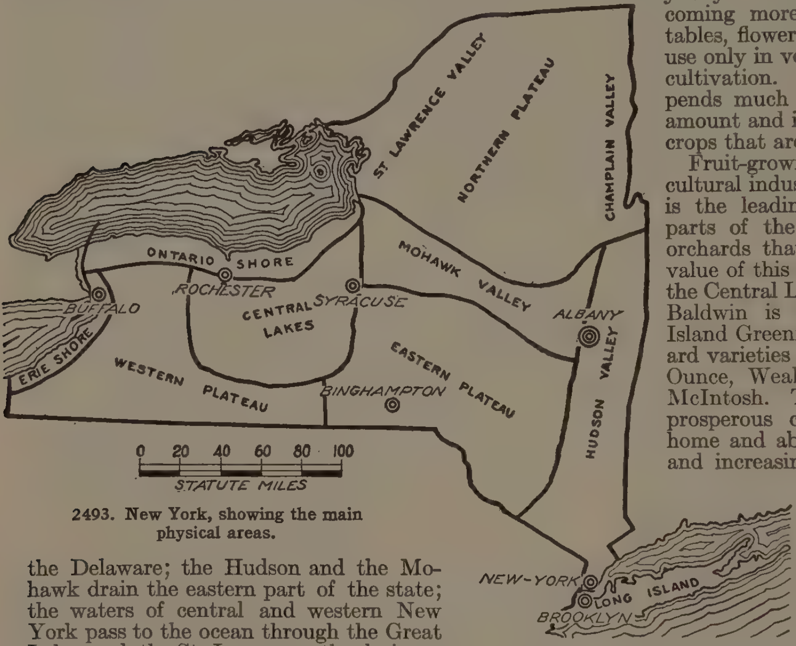
New York.

By virtue of its many substantial interests in horticulture, New York (Fig. 2493) is preëminent in this division of agriculture among the states of the Union. Thus, New York ranks first or takes a high place in fruit-growing, truck- and vegetable-growing, the production of nursery stock, the growing of cut-flowers, and in the plant and seed trade for vegetables and flowers. To these horticultural crops of first magnitude must be added the culture of nuts and of medicinal herbs. These industries, divided into a great number of distinct horticultural occupations,—for the tendency is to specialize more and more,—probably occupy the time of more workers than any other form of husbandry in the state, though the monetary value of the products is less than that of cereal and forage crops or of dairy products.

Horticultural industries in New York take high rank chiefly because climate and soil are so diverse and so favorable as to make possible one of the most highly specialized areas of American farming, but also because in its commercial supremacy the state supplies unusual markets for the products. Thus, to consider the last factor first, more than 9,000,000 persons live within the borders of New York. In the state there are five cities with more than 100,000 inhabitants, sixteen with 25,000 to 100,000, and one hundred and twenty-seven with from 2,500 to 25,000. This vast and prosperous population is most varied, consisting of many nationalities of all gradations of wealth and employed in nearly all the means of livelihood known to mankind, so that there are diverse demands as well as extensive markets for horticultural products.

New York ranks twenty-ninth in land area among the states and territories of the United States. The state extends east and west 412 miles, north and south 310 miles. About one-twentieth of the state, chiefly comprising Long Island, lies below an altitude of 100 feet, sixteen-twentieths between an elevation of 100 and 1,500 feet, while the mountainous regions of the Adirondacks and Catskills—three-twentieths of the total area—rise above 1,500 feet, the maximum altitude being above 5,000 feet in a few peaks in the Adirondacks. Excepting a small area in the southwestern part, the surface of the whole state shows, in a marked degree, the effects of the erosions, drifts and moraines of the Ice Age.

The state is drained by five water-systems. Excess water in a small area in the southeast passes through the Delaware; the Hudson and the Mohawk drain the eastern part of the state; the waters of central and western New York pass to the ocean through the Great Lakes and the St. Lawrence; the drainage of the southwestern part is through the Allegheny into the Mississippi system; while the Susquehanna carries the waters of south-central New York into Chesapeake Bay.



2493. New York, showing the main physical areas.

Through its physical features, the state is divided into nine areas, which are somewhat distinct in natural vegetation and more or less so in their agriculture and horticulture. The nine regions are shown in the accompanying map. The great specialization to be noted in the horticulture of New York is largely accounted for by the differences in the soil and climate of these natural divisions. They are outlined as follows: (1) The Long Island district, a lowland plain, for most part, covered with a thick moraine deposit, in which sand predominates; (2) the Hudson Valley region, lying on both sides of the Hudson River from its mouth north to Lake George—a region of very uneven topography and of several geological formations so varied in soils and climate that in it several special horticultural interests have developed; (3) the St. Lawrence and Champlain region, consisting of high and rolling lands and valleys, adjacent to the St. Lawrence River and Lake Champlain, to which may be added the tillable land in the Adirondack Mountains; (4) the broad and fertile valley of the Mohawk from Oneida Lake to the Hudson; (5) the eastern plateau, consisting of the Catskills and the highlands to the west, reaching to the basin of the Central Lakes; (6) the great basin, in which lie the Central or Finger Lakes, large and deep bodies of water having great influence on the climate of the region; (7) the shore of Lake Ontario, from the St. Lawrence to Niagara River, extending from the lake inland several miles to and including a high escarpment; (8) the Erie shore, a narrow plain from the Niagara River to Pennsylvania, bounded on the north by the lake and on the south by a high escarpment; (9) the western plateau, comprising the area west of the basin of the Central Lakes and south of the Erie and Ontario shore regions.

The rainfall in New York is exceedingly variable, owing to the uneven surface of the land. It varies greatly, in some cases, even within the limits of a county, the annual precipitation being sufficient for most crops in one part, and in another drought may yearly lie heavily on the land. Irrigation is coming more and more into favor for vegetables, flowers and small-fruits, but, as yet, is in use only in very limited areas and with intensive cultivation. Specialization in horticulture depends much upon the rainfall, both the total amount and its distribution helping to decide the crops that are grown in a region.

Fruit-growing is chief of the several horticultural industries in New York, and the apple is the leading fruit. Apples are grown in all parts of the state, but the great commercial orchards that give New York first rank in the value of this fruit are found in the Ontario shore, the Central Lake and the Hudson Valley regions. Baldwin is the leading variety, with Rhode Island Greening a distant second. Other standard varieties are Northern Spy, King, Twenty Ounce, Wealthy, Oldenburg, Ben Davis, and McIntosh. The apple industry is in a most prosperous condition, with large demands at home and abroad for boxed and barreled stock and increasing demands for fruit at the many evaporators and cider mills in the state. Apple-culture in New York has been greatly stimulated by the general tuning up in agriculture everywhere experienced during the past quarter-century. Good care is now the rule, while but a short time ago it was the exception.

The grape is second to the apple in importance in New York. Exclusive of California, New York produces nearly half of the grapes grown in the United States, and the yield in Chautauqua County alone is many times more than that of any other state excepting California. The industry is centered in the Erie shore, Central Lake and Hudson Valley regions. On the Erie shore, several times as many Concords are grown as all other varieties combined, the product going to the general markets and for the manufacture of grape-juice. About the Central Lakes, Catawba is the leading variety, a large part of the crop being used in the manufacture of wine and champagne. In the Hudson Valley, Concord, Delaware and Niagara are the leading varieties. The most striking feature in the grape industry at present is the rapid development in the manufacture of grape-juice, an industry which did not exist in 1900, but in which it is estimated more than 30,000 tons of grapes were used in 1915. Improvements in grape-culture have not kept pace with advances in growing other fruits, growers, in the main, cultivating too many acres from which they skim comparatively small returns.

The peach takes third place in commercial importance among the fruits of New York. The industry is most highly developed along the shores of Lake Ontario, from Oswego west, but is also in very thriving condition about the Central Lakes and in the valley of the Hudson. Some peaches are grown on the grape lands bordering Lake Erie. Elberta is the mainstay in all commercial orchards in New York, with no close second. Peach-growing is a fine art in the state, and nowhere can finer orchards of this fruit be found.

LXXI. North American horticulture.—A commercial cabbage field in New Jersey.

Pears are more or less grown in all the apple regions of New York. Bartlett and Seckel are the staple sorts, with Bosc, Anjou, and Winter Nelis largely grown. While New York ranks first among the states of the Union in number of trees and value of product, yet pear-growing is a great risk because of the blight which few attempt to control and which annually takes tremendous toll.

Increased plantings of cherries in recent years give this fruit greater value than the plum, which long held higher commercial rank. Montmorency is the leading sour cherry. Early Richmond and English Morello are standard kinds. These are grown wherever the apple thrives. By far the largest part of the sour cherry crop goes to the canneries. Napoleon, Windsor, Schmidt, Governor Wood, and Black Tartarian are the sweet sorts most commonly grown, the product going almost wholly to fresh-fruit markets. Sweet cherries are planted only in the peach regions. Cherry-growing in New York, as elsewhere, has many ups and downs, sweet cherries being, possibly, more at the mercy of the seasons than other fruits, and both sweets and sours having to weather many depressions in prices.

The leading variety of plum is Bradshaw, with Reine Claude, Italian Prune, German Prune, Lombard, Shropshire Damson, and Grand Duke following in order of importance. The plum industry is almost wholly confined to the Ontario shore and Central Lakes regions. Abundance and Burbank, Japanese sorts, are widely planted and give general satisfaction. Native plums, even at the best, are so inferior to the domestica sorts that they are seldom planted. The development of rapid transportation and refrigerator service has enabled Pacific coast growers so to compete with New York that plum-growing seems now to be on a decrease in the state, though recent turns in the markets indicate increasing demands for New York plums, which are better flavored because there is not the need to pick before fully mature for shipment.

One-fourth of all the quinces grown in the United States come from New York. Orange is the standard variety. Apricots thrive in the peach lands of the state, but spring frosts take such heavy toll and the curculio is so aggressive that this fruit is seldom profitably grown.

New York stands first in rank in the value of small-fruit products, but in acreage falls below New Jersey. Small-fruits, excepting cranberries, the culture of which is confined to Long Island, are grown in all parts of the state. Black raspberries are largely grown in the Central Lakes region for evaporation, the annual output ranging from 1,200 to 1,500 tons. Strawberry-growing assumes large proportions.

Several factors greatly favor truck- and vegetable-growing in New York; as, proximity to markets, many means of transportation, the cheapness of labor (largely performed by women and children), the demands of the many canneries, and a large acreage of suitable soil. Long Island is the region of highest specialization in vegetable-growing, most of the cultivated land there being devoted to the culture of truck and seed crops; but vegetables are everywhere grown commercially, the industry becoming especially prominent on the many muck formations in various parts of the state. The vast quantity of truck is nearly all used within the state, much of it, however, being taken by the canneries, the product of which, of course, finds sale in considerable quantities outside of New York.

For nearly a century, western New York has been the center of the nursery trade in the United States. The trees and plants are grown in the Central Lakes and Ontario shore regions, but are distributed chiefly from Rochester, Geneva, and Dansville. The most significant thing in the recent development of the nursery business is the very great increase in the proportion of ornamentals. The nursery business has suffered greatly from San José scale in the years just passed, but this pest has now been brought under control.

New York is also the center of the flower and plant trade of the United States. The floricultural and forcing interests are somewhat localized, though near every city and large town there are floral and forcing establishments. No doubt the greenhouse industry is most highly developed on Long Island, where roses, carnations and flowers for the retail trade are grown. Violet-growing is a thriving business at Rhinebeck on the Hudson. Vegetable-forcing thrives in and about Rochester. Large quantities of bulbs are grown on Long Island.

While there are but few commercial plantations of nuts in New York, the many trees about homes make a good showing for nut-growing in the state. In 1910, there were 164,333 bearing trees in New York; 51,239 not yet in bearing. Interest in nut-culture is yearly increasing.

Many vegetable and flower seeds are grown in New York, the state taking third place in the value of the product in 1909, the total value being $72,991. The principal seed crops grown are bush-bean, brussels sprouts, cabbage, sweet corn, cucumber, kale, onion, pea, turnip, asparagus, and the seeds of a considerable number of flowers, of which New York leads in the production of aster seeds.

Ginseng-culture is profitably carried on in several counties in the state. The value of the product in 1909 was $27,138, giving New York first place among the states of the Union.

The history of horticulture, as well as of countries, is that of its great men. So measured, New York has contributed much to American horticulture. The following is a partial roll-call of her eminent men in this profession not now living: C. L. Allen, seedsman, florist and author; Patrick Barry, nurseryman, editor, and author; Thomas Bridgeman, gardener, florist, seedsman, and author; E. S. Carman, editor and experimenter; John Craig, horticulturist and educator; A. J. Downing, landscape gardener and pomologist; Charles Downing, pomologist and author; George Ellwanger, nurseryman; Peter Henderson, florist, seedsman and author; F. M. Hexamer, nurseryman and editor; Jacob Moore, plant-breeder; Samuel B. Parsons, landscape gardener and author; William Prince (I), nurseryman; William Prince (II), nurseryman and author; William Robert Prince, nurseryman and author; A. M. Purdy, horticulturist and author; J. J. Thomas, pomologist and author; Grant Thorburn, seedsman; Luther Tucker, editor; Calvert Vaux, landscape gardener; and James Vick, seedsman and editor. See Volume III for biographies.

Public-service agencies for horticulture.

The State College of Agriculture was established in 1904 at Ithaca. Before this time, however, agriculture had been taught as a department in Cornell University. There are nineteen members of the horticultural staff.

Two experiment stations are doing research work in horticulture for the state. In 1879, the Cornell University Agricultural Experiment Station was organized at Ithaca. In 1888, this institution, one of the first of its kind in North America, was reorganized as a federal station. The New York Agricultural Experiment Station, located at Geneva, was established in 1882, and is supported by the state. Both stations give special attention to horticultural problems.

Horticultural education is provided for in a number of high-schools in the state; in secondary schools of agriculture at Alfred, Canton, and Morrisville.

Extension work in horticulture is also carried on in the state, through schools, farmers' institutes, and the like.

The various horticultural interests are nearly all organized into trade or educational societies, the time having long since passed when all could be represented in one organization. The first of these societies was the New York Horticultural Society, founded in New York City in 1818, long since extinct, probably the first organization of the kind in North America. In 1829 the Albany Horticultural Society was organized, but was short-lived. February 27, 1855, the Western New York Horticultural Society, now the oldest such society in the state, was organized, with headquarters at Rochester. February 27, 28, 1910, the New York State Fruit-Growers' Association was organized at Syracuse. The two societies named last have larger membership lists than any similar organization in North America. The nurserymen of the state have long had a trade organization, and the vegetable-growers are represented by the New York State Vegetable-Growers' Association, founded in 1913.

The State Department of Agriculture, at Albany, provides inspection service to control insects, diseases, fruit-grading, and fertilizers.

Statistics (*Thirteenth Census*).

The approximate land area in 1910 was 30,498,560 acres. The amount of this area that was in farm land in 1910 was 22,030,367 acres. Of this land in farms, 14,844,039 acres were improved; 4,436,145 were woodland; and the unimproved land in farms numbered 2,750,183 acres. The number of all the farms in 1910 was 215,597, and the average acreage a farm was 102.2. [The total area of New York is 49,204 square miles].

The leading agricultural crops are cereals, hay and forage, and forest products. In 1909, the acreage of cereals was 2,602,461, as compared with 3,125,077 in 1899, and the value of the cereals in 1909 was $43,099,988. Hay and forage decreased in acreage from 5,154,965, in 1899, to 5,043,373 in 1909, a decrease of 2.2 per cent. The value of hay and forage in 1909 was $77,360,645. The value of the forest products of the farms in 1909 was $10,365,651, as compared with $7,671,108 in 1899, showing an increase in value of 35 per cent.

Horticultural crops grown in New York are fruits and nuts, potatoes and other vegetables, small-fruits, flowers and plants, and nursery products. The value of the fruits and nuts in 1909 was $22,024,996, as compared with $13,377,105 in 1899, showing an increase in value of 64.6 per cent. The acreage of potatoes in 1909 was 394,319, as compared with 395,640 in 1899, and the value of the potatoes produced in 1909 was $20,338,766. Excluding potatoes, the acreage of other vegetables increased from 144,318, in 1899, to 175,402 in 1909, an increase of 21.5 per cent, and their value in 1909 was $15,963,384. The acreage of small-fruits in 1909 was 22,496, as compared with 25,051 in 1899, a decrease of 10.2 per cent, and their value in 1909 was $2,875,495. Flowers and plants and nursery products increased in acreage from 9,734, in 1899, to 11,659 in 1909, an increase of 19.8 per cent, and their value was $7,899,906.

The total quantity of orchard-fruits produced in 1909 was 29,456,291 bushels, valued at $17,988,894. Apples contributed about six-sevenths of this quantity, there being produced in 1909, 25,409,324 bushels, valued at $13,343,028. The number of apple trees of bearing age in 1910 numbered 11,248,203; those not of bearing age numbered 2,828,515. Peach and nectarine trees of bearing age in 1910 numbered 2,457,187; those not of bearing age, 2,216,907, and the production in 1909 was 1,736,483 bushels, valued at $2,014,088. Pear trees of bearing age in 1910 numbered 2,141,596; those not of bearing age, 1,502,661, and the production in 1909 was 1,343,089 bushels, valued at $1,418,218. Other orchard-fruits produced in 1909 were: 553,522 bushels of plums and prunes, valued at $519,192; 271,597 bushels of cherries, valued at $544,508; 132,451 bushels of quinces, valued at $135,345; and 9,805 bushels of apricots, valued at $14,490.

The total production of nuts in 1909 was 2,773,858 pounds, valued at $74,420. The more important productions of the various nuts were 286,227 pounds of chestnuts, valued at $23,589; 1,519,279 pounds of butternuts, valued at $21,631; 487,768 pounds of hickory-nuts, valued at $16,742; 465,918 pounds of black walnuts, valued at $11,485; and 9,346 pounds of Persian or English walnuts, valued at $858.

The number of grape-vines of bearing age in 1910 was 31,802,097; those not of bearing age, 3,801,800. The production of grapes in 1909 was 253,006,361 pounds, valued at $3,961,677, thus forming an important industry.

Of the small-fruits grown in New York, strawberries, raspberries and loganberries are the most important, with currants ranking next. The acreage of strawberries decreased from 7,311, in 1899, to 6,382 in 1909, when the production was 15,945,863 quarts, valued at $1,187,410. Raspberries and loganberries decreased in acreage from 12,376, in 1899, to 11,057 in 1909, when the production was 14,751,940 quarts, valued at $1,168,062. Currants decreased in acreage from 2,594, in 1899, to 2,557 in 1909, when the production was 3,982,389 quarts, valued at $264,051. The production of other small-fruits in 1909 was 2,509,851 quarts of blackberries and dewberries, valued at $210,986; 331,135 quarts of gooseberries, valued at $23,427; and 327,370 quarts of cranberries, valued at $20,743.

The value of vegetables, produced in 1909, excluding the potato, was $15,963,384, not exceeded by any other state in the United States in value of vegetable products. The leading vegetables grown in 1909 were 35,269 acres of cabbage, valued at $2,335,999; 2,926 acres of celery, valued at $946,424; 23,739 acres of sweet corn, valued at $942,023; 5,558 acres of onions, valued at $954,610; 16,992 acres of green peas, valued at $815,256; 8,636 acres of tomatoes, valued at $775,803. Other important vegetables grown in 1909 were asparagus, green beans, beets, carrots, cauliflower, lettuce and turnips, spinach, rhubarb, radishes, parsnips, horse-radish, cucumbers, cantaloupes, and muskmelons.

New York ranks first among the states in the production of flowers and plants. The acreage devoted to this industry increased from 1,496, in 1899, to 2,979 in 1909. The area under glass in 1909 was 15,066,587 square feet, of which 13,876,857 were covered by greenhouses and 1,189,730 were covered by sashes and frames. The value of the flowers and plants produced in 1909 was $5,148,949, as compared with $2,867,673 in 1899.

New York also ranks first in the value of nursery products produced. The acreage devoted to this industry increased from 8,238, in 1899, to 8,680 in 1909. The value of the nursery products in 1909 was $2,750,957, as compared with $1,642,107 in 1899.

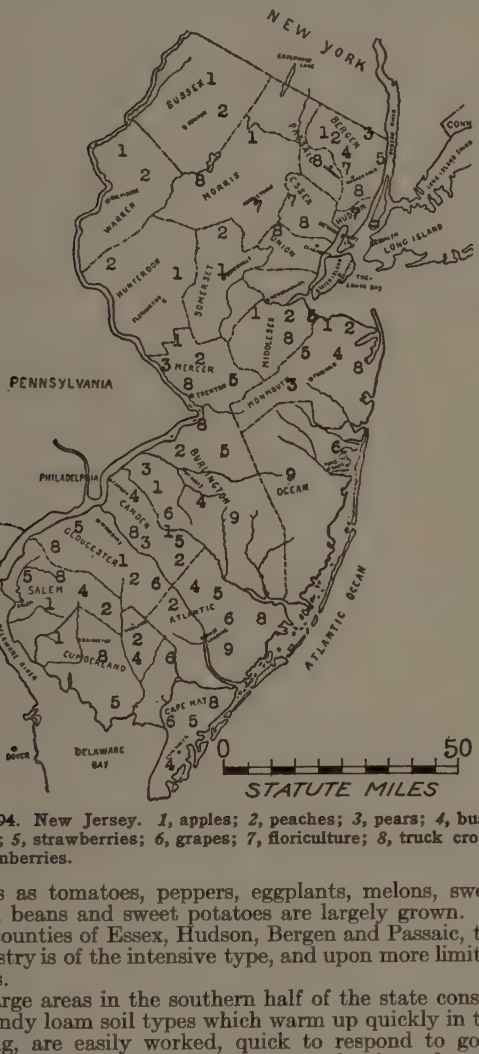
U. P. Hedrick.

New Jersey.

Considering its area, New Jersey (Fig. 2494) is wonderfully favored in its range of soil and climatic conditions. In the northern part, the land is rolling and hilly, with areas rich in lime and mineral plant-food, and with climatic conditions suitable for such apples as the Baldwin and Greening. South of this hilly area is a plains region crossing the counties of Somerset and Hunterdon, where varieties requiring a little longer season should be grown. The southern half of the state has soil types varying from clay loams to the lightest sand, offering ideal conditions for the growing of all crops from the sweet potato to celery, corn and grass, and from the cranberry to the peach. The southern counties have conditions resembling those of the Delaware and Maryland peninsula and early truck crops can be grown to good advantage. The northern counties have conditions resembling parts of New York and New England.

Situated between the greatest markets on the Atlantic seaboard, and near numerous industrial centers, the lands of the state are intensively cultivated to yield a great variety of horticultural products.

Vegetable and truck crops are produced to exceed a value of $7,000,000 annually, exclusive of potatoes and sweet potatoes. In the southern counties, the industry is conducted upon an extensive trucking basis, and such crops as tomatoes, peppers, eggplants, melons, sweet corn, beans and sweet potatoes are largely grown. In the counties of Essex, Hudson, Bergen and Passaic, the industry is of the intensive type, and upon more limited areas.



2494. New Jersey. *1*, apples; *2*, peaches; *3*, pears; *4*, bush-fruits; *5*, strawberries; *6*, grapes; *7*, floriculture; *8*, truck crops; *9*, cranberries.

Large areas in the southern half of the state consist of sandy loam soil types which warm up quickly in the spring, are easily worked, quick to respond to good management and ideal for the production of early vegetables upon an extensive scale. An extensive trucking area extends from just south of Bordentown along the Delaware River to Palmyra. Early peas, beans, sweet corn, rhubarb, asparagus, and other vegetables are grown in succession and companion cropping systems. Another characteristic of this section is the large number of young peach, apple and cherry orchards intercropped with vegetables. Another large trucking area centers about Moorestown. Fruit and vegetables are the important crops upon many farms in this region.

Swedesboro is the center of the great tomato and sweet potato section in Gloucester County, and is one of the leading shipping stations for vegetables in the United States. From fifty to sixty carloads of tomatoes is a common daily shipment at the height of the season, and during July, 1912, more than 400,000 crates were shipped by rail to distant points, while large quantities were sold in Philadelphia and other nearby markets. One day's shipment of tomatoes from Swedesboro in 1910 comprised 36,000 crates and 25,000 baskets. The industry about Swedesboro has become a specialty in the production of early tomatoes to be placed on the market after the southern crop has been shipped. Earliana is the variety almost exclusively grown.

Tomatoes are also grown very extensively outside the Swedesboro district. The reported acreage in New Jersey in 1910 was about one-eighth the reported acreage of the entire country and the value of the New Jersey crop was estimated to be about one-sixth the value of the crop in the United States. New Jersey tomatoes are consumed in large quantities in the smaller towns and cities of the state as well as at the large seashore resorts. Soil conditions are favorable to the production of tomatoes at no great distance from these local markets and they are kept well supplied throughout the season. Along the Delaware River, tomatoes are shipped by boat to Wilmington, Baltimore and Philadelphia. Refrigerator cars are employed for distant shipments by rail to such points as Boston, Pittsburgh, and Chicago. A few shipments are even made to markets as far south as Florida.

Another prominent feature of the tomato industry is the canning business. Large areas of tomatoes are grown under contract for the canning trade. Prices for canning tomatoes commonly range from $8 to $10 a ton. The medium- and late-crop tomatoes are the ones used for canning, and such varieties as Bonny Best, Cumberland, Stone, and Greater Baltimore are the most popular. The plant of the Campbell Soup Company is at Camden, and vast quantities of tomatoes are contracted for and purchased throughout southern New Jersey. At the height of the season, long lines of market wagons loaded with 175 to 250 baskets of tomatoes can be seen going into Camden.

Tomatoes are not the only vegetables that are canned in the state. More than fifty canning factories were in operation in central and southern New Jersey in 1912, and peas, beans, beets, sweet potatoes, and other vegetables are canned annually. The acreage and value of many vegetable crops are large in the state.

The floricultural interests of the state are great and products amounting to more than $2,850,000, are produced annually. The center of this industry is in Morris, Essex and Hudson counties, but with large individual plants at Riverton and other points.

Orchard-fruits are produced at an annual value exceeding $1,975,000. The introduction of the San José scale caused great damage to the orchards about 1900, but the culture of these fruits is now progressing as never before. Monmouth, Burlington and Gloucester counties now lead in the production of apples. Such varieties as Yellow Transparent, Duchess of Oldenburg, Williams, Gravenstein, English Codlin, Starr, Wealthy, Twenty Ounce, McIntosh, Grimes, Stayman, Baldwin, Rome, Delicious and Arkansas (Paragon) comprise a good commercial list for the state. The summer and fall varieties prove to be as profitable as the winter apples, and are being planted liberally.

Peach-production is increasing very rapidly upon modern lines. About the year 1900 the counties in the northwestern part of the state were leaders, but at present Burlington and Monmouth are assuming the lead with Gloucester, Atlantic and Cumberland making rapid strides. Annual plantings of 20,000 to 30,000 trees are being made about small centers where only an average of 4,000 to 8,000 trees were planted in 1908 and 1909. There has been a marked change in the popularity of varieties also. At one time Mountain Rose, Early Crawford and Reeves were leading commercial sorts, but today the list would be selected from such varieties as Greensboro, Carman, Lola, Hiley, Belle, Elberta, Frances, Iron Mountain and Krummel. Shipments were made in sixteen-quart baskets almost exclusively about 1900, but the Georgia carrier is now preferred for shipments by rail. The sixteen-quart and twenty-quart baskets are still used extensively where the fruit is hauled direct to the Philadelphia and local markets.

Pears are still grown in large quantities in Burlington, Gloucester, Camden and Monmouth counties, but apples and peaches have received more attention since the pear-blight appeared. In spite of this disease, however, the industry is holding its place. Such sorts as Bartlett, Seckel, Kieffer, Duchess and Lawrence are the most widely grown.

Plums are not being planted to any extent commercially. Most of this fruit is now produced in Bergen, Somerset and Morris counties.

The planting of sour cherries is on the increase, especially in Burlington and in counties south of it. Early Richmond and Montmorency are the most popular sorts.

Sweet cherries are planted to a limited extent only. Quinces are just beginning to receive attention commercially under modern methods and increased plantings are likely to be made each year.

The annual production of small-fruits holds nearly equal rank to that of the tree-fruits in New Jersey with a total area exceeding 24,000 acres. And of these the strawberry leads with an acreage exceeding 8,600 acres. Cumberland, Burlington and Atlantic counties lead in the production of this fruit.

The cranberry industry is the most extensive of any state in the Union. Over 9,000 acres are devoted to this crop. The features of the industry are the development of distinct varieties and the fertilizing and spraying of the bogs. This industry is centered in Burlington, Atlantic and Ocean counties.

Blackberries, dewberries and raspberries are extensively grown in all the southern counties of the state. The center of the industry is in Atlantic County about Hammonton. The Ranere (St. Regis) raspberry is said to have originated in this district. Ward is the most popular variety of blackberry, and Lucretia is the only dewberry grown to any extent. Currants and gooseberries are being planted in larger quantities, especially in Burlington, Monmouth, Camden and Bergen counties. Red Cross, Fay and Wilder are leading commercial currants, while Downing leads as a gooseberry.

The planting of vineyards is increasing. Large numbers of small vineyards are being set by Italian farmers in Atlantic, Cumberland and Gloucester counties. Vineyards of 100 acres or more in extent occur in Cumberland and Camden counties. The most popular varieties are Concord, Ives, Niagara, Diamond and Moore Early.

The motor-truck is becoming an important factor in New Jersey horticulture. Some fruit-growers and truckers are becoming independent of the railroads in getting their produce to market.

The following men did much to advance horticulture in New Jersey in early years: George Thurber, Passaic; E. Williams, Montclair; W. R. Ward, Lyons Farms; Joseph Ward, Lyons Farms; Patrick Quinn, Newark; Peter Henderson, Jersey City; Col. A. T. Pearson, Vineland; William Parry, Cinnaminson, and John Repp, Glassboro.

Public-service agencies for horticulture.

The land-grant college of New Jersey was established at New Brunswick in 1864 in connection with Rutgers College. There are now three men on the horticultural staff.

Both the College Station and the State Experiment Station are located in New Brunswick. The State Station is the only one conducting special horticultural investigations at the present time, and the staff consists of seven men. Much plant-breeding work with vegetables is being conducted at the College Experiment Station, which can be classed as either botanical or horticultural. Extensive peach investigations are conducted in different parts of the state but principally at Vineland where about 12 acres of land are leased by the Station. Eight bulletins have been issued relative to fruit-culture; thirteen to vegetable crops and one relative to both; thirty-six bulletins to insects injurious to fruits and vegetables; fourteen to diseases of fruits and vegetables, and one to both insects and diseases of fruits and vegetables. Five circulars and special bulletins have been issued in regard to fruit, three upon vegetable crops and ten upon insects and diseases affecting vegetable crops. One bulletin upon rose-culture is now ready for issue.

Three vocational schools have just been established in Atlantic County in which horticulture is taught. Horticulture is also taught in a few of the high-schools, especially at Freehold.

There is no provision made for horticulture in any state department at present. Extension work in horticulture is being conducted by one specialist and assistant in fruit-growing and one specialist in market-gardening.

Inspection of nursery stock for insects and diseases is in charge of the State Entomologist, and the State Plant Pathologist, who are both members of the Station staff.

The New Jersey State Horticultural Society has been an important factor in the progress of horticulture in New Jersey. This Society was organized August 17, 1875, at New Brunswick. George Thurber was elected as first president. A vegetable section was formed in December, 1914, in order to bring about coöperation between the trucking and fruit interests.

Statistics (Thirteenth Census).

The approximate land area of New Jersey in 1910 was 4,808,960 acres. The land in farms was 53.5 per cent of the land area, or 2,573,857 acres. Of this area in farms, 1,803,336 acres were improved land; 538,131 acres were in woodland; and 232,390 acres was other unimproved land in farms. The number of all the farms in 1910 was 33,487 and the average acreage to the farm 76.9. [The total area of the state is 8,224 square miles.]

The leading agricultural crops are cereals and hay and forage. The acreage devoted to cereals decreased from 588,853 in 1899 to 503,651 in 1909, when the value of the production was $9,797,937. Hay and forage decreased in acreage from 444,610 in 1899 to 401,315 in 1909, when the production was valued at $7,627,402. The value of the forest products of the farms in 1909 was $758,515, as compared with $469,055 in 1899.

Horticultural crops produced in New Jersey are fruits and nuts, small-fruits, vegetables including potatoes and sweet potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $2,115,321 as compared with $2,697,399 in 1899. Small-fruits decreased in acreage from 25,350 in 1899 to 24,069 in 1909, when 38,822,987 quarts were produced, valued at $1,954,125. In 1909 the total acreage of vegetables, including potatoes and sweet potatoes, was 181,722, and their value $14,073,467. Vegetables, excluding the potato and sweet potato, increased in acreage from 77,779 in 1899 to 86,227 in 1909, when the production was valued at $7,566,493. It is thus seen that the raising of vegetables is a very important industry in New Jersey, as 34.9 per cent of the total value of all crops in 1909 was produced by the vegetables, including potatoes. The raising of flowers and plants and nursery products is of considerable importance, the acreage having increased from 2,395 in 1899 to 3,603 in 1909, when the production was valued at $3,539,523.

The production of orchard fruits in New Jersey in 1909 was 2,372,358 bushels, valued at $1,975,044. Apples produced nearly three-fifths of this quantity, peaches and nectarines and pears most of the remainder. The production of apples in 1909 was 1,406,778 bushels, valued at $956,108. The number of apple trees of bearing age in 1910 was 1,053,626 and those not of bearing age 519,749. Peach and nectarine trees of bearing age in 1910 numbered 1,216,476; those not of bearing age, 1,363,632, and the production in 1909 was 441,440 bushels, valued at $652,771. The number of pear trees of bearing age in 1910 was 731,616; those not of bearing age, 238,401, and the production in 1909 was 463,290 bushels, valued at $254,582. Other fruits produced in 1909 were: 44,636 bushels of cherries, valued at $87,225; 9,594 bushels of plums and prunes, valued at $13,476; 6,442 bushels of quinces, valued at $10,583; and 178 bushels of apricots, valued at $299.

The production of grapes increased from 4,235,000 pounds in 1899 to 6,501,221 pounds in 1909, valued at $132,957. The grape-vines of bearing age in 1910 numbered 1,603,280; those not of bearing age, 558,945.

The total production of nuts in 1909 was 249,626 pounds, valued at $7,116. The production of the more important of the individual nuts was 151,828 pounds of black walnuts, valued at $2,766; 62,243 pounds of hickory-nuts, valued at $2,468; and 25,987 pounds of chestnuts, valued at $1,413.

Strawberries are the most important of the small-fruits grown in New Jersey, with cranberries second in importance. The acreage of strawberries decreased from 8,746 in 1899 to 8,684 in 1909, when the production was 18,767,473 quarts, valued at $929,108. The acreage of cranberries increased from 8,356 in 1899 to 9,030 in 1909, when the production was 12,072,288 quarts, valued at $504,026. The acreage of blackberries and dewberries decreased from 5,254 in 1899 to 4,332 in 1909, when the production was 5,456,789 quarts, valued at $313,480. Raspberries and loganberries decreased in acreage from 2,240 in 1899 to 1,744 in 1909, when the production was 2,143,877 quarts, valued at $178,579. The production of gooseberries in 1909 was 221,337 quarts, valued at $16,171; and that of currants 161,223 quarts, valued at $12,761.

The potato industry increased from an acreage of 52,896 in 1899 to 72,991 in 1909, when the production was 8,057,424 bushels, valued at $4,979,900. The sweet potato and yam acreage increased from 20,588 acres in 1899 to 22,504 in 1909, when the production was 3,186,499 bushels, valued at $1,527,074. Of the other vegetables produced in New Jersey in 1909, the more prominent were: 26,552 acres of tomatoes, valued at $2,131,973; 5,148 acres of asparagus, valued at $602,317; 10,442 acres of sweet corn, valued at $557,708; 4,864 acres of cabbage, valued at $368,454; 3,861 acres of cantaloupes and muskmelons, valued at $306,073; 3,740 acres of green beans, valued at $238,149; 4,912 acres of green peas, valued at $208,934; 621 acres of celery, valued at $201,735; 1,417 bushels of onions, valued at $171,344; and 2,226 acres of watermelons, valued at $137,584. Other vegetables produced were beets, carrots, cauliflower, cucumbers, eggplant, horse-radish, lettuce, parsley, parsnips, green peppers, pumpkins, radishes, rhubarb, spinach, squash and turnips.

The acreage devoted to the flower and plant industry increased from 613 in 1899 to 1,436 in 1909. The area under glass in 1909 was 8,840,511 square feet, of which 7,984,752 were covered by greenhouses and 855,759 by sashes and frames. The value of the flowers and plants produced in 1909 was $2,857,709.

Nursery products increased in acreage from 1,782 in 1899 to 2,167 in 1909, when the nursery products were valued at $681,814, as compared with $339,926 in 1899.

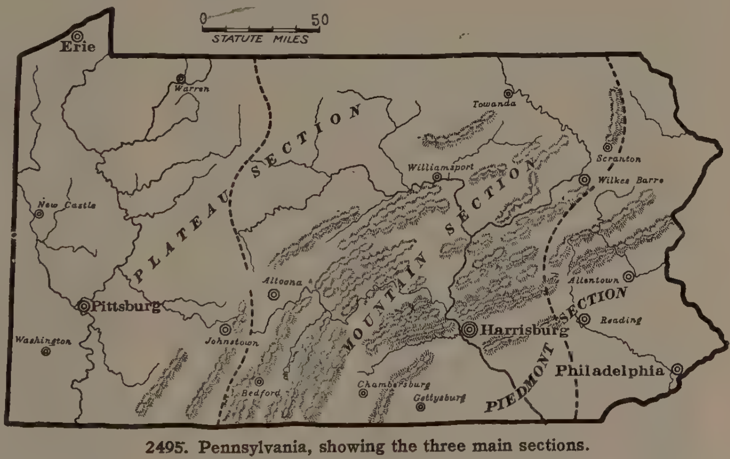
M. A. Blake.

Pennsylvania.

Pennsylvania (Fig. 2495) is the second state in the Union in population, although only the thirty-second in size. It is located between parallels 39° 40′ and 42° north, and in longitude between 75° and 80° 30′ west. It is roughly rectangular in shape, averaging 285.8 miles in length and 157.8 miles in width, about 65 per cent of its area being in farms. The large unfarmed area remaining is due chiefly to the fact that the entire Appalachian system swings diagonally across the state, leaving most of it rough and mountainous. It is also partly due to the great strength of the coal-mining and the gas, petroleum and lumbering industries, some of which, however, are now on the wane. In altitude, the state varies from practically sea-level in the Philadelphia section to a height of nearly 3,000 feet in the central mountain and plateau region, and then sinks again to about 600 feet above sea-level along the Lake Erie shore.

The precipitation varies considerably in different localities, owing largely to their relation to the adjacent mountains, but in general it is satisfactory. Towanda is in one of the lowest sections, with an annual average of only 34.6 inches. From this, the average rises to 38.2 inches at Erie and to 40.9 inches annually at Philadelphia. At Pittsburgh, State College and Harrisburg, the averages have been 36.2, 38.9, and 36.9 inches respectively, over observation periods ranging from twenty to sixty-three years. At State College, the extremes during the last thirty years have been 25.2 and 45.8 inches.

The annual temperatures also naturally vary considerably as a result of mountain or of water influences. At representative points in the state the records show the following averages over long periods: Erie, 48.8°; Pittsburgh, 52.7°; State College, 48.6°; Towanda, 47.8°; Harrisburg, 51.6°; and Philadelphia, 52°. Similarly the records show that the average growing season, or the average period between killing frosts, is especially variable, showing the great influence of altitude or of large bodies of water on the average length of the frost-free period.



2495. Pennsylvania, showing the three main sections.

Looking at the general surface of the state in greater detail, it is seen that it is divided into three great sections. The first of these lies east and south of the Blue Mountains, which run in a broad curving line from Franklin County around north of Harrisburg to the northern side of Northampton County. This section has a generally rolling to hilly topography, broken by a few irregular low mountain groups, of which the South Mountains, Welsh Mountains and the Reading Hills are most prominent. This was the region first settled, and it is now mostly under cultivation and contains probably the best lands of the state. It includes the small coastal plain region, the Piedmont plateau, and a part of the Limestone Valley and Alleghany Mountain provinces, the latter of which crops out in the low mountain groups referred to above.

The second section extends from the Blue Mountains to the Alleghany escarpment, which runs from Somerset County around west of Altoona, slightly north of Williamsport and on eastward in reduced form through Lackawanna and Wayne counties. In general form, this section is a large crescent, about 50 to 60 miles in width, and comprises about a fourth of the state. It consists of a numerous succession of parallel mountain ranges, derived from hard sandstones and separated by comparatively narrow valleys which have been carved out from shales or soft sandstones. It includes parts of the Alleghany Mountain, Limestone Valley, and glacial provinces. The broader valleys in this section, especially those of limestone origin, are fertile and well adapted to general farm crops, but the hills and mountain slopes are usually stony and more or less barren.

The third or plateau section lies west and north of the Alleghany escarpment and includes about 55 per cent of the area of the state. It consists of a much-dissected plateau, broken by occasional mountain ridges, and deeply scored by frequent streams or cañons, some of the latter being as much as 800 feet deep in the northern part, where the general elevation is greatest. Most of this area is distinctly mountainous in character. It has been very largely in forests, and much of it has been cleared so recently that but little has yet been accomplished toward its utilization along other lines. The soils of the DeKalb series are much the most extensive in this general region, though the Westmoreland, Upshur, and Berks soils are fairly prominent. The general location and adaptations of these and all other important soils in the state, are well given in a recent Bulletin, No. 132, by C. F. Shaw, from the Pennsylvania Station.

From the horticultural viewpoint, there is probably no state in the Union with greater possibilities than Pennsylvania. Its general location, large population, wide range of soils and almost unlimited choice of topography within relatively small areas, offer advantages that are very difficult to equal elsewhere. These advantages have only begun to be realized, however, and although the production is already large along many lines, it has generally been due to the large aggregate of relatively small growers producing for local markets, rather than to any large and well-managed commercial efforts. The present development, therefore, must be regarded only as a beginning.

In total value of horticultural products, Pennsylvania usually ranks third, being preceded by California and New York and followed by Michigan. In 1909, Michigan forged slightly ahead in total value of fruit, but even in that year the shortage in fruit was much more than made up by the difference in vegetables, flowers and nursery products, and with the latter included the state easily secured third place with a margin of more than $4,500,000.

Among the specific horticultural crops, apples are probably the most cosmopolitan, since they usually thrive in almost any part of the state where both local conditions and varieties have been properly selected. They contributed about five-sixths of the total orchard production in 1909. Both apples and peaches do especially well in proper locations over the entire Piedmont section of southeastern Pennsylvania, referred to above. They are also grown with special success on many of the foothills and more gentle slopes of the eastern and southern ranges of the Appalachian system. In Erie County, the narrow glacial lake area in the extreme northwestern part of the state is being rapidly developed for the production of grapes and peaches especially, with considerable commercial interest also in apples, cherries, plums and vegetables. This county is distinctly in the lead in horticultural products as a whole, and is followed in order by Lancaster and York, whose high totals are due chiefly to their large vegetable-production. In apples, however, the most intensive commercial area at present is the one in Adams County, although there are a number of other localities in the state where the natural advantages are fully as good, as shown by the marked success of individual orchards.

Many important varieties of fruits have originated in Pennsylvania, some of them now being grown widely. Among apples, the most important are as follows: York Imperial, Smokehouse, Rambo, Cornell (Fancy), Sweet Winesap, Smith (Cider), Jefferis, Ewalt (Walker Beauty), Major, Minkler, Winter Sweet Paradise, York Stripe, Winter Blush, Fallawater, Early Ripe, Doctor, Belmont, Strode (Birmingham), Wine, Cooper Market, Dickinson, Evening Party, Golden Spy, Krauser, and Lehigh (Greening). Altogether, Pennsylvania is credited with the origin of no less than 314 varieties of apples.

Among the pears, the following are the most important that have originated in Pennsylvania, viz., the Seckel, Tyson, Rutter, Brandywine, Kieffer, Garber and Ott. Of the plums, the most important of Pennsylvania origin are the Richland, Hulings, and Spaulding; of raspberries, the Cumberland, Philadelphia (purple-cane) and the Orange (a hybrid of *Rubus Idæus* and a native American species, originated by Dr. Brincklé); of blackberries, the Allen and Erie are most important; of strawberries, Brandywine, Cumberland, Glen Mary and Sharpless; of peaches, the Globe, Klondike, and Tippecanoe; of cherries, the Ida; of chestnuts, the Paragon, Bartram, Miller, Numbo, Corson, Comfort, and Styer; of Persian walnuts, the Rush.

The opportunities for commercial vegetable-production are especially good in Pennsylvania because of its unusual number of good-sized cities and towns, in which the people are chiefly engaged in manufacturing or other industrial pursuits. In fact Pennsylvania contains fifty-eight cities of more than 10,000 inhabitants, which is seven more than any other state. This has developed large local production of vegetables around these cities in all parts of the state. In addition, there are considerable areas producing cabbage and other vegetables for shipment,—notably in Lancaster, York and Erie counties.

Another vegetable area of very intensive production has been developed on the muck soils around Wellsboro in Tioga County. In this place a total of about 280 to 300 acres of regular mucklands are in active service, besides some of the more fertile adjacent loams, which have sufficient fiber to produce good crops for a few years in favorable seasons. The annual production is estimated to bring in to the growers from $125,000 to $150,000, depending on season and prices. Celery and head lettuce are the only crops produced to any extent, and only one variety of each is used,—the Golden Self-blanching celery and the Big Boston lettuce. The former constitutes about 70 per cent of the crop. The crop is marketed in carlots, all of the lettuce and most of the celery going to Philadelphia.

Some of the leading varieties of vegetables that have apparently originated in Pennsylvania are as follows: bean, Burpee Bush Lima,—the fore-runner of all the large-podded bush limas, which was found as a chance variation in a field of Large White limas on the farm of Asa Palmer near Kennett Square, in 1883; celery, Fordhook Emperor; beet, Burpee Extra Early, Bastian Extra Early Turnip, and Bastian Half-long Turnip; cabbage, Burpee Surehead and Houser. The latter is said to be the result of a cross between Flat Dutch and Fottler Brunswick. It was developed by George Houser about 1890 and introduced by the Holmes Seed Company in 1900; tomato, Chalk Jewel and Bonny Best. The former is the result of a cross between Hubbard Curled Leaf and Livingston Perfection, made by James Chalk of Norristown, in 1889. Bonny Best is said to be a selection of Chalk Jewel and was introduced by W. P. Stokes, in 1908.

The floricultural and special-crop interests have been developed to an unusual extent in the general vicinity of Pennsylvania. Some fifteen or twenty years ago, the carnation industry had developed to such an extent, especially around Kennett Square, that it had become known as the "carnation belt." There was also an unusual development of mushroom-production in the same district. Both industries then dropped back very materially for a time, but in the last few years the production of carnations, and especially of sweet peas, has come in again. The special carnation area has also extended and is now being developed to a large extent north of Philadelphia as far out as Hatboro, and even up to Lancaster. The latter city is becoming a carnation center, and is also producing considerable quantities of sweet peas, of which the leading varieties in this general section are of the Spencer class.

All the large growers in and around Philadelphia are also engaged in rose-production with a few fairly large places that are specializing in them. The American Beauty is the leading variety, especially in the Chestnut Hill district, which has the reputation of producing this rose in the highest state of perfection. The state as a whole, is credited with 1,331 floricultural establishments in 1909 with a value of $3,803,000. It was excelled only by New York in this respect.

The nursery and seed interests around Philadelphia are also noteworthy. The seed-farms of Burpee & Company near Doylestown, and of the D. Landreth Seed Company near Bristol are among the largest in the country,—the former involving about 450 acres and the latter about 600 acres. The latter seed-house was established in Philadelphia in 1784. In nurseries, for both fruit and ornamental stock, there is now a total of more than 2,600 acres within a few miles of Philadelphia,—in Chester, Bucks, Montgomery, and Philadelphia counties,—which makes this one of the leading centers of the country for these industries.

In parks and city improvement systems, Pennsylvania is showing an unusual degree of interest. The oldest and largest rural park in the state is Fairmount in Philadelphia, which now has 3,448 acres and is being extended annually, part of it at great cost. It now includes the old Bartram Garden, established in 1728, the first attempt in the United States to gather trees for study purposes. The Centennial Exposition of 1876 was located in this park. Other smaller areas are annually being acquired for rural or community parks in various sections of the city. Pittsburgh has two rural parks, Schenley and Highland, and also the Alleghany Parks formerly known as the Commons. Especially notable park and civic improvements have been made in Harrisburg since 1902. The parking of the Susquehanna River front, the flood-prevention, extension of Reservoir Hill Park, establishment of playgrounds under supervision, the extension of Capitol Park, and the city control of shade trees are worthy of emulation by larger cities.

Among those now deceased who have rendered important service in one or more phases of horticulture, the following may be mentioned: John Bartram (volume III, page 1564), the founder of the Bartram Garden; John Adlum (page 1563), a native of York County, who first called special attention to the Catawba grape; William D. Brincklé (page 1566), of Philadelphia, the second president of the American Pomological Society, experimenter with raspberries, strawberries, and pears, originator of the Orange raspberry in 1843, which is even yet the quality ideal in this fruit; Henry A. Dreer (page 1573), one of the pioneer seedsmen and nurserymen especially along ornamental lines; Thomas Meehan (page 1587), nurseryman and extensive writer along floricultural and landscape lines; W. G. Waring, nurseryman, fruit-grower, friend of Downing, and one of the first teachers of general horticulture in the College; Wm. A. Buckhout, and G. C. Butz (page 1568), botanists and horticulturists, long connected with the teaching staff of the College and state; and Gabriel Hiester (page 1580), fruit-grower, horticultural writer, long-time president of the State Horticultural Association.

Public-service agencies for horticulture.

The land-grant college of the state was opened for students in February, 1859, under the name of the "Farmers' High-School." This name was changed to "The Agricultural College of Pennsylvania" in May, 1862, and this again was changed to "The Pennsylvania State College" in 1874. It was accepted by the state as the land-grant college in 1863. There are now (in 1915) eleven men on the horticultural staff.

The Experiment Station is located at the College, and, including the Institute of Animal Nutrition, it involves a staff of eighty-eight persons. Thirty bulletins on horticultural subjects have been published by the Station, and twenty-one by the State Department of Agriculture, located at Harrisburg.

The School of Horticulture for Women at Ambler has a total of 90 acres of land, 20 acres being reserved for horticultural work. There are some thirteen agricultural high-schools in the state, giving more or less instruction in horticulture.

Some horticultural work, especially along the line of spraying and pruning demonstrations in connection with pest control, has been done for the past five or six years by the State Department of Agriculture at Harrisburg. The nursery inspection for the state is also done there, while the plant-disease work is in charge of the College. Definite inspection of the grading of fruit has not been provided for as yet.

A considerable amount of extension work in horticulture is done by the College staff, working especially through the state and county horticultural organizations. The experimental orchards of apples and peaches maintained by the College in the various fruit-growing sections of the state may also be considered as an important part of the extension work in the state.

Other associations devoted to horticultural interests are the State Horticultural Association of Pennsylvania, the Pennsylvania Horticultural Society (devoted chiefly to floricultural interests) and Pennsylvania Nurserymen's Association.

Statistics (*Thirteenth Census*).

The approximate land-area in 1910 was 28,692,480 acres. The land in farms was 64.8 per cent of the land area or 18,586,832 acres. Of this land in farms, the improved land numbered 12,673,519 acres; the woodland 4,281,439 acres; and other unimproved land in farms 1,631,874 acres. The number of all the farms in the state was 219,295, and the average acreage a farm 84.8. [The total area of Pennsylvania is 45,126 square miles.]

The leading agricultural crops of Pennsylvania are cereals, hay and forage, and tobacco. The acreage devoted to cereals decreased from 4,738,195 in 1899 to 4,324,058 in 1909, when the production was valued at $70,348,726, which was 42.2 per cent of the total value of all crops. Hay and forage decreased in acreage from 3,269,441 in 1899 to 3,088,105 in 1909, when the production was valued at $45,623,573, which was 27.4 per cent of the total value of all crops. Tobacco increased in acreage from 27,760 in 1899 to 41,742 in 1909, when the production was valued at $3,926,116. The value of the forest products of the farms was $7,986,599 in 1909, as compared with $6,481,181 in 1899.

Horticultural crops raised in Pennsylvania are fruits and nuts, small-fruits, potatoes and other vegetables and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $9,619,156, as compared with $8,707,131 in 1899. Small-fruits decreased in acreage from 12,271 in 1899 to 8,678 in 1909, when the production was 13,620,047 quarts, valued at $1,175,016. The total acreage of potatoes and other vegetables in 1909 was 357,430 acres and their value $22,092,197. Excluding potatoes, the acreage of the other vegetables increased from 79,126 in 1899 to 94,111 in 1909, when the production was valued at $10,013,920. The acreage devoted to the production of flowers and plants and nursery products increased from 4,274 in 1899 to 4,860 in 1909, when the production was valued at $4,725,987.

The production of all orchard-fruits in 1909 was 13,285,953 bushels, valued at $8,677,986. The production of apples, the most important of the orchard-fruits, was, in 1909, 11,048,430 bushels, valued at $5,557,616. The number of apple trees of bearing age in 1910 was 8,000,456; those not of bearing age, 2,501,185. The number of peach and nectarine trees of bearing age, in 1910 was 2,383,027; those not of bearing age, 2,179,386. The production in 1909 was 1,023,570 bushels, valued at $1,351,175. The other orchard-fruits produced were 378,825 bushels of pears, valued at $356,240; 295,158 bushels of plums and prunes, valued at $396,005; 475,093 bushels of cherries, valued at $909,975; 62,350 bushels of quinces, valued at $102,431; and 2,502 bushels of apricots, valued at $4,497.

The production of grapes in 1909 was 34,020,198 pounds, valued at $850,708. The grape-vines of bearing age in 1910 numbered 5,271,264; those not of bearing age, 8,252,811.

The total production of nuts in 1909 was 3,795,804 pounds, valued at $90,447. The individual production of the various nuts was: 2,162,471 pounds of black walnuts, valued at $39,306; 593,200 pounds of hickory-nuts, valued at $25,348; 233,834 pounds of chestnuts, valued at $15,185; 782,415 pounds of butternuts, valued at $9,408; 14,885 pounds of pecans, valued at $532; and 4,523 pounds of Persian or English walnuts, valued at $516.

Strawberries are the most important of the small-fruits grown in Pennsylvania, with raspberries and loganberries second in importance. The acreage of strawberries decreased from 5,667 in 1899 to 4,136 in 1909, when the production was 9,033,904 quarts, valued at $759,154. Raspberries and loganberries decreased in acreage from 3,938 in 1899 to 2,594 in 1909, when the production was 2,906,302 quarts, valued at $272,337. Blackberries and dewberries decreased in acreage from 1,383 in 1899 to 1,235 in 1909, when the production was 1,063,257 quarts, valued at $91,007. Other small-fruits produced were: 493,871 quarts of currants, valued at $42,181; 109,104 quarts of gooseberries, valued at $9,047; and 5,728 quarts of cranberries, valued at $503.

The acreage of potatoes in Pennsylvania increased from 227,867 in 1899 to 262,013 in 1909, when the production was 21,740,611 bushels, valued at $11,973,843. The more important of the other vegetables produced in 1909 were: 11,764 acres of sweet corn, valued at $507,736; 5,679 acres of cabbage, valued at $502,969; 4,204 acres of tomatoes, valued at $412,519; 1,096 acres of celery, valued at $254,693; 1,191 acres of asparagus, valued at $174,965; 551 acres of onions, valued at $107,307; and 1,752 acres of turnips, valued at $86,079. Vegetables the production of which was valued between $10,000 and $50,000 were green beans, beets, cantaloupes and muskmelons, carrots, cucumbers, horse-radish, lettuce, green peas, radishes, rhubarb, spinach, and watermelons. Vegetable products, the production of which was valued at less than $10,000, were cauliflower, pop-corn, eggplant, kale, parsley, parsnips, green peppers, pumpkins, rutabagas and squash.

Flowers and plants increased in acreage from 1,073 in 1899 to 2,032 in 1909. The area under glass in 1909 was 13,846,672 square feet, of which 12,887,672 were covered by greenhouses, and 959,000 by sashes and frames. The value of the flowers and plants produced in 1909 was $3,803,418, as compared with $2,246,075 in 1899.

The acreage devoted to nursery products decreased from 3,201 in 1899 to 2,828 in 1909, when the value of the nursery products produced was $922,569, as compared with $541,032 in 1899. The production of flower and vegetable seeds was valued at $36,316 in 1909, as compared with $104,229 in 1899.

John P. Stewart.

EAST NORTH CENTRAL STATES.

Ohio.

Ohio (Fig. 2496) is essentially an agricultural state. This is not because the soil and climate are not adapted to the production of horticultural products, but rather for the reason that in early days the markets for fruit and vegetables were limited. With the growth of cities and the opening of markets in other states and countries, there has been a steady increase in the production of most kinds of horticultural products which are adapted to the climate.

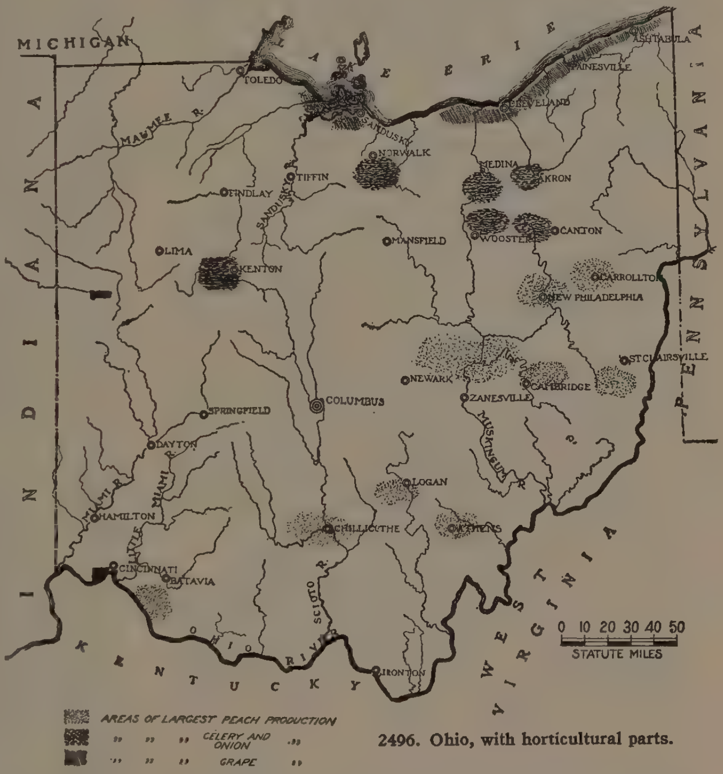
The climate is well suited to fruit-culture except in an occasional season. Even in such cases, losses by extreme cold may usually be avoided by proper selection of site. There are only limited areas where the soils are unadapted either to fruits or vegetables. There are many soils which are found to be well adapted to specialized crop-production. The annual rainfall is about 38 inches and crop failures because of severe drought seldom occur.

The influence of Lake Erie, on the north, is very marked upon fruit-culture in general. In that region, peach buds are seldom killed in winter, while both early and late frosts seldom harm early blossoms or late-ripening fruits. Fruit-production for this reason has been greatly stimulated in that region. Convenience to markets has been a potent factor also. The soil in the lake region varies from a sandy to heavy clay, thus making it possible to grow all of the fruits which thrive within the state. More back-to-the-land fruit-growers are found in this region than in any other part of the state. The larger number, however, are men of considerable practical experience, most of whom are successful along special lines of fruit-culture.

The hill lands in the southern and eastern parts of the state constitute another distinct division suitable for most kinds of fruits. The special virtue of these lands is that they give high color, good flavor and excellent keeping quality to apples, peaches and pears. This is particularly true of the greatest elevations. Comparative freedom from frost is another virtue of the hill lands. In many cases, however, the soil on the hills is much worn and lacking in humus. The success of the Experiment Station in the use of commercial fertilizer on apple orchards in this region has stimulated apple-growers to practise better methods. Many orchards have been brought back from low crop-production to a very satisfactory condition of fruitfulness. The restoration of humus has not kept pace with fertilizing, but without doubt this important feature of orchard rejuvenation will not be neglected much longer.

On the whole, Ohio compares favorably with other states as to horticultural possibilities, but not as to development. However, there have been marked increases in crop-production within recent years of apples, peaches, cherries, potatoes, onions, celery, tomatoes, greenhouse vegetables and canning crops. There has been some falling off in grapes and berries, but enough are still produced for the local markets.

Increased interest in horticultural work is manifest along many lines but the greatest is in apple-culture. Old orchards are decaying rapidly but many new ones have been planted and the best of the old ones rejuvenated. The apples have been greatly improved in quality by proper care of the trees. This is plainly shown by the rapidly improving excellence of the apple shows, both as to quality and quantity of fruit displayed. The stimulus of the shows seems to have been more to improve the quality than to increase the quantity, and yet many orchards have been planted recently. Many of these are of considerable size; 50- and 100-acre orchards are becoming quite common. It does not appear, however, that overplanting has been done as the standard of excellence is maintained. The greater part of the planting is in the eastern and southeastern part of the state. Nearly all of the orchards planted are for commercial purposes. Home orchards are decaying more rapidly than new ones are being planted.



2496. Ohio, with horticultural parts.

It cannot be said that there are any well-defined apple-belts within the state. Apple orcharding is usually carried on with general farming or with some other line of fruit-growing. Mature apple orchards are not usually cultivated in the hilly part of the state. Mulching is often practised where material can be secured. Young orchards are usually cultivated for a few years, but orchards set in grass and well mulched are not uncommon.

Rome Beauty is the general favorite for market in the southern part of the state and Baldwin takes the same place in the northern part, although it is not planted so exclusively as the Rome Beauty. Ben Davis has been a favorite in all sections but its popularity is waning, although it is still retained by many growers in the southern counties. There are no other varieties so extremely sectional as those named, although Rhode Island Greening and Northern Spy are nearly so in the north, and Willow Twig in the eastern part of the state.

Peaches are not grown to any extent commercially except along the southern shore of Lake Erie. Peach orchards have nearly supplanted vineyards in the lake counties. Partial or full crops are often produced in the central and southern part of the state, and these have the effect of keeping the industry alive, although less flourishing in Athens, Muskingum and Coshocton counties than formerly. Better cultural conditions and more care in protecting against peach-tree enemies are given peach orchards in the lake region than elsewhere in the state. Ottawa is the best peach county of the state in sureness of crop, care given and crop-production.

Pears are not extensively grown in any part of Ohio, the Kieffer being planted more than any other variety. This variety has recently shown such susceptibility to blight that it is now regarded as a menace to pear- and apple-culture. The destruction of Kieffer pear trees is regarded by some as a necessary step in orchard sanitation.

American and Japanese plums are discarded by plum-growers and but few remain to mark an erratic and unprofitable venture. No varieties but European are now planted, but the attention given to plum-culture within the state is limited.

The culture of cherries is confined almost wholly to sour varieties. The center of this industry is at Clyde, but small orchards are found in most parts of the state.

Grape-culture along the lake shore east of Cleveland has fallen off considerably in recent years because of the encroachment of the city and failure of the growers to control the berry moth. Prices also have been unsatisfactory. The manufacture of unfermented grape-juice, which has assumed considerable proportions, has helped to improve prices somewhat on the islands, but has not stimulated planting to any extent.

Small-fruits of all kinds are grown in sufficient quantities for the home markets, by local growers, but few shipments are made to points outside the state. There are no small-fruit belts within the state, although more are grown in the northern part than elsewhere.

There is much interest in Persian walnuts and pecans at present, and plans have been considered of starting orchards of these nut-bearing trees. Along Lake Erie and the Ohio River, a few trees are known to be producing fruit. Thus far both of these species appear to be tender in winter. Persian walnut trees, except along the lake shore, almost always die back to the ground in winter. Pecans are more hardy, and early ripening varieties may prove satisfactory. But little effort has been made, however, to use grafted trees, especially in the case of Persian walnuts, thus courting failure. No orchards are known to have been planted of these nut-trees, and the same is true of other nut-bearing trees.

Market-garden crops, including potatoes, bring greater returns than the fruit crops. Potato-culture has assumed considerable proportions in Portage, Stark, Summit, Cuyahoga and Wayne counties, following closely what is termed the "wheat belt." Hamilton produces more early potatoes than any other county.

Celery and onions are grown largely on mucklands in Hardin, Huron, Medina, Wayne, Cuyahoga, Stark and Ashtabula counties. It has been found possible to sub-irrigate some of these muck farms, making crop production more sure.

Tomatoes are grown in various parts of the state, in large quantities for canning factories. In the southeastern part of the state, near Marietta, several hundred acres are devoted to growing early tomatoes. Staking the plants is the universal practice, as it is conducive to early maturity.

Early cabbage is grown in the same locality and at various other points along the Ohio River. Late cabbage, for krout, is an important crop in Sandusky and Seneca counties.

Several thousand acres, in various parts of the state, are devoted to cucumbers for pickling establishments. Canneries use sweet corn, tomatoes and peas almost exclusively, except peaches in the peach-belt.

Vegetable-culture under glass has assumed very large proportions at Ashtabula, Cleveland, Columbus, Newark and Toledo, but vegetable houses of considerable size are found in all parts of the state. Grand Rapids lettuce, tomatoes and cucumbers are the principal crops grown.

There are about 300 acres under glass within the state devoted to vegetable-culture, with an investment of $6,000,000. One house in Toledo covering 10 acres, is said to be the largest in the world devoted to vegetable-culture. Vegetable-forcing about Cincinnati has been conducted mostly in hotbeds and coldframes, but greenhouses are now taking the place of beds. The greatest development of this industry is at Ashtabula, Toledo, Cleveland, Columbus, Newark, and Barberton. Small houses are also found in many towns. The usual custom is to change the soil in vegetable houses at frequent intervals. Soil-sterilization by steaming is practised, and manure or some fresh compost added each year. It has been found that mulching the soil with coarse manures as soon as the spring crops are off, and watering frequently, answers essentially the same purpose as sterilization. Beds have been kept in good condition eight years by this method.

Floral establishments are found in nearly every city and town. The larger number of these are for cut-flowers but a few do a mail order business and others grow pot and bedding plants.

The nursery business is very large and supplies more trees than are needed within the state, possibly apple trees excepted. A large increase in ornamental stock is reported, and there is evident improvement in methods of planting home grounds.

Among those influential in the early development of Ohio horticulture are: J. P. Kirtland (Volume III, page 1582); J. A. Warder (page 1602), with whom were closely associated Nicholas Longworth (page 1585), A. H. Ernst (page 1574), S. S. Jackson and A. H. Hoopes; George W. Campbell (page 1568); M. B. Bateham; F. R. Elliott (page 1574); Nelson Cox, who demonstrated the feasibility of apple-culture on the hill lands of the state; A. W. Livingston, who greatly improved the tomato and N. Ohmer.

Public-service agencies for horticulture.

The College of Agriculture of Ohio is located at Columbus. There are six teaching members of the horticultural staff.

The Experiment Station is at Wooster. Much experimental work is in progress at three branch stations, or test farms, belonging to the station, and six county farms under station control.

The Bureau of Nursery and Orchard Inspection at Columbus has charge of the inspection work.

The first horticultural organization was the Ohio Pomological Society in 1847. The name was afterward changed to the Ohio State Horticultural Society.

Statistics (Thirteenth Census).

The approximate land area of Ohio in 1910 was 26,073,600 acres. The land in farms was 92.5 per cent of the land area, or 24,105,708 acres. Of this land in farms, the improved farm land numbered 19,227,969 acres; the woodland 3,285,376 acres; and other unimproved land in farms 1,592,363 acres. The total number of farms in 1910 was 272,045, and the average acreage 88.6 acres. [The total area of the state is 41,040 square miles.]

The leading agricultural crops of Ohio are cereals, hay and forage, tobacco, and forest products of farms. The acreage devoted to cereals decreased from 8,214,960 in 1899 to 7,649,873 in 1909, when the production was valued at $137,907,934, which was 59.9 per cent of the total value of all crops of the state. The acreage of hay and forage was 3,015,261 in 1899 and 3,306,461 in 1909, when the production was valued at $42,357,364. Tobacco increased in acreage from 71,422 in 1899 to 106,477 in 1909, when the product was valued at $8,998,887. Forest products of farms in 1909 were valued at $5,761,941, as compared with $5,625,897 in 1899.

Horticultural crops produced in Ohio are fruits and nuts, small-fruits, potatoes and vegetables, and flowers, plants, and nursery products. In 1909 the value of the fruits and nuts produced was $6,561,861, as compared with $7,138,734 in 1899. Small-fruits decreased in acreage from 21,121 in 1899 to 11,591 in 1909, when the production was 15,721,023 quarts, valued at $1,296,343. In 1909 the total acreage of potatoes and other vegetables was 337,412, and their value $20,875,927. Excluding potatoes, the acreage of the other vegetables increased from 103,346 in 1899 to 123,461 in 1909, when the production was valued at $11,393,791. The raising of flowers and plants and nursery products is of considerable importance, the acreage having increased from 5,384 in 1899 to 5,788 in 1909, when the production was valued at $3,245,181.

The total production of orchard-fruits produced in 1909 was 6,711,208 bushels, valued at $5,691,530. Apples contributed about two-thirds of this quantity, and peaches and nectarines most of the remainder. The number of apple trees of bearing age in 1910 was 8,504,886; those not of bearing age 2,438,436. The production in 1909 was 4,663,752 bushels, valued at $2,970,851. The number of peach and nectarine trees of bearing age in 1910 was 3,133,368; those not of bearing age, 2,092,300. The production in 1909 was 1,036,340 bushels, valued at $1,349,311. The production of other orchard-fruits was: pears, 374,871 bushels, valued at $332,727; cherries, 338,644 bushels, valued at $657,406, 215,657 bushels of plums and prunes, valued at $278,505; 81,101 bushels of quinces, valued at $101,369; and 835 bushels of apricots, valued at $1,343.

The production of grapes in 1909 was 43,933,207 pounds, valued at $858,594. The vines of bearing age in 1910 numbered 8,326,800; not of bearing age, 455,750.

The production of nuts in 1909 was 559,093 pounds, valued at $11,691. This production consisted of 354,135 pounds of black walnuts, valued at $4,645; 135,626 pounds of hickory-nuts, valued at $3,856; 36,091 pounds of chestnuts, valued at $2,584; 29,100 pounds of butternuts, valued at $360; 2,461 pounds of Persian or English walnuts, valued at $154; and 1,010 pounds of pecans, valued at $70.

Strawberries are by far the most important of the small-fruits, with raspberries and loganberries, and blackberries and dewberries second and third respectively. The acreage of strawberries decreased from 9,373 in 1899 to 4,706 in 1909, when the production was 8,501,065 quarts, valued at $677,767. Raspberries and loganberries decreased in acreage from 6,795 in 1899 to 3,869 in 1909, when the production was 4,029,480 quarts, valued at $364,272. The acreage of blackberries and dewberries decreased from 3,397 in 1899 to 2425 in 1909, when the production was 2,465,407 quarts, valued at $195,294. Other small-fruits produced in 1909 were: 460,575 quarts of currants, valued at $39,829; 255,840 quarts of gooseberries, valued at $18,404; and 4,256 quarts of cranberries, valued at $352.

The acreage devoted to the production of potatoes in Ohio increased from 167,590 in 1899 to 212,808 in 1909, when the production was 20,322,984 bushels, valued at $9,377,955. Of the other vegetables, the more important in 1909 were 6,132 acres of onions, valued at $858,440; 17,298 acres of sweet corn, valued at $528,162; 8,263 acres of tomatoes, valued at $501,020; 6,279 acres of cabbage, valued at $366,901; 1,473 acres of celery, valued at $331,230; and 1,665 acres of cantaloupes and muskmelons, valued at $154,434. The value of other vegetables produced was as follows: asparagus, $39,391; green beans, $39,352; pop-corn, $16,878; cucumbers, $113,238; lettuce, $76,372; green peas, $69,009; radishes, $15,194; rhubarb, $11,329; turnips, $31,791; and watermelons, $46,063. Vegetables produced, valued at less than $10,000, were beets, carrots, cauliflower, horse-radish, parsnips, green peppers, pumpkins, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 685 in 1899 to 1,070 in 1909. The area under glass in 1909 was 7,582,562 square feet, of which 7,091,976 were covered by greenhouses, and 490,586 by sashes and frames. The value of the flowers and plants produced in 1909 was $2,384,830.

There was a slight increase in the acreage devoted to nursery products—from 4,699 in 1899 to 4,718 in 1909, when they were valued at $860,351, as compared with $538,012 in 1899.

W. J. Green.

Indiana.

Indiana (Fig. 2497), classed among the North Central States, has a land area of 23,068,800 acres. The greater part of the state is gently undulating, yet much of the highest land in the central counties is very level. The mean elevation of the state is estimated at 700 feet above sea-level. The highest lands are above 1,000 feet and are found along the Ohio line in east-central Indiana and near the Michigan line in extreme northeastern Indiana. The area in which the altitude is from 500 to 1,000 feet constitutes four-fifths of the entire state. The lowest elevation within the state is found in the western and southwestern counties along the Wabash River, where the land surface rises in general to an altitude of less than 500 feet above sea-level.

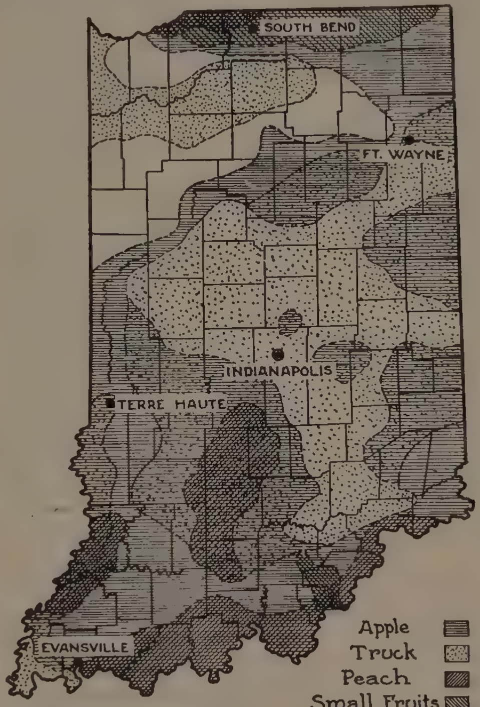
The climate differs little from the northern or middle states of the Atlantic seaboard. The mean annual temperature for the state is 52.3°, and the average rainfall is 38.4 inches.

Indiana has never been looked upon as a fruit-growing state. This is due to a happy combination of circumstances and conditions which make Indiana preëminently an agricultural state. Corn has been "king" in Indiana and probably always will be. The soil and climate of the middle western states are especially adapted to the necessary food-crops. These crops have been produced in an abundance and have overshadowed the horticultural crops.

From the earliest years of the last century, when Johnny Appleseed made his plantings in the wilderness, it has been evident that the soil and climate of the state were adapted to fruit. Numerous of these early orchards can be identified at present and their fruits are often shown at the state apple shows. Henry Ward Beecher, writing from Indianapolis in 1843, says that at that time there were "eighteen nurseries in the state whose proprietors are chiefly supported by their sales. Apple trees sell for 10 and pear for 20 cents. An orchard is to be found upon almost every farm and lately the pear has been made more than ever sought after. . . . Long summers, brilliantly clear atmosphere, great warmth and dryness during the fall ripening months, give our fruit great size, color and flavor."

The early horticulture was principally along the Ohio River and its smaller tributaries. Large plantings were made to apples and peaches. With the experiences of the Dufours ever before them, the early horticulturists paid very little attention to the grape. Nevertheless, several vineyards were planted on the terraced river bluffs only to fall easy victims to plant disease and insect pest. Some of the largest peach and plum orchards of the country were then to be found in Jefferson, Floyd, Clark, Harrison and Perry counties, in the southern part of the state. In fact, fruit-growing was the principal industry of the section.

At length there came a change in condition. The pear and apple orchards suffered from the fire blight. The peach orchards were ravaged by the San José scale and the yellows. The codlin-moth and the curculio multiplied unchecked; the scab, the various rots and other fungous diseases reduced the crops in both quantity and quality and many of the once profitable orchards were practically abandoned except for an occasional year of excessive production. The fruit was then perhaps harvested, but, owing to its poor quality, found a slow sale on a heavily supplied market.



2497. Indiana, to show horticultural regions.

With the establishment of the experiment station in 1887 dates the present revival in horticulture. Control measures were developed for crop pests and disease. Large companies have been formed for speculation in fruit lands, for exploitation of orchard-renovation schemes or for straightforward business development of commercial fruit-growing.

Time has shown that the soil and climate of Indiana are adapted to all of the horticultural crops of its latitude. This certainty of production, coupled with the location of the state make it a very attractive district for the production of perishable horticultural crops. Indianapolis, the capital and center of the state, is within 50 miles of the center of population of the United States. It is the geographical center of the territory stretching from Maine to Colorado, which embraces 92½ per cent of the total population of the nation. A circle with a 300-mile radius, having Indianapolis as its center, includes over one-quarter of the population of the country.

Another factor of no little importance to the horticultural interests of the state is the low price of lands suited to the various horticultural crops. Excellent land for orchard and truck crops can be purchased from $25 to $50 an acre.

Many horticultural crops are now grown in Indiana, but the apple easily stands first. The state ranks seventh in the ten-year average production of this fruit, so far as quantity is concerned. The present apple-growing sections are found in the northern counties, the valleys of the Wabash, White-water, White and Ohio rivers and the south-central hill counties. Large commercial plantings are being made in these regions. In the northern sections, the Baldwin, Spy, and Greenings predominate. In the central and southern sections the new plantings are being made of Grimes, Rome, Winesap, Stayman, and Ben Davis. The early sorts are not being planted so extensively as the market seems to warrant. Several large plantations, however, have used Yellow Transparent, Wealthy, Duchess, and Wagener as fillers. The larger part of commercial orchards are well sprayed. The very abundance of pests makes this a necessity. Unsprayed trees in Indiana live in the shadow of a signed death warrant. The San José scale, blotch, bitter-rot and blight soon remove the unfit. These pests are the best friends of the commercial grower for they clear his markets of undesirable bulk stock. Lime-sulfur is generally used as a winter spray for San José scale and general sanaticide. Bordeaux has been replaced in the northern sections by dilute lime-sulfur. In the central and southern regions, however, where blotch and bitter-rot are ever present, the old tried and true bordeaux is still used. Dry arsenate is almost universally accepted as the standard insecticide for chewing insects. The bulk of the Indiana apple crop is marketed in the barrel. The box is receiving attention in some sections but is not yet a common package. The fancy and choice grades are generally stored in commercial cold-storage rooms. The state is well equipped with storage facilities. Excellent houses are found in Indianapolis, Vincennes, Washington, Seymour, Martinsville, Terre Haute, Brazil, South Bend and Ft. Wayne.

The Indiana orchardist is now making the most of his long neglected opportunities. Old orchards are being leased and new ones planted on every side. Neglected orchards are being pruned, cultivated, sprayed, and fertilized as never before.

Indiana has given one hundred varieties of apples to the pomology of the country. The most important of these are: Banana, Clayton, Indian, Indiana Favorite, Pound Sweet, Ragan, Ronk, and Wilson. Other Indiana varieties are the Hoosier Cling peach, Wilder currant, Gregg raspberry, and the Taylor and Snyder blackberries.

The peach, plum, and cherry thrive in every part of the state and are always found in the home orchard. They are of commercial importance, however, only in exceptionally favored locations, along the southern shore of Lake Michigan, the lower Wabash Valley, the central hill counties, and the old Ohio Valley peach region. Orchards in these locations do remarkably well and the industry is being extended each year. Commercial peach plantings are largely limited to the Elberta. This variety does exceedingly well in the southern sections. Cherry orchards are planted only of Early Richmond and Montmorency. Plums are planted very little in a commercial way.

Small-fruit plantations are found around every city of importance. Sections of Floyd and Clark counties (southeastern part of Indiana) are devoted almost entirely to the production of early berries for northern markets. The fruit from this region strikes a free market and finds a very ready sale. The northern tier of counties also produce berries of high quality and at a time of free and brisk markets.

Several wild fruits and nuts grow to perfection in Indiana and have assumed commercial importance in some localities. The cranberry and blueberry are found in the muck, swampy soil regions, the persimmon and pawpaw in all parts of the state and the pecan in the southern river-bottoms.

The trucking interests are especially strong in Indiana. Thousands of acres along the Kankakee River are of a muck formation. When properly drained, this soil is excellent for the large number of vegetable crops

Onions are the most important crop grown in this region. The land is drained by county ditches and intricate systems of tile drains. Large areas are generally held by one owner who leases the land to foreign labor. The Southport Globes, yellow and red, are almost exclusively grown. Yields of 800 to 900 bushels to the acre on this rich soil are not at all uncommon. Celery is also a favorite crop for this soil. Golden Self-blanching, Winter Queen, and Giant Pascal are grown for the Chicago market. Large areas of cabbage are planted mainly for the kraut factories. The varieties most generally grown are Flat Dutch, All Seasons, and similar sorts. Potatoes are grown for the early and late markets. The main planting is of the late varieties, generally Rural New Yorker. Large fields of peppermint are grown for the oil-stills. Excellent yields are secured and handsome profits made.

The central area or corn-belt is a large producer of the canning crops. Tomatoes and corn are the principal crops. The sandy soils of Knox (in the southwestern part of the state) and surrounding counties produce cantaloupes and watermelons which supply the markets of the country by train-loads. Sugar-beets are grown in several sections of the state but reach their highest state of excellence in Adams, Well, and Jay counties, in the eastern part of the state. The truck industry of Indiana is of great importance and is very diversified.

No sketch of the early history of Indiana horticulture, however fragmentary and incomplete, can omit the names of some of the pioneer horticulturists of the state. The names of the Ragans, of Teas, and Fletcher, and Warder, and a dozen of their fellows, will always be remembered in connection with the early founding, the rapid spread, and the abundant success of pioneer Indiana horticulture.

The nursery business in Indiana has kept pace with the ever-growing demand for horticultural stock. There are now 150 regularly inspected nurseries in the state. The largest cherry nursery in the country is located at Vincennes. Several nurseries catering only to the ornamental trade are found near Indianapolis. The larger number of firms, however, deal in general stock and cater especially to the general farm orchard.

Indiana floriculture is well developed and in a thriving condition. Large ranges of commercial houses are found around the more important cities, such as Ft Wayne, South Bend, Indianapolis, Terre Haute, and Evansville. These ranges are devoted primarily to the wholesale and retail trade. The plant-breeder and introducer seems to favor the smaller towns. Some of the most important varieties of roses, carnations, and chrysanthemums have been produced in small Indiana plants. The Newcastle roses are justly famous the world over. The Sunburst and Ophelia roses, as well as many others, were produced at Richmond. One of the largest breeders and introducers of carnations in the United States is located at LaFayette.

Public-service agencies for horticulture.

Early in 1865, the State Legislature obligated the state to "accept and claim the benefits of the provisions of the Acts of Congress, approved July 2, 1862, and April 4, 1864," which provided for the land-grant colleges. The state further accepted donations from John Purdue and other citizens of Tippecanoe County, and in 1869 the Legislature located the University at Lafayette. This same act provided that the institution be called "Purdue University." While named after a private individual, the University is, however, a land-grant college and is exclusively under state control. The work of this institution is divided into three district divisions: The Collegiate Departments; Agricultural Experiment Station; and Agricultural Extension Department. There are thirteen members of the horticultural staff. Forty-two bulletins have been issued from the horticultural department.

Several of the secondary colleges of the state are offering either special work in horticulture or courses in applied botany. The most complete course of this kind is that offered by Winona Agricultural College. Under a legislative act of 1911, the teaching of agriculture became compulsory in the rural schools. Special courses in fruit-growing and vegetable-gardening have been outlined and published for the seventh and eighth grades and for high-schools. This rural school work is closely supervised either by the special county agricultural agents or special agricultural supervisors.

The state maintains a special department for the enforcement of horticultural laws. This division is headed by the State Entomologist. His main duty is that of guarding against the introduction and spread of noxious insects and plant diseases.

The Horticultural Society is one of the most important public-service agencies for horticulture in Indiana. It was founded in 1860.

Statistics (Thirteenth Census).

The approximate land area of Indiana, according to the Census Report of 1910, is 23,068,800 acres. The land in farms is 92.3 per cent of the land area, or 21,299,823 acres. The number of acres of improved land in farms is 16,931,252; that of woodland 3,370,791, and other unimproved land in farms numbers 997,780 acres. The number of all the farms in the state, in 1910, was 215,485. The average acreage to a farm was 98.8. [The total area is 36,354 square miles.]

The leading agricultural crops of the state are cereals and hay and forage. In 1909, the cereals contributed about three-fourths, or 74.4 per cent of the total value of all crops, and hay and forage about one-eighth, or 12.2 per cent. Of the improved land in the state in 1909, 51.7 per cent, or 8,752,732 acres were occupied by cereals, the products of which amounted to $151,898,146. The acreage of hay and forage in 1909 was 2,300,579, and the value of the products, $24,883,461. The acreage devoted to tobacco in Indiana increased from 8,219, in 1899, to 23,694 in 1909, when the value of the products was $2,145,193. The value of the forest products of the farms of Indiana, in 1909, was $5,603,322, about the same as in 1899, when it was $5,235,459.

Horticultural crops grown are fruits and nuts; small-fruits; vegetables, including potatoes, sweet potatoes and yams; and flowers and plants and nursery products. The total value of fruits and nuts grown in 1909 was $4,004,367, as compared with $3,522,896, their value in 1899. The acreage devoted to raising small-fruits decreased from 13,115 acres, in 1899, to 5,919 acres in 1909, when 7,424,831 quarts of fruit were produced, valued at $612,725. In 1909, the total acreage of potatoes and other vegetables was 215,332, and their value, $11,454,036. Excluding potatoes, and sweet potatoes and yams, the acreage of the other vegetables was 114,267, and their value, $7,498,024, as compared with an acreage of 95,434 in 1899, when the value of their products was $4,524,435. The acreage devoted to the growing of flowers and plants and nursery products increased from 1,820 acres, in 1899, to 2,346 in 1909, when the products were valued at $1,624,278.

The total quantity of orchard-fruits produced in 1909 was 4,713,537 bushels, valued at $3,709,275. Apples contributed more than half of this quantity, with peaches and nectarines next in importance. The production of apples alone, in 1909, was 2,759,134 bushels, valued at $1,720,811; that of peaches and nectarines, 1,174,389 bushels, valued at $1,123,248; that of cherries, 363,993 bushels, valued at $508,516; and that of pears, 319,925 bushels, valued at $243,698. Plums and prunes were produced to the value of $89,073; quinces, to the value of $22,431; apricots, to the value of $1,472; and mulberries, to the value of $26.

The grape-vines of bearing age in 1910 were 1,049,232, and those not of bearing age, 149,441. The production in 1909 was 12,817,353 pounds, valued at $287,707.

The total production of nuts in 1909 was 439,644 pounds, valued at $7,344. Black walnuts are by far the most important of the nuts grown in Indiana. In 1909 the production of black walnuts was 378,842 pounds, valued at $4,386; that of pecans, 19,287 pounds, valued at $1,940; and that of hickory-nuts, 31,950 pounds, valued at $753.

The total acreage of small-fruits in 1909 was 5,919, and in 1899, 13,115, a decrease of 54.9 per cent. The production in 1909 was 7,424,831 quarts, as compared with 22,088,000 quarts in 1899, and the value, $612,725, as compared with $1,113,527. Strawberries are by far the most important of the small-fruits, with raspberries and loganberries, and blackberries and dewberries ranking second and third respectively. The acreage of strawberries decreased from 4,714, in 1899, to 2,574 in 1909, when the production was 3,759,132 quarts, valued at $310,430. The acreage of raspberries and loganberries decreased from 3,277, in 1899, to 1,412 in 1909, when the production was 1,595,921 quarts, valued at $140,204; and the acreage of blackberries and dewberries decreased from 3,192, in 1899, to 1,347 in 1909, when the production was 1,482,909 quarts, valued at $113,322. Other small-fruits produced in 1909 were 320,963 quarts of gooseberries, valued at $25,682; 208,049 quarts of currants, valued at $16,901; and 7,552 quarts of cranberries, valued at $498.

Of the vegetables grown in Indiana, the potato is by far the most important. In 1909, the acreage devoted to the potato was 99,504, and the production was 8,905,679 bushels, valued at $3,816,126. The leading vegetables grown in 1909, their acreage and value of products were: tomatoes, 18,472 acres, value of product, $501,180; onions, 4,048 acres, valued at $488,811; watermelons, 7,915 acres, valued at $291,027; cantaloupes and muskmelons, 3,855 acres, valued at $198,531; sweet corn, 7,977 acres, valued at $188,054; sweet potatoes and yams, 1,561 acres, valued at $139,886; cabbage, 2,107 acres, valued at $126,052; cucumbers, 2,095 acres, valued at $111,268; and green peas, 4,084 acres, valued at $103,613. Vegetables of less importance grown were asparagus, beans, celery, pop-corn, lettuce, radishes, rhubarb, and turnips.

The growing of flowers and plants is of some importance in Indiana, the acreage increasing from 174 acres, in 1899, to 496 acres in 1909, an increase of 185.1 per cent. The area of land under glass, in 1909, was 3,741,269 square feet, of which 3,650,443 square feet were covered by greenhouses and 90,826 square feet by sashes and frames. The value of the flowers and plants, in 1909, was $1,212,891, as compared with $400,730, in 1899, an increase of 202.7 per cent.

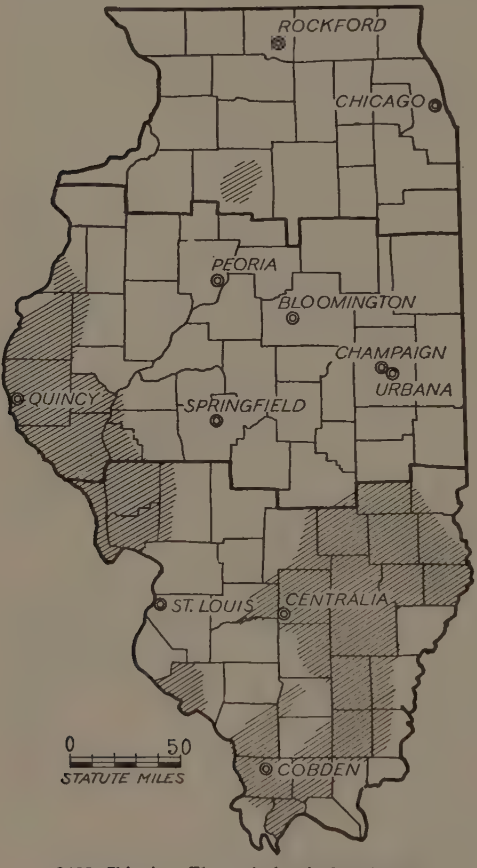
The acreage devoted to the growing of nursery products increased from 1,646 acres, in 1899, to 1,850 acres in 1909, an increase of 12.4 per cent. The value of the nursery products sold in 1909 was $411,387, as

compared with $254,893 in 1899, an increase of 61.4 per cent.
M. W. Richards.

Illinois.

The state of Illinois (Fig. 2498) lies in the heart of the Mississippi Valley, the most fertile portion of the United States. Its eastern boundary is over 700 miles from the Atlantic coast; it has a range north and south of a little over 350 miles, extending from 37° to 42° 30′ north latitude, and a breadth east and west of about 200 miles at its widest point. In spite of its great length, the difference in mean annual temperature between the extreme northern and southern parts of the state is only 10° F.

Soil conditions alone considered, Illinois stands, agriculturally, at the very forefront. It is known as the great prairie state, and with the exception of Delaware and Louisiana, is the most level state in the Union. Third in population (1910), and second in railroad mileage, it is first in total value of agricultural products. Over nine-tenths of its total area is in farms. There are no considerable tracts of worthless land, and the statistics of the United States Census for 1910 show every one of the 102 counties to be fruit-producing.



2498. Illinois.—The main horticultural areas.

The most distinctive fruit section of Illinois is the southern third. This area contains something over 150,000 acres devoted to the growing of apples alone. Other deciduous fruits, notably peaches and pears, and small-fruits, especially strawberries, are also grown in large quantities in this part of Illinois. Increased shipping facilities and the coming into bearing of orchards already some time planted have brought southern Illinois into close competition with Michigan in the production of peaches.

The southern fruit district, as indicated on the map, lies between 37° and 39° 30′ north latitude, the former being the latitude of Norfolk, Virginia, and the latter that of Baltimore, Maryland. The climate of this district is best indicated by the fact that the isotherm 55° F. passes through the northern part of the district, the same temperature line also passing through the peach and sweet potato districts of Delaware and southern New Jersey. The 50° isotherm passes through Illinois about on the dividing line between the northern and central fruit districts, thus showing the mean annual temperature of the northern district to be practically the same as that of the great grape and small-fruit sections of central New York. It should also be noted that the mean annual temperature of the famous Santa Clara Valley and the Santa Cruz mountain wine-grape district is 55° F., or about that of Madison and Bond counties in Illinois.

In 1913 the total annual precipitation at Galena, in the extreme northwest corner of the state, was 32 inches; in Henderson County and from thence along a line northeast across the state and down to Ford and Iroquois counties, 34 inches; in a circle taking in Pike, Adams, Hancock, Fulton, Knox, and up to LaSalle and a little beyond into Kane and DeKalb counties, down to McClean and the northern parts of Champaign and Vermilion counties, then west across the state including DeWitt, Sangamon, and Morgan counties, 34 to 36 inches; directly south, in a section including Clark, Edgar, and the southern part of Vermilion County on the east, and Scott and Calhoun counties on the west, 36 to 38 inches; along a line entering the state in Madison County, bending north to the southern boundary of Macon County and thence southeast to Crawford County, 38 to 40 inches; from thence to the seven or eight extreme southern counties, which have an average precipitation of 46 to 48 inches and over, 40 to 44 inches. The mean annual rainfall for ten years up to and including 1913 at the Illinois Agricultural Experiment Station at Urbana, Champaign County, was 35.37 inches.

In recent years there has been a steadily increasing interest in the apple as a commercial crop. Taking the state as a whole, this fruit is far in advance of other tree-fruits in area planted, in size of individual orchards, and in crop values. The introduction of modern business methods which have in great part supplanted the careless and unprofitable methods common a decade or so ago has brought great changes, and has established commercial apple-culture upon a stable and profitable basis. Attention to cultural methods and details of management is now almost universal; grades of fruit are rapidly being standardized, storage facilities are utilized, and markets carefully studied. Many orchards that were formerly neglected have been renovated and made profitable, and the planting of new apple orchards as commercial ventures is increasing. These new projects evidence study and the effort to apply those fundamental principles that make for success. The varieties planted are few in number, chosen because of their known adaptability to the particular region and their established position in the market to be served. In planting, the varieties are distributed in such manner as to promote interpollination. For the northern and central districts, fall and winter varieties are most in favor for commercial planting, while in the southern district new orchards are largely of summer varieties. In large orchards, cultural operations are now performed by traction engines with such satisfactory results that the use of these tractors promises to become universal in all commercial orchards.

In the southern district of the state there is in progress a notable revival in peach-planting. This fruit was neglected for several years because of losses resulting from brown-rot, peach-scab, peach leaf-curl, and other diseases. With the demonstration that these diseases could be completely controlled by persistent application of perfected methods of spraying, return to planting began and has extended until the area in new peach orchards equals, if it does not exceed, the area newly planted with apples. Elberta is the variety most in favor for commercial planting.

According to the Census Reports for 1910, Illinois ranks third among the states in value of flowers and ornamental plants produced, and second in value of flower and vegetable seeds. The largest commercial establishment in the United States for the production of cut-flowers is that of Pullman Brothers of Morton Grove (having a total of 45 acres under glass). Chicago has been for years the second largest market in the United States for cut-flowers. The business has grown considerably of late, although exact figures are not obtainable. An interesting fact in this connection is that the Chicago market is supplied almost entirely by Illinois establishments, while the demand in New York City, which is the center of the greatest market for cut-flowers in the country, is met largely by floricultural interests located in New Jersey.

The nursery business is flourishing in Illinois. There are approximately 214 nursery establishments in Illinois which are regulated according to the inspection laws, ninety in the northern division, seventy-four in the central, and fifty in the southern.

Other branches of horticultural industry are also well developed. Gardening for the Chicago market forms a large and important business in itself, while the growing of vegetables for shipment in certain sections of southern Illinois has assumed large proportions. At times, from Cobden, in Union county, thirty cars of tomatoes are shipped in one day, and it is not unusual for sixty to seventy cars of produce to be shipped from that county in one day.

Market-gardening has also been well developed in the vicinity of nearly every city of any considerable size in the state. In a number of the gardens, modern methods of overhead irrigation are employed to supplement the natural rainfall in certain seasons. At many places the culture of vegetables under glass has become an important industry, the principal crops being lettuce and cucumbers. Among the counties of the United States, Cook County, Illinois, ranks first in acreage of cucumbers, third in acreage of cabbage, third in acreage of onions, fourth in acreage of lettuce, fourth in acreage of celery, and fourth in the production of radishes. Union County has a larger acreage of rhubarb than any other county in the United States, while Iroquois County ranks third in acreage of sweet corn. Illinois ranks second among the states in the production of sweet corn, and third in the production of squashes.

Watermelons constitute an important truck-crop in certain localities, the leading centers of the industry being Carmi, in White County, Beardstown, in Cass County, and Thomson, in Carroll County. The normal production in each of these regions is about 400 carloads a year.

Onions, and especially onion sets, are extensively grown in the vicinity of Chicago. Many of the sets are grown in small areas under contract by market-gardeners for seedsmen and other large dealers. However, there are a few growers who make a specialty of sets, and plant a large acreage every year. One firm operating within the city limits of Chicago, ordinarily produces over 200 acres of sets. In the weeding and harvesting seasons, a special train is run to bring their workmen from the city.

The most notable examples of landscape horticulture or landscape gardening in the state are to be found in the Chicago city park system, which is the largest and in some respects the finest in the entire country. A recent development is the promotion of an "Illinois way of planting," which tends to emphasize the prairie style of landscape gardening as opposed to the formal or gardenesque style, and to unify and give character to the state as a whole.

Most of the men and women who have been influential in promoting the horticultural interests of the state have been identified with the State Horticultural Society. Some of those who are no longer living who will be remembered for their connection with the advancement of the horticultural activities of the state are: H. Augustine, Normal; W. W. Barnard, Johnson; S. N. Black, Clayton; Arthur Bryant, Princeton (page 1567); A. C. Canfield, Springfield; H. L. Daw, Jacksonville; C. N. Dennis, Hamilton; Robert Douglas, Waukegan (page 1572); M. L. Dunlap, Savoy; Samuel Edwards, LaMoille; Geo. Endicott, Villa Ridge; Willard C. Flagg, Moro; O. B. Galusha, Peoria; R. O. Graham, Bloomington; W. H. Gullett, Lincoln; A. C. Hammond, Warsaw; Jas. Hartzorne, Joliet; P. J. Hauswirth, Chicago; Jos. Heinl, Jacksonville; E. S. Hull, Alton; John F. Jolly, Olney; W. B. Lloyd, Kinmundy; W. H. Mann, Gilman; S. G. Minkler, Oswego; J. M. Pearson, Godfrey; Jonathan Perriam, Chicago; G. H. Perrine, Centralia; F. K. Phoenix, Bloomington; Edgar Sanders, Chicago; J. B. Turner, Jacksonville; F. D. Voris, Neoga; and A. Washburn, Bloomington.

Public-service agencies for horticulture.

The land-grant college was established in Urbana, Champaign county, February 28, 1867. The institution was called the "Illinois Industrial University" until 1885, when the name was changed to the "University of Illinois." At first there was no special instruction or equipment in horticulture.

In 1888, the Illinois Agricultural Experiment Station was established at the University of Illinois; the Board of Trustees of the University assumed charge, and some of the farm land belonging to the University was set aside for experimental purposes. At that time there were two members of the horticultural station staff; there are now twenty-two. Experimental work is being carried on in pomology, olericulture, plant-breeding, and floriculture. The area set apart for horticultural interests is 360 acres, about 300 acres of which are devoted to instructional work and about 60 acres to experimental work. This will fluctuate, however, from time to time. Thirty-eight horticultural bulletins have been published by the station to date, and thirty-two circulars.

With the exception of courses in colleges teaching agriculture, no advanced or special instruction in horticulture is given in the state. However, most of the common and secondary schools of the state offer courses in agriculture, in connection with which elementary horticultural instruction is included.

As a result of a state-wide demand for advice upon the improvement of home and public grounds, the Department of Horticulture at the State University has organized a corps of men especially for extension work in landscape gardening. Four members of the staff devote their entire time to this phase of the work. It consists of making special designs for school and other public grounds to serve as illustrations of proper landscape planting in the respective communities, publishing circulars and pamphlets designed to stimulate an interest in rural and civic improvement, giving illustrated lectures at meetings of civic clubs, farmers' institutes, and other organizations, and of demonstration work in the planting of public and private grounds.

Inspection service for insects and plant diseases is provided for by an act of the legislature, now in force as amended July 1, 1909. All nursery stock shipped or delivered must bear a copy of certificate of inspection.

No laws in regard to fruit-grading are now in force in Illinois except those which have been enacted by the federal goverment. A standard of grading of apples which is universally followed in the state, however, is that adopted in 1903 by the Illinois State Horticultural Society. According to this standard, apples are graded as No. 1's, No. 2's, and culls.

The horticultural interests of Illinois have been well looked after and carefully placed on a permanent basis by the legislature. In 1874 an act was passed by that body establishing the Illinois State Horticultural Society (which was organized in 1855) as a public corporation of the state. The State Horticultural Society is divided into three subdivisions, the Northern, Central, and Southern Horticultural Societies, each taking in about one-third of the state (see map). For the advancement of floriculture, the Illinois State Florists' Association was incorporated under the laws of the state of Illinois, March 9, 1905.

Statistics (*Thirteenth Census*).

The approximate land area of Illinois, according to the Census Report of 1910, is 35,867,520 acres. Of this, 90.7 per cent or 32,522,937 acres are in farms; 28,048,323 acres of the farm land are improved; 3,147,879 acres are in woodland; and there are 1,326,735 acres of other unimproved land in farms. The number of farms in the state totals 251,872. The average acreage to the farm is 129.1 acres. [The total area of the state is 56,665 square miles.]

The leading agricultural crops are cereals and hay and forage. In 1909, 59 per cent of the improved land was occupied by the cereals, or 16,536,457 acres. The value of the products from the cereals was $297,523,098, which was 79.9 per cent of the total value of all the crops. Hay and forage occupied 11.9 per cent of the improved land, or 3,349,435 acres. The value of the products was $40,560,220, which was 10.9 per cent of the total value of all crops. Crops of lesser importance were broom-corn, which occupied 38,452 acres in 1909, the products of which were valued at $1,457,172; and the sugar crops, which occupied 16,220 acres, whose products were valued at $573,846. The value of the forest products of the farms was $3,325,259 in 1909 and $2,555,890 in 1899.

Horticultural crops grown are fruits and nuts, vegetables including potatoes, small-fruits, and flowers and plants and nursery products. The value of fruits and nuts grown in 1909 was $4,304,847, as compared with $4,168,500 in 1899. The total acreage of potatoes and other vegetables in 1909 was 268,911, and their value $16,300,654, which is far above the value of any of the other horticultural crops. The acreage of small-fruits was 11,723 in 1909, as compared with 16,794 in 1899, a decrease of 30.2 per cent. The value of the small-fruits in 1909 was $1,109,747. The raising of flowers and plants and nursery products is of comparative importance, 4,793 acres being devoted to them in 1909 and the product being valued at $4,517,085.

The total quantity of orchard-fruits produced in 1909 was 4,939,211 bushels, valued at $3,857,743. Apples produced three-fifths of this quantity, the production in 1909 being 3,093,321 bushels, valued at $2,111,866. Peaches and nectarines were next in importance of the orchard-fruits, the production being 1,222,570 bushels, valued at $999,516. In 1909 the production of cherries was 287,376 bushels, valued at $453,474; that of pears, 249,365 bushels, valued at $202,965; that of plums and prunes, 78,566 bushels, valued at $80,384; that of quinces, 6,723 bushels, valued at $8,037; and that of apricots, 1,250 bushels, valued at $1,457.

Grapes produced in 1909 amounted to 16,582,785 pounds, valued at $426,468. The production in 1899 was 20,009,400 pounds.

The total production of all the nuts in 1909 was 714,478 pounds, valued at $20,550. The most important of the nuts were the pecans, producing 107,069 pounds, valued at $10,301; the black walnuts, producing 530,730 pounds, valued at $7,411; and hickory-nuts, producing 60,124 pounds, valued at $1,954. The nuts of lesser importance were the Persian or English walnuts, the chestnuts, and the butternuts.

Of the small-fruits, strawberries are the most important, with blackberries and dewberries, and raspberries and loganberries ranking second and third, respectively. The acreage of strawberries in Illinois in 1909 was 5,410, producing 8,031,824 quarts of berries, valued at $613,917; the acreage of blackberries and dewberries was 3,503, producing 2,915,473 quarts of berries, valued at $237,058; and the acreage of raspberries and loganberries was 1,945, producing 1,834,337 quarts of berries, valued at $191,401. The small-fruits of less importance that were produced in 1909 were: 541,498 quarts of gooseberries, valued at $44,238, 265,858 quarts of currants, valued at $21,863; and 13,418 quarts of cranberries, valued at $1,248.

Of the vegetables produced in Illinois, potatoes are by far the most important. The acreage in 1909 was 138,052, and the production 12,166,901 bushels, valued at $6,401,598. The acreage devoted to sweet potatoes and yams was 10,568, the production being 1,050,932 bushels, valued at $506,760. The acreage devoted to the production of all other vegetables, excluding the potato, sweet potato and yam, was, in 1909, 120,291 and the production was valued at $9,392,296. The leading vegetables, their acreage, and the value of the product were as follows: sweet corn, 19,976 acres, valued at $558,746; onions, 3,315 acres, valued at $546,951; tomatoes, 5,316 acres, valued at $343,132; cabbage, 5,207 acres, valued at $341,161; cucumbers, 2,981 acres, valued at $234,203; watermelons, 6,211 acres, valued at $188,869; asparagus, 2,241 acres, valued at $181,557; 231 acres of lettuce, valued at $153,784. Other vegetables of less importance in 1909 were green beans, beets, cantaloupes and muskmelons, carrots, cauliflower, celery, pop-corn, horse-radish, parsnips, green peas, green peppers, radishes, rhubarb, spinach, and turnips.

The acreage devoted to the growing of flowers and plants has increased from 679 in 1899 to 1,339 in 1909, an increase of 97.2 per cent. The total area covered by glass in 1909 was 15,950,853 square feet, of which 14,380,927 were covered by greenhouses, and 1,569,926 by sashes and frames. The value of the flowers and plants produced in 1909 was $3,694,801, as compared with $1,894,960 in 1899.

The acreage occupied by farms and establishments growing nursery products in 1909 was 3,454, as compared with 3,142 in 1899. The value of the products in 1909 was $822,284, an average value an acre of $238.07.

J. C. Blair.

Michigan.

No state in the Union has greater natural advantages than Michigan (Fig. 2499) and few if any have made more use of them along horticultural lines. Not only are the soil and climate unusually well adapted for the growing of flowers, vegetables and nearly all the deciduous fruits, but excellent shipping facilities are provided.

Almost any kind of soil may be found in every county in the state and often upon the same farm. The sandy-loam soils which are so desirable for peaches, cherries and grapes, are widely distributed, as are somewhat heavier soils for apples, plums, pears and the small-fruits. Even when the soil upon the surface appears so light as to be worthless, a clay subsoil is often found upon which trees of all kinds will grow luxuriantly. Along the shores of Lake Michigan is some of the best fruit-land where the soil is of a sandy nature and absolutely devoid of clay. From this the soil varies through the sandy loams to light and heavy clay loams, to clay soils which when overlying an open subsoil answer well for growing pears, apples and even for the other fruits like peaches, for which it is generally understood that a sandy loam soil is better adapted.

Aside from the nature of the soil itself, the general contour of the land aids in making Michigan a great fruit state. While much of the land is level to the extent of being low and swampy, and still other extensive areas are so steep and rough as to be of little value for the highest type of fruit-culture, a large proportion of the land in nearly every county is gently rolling, with slopes that often extend to points 100 or more feet above the land in the neighboring valleys. This not only provides the needed drainage for water, but favoring the movements of the air, it permits the cold air to pass off to the lower levels, thus lessening the injury from late frosts in the spring as well as from early frosts in the fall, besides making a difference of 5° to 10° in the minimum winter temperatures.

Another horticultural asset of almost inestimable value to Michigan comes from the fact that the state is surrounded on three sides by the waters of the Great Lakes, besides having thousands of inland lakes within her borders. They aid not only in providing almost ideal climatic conditions, but in furnishing quick, cheap and excellent conditions for the transportation of fruit and other perishable products to market.

In addition to the splendid service in the handling of horticultural products provided by the steam and trolley lines, the fruit-grower is favored by the many trans-lake steamship lines, which take the fruit during the night to the market points to which it is consigned in time for the morning market. Not only are there several lines which skirt the eastern shores, but on Lake Michigan there are no less than a dozen lines which take the fruit from twenty or more ports direct to Chicago, Milwaukee and other points, besides a number of minor connecting lines of boats. Besides furnishing regular and comparatively cheap service, the boat-lines make it possible to ship the fruit under almost ideal conditions, in the cool night air of the lake and without the jar and shaking to which it would necessarily be exposed if shipped by rail.

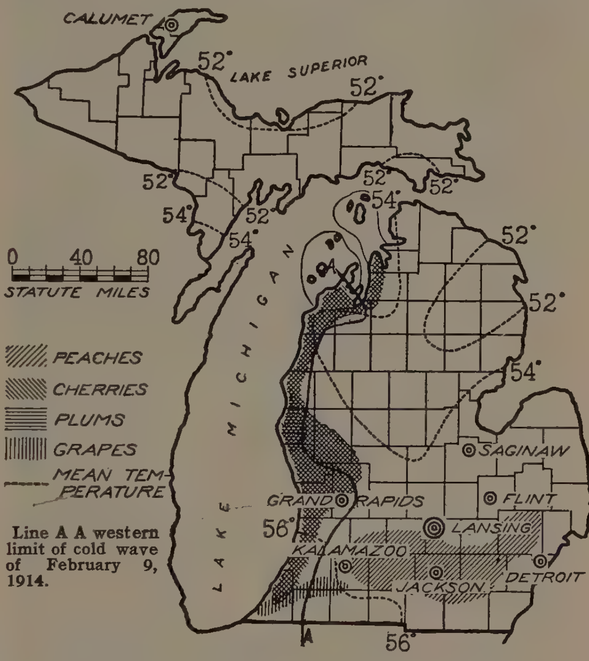
Although in the early times nearly every farm had its home-orchard in which a general variety of fruits was grown, there were very few that could be called commercial orchards, except in the counties bordering upon Lake Michigan. The peach in particular was an exception, and to such an extent that the region from Benton Harbor to Grand Haven was known as the Michigan Fruit-Belt, or Peach-Belt, but it was soon learned that this region by no means included all of the land in Michigan that was suited to commercial orcharding. While by far the larger area is still in the southern half of the lake-shore counties, extensive orchards of the peach and other fruits are now found all along the shore as far north as Charlevoix, and especially about Ludington, Manistee, Frankfort and Traverse City. The planting, however, has not been confined to the counties bordering upon Lake Michigan, some of the largest orchards in the state being in Newaygo, Kent, Barry, Kalamazoo, Oakland, Livingston and other interior counties. The principal requirements being a moderately rich and well-drained soil and a location considerably above the land immediately surrounding it, these can and are being met in nearly every county in the lower peninsula, although there are very few commercial peach orchards in the northern half of the state, except within 20 miles of Lake Michigan.

Plums, also, have been very generally planted, although the acreage is much smaller than that of peaches. The southern lake-shore counties are giving especial attention to this crop, the largest areas being in Oceana, Allegan, Berrien, Mason, Kent, Van Buren and Ottawa counties. Under proper care the crop is a profitable one, but from lack of proper spraying and the resulting loss of the foliage from leaf-blight, many of the trees are seriously injured and often killed by the winter.

While the sour varieties of cherries do well in almost all of the Michigan counties, the northern half of the western lake-shore counties seem to be especially suited to them and very large plantings have been made, particularly about Traverse City, Manistee, Frankfort, Northport and Charlevoix. The same region is also well adapted to the sweet cherry and extensive plantings have been made. The trees seem to be hardy, bear profusely and the fruit readily finds a market at about twice the price of the sour varieties.

Vineyards of considerable extent are found in most of the southern counties, but from a commercial standpoint Berrien and Van Buren counties take the lead, and grapes from the Lawton and St. Joseph grape regions are shipped to nearly every state in the Union. Kent, Cass, Ottawa, Allegan, Monroe, and Kalamazoo counties also have many extensive vineyards.

Nearly every county in the southern peninsula has large commercial apple orchards and nearly three-fourths of them have 100,000 trees or more. Although they are being very generally planted all over the state, the more extensive plantings are along the western border. The largest percentage of increase has been in Manistee, Benzie, Leelanaw, Grand Traverse, Antrim, Charlevoix and Cheboygan counties. Large plantings of the Oldenburg have been made in the more southern counties, this variety for a number of years having been exceedingly profitable.



Line A A western limit of cold wave of February 9, 1914.

2499. Michigan, showing horticultural parts or districts.

While six of the southern lake-shore counties grow more small-fruits than all the remainder of the state these being the only ones which have over 800 acres, there are at least thirty counties in which 100 acres or more are grown. The northern part of the state, including the upper peninsula, is coming to the front with its late varieties of strawberries which come on after the season is over in the southern counties, and these with the "everbearing" kinds make it possible in some seasons to have Michigan-grown strawberries for six months of the year.

As the years go by, the growing of fruit becomes more and more the work of specialists. It has been found that the slipshod methods formerly in vogue will not give results, and with greater attention to the selection of orchard-sites, a better choice of varieties, and with up-to-date methods in caring for and spraying the trees, and in picking, grading and packing the fruit, a new era in Michigan fruit-culture seems at hand.

While the development in fruit-culture in Michigan has been rapid, even greater progress has been made in the cultivation of flowers and vegetables under glass. For the most part the larger commercial greenhouses are located near Detroit or Grand Rapids, but every city and many of the villages have greenhouses used for commercial purposes. The houses of today are twice as large in each of their dimensions as thirty years ago. Michigan also has the first full-sized, portable, commercial greenhouse ever constructed, at Redford, near Detroit.

Equal progress has also been made in the size of the flowers, and many of the varieties of roses, carnations and chrysanthemums developed by Michigan specialists have also doubled. There is a large wholesale trade in all of the above as well as in violets and sweet peas. The florists' plant business is also rapidly increasing. In addition to the local demand, the reputation of the Michigan growers brings orders for chrysanthemum, carnation, rose and geranium plants from all parts of the country. Several gladiolus, dahlia and canna specialists also do a large plant business.

The attention given to the growing of greenhouse vegetables has also increased. At Grand Rapids alone, 1,500,000 square feet of glass are used for this purpose, the business giving employment to 600 men. The loose-leaf, curled variety of lettuce, known as Grand Rapids Forcing, is the only kind used. Three crops are grown each year, the last crop being followed by tomatoes, cucumbers or parsley. The heads are packed in paper-lined barrels and shipped in refrigerator cars to points as far distant as Buffalo, Cincinnati and Louisville.

Many years ago Kalamazoo became known for the fine celery grown there, but there are hundreds of points where an equally fine article is produced today. Many thousand tons are shipped in carload lots and by express all over the country. The soil generally used for this crop is muckland which has been drained, but where the water stands within 2 feet of the surface, thus affording sub-irrigation for the crop. Nearly every city and large town has celery gardens to supply the local demand and many of them do a large shipping business.

There are also many crops commonly classed as garden vegetables which are grown upon such extensive plans as almost to become field-crops. Among them are cabbages, onions, watermelons and muskmelons, garden peas, beans, asparagus, and potatoes. For cabbages and onions, as well as for the growing of celery, the clearing of thousands of acres of swampland has furnished almost ideal conditions, and hundreds of carloads are shipped out of the state after supplying the local demand. There are several "kraut" factories in the state, each of which uses several hundred tons of cabbages.

Michigan also leads all other states in the acreage of garden peas and beans, there being an enormous amount used by the canning factories, besides what are required for local consumption and for shipping in the fresh state. In field beans the crop equals the combined yield of all of the other states, and the yield of potatoes is excelled by few, if any, states.

In addition to the area used for the growing of the above-mentioned crops for food purposes, large tracts are devoted to the production of seeds, the quality of Michigan-grown seed being generally recognized by seedsmen who send there for their supply. It is estimated that not less than 15,000 acres are used for growing seed of garden varieties of peas, 10,000 acres for garden beans, 2,000 acres for sweet corn, with 1,000 acres of cucumbers, 1,000 acres of melons, 500 acres of tomatoes, besides large areas devoted to onion, radish, cabbage and other vegetable seeds.

Reference has been made to the use of peas and beans by canning factories, but they also require immense quantities of other vegetables, such as asparagus, rhubarb, sweet corn, pumpkins, squashes, and tomatoes, to say nothing of the cucumbers, onions, and peppers used for pickling. The length and breadth of the state is dotted with salting and pickling stations, the number being little if any less than one thousand. The canning factories also use hundreds of thousands of bushels of strawberries, raspberries, blackberries, gooseberries, cherries, plums, peaches, pears and apples.

To furnish trees for the orchardists in this and other states, there are more than 100 nurseries, from which trees, shrubs and fruit-plants are sold. Several of the larger nurseries are located at Monroe, in the southeast corner of the state, where the soil seems to be especially adapted for the growing of trees. There are also nearly fifty firms which make a specialty of growing and selling small-fruit plants.

Although one generally thinks and speaks especially of the lower peninsula as the horticulturist's paradise, there is an immense area between Lake Michigan and Lake Superior which presents strong claims for recognition. While the climate is severe for the more tender species and varieties, the hardier kinds of apples, cherries and plums, as well as the small-fruits, do remarkably well. The fruit excels in color and flavor, and this section has a promising future horticulturally.

To mention the men who have done most to promote the horticultural interest of Michigan one would have to write a history of horticulture in nearly every county. B. Hathaway, of Little Prairie Ronde, C. Engle, of Paw Paw, and Geo. Hosford, of Ionia, have been especially successful in developing new varieties of fruit; I. E. Ilgenfritz, of Monroe, L. G. Bragg, of Kalamazoo, and N. P. Husted, of Lowell, were for many years the proprietors of the largest nurseries in the state; R. M. Kellogg, of Three Rivers, worked for years to develop improved strains of strawberries and for better methods of culture; C. D. and G. W. Lawton were pioneers in the grape industry at Lawton; J. G. Ramsdell and George Parmalee did much to develop an interest in fruit-culture in the Grand Traverse region, and L. H. Bailey was for years the leading apple-grower at South Haven. More than anyone else, T. T. Lyon fostered the interests of horticulture in Michigan (see Volume III, page 1585).

Public-service agencies for horticulture.

The Land-Grant College of Michigan is located at East Lansing, and was established in 1855. There are six members of the horticultural staff.

The Experiment Station is also situated at East Lansing and the horticultural force consists of six members. Four or five bulletins on horticultural subjects are published each year. Branch stations, at which considerable attention is given to horticulture, and to fruit-growing in particular, are maintained at South Haven and at Chatham in the upper peninsula.

Extension work is conducted in horticulture, by means of farmers' institutes, extension schools and the like. There are also three men connected with the extension service of the College who give especial attention to horticulture. They are specialists in fruit-growing, the control of insects and diseases, and potato-growing and truck-gardening.

Horticulture forms a part of the curriculum at the state normal schools at Kalamazoo and Mt. Pleasant and at the Menominee and Chippewa county agricultural schools, and is given considerable attention at fifty high-schools which have an agricultural department.

The work of the State Horticultural Society in furthering the horticultural interests should not be overlooked. Established in 1870 as the State Pomological Society, its field of work gradually broadened until 1880 when the name changed to "The State Horticultural Society." There are also in Michigan some twenty local county or district horticultural societies, auxiliary to the State Society. A number of coöperative organizations have been organized for the purpose of providing for a better distribution of fruit, securing improved transportation facilities, shipping in carload lots, and so far as possible selling direct to the retailer. There have been three associations which have handled the grapes in the Lawton district for a number of years to the general satisfaction of the growers, and while some among the other associations have been more or less failures, in many instances excellent results have been attained.

The State Board of Agriculture is in charge of the nursery and orchard inspection and the enforcement of the laws relating to the spraying for dangerous insects and diseases.

Statistics (*Thirteenth Census*).

The approximate land area of Michigan in 1910 was 36,787,200 acres. The land in farms was 51.5 per cent of the land area, or 18,940,614 acres. Of the land in farms, 12,832,078 acres were improved land; 2,927,554 were woodland; and 3,180,982 acres other unimproved land. The total number of farms in 1910 was 206,960. The average number of acres to a farm was 91.5. [The total area is 57,980 square miles.]

The leading agricultural crops of the state are cereals, hay and forage, and forest products of the farms. Cereals, in 1909, occupied 34.4 per cent of the improved land, or 4,415,629 acres. The value of the cereals in 1909 was $70,544,250, or 43.5 per cent of the total value of all crops. Hay and forage, in 1909, occupied 21.2 per cent of the improved land, or 2,715,301 acres, and the value of hay and forage for the same year was $36,040,087, or 22.2 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was $7,911,901, as compared with $7,530,369 in 1899. Sugar beets are also grown extensively, particularly in the "Thumb" section of the state, the acreage increasing from 40,624 in 1899 to 79,195 in 1909, an increase of 94.9 per cent, when the value of the production was $4,032,718.

Horticultural crops grown are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts grown in 1909 was $10,570,855, as compared with $4,186,549 in 1899. Small-fruits decreased in acreage from 29,197 in 1899 to 21,414 in 1909, a decrease of 26.6 per cent, when the total value was $2,028,865. In 1909 the total acreage of potatoes and other vegetables was 456,368 and their value $16,201,328. The acreage of vegetables, excluding potatoes, was 90,861, an increase of 58 per cent over the acreage in 1899, and the value of these vegetables in 1909 was $6,286,645. Flowers and plants and nursery products increased in acreage from 2,060 in 1899 to 3,736 in 1909, an increase of 81.4 per cent, when their value was $1,786,538.

The total quantity of orchard-fruits produced in 1909 was 15,220,104 bushels, valued at $9,020,842. Apples contributed about four-fifths of this quantity, peaches and nectarines and pears most of the remainder. The number of apple trees of bearing age in 1910 was 7,534,343; those not of bearing age, 2,253,072. The production in 1909 was 12,332,296 bushels, valued at $5,969,080. The peach and nectarine trees of bearing age in 1910 numbered 2,907,170; those not of bearing age, 2,991,090. The production in 1909 was 1,686,586 bushels, valued at $1,700,330. The number of pear trees of bearing age, in 1910 was 1,136,151; those not of bearing age 623,931. The production in 1909 was 666,023 bushels, valued at $535,771. The production of cherries in 1909 was 338,945 bushels, valued at $590,829; that of plums and prunes 181,188 bushels, valued at $205,765; and that of quinces 13,484 bushels, valued at $16,858.

The production of grapes in 1909 was 120,695,997 pounds, as compared with 41,530,369 pounds in 1899. The value of grapes in 1909 was $1,531,057. The grapevines of bearing age in 1910 numbered 11,013,576; those not of bearing age, 1,869,648.

The total production of nuts in 1909 was 961,137 pounds, valued at $18,956. Most of the nuts consisted of black walnuts, hickory-nuts, and chestnuts, there being 546,779 pounds of black walnuts produced, valued at $7,804; 276,015 pounds of hickory-nuts, valued at $6,681; 112,488 pounds of butternuts, valued at $1,552; and 23,369 pounds of chestnuts, valued at $2,762.

Strawberries are by far the most important of the small-fruits raised in Michigan, with raspberries and loganberries, and blackberries and dewberries ranking second and third respectively. The acreage of strawberries decreased from 10,837 in 1899 to 8,051 in 1909, when the production was 14,218,768 quarts, valued at $1,000,788. The acreage of raspberries and loganberries decreased from 10,193 in 1899 to 8,786 in 1909, when the production was 8,381,943 quarts, valued at $695,019. The acreage of blackberries and dewberries also decreased from 4,385 in 1899 to 2,973 in 1909, when the production was 3,075,954 quarts, valued at $218,174. There were also produced 768,259 quarts of currants, valued at $58,288; 403,680 quarts of gooseberries, valued at $28,932; and 125,536 quarts of cranberries, valued at $6,992.

Of the vegetables, potatoes are by far the most important. The acreage increased from 311,963 in 1899 to 365,483 in 1909, when 38,243,828 bushels were produced, valued at $9,913,778. Dry edible beans are grown in Michigan also. In 1909 the acreage was 403,669, from which were harvested 5,282,511 bushels, valued at $9,716,315. Dry peas were produced to the amount of 1,162,403 bushels, valued at $1,337,430. Other vegetables of importance grown in 1909 were: 2,850 acres of celery, valued at $488,610; 7,061 acres of cucumbers, valued at $342,042; 4,314 acres of cabbage, valued at $257,144; 2,850 acres of tomatoes, valued at $217,256; 5,726 acres of sweet corn, valued at $147,762; 1,829 acres of cantaloupes and muskmelons, valued at $146,801; 1,130 acres of onions, valued at $146,507; and 4,548 acres of green peas, valued at $102,263. Vegetables of lesser importance were asparagus, green beans, beets, carrots, cauliflower, pop-corn, horse-radish, lettuce, parsnips, green peppers, radishes, rhubarb, rutabagas, squash, turnips and watermelons.

The acreage devoted to the production of flowers and plants increased from 220 acres in 1899 to 702 in 1909, an increase of 219.1 per cent. The total area under glass in 1909 was 4,122,099 square feet, of which 3,922,772 were covered by greenhouses and 199,327 by sashes and frames. The value of the products in 1909 was $1,143,764.

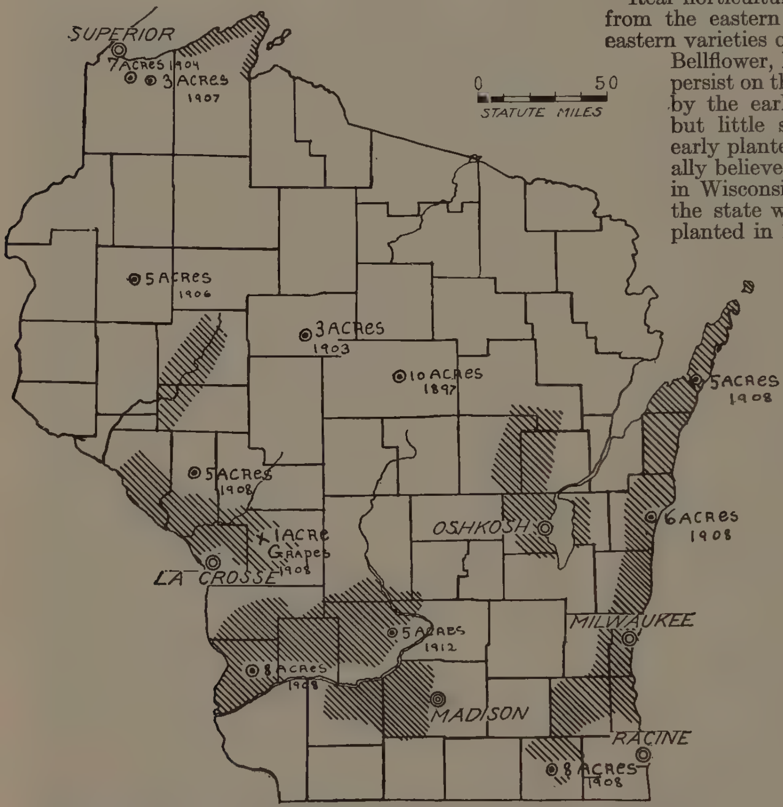
The acreage devoted to nursery products increased from 1,840 in 1899 to 3,034 in 1909, an increase of 64.9 per cent, when the value of the nursery products was $642,774.

L. R. Taft.

Wisconsin.

The surface of the state of Wisconsin (Fig. 2500) is, in general, one of low relief. The lowest parts are about 600 feet and the highest nearly 2,000 feet above sea-level. In the southwest quarter of the state—the unglaciated part—differences in elevation from 200 to 500 feet within a distance of a mile or two are common, and the area is hilly in general. In this hilly part of the state, the drainage is perfect. There are no swamps or lakes, and, while the soil in some parts is sandy, it is mostly a rich clay and loam derived from the decay of limestone. In the glaciated part of the state the surface is undulating, local relief of more than 100 feet being uncommon. The drainage is characteristic of glacial areas, being poorly developed, so that there are numerous marshes and small lakes. The soil presents all variations in character, but is mostly very fertile.

According to Whitson and Baker, the mean annual temperature of the state is 43.3°, varying from 48° for the southwest corner to 39° for the northeastern part. Acccording to the seasons, the mean temperature is as follows: Winter, 17°; spring, 42°; summer, 67°; fall, 47°. "Southern Wisconsin has a summer temperature similar to that of central France, southern Germany and the Danube Valley, while northern Wisconsin is about as warm in summer as London or Berlin. The winter temperature of the state, however, resembles that of Sweden and central Russia. The length of time from frost to frost varies widely, ranging from 175 to 75 days. Thus, the length of the frostless period at Beloit and Madison is as long as in the higher hills of Georgia or the Valley of Virginia. It is worthy of note that the growing season at both Bayfield and Sturgeon Bay is longer than that at North Yakima, Washington, and Hamilton, Montana, and equal to that at Montrose; while the season at Milwaukee and Madison is about the same as at Rochester, New York."



2500. Wisconsin, to show horticultural regions; the point-circles indicate location and acreage of trial orchards maintained by the State Horticultural Society.

Wisconsin has an average yearly rainfall of 28 to 34 inches, about one-half of which is in May, June, July and August, and 70 per cent April to September.

Any survey of horticulture in Wisconsin must include an outline at least of its history, for the development or rather the evolution of horticulture in Wisconsin constitutes one of the most interesting chapters in the annals of American horticulture.

In the middle western states, orchards and gardens simply moved westward from their original homes along the Atlantic coast and are now merely replicas of the parent orchards and gardens. The Baldwin apple and the Flemish Beauty pear, standards in Massachusetts and New York, are likewise standards in Ohio, Indiana and Michigan. Horticulture in these states has been and is now merely an extension of horticulture in the eastern states. In Wisconsin and the upper Mississippi Valley, it has been an evolution.

The first gardens in Wisconsin, planted by civilized people, were at Green Bay and on Madaline Island, one of the Apostle group. At these places the Jesuit missionaries or their followers planted gardens, not alone of vegetables but seeds of the apple and cherry. Along the shores of Madaline Island may still be found thickets of cherry, offspring of the seedling trees planted by the missionaries.

Real horticulture dates from the coming of settlers from the eastern states, 1830 to 1840, who brought eastern varieties of apples, such as Baldwin, Greening, Bellflower, King and others. These did not long persist on the black alluvial soils first preëmpted by the early settlers; long winters, often with but little snow, soon wiped out most of the early planted orchards until it came to be generally believed that tree-fruits could not be grown in Wisconsin. The rougher broken sections of the state were settled later, and here orchards planted in 1845 to 1855 still stand.

The introduction of the Russian varieties was the cause of another set-back, at least delaying the development of commercial horticulture in Wisconsin for a generation. The Russian apples all proved hardy enough but also proved generally worthless. Something of value resulted, as there have been saved as standard sorts Duchess, Astrachan, Longfield, Yellow Transparent and a few others, but the loss was greater than the gain.

During these two periods, however, there were many earnest men who were not content to wait but, by planting seeds, picking up strays from fence-corners, testing, discarding, created, as a result of fifty years' effort, a new race of fruits belonging to the state and a part of it. The inhabitants of the upper Mississippi Valley owe almost all their horticulture to the tireless, painstaking efforts of these pioneers.

The following fruits, all recognized as standards in Wisconsin and Minnesota and many of them adopted by other fruit sections, were all originated in Wisconsin: Apples—Gem, Newell, Plumb Cider, McMahan, Northwestern Greening, Windsor, Milwaukee, Pewaukee, Wolf River. Crabs—Brier, Gibb. Plums—De Soto, Springer. Grapes—Janesville. Blackberries—Ancient Briton, Stone. Raspberries—Loudon. Strawberries—Jessie. From Minnesota, Wisconsin growers have the Wealthy; from Iowa, the Patten Greening; and from Maine, the Dudley apples.

The period of evolution occupied fully fifty years from the forties to the nineties and was almost wholly confined to amateur lines, the home orchard and garden. In the past ten years the business of growing fruit for market has developed very rapidly. While in 1902, a 60-acre apple orchard was the largest in the state, orchards of 75 to 100 acres are not now uncommon.

The principal orchard sections of the state comprise parts of Bayfield, Door, Chippewa, Waupaca, Sauk, Richland, and Crawford counties in addition to the counties south of Door bordering on Lake Michigan. Some of the best apple lands in the state are to be found on the ridges bordering the valley of the Kickapoo River in Crawford County. These unglaciated ridges extend from Wauzeka to La Farge, west to the Mississippi and east to Richland County. Several thousand acres of commercial apple orchards are now being developed in this section. Probably the most remarkable phase in the development of commercial horticulture in Wisconsin is the extensive planting of tree-fruits in Door and Bayfield counties, both north of the 45th parallel. The acreage of tree-fruits at the present time in Door County exceeds 7,500 largely sour cherries, including one plantation of 670 acres of Montmorency and Early Richmond. The Bayfield district comprises a narrow strip along the shore of Lake Superior from 2 to 5 miles wide and extending north and west from Washburn to the east line of Douglas County. Over 600 acres of apples and cherries are now planted here in addition to an equal or greater acreage of small-fruits. The success of fruit-growing in these districts is clearly due to the modifying influence of lakes Superior and Michigan.

Pears are not extensively grown in Wisconsin on account of lack of hardiness of the tree as well as the ravages of fire blight.

The americanas are the only plums that can be depended upon to bear fruit regularly in all parts of Wisconsin. The hardier sorts of the European plum, *Prunus domestica*, and of the Japanese plum, *Prunus triflora*, are fairly fruitful in the eastern part, notably in Door and Kewaunee counties. The trees of the last two species, as of those of *Prunus hortulana* and *Prunus angustifolia*, endure the winters throughout the state, but the flower-buds are destroyed whenever the thermometer registers much lower than 20° below zero.

The peach and apricot are not fruitful in any part of Wisconsin except after unusually mild winters. The trees are frequently grown in gardens, and sometimes attain considerable size, but they freeze back more or less in the average winter. Trees of the apricot, imported from Russia, have been frequently planted in Wisconsin, by way of experiment, but are nowhere fruitful. Even if the flower-buds escape destruction, the fruit almost invariably falls soon after setting.

The grape, with winter protection, is successfully grown throughout southern and eastern Wisconsin, when planted on light soil, with southern exposure.

Strawberries and other small-fruits are grown in sufficient quantities to supply local markets and, in addition, from 250 to 300 carloads are shipped annually to Minnesota and the Dakotas, mainly from Sturgeon Bay, Bayfield and Sparta.

Huckleberries and blueberries are extensively gathered from wild plants in certain parts of west-central Wisconsin, and are shipped in large quantities to cities of the Northwest. Wisconsin is one of the chief cranberry-producing states. In parts of Wood, Adams, and Juneau counties, and in less degree in Waupaca and Green counties, the cranberry plant was native over very large areas, and before the settlement of the country the Indians gathered the fruit extensively in bearing years. Latterly, the wild marshes have been largely improved by clearing and providing flooding facilities. In some seasons the total output of cranberries from Wisconsin has aggregated nearly 100,000 barrels. The varieties grown are mostly native, and the quality and keeping of the fruit are excellent. In the years 1894 and 1895, the cranberry industry of Wisconsin suffered a serious check by the destruction of many marshes by fire during an exceptionally dry period. But the business is rallying and may, in a few years, recover its former magnitude.

The trucking industry is confined largely to the southeastern part of the state, mainly Racine, Kenosha and Milwaukee counties.

Wisconsin is one of the leading cabbage-producing states of the country, shipping annually over 5,000 carloads of the hard winter varieties. Domestic cabbage are also produced in large quantities for the manufacture of kraut. The principal producing counties are: Brown, Columbia, Kenosha, LaCross, Milwaukee, Outagamie, Pierce, Racine, Rock, St. Croix, and Wood. Outagamie is probably the heaviest producer, about 40,000 tons being the annual production of recent years. Within the past few years the cabbage industry of the southeastern part of the state has been threatened with destruction, owing to the ravages of a relatively new disease known as "yellows." By selection, a disease-resistent strain of winter cabbage has been secured which stands up almost perfectly under the most adverse disease conditions. This strain has been distributed under the name "Wisconsin Hollander." Further trials show that similar disease-resisting strains of the other commercial types are obtainable.

The onion industry of Wisconsin centers along the lake shore in Kenosha, Racine, and Milwaukee counties, and is extending into other sections. The types of onions usually grown are the Red and Yellow Globe, although the white onions are raised to a certain extent. The land best adapted for this crop is rather limited, about 600 acres being raised annually at the present time. Owing to the profitableness of this crop, the acreage is tending to increase. The yield to the acre varies greatly with the fertility of the soil and the care given the plants in their early growth. The average yield is above 400 bushels an acre with occasional yields running over 700 bushels. With fair market conditions, the growers receive $200 to $500 an acre.

Forty-three per cent of all canned peas in the United States are produced in Wisconsin. In 1909, this state produced 1,165,055 bushels of dry peas, more than any other state.

Coincident with the extension of fruit-planting has come the development of selling organizations. Fruit-selling associations, purely coöperative in character, have been in successful operation for several years at Sparta, Sturgeon Bay and Bayfield.

In esthetic horticulture Wisconsin compares favorably with any other state. The park systems of the larger cities receive liberal support both from the municipalities and private gifts. About Geneva Lake, in the southeastern part of the state, are the summer homes of many wealthy persons, largely residents of Chicago. Here may be found some excellent examples of landscape art and architecture.

Public-service agencies for horticulture.

The College of Agriculture is located at Madison. The Department of Horticulture was organized in 1889, and is one of the most potent forces in the development of horticulture in the state. There are eight teaching members of the horticultural staff.

The Experiment Station is also at Madison. The research work is varied, dealing with particular problems in the culture of the various horticultural crops. Most of this work is carried on at Madison but a portion of it is done in connection with the work at the branch stations. Considerable work has been done with variety testing of fruits.

The extension service is of more recent development. Three members of the staff give most of their time to this line of work. The organization of community centers for the growing of pure potato seed stock, inspection and certification of potatoes, orchard rejuvenation, spraying demonstrations, tobacco seed-bed sterilization, home and school ground improvement, lectures and garden and fruit schools are some of the lines of activity of the department.

The office of State Entomologist was created in 1915, and has sole charge of the nursery and orchard inspection, the inspection of apiaries and the examination and analysis of insecticides and fungicides. This office is also authorized to engage in extension work.

The Wisconsin State Horticultural Society, organized in 1865, and chartered by the state in 1871, maintains a bureau of information and answers all questions on fruit-growing submitted to the secretary. In addition, the Society maintains ten trial orchards or demonstration stations for the purpose of testing the adaptability of varieties to the soils and climates of these particular regions. In addition to its annual report, it issues a monthly magazine "Wisconsin Horticulture." This Society is purely an educational institution and its purpose is the advancement of every branch of horticulture in the state.

Statistics (*Thirteenth Census*).

The approximate land area of Wisconsin in 1910 was 35,363,840 acres. The land in farms was 59.6 per cent of this area, or 21,060,066 acres. Of this land in farms, the improved land numbered 11,907,606 acres; the woodland, 5,377,580 acres; and other unimproved land in farms, 3,774,880 acres. The number of all the farms in 1910 was 177,127, and the average acreage to a farm, 118.9. [The total area is 56,066 square miles.]

The leading agricultural crops grown in Wisconsin are cereals, hay and forage, and tobacco. Cereals decreased in acreage from 5,376,944 in 1899 to 4,951,066 in 1909, when the production was valued at $73,141,919, or 49.3 per cent of the total value of all crops. Hay and forage increased in acreage from 2,397,982 in 1899 to 3,079,102 in 1909, when the production was valued at $40,866,396, or 27.5 per cent of the total value of all crops. Tobacco increased in acreage from 33,830 in 1899 to 40,458 in 1909, when the production was valued at $3,855,033. The value of the forest products of the farms in 1909 was $9,559,428, as compared with $6,116,033 in 1899.

Horticultural crops grown in Wisconsin are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $2,130,935, as compared with $284,024 in 1899. Small-fruits decreased in acreage from 12,389 in 1899 to 6,305 in 1909, when the production was 9,782,779 quarts, valued at $765,437. The total acreage of potatoes and other vegetables in 1909 was 360,312, and their value, $12,511,816. Excluding potatoes, the acreage of other vegetables increased from 39,578 in 1899 to 70,123 in 1909, when the production was valued at $4,593,865. Flowers and plants and nursery products increased in acreage from 930 in 1899 to 1,007 in 1909, when the production was valued at $893,866.

The total quantity of orchard-fruits produced in 1909 was 2,343,517 bushels, valued at $2,087,202. Apples contributed about 95 per cent of this quantity, and cherries most of the remainder. Apple trees of bearing age in 1910 numbered 2,430,232; those not of bearing age, 1,408,726. The production in 1909 was 2,232,112 bushels, valued at $1,896,681. The number of cherry trees of bearing age in 1910 numbered 290,495; those not of bearing age, 148,775. The production in 1909 was 81,340 bushels, valued at $152,119. The production of other orchard-fruits in 1909 was: 15,907 bushels of plums and prunes, valued at $20,944; 12,992 bushels of pears, valued at $16,551; 956 bushels of peaches and nectarines, valued at $552; 100 bushels of apricots, valued at $211; and minor quantities of quinces and mulberries.

The production of grapes in 1909 was 701,329 pounds, valued at $25,537. The vines of bearing age in 1910 numbered 148,348; those not of bearing age, 63,098.

The total production of nuts in 1909 was 609,428 pounds, valued at $18,196. The nuts contributing to this production were: 496,722 pounds of hickory-nuts, valued at $15,954; 86,086 pounds of black walnuts, valued at $1,617; and 20,310 pounds of butternuts, valued at $450.

Strawberries are the most important of the small-fruits produced in Wisconsin, with cranberries second in importance. The acreage of strawberries decreased from 3,508 in 1899 to 2,863 in 1909, when the production was 5,188,117 quarts, valued at $434,971. Cranberries decreased in acreage from 5,821 in 1899 to 1,689 in 1909, when the production was 2,549,344 quarts, valued at $127,212. Raspberries and loganberries decreased in acreage from 1,616 in 1899 to 964 in 1909, when the production was 1,053,889 quarts, valued at $114,578. Other small-fruits produced were: 498,119 quarts of blackberries and dewberries, valued at $48,707; 383,982 quarts of currants, valued at $31,078; and 107,708 quarts of gooseberries, valued at $8,751.

Potatoes, the most important of the vegetables in Wisconsin, increased in acreage from 256,931 in 1899 to 290,185 in 1909, when the production was 31,968,195 bushels, valued at $7,917,754. The production of the most important of the other vegetables was: 10,506 acres of cabbage, valued at $686,296; 11,182 acres of green peas, valued at $321,324; 650 acres of onions, valued at $95,595; 3,789 acres of sweet corn, valued at $83,502; 1,563 acres of cucumbers, valued at $82,735; 363 acres of tomatoes, valued at $42,300; 137 acres of celery, valued at $36,570; 187 acres of cantaloupes and muskmelons, valued at $25,591; 685 acres of turnips, valued at $19,888; 497 acres of green beans, valued at $16,067; 87 acres of asparagus, valued at $11,498; and 168 acres of watermelons, valued at $11,355. Vegetables of less importance are beets, carrots, cauliflower, popcorn, horse-radish, radishes, rutabagas, and spinach.

The acreage devoted to the production of flowers and plants increased from 194 in 1899 to 252 in 1909. The total area under glass in 1909 was 2,007,310 square feet, of which 1,875,858 were covered by greenhouses and 131,452 by sashes and frames. The value of the flowers and plants produced in 1909 was $592,839, as compared with $270,872 in 1899.

Nursery products increased in acreage from 736 in 1899 to 755 in 1909, when the products were valued at $301,027, as compared with $85,087 in 1899.

FREDERIC CRANEFIELD.

WEST NORTH CENTRAL STATES.

Minnesota.

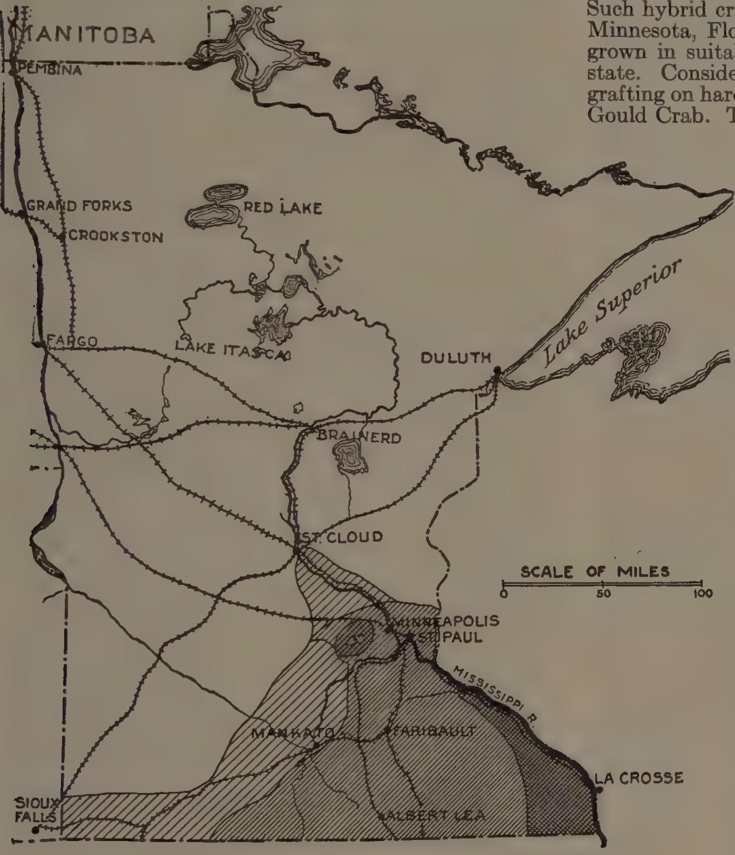
The surface of Minnesota (Fig. 2501) is gently undulating, except in the extreme northwestern part, where, in the Red River Valley, are large, fertile, level prairies. Its roughest agricultural land is found in the eastern part, along the Mississippi River, and in many places the bluffs reach a height of 400 feet above the valley. About one-half the state, embracing the northeastern and eastern parts, was originally heavily timbered, and much timber still remains in the northeast, while many scattered groves of timber will be found elsewhere, especially along the rivers.

There are many lakes, the number of which has been estimated at 10,000. These lakes and the timber in the northern part of the state afford excellent camping-grounds and are visited by thousands of people from the cities of the state and from many states farther south. They are especially numerous in the central and northern parts, where they greatly modify the climate of lands in their vicinity. There are great variations of climate between the extreme northern half, where the summers are very short, and the southern half, where killing frosts seldom occur before the first of October. The winters are generally pleasant, but occasionally severe, and 40° below zero is sometimes experienced.

The soil is generally rich and well adapted to a variety of crops, but it is very variable, and there are some extended areas in the northern part where there is much sandy land that should never be used for agriculture, but should rather be devoted to forestry or turned into forest and game preserves. The undulating surface, variety of good soil and vegetation, and abundance of lakes, afford many very picturesque and beautiful locations for successful horticulture.

The annual precipitation averages about 25 inches, and is well distributed during the growing season. The snowfall is light, and what falls remains usually during the winter. The spring usually opens early, and the transition from winter to spring is very rapid. The soil at St. Paul and southward can generally be worked by April 15, and frequently earlier. The summers and autumns are bright and sunny, and vegetation grows with great rapidity.

Currants, gooseberries, raspberries, blackberries, strawberries, juneberries, americana plums, and the frost or river-bank grapes are native fruits that are found wild in abundance in favorable locations throughout the state. Most of the well-known cultivated sorts of the five species first named do well under cultivation, and large quantities are raised for home consumption and are profitably marketed. The Concord, Worden, Delaware, and grapes of similar character, are easily raised in the many good locations along the lake shores and the river bluffs, and this is an important industry, notwithstanding the fact that the grapes have to be covered in winter, which adds somewhat to the expense of culture. However, on account of the peculiar adaptability of the Delaware grape to some of the soils and to the climate, it is raised with profit in competition with the growers of the eastern states, though the Concord is not high enough in price by one cent a pound to permit of this to any great extent.



2501. Minnesota, showing the best developed horticultural parts.

Apples are raised on a commercial scale in southern and eastern Minnesota, the high, rolling land in the southeastern part being especially well adapted to their cultivation. The varieties of the eastern and central states generally prove a failure here. The Duchess of Oldenburg is the standard of hardiness in apples, and can be grown successfully in good locations as far north as St. Paul, and in a small way 100 miles farther north. The Talman Sweet is raised to some extent, but is liable to suffer in severe winters. The Minnesota seedling apple known as the Wealthy is generally the most profitable kind grown. (See *Gideon*, page 1577.) A great many Russian varieties were formerly planted, but have proved unsatisfactory in most cases and very few are now grown. The hardiest variety of this origin so far found is the Hibernal, which represents a class of sour autumn apples that will thrive on suitable soil in almost any part of the state. The Charlamoff is another very hardy early autumn apple of the same class. Such hybrid crabs as the Transcendent, Gideon No. 6, Minnesota, Florence and Lyman, may be successfully grown in suitable locations and soil over most of the state. Considerable attention is being given to top-grafting on hardy stocks, such as Virginia, Hibernal and Gould Crab. This has proved a good method in many parts of the state and in the northern part appears to be the best way to establish apple orchards. Some good-sized apple orchards are found along the Mississippi River in southeast Minnesota and in the Lake Minnetonka regions. The fruit associations about Lake Minnetonka alone do a business of $50,000 to $75,000 a year.

The americana class of plums is found growing wild all over the state, and the fruit is gathered in large quantities. The cultivated sorts of this class are easily grown everywhere. Wild plums can generally be obtained in abundance in autumn at about $1.50 a bushel. There is no variety of any other class of plums that is appreciably cultivated, although in very favorable locations a few of the Japan and domestic sorts are grown.

Cherries may be successfully grown on a large scale in extreme southeastern Minnesota, and there are some commercial orchards there, but generally throughout the state the fruit-buds are so injured in winter that the trees are unproductive, although they may make a very satisfactory tree growth.

Pears usually blight to death early, and there is no variety that is generally cultivated. Several of the Russian pears are as hardy as the Duchess apple, but they have died, so far as they have been tried, from blight before becoming very productive. Apricots are not sufficiently hardy.

The most common injury to trees is known as sunscald of the trunks, which often causes severe loss. It is easily avoided by shading the trunks. Blight seriously injures some varieties of apples. Winter-protection of various kinds is important and carefully attended to by the best horticulturists.

Vegetables of all the kinds grown in the northern states are very easily raised, and the display of these products in the large markets is excellent. Cabbage, cauliflower, celery, peas, lettuce, potatoes, beans, corn, cucumbers, tomatoes, squash, watermelons, muskmelons and eggplant are to be had in abundance, and the markets are often glutted with them. Native muskmelons and tomatoes occasionally retail at 10 to 15 cents a bushel. The canning of vegetables is becoming an important industry at several points. The climate seems to be especially favorable to vegetables, and there is much less trouble from disease than in many more humid sections. There are two vegetable-growers' associations in the state. The Minneapolis and St. Paul associations, which have a membership of over 200, have been very instrumental in getting a more uniform and better grade of produce on the market. While they do not attempt to set the price of produce. they have proved of much value to the trucking interests both in raising and marketing produce.

One of the important crops of the state is potatoes. These are grown quite largely in the Red River Valley and in the section of country north and northeast of Minneapolis nearly to Duluth. Large quantities are shipped South and West for seed purposes. Special potato organizations have taken hold of the work and are building an important business.

The growing of vegetables under glass has increased greatly in the past few years. Lettuce, tomatoes, and cucumbers are the principal crops grown under glass, although mint, cress, radishes, and parsley are grown to some extent, and find a ready market. A number of larger growers have installed irrigation systems in their greenhouses and find them very satisfactory. They are also used to some extent for outdoor crops. Probably $800,000 to $1,000,000 is invested in the business.

Mushrooms for market are grown to a considerable extent about the Twin Cities. One of the largest pure-culture mushroom-spawn plants in the country is located in St. Paul. This same plant grows large quantities of mushrooms for market.

There are something over 100 nurseries in Minnesota, totaling about 3,000 acres of land and ranging in size from an acre or less to 250 or 300 acres of actual nursery stock. Large importations of bulbs and plants are made from Europe and from outside the state each year. Up to the present time, much of the nursery stock except fruit has been propagated outside the state. With the advent of more greenhouses in connection with the business, much more stock is now propagated at home. Nearly all nurseries doing a large business have established landscape-gardening departments to handle their increasing work along ornamental lines. A number of nurseries have been established specializing only in ornamental shrubs, peonies, iris and perennials.

The demand for ornamental horticulture is considerable and rapidly increasing, giving investment to at least $1,000,000 in the greenhouse business, besides large quantities of flowers and plants purchased outside the state and sold through retail flower-stores. Carnations, violets and chrysanthemums are grown in large quantities. A limited amount of sweet peas, snapdragons, and the like, are also grown and easily disposed of. Large quantities of bulbs, such as tulips, narcissi, and Easter lilies, are forced principally for Christmas and Easter. Roses and some other flowers are brought in from growers outside of the state to a considerable extent, although there are a number of large growers in the state. Peonies, dahlias, asters, sweet peas and iris are grown in large quantities outside for cut-flowers. The demand for these has developed a number of specialists who supply the very best class of material. Minneapolis and St. Paul each have strong florist associations.

The love for horticulture is also shown by the immense sums spent by the cities and small towns for public parks. Minneapolis alone has 3,800 acres of city parks, 50 miles of drives and 1,305 acres of lake surface. St. Paul, Duluth, and other cities and towns of the state will easily bring the park acreage up to 8,000 or 10,000 acres. Besides this, there are three or four state parks, containing something over 1,000 acres, and about 44,000 acres of forest reserve, a part of which is used as a natural public park or playground. These parks are visited by several millions of persons each year, and undoubtedly exert much influence.

Public-service agencies for horticulture.

The University of Minnesota is at Minneapolis, and in 1869 the Department of Agriculture was established at St. Anthony Park about 3 miles from the main campus. Here are located the Experiment Station, School of Agriculture, and College of Agriculture. Although the Agricultural Department was established in 1869, it was not of much importance until about 1885, when a part of the present farm was purchased and the first School of Agriculture established in 1889. There are sub-stations at Crookston, Morris, Grand Rapids, Waseca, and Duluth. A trial fruit station is maintained at Owatonna. This was originally used for raising apple seedlings, but this work has now been taken over by the Fruit Breeding Farm at Excelsior and the Owatonna Station is used only as a trial station.

Schools of agriculture are maintained at Crookston and Morris, in which horticulture is taught to some extent. Horticulture is taught in most of the high-schools in the state having agricultural courses. School-gardens and nature-study classes in some form or other are to be found in nearly all schools.

The Extension Division of the Agricultural Department has a horticulturist who holds institutes, short course lectures, and demonstrations in horticulture throughout the state. Members of the regular Station staff aid in this work to some extent.

Several hundred farmers' clubs scattered throughout the state are aiding in the spread of better agricultural methods. Many of these clubs have special horticultural programs and committees and study horticultural problems systematically.

The Minnesota State Horticultural Society is a very strong and popular organization. Great interest is taken in the raising of seedling apples, and at some of the state fair meetings more than 300 separate varieties of Minnesota origin have been shown. A number of years ago $1,000 was offered for a seedling winter apple, especially adapted to Minnesota conditions. No one has yet been able to claim the prize. One hundred dollars is offered as a prize for a seedling plum of certain qualities, and about $1,000 in prizes are offered for the encouragement of apple-growing. The Society has some eight or ten trial stations operated in different parts of the state at which new fruits, flowers, and so on, are tested. Through the reports of the superintendents of these stations, a fair index of the value of a plant for general use may be obtained. There are a number of local horticultural societies in the state besides a state florist society, which affiliate with the State Horticultural Society. There are also two or three vegetable associations.

The legislature of 1907 appropriated $16,000 for buying land for a fruit-breeding farm. Near Excelsior, 77.89 acres were purchased and equipped with greenhouse, house, storage-cellar, barn and other buildings. Large numbers of seedling strawberries, plums, raspberries and apples are being grown there. The seedling apples are just beginning to fruit, but very promising seedling plums, strawberries and raspberries have already been produced and are distributed over the state. Excellent results have been obtained and its usefulness is just beginning. Nearly the whole acreage is now in seedling fruits bred at this farm.

Statistics (*Thirteenth Census*).

In 1910 the approximate land area of Minnesota was 51,749,120 acres. The land in farms was 27,675,823 acres, or 53.5 per cent of the land area. Of the land in farms 19,643,533 acres were improved; 3,922,391 acres were in woodland; and 4,109,899 acres were unimproved. The number of all the farms in the state in 1910 was 156,137. The average acreage to a farm was 177.3. [The total area of the state of Minnesota is 84,682 square miles.]

The leading agricultural crops are cereals, hay and forage, and forest products of the farms. In 1909, 51.6 per cent of the improved land, or 10,139,850 acres were occupied by cereals and the valuation of the production was $140,864,148, which was 72.8 per cent of the total value of all the crops. The acreage of hay and forage increased from 3,157,690 in 1899 to 3,946,072 in 1909, an increase of 25 per cent, when the production was valued at $26,724,801, or 13.8 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was $5,181,508, as compared with $2,602,335 in 1899. In 1909 flaxseed was produced to the amount of 3,277,238 bushels, valued at $4,863,328.

The horticultural crops produced were fruits and nuts, small-fruits, vegetables including potatoes, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $813,971, as compared with $125,240 in 1899. Small-fruits increased in acreage from 3,092 in 1899 to 3,738 in 1909, when the production was 4,476,575 quarts, valued at $493,406. In 1909 the total acreage of potatoes and other vegetables was 269,713 and their value $11,044,391. Excluding potatoes, the acreage of the other vegetables was 46,021, and their value $3,359,052, both acreage and value being materially greater than in 1899. Flowers and plants and nursery products increased in acreage from 1,270 in 1899 to 4,017 in 1909, when the value of their products was $1,466,949.

The total quantity of orchard fruits produced in 1909 was 1,066,659 bushels, valued at $801,112. Apples contributed 97.9 per cent of this quantity, and plums and prunes most of the remainder. The apple trees of bearing age in 1910 numbered 1,380,396; those not of bearing age, 1,571,816. The production in 1909 was 1,044,156 bushels, valued at $769,114. The plum and prune trees of bearing age in 1910 numbered 233,736; those not of bearing age, 167,926. The production was 19,920 bushels, valued at $27,808. Other orchard-fruits produced in 1909 were 1,526 bushels of cherries, valued at $2,973; 559 bushels of peaches and nectarines, valued at $659; 400 bushels of pears, valued at $465; and apricots, quinces and mulberries in minor quantities.

Grapes were produced to the amount of 293,805 pounds in 1909, valued at $11,021. In 1899 the production of grapes was 573,272 pounds. The number of vines of bearing age in 1910 was 61,916; those not of bearing age, 35,950.

The nut industry is not an important one in Minnesota, the total production in 1909 being 81,555 pounds, valued at $1,838. The most important of the nuts is the black walnut which produced in 1909, 65,074 pounds, valued at $1,490. Other nuts which are growing in Minnesota in very limited quantities are the butternuts, hickory-nuts, chestnuts and others of more or less importance.

Of the small-fruits grown in Minnesota, strawberries are by far the most important, with the different raspberries ranking next. The acreage of strawberries increased from 1,302 in 1899 to 1,873 in 1909, when the production was 2,730,099 quarts, valued at $268,772. The acreage of raspberries and loganberries increased from 1,115 in 1899 to 1,388 in 1909, when the production was 1,340,469 quarts, valued at $178,689. Other small-fruits produced in 1909 were 182,825 quarts of currants, valued at $19,783; 139,741 quarts of blackberries and dewberries, valued at $17,696; 60,661 quarts of gooseberries, valued at $6,412; and 22,112 quarts of cranberries, valued at $1,981.

Of the vegetables, potatoes far exceed any of the others. The acreage of potatoes increased from 146,659 in 1899 to 223,692 in 1909, when the production was 26,802,948 bushels, valued at $7,685,259. The more important of the other vegetables produced were 1,099 acres of onions, valued at $182,069; 2,315 acres of cabbage, valued at $128,430; 4,697 acres of dry edible beans, valued at $124,996; 2,829 acres of sweet corn, valued at $62,387; 1,190 acres of cucumbers, valued at $59,512; 499 acres of tomatoes, valued at $52,631, and 453 acres of cantaloupes and muskmelons, valued at $41,913. Vegetables of minor importance were asparagus, green beans, beets, carrots, cauliflower, celery, pop-corn, lettuce, green peas, radishes, rhubarb, squash and watermelons.

The acreage devoted to flowers and plants increased from 143 in 1899 to 163 in 1909, an increase of 14 per cent. The total area under glass in 1909 was 1,419,196 square feet, of which 1,332,758 were covered by greenhouses, and 86,438 by sashes and frames. The value of flowers and plants produced in 1909 was $603,935, as compared with $288,055 in 1899.

The acreage occupied by nursery products in Minnesota increased from 1,127 in 1899 to 3,854 in 1909, an increase of 242 per cent. The value of the nursery products in 1909 was $863,014, as compared with $383,105 in 1899.

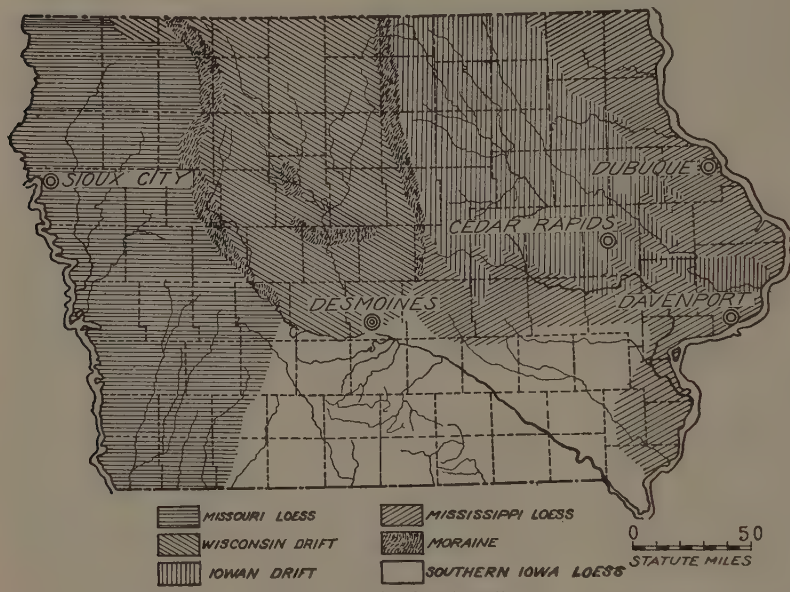
LEROY CADY.

Iowa.

Iowa (Fig. 2502) is nearly a rectangle, about 200 miles north and south between the parallels 40° 36′ and 43° 30′, and 300 miles east and west, bordered on the east by the Mississippi and on the west by the Missouri and Big Sioux rivers. Its extreme elevations are 444 feet in the southeast corner and 1,694 feet at the highest point near the northwest corner, the average elevation being about 800 feet above the sea. The annual rainfall, coming largely from the moist airs of the Gulf, varies with the altitude; in the southeast corner, 37 inches and in the northwest corner, 27.37 inches, at Des Moines, 32.66 inches, which last is nearly the average for the state. The annual temperature is 51° in the southeast, 44° in the northwest and 40° at Des Moines, also about the average of the whole state. The surface is a gently undulating grassy plain, well drained by numerous streams flowing into the rivers at its borders. All these streams are bordered more or less broadly with belts of native timber, often many miles in width along the lower parts of the larger ones. The divide between the streams flowing eastwardly and those flowing westwardly is a line running from a little east of the northwest corner, southwardly to about the middle of the state at the south line, draining three-fourths of the state into the Mississippi and one-fourth westwardly. The entire surface, except a short and narrow belt along the Mississippi at the northeast corner, is deeply covered with glacial drift, the depth varying from a few feet to 200 feet or more. In about half the state this drift is overlaid more or less deeply with a peculiar deposit called loess, this being mainly in the south and extending north on the west side, and in a narrower belt on the east, to the north line of the state. There are no other regions the size of Iowa which contain fewer acres unfit for agriculture; which is as profitable in the northern as in the southern part.

Horticulture is, however, profoundly affected by a region of glacial drift which, coming in from the north, occupies much more than half of the state; embracing that part of Iowa lying north of a line drawn from about latitude 42.5° (Sioux City) on the west, to 41.5° (Des Moines) in the central part, thence to the northeast corner of the state, latitude about 43.5°. In this new drift soil, fruit-growing is much more difficult than in the loess regions above mentioned. During the past few years, however, artificial drainage in this region has been rapidly developed, making it one of the richest agricultural sections in the Union and greatly increasing the range of horticultural possibilities. There, while statistics are still unavailable, are found the greatest development of the americana (native) plums, strawberries, gooseberries and currants, in this state, with splendid home market. Hardy varieties of apples and grapes, hybrid plums, raspberries, and blackberries are being successfully planted, though not yet in sufficient quantity to supply the local demand.

The most favorable regions for the apple are found in the southwest and southeast along the Missouri, Mississippi and Des Moines rivers, where the so-called "bluff deposits" have their greatest development. This is a light-colored, porous soil which endures drought and flood, and is especially friendly to the apple, the cherry, and the grape, and, in fact, all fruits of the region. The leading varieties of apples in the older commercial orchards are Jonathan, Grimes, Ben Davis, Gano, Winesap and Black Twig, probably ranking in value according to the order named. Of late, Delicious, Stayman, and Ingram have been very freely planted in the southern part; while in the north, Wealthy, Malinda, and Northwestern Greening are most prominent. Spraying is generally carried on in the larger centers but clean tillage in the older orchards is rather the exception than the rule.



2502. Iowa, showing the soil areas.

The sour cherry occupies second place in Iowa fruits and promises most rapid development. Especially successful wherever the loess soil is found, it does not reach commercial importance beyond latitude 42.5° (Sioux City and Dubuque) on the west and east of the state, the line of success dropping about 1° of latitude southwardly in the center of the state, where the newer drift has overlaid the loess. By reason of the failure of cherry in the northern half of the state, there is a splendid market, practically inexhaustible, at good margin, for all surplus cherries grown in the southern half. Early Richmond is by far the most valuable, with Montmorency second and English Morello third. Sweet cherries do not succeed.

The plum, while of considerable annual value, is not strictly a commercial fruit of Iowa. Being the native home of a large number of pure americana varieties, this class of course finds its greatest development within the state, especially the northern part. Of these, Terry, De Soto, Wyant, Hawkeye, Wolf and Hammer remain most prominent, with Wild Goose leading the Chickasaw or narrow-leaf type. The many fine hybrid plums promise to bring Iowa forward as one of the principal plum-growing sections of the Middle West.

The culture of the peach, domestica and Japanese plums does not reach north much beyond latitude 41.5°, though it is pushing steadily northward by the adoption of newly introduced seedling varieties. The peach is developing considerable commercial importance in the extreme southern part, while the domestica and Japanese plums are decreasing in favor owing to the lack of hardiness and strong tendency to rot.

Pears, while rather freely planted throughout the loess soil sections of the state, have become commercially prominent only in a few limited areas, notably the bluffs along the river south of Des Moines and near the eastern border from Davenport southward. The largest individual pear orchard at present includes over 100 acres, owned by B. A. Matthews, of Knoxville, largely Kieffer, from which eight to fifteen carloads are shipped annually. Generally, however, the soil is found too heavy for successful pear-culture; only the thin-soiled bluffs and hillsides can be recommended for pear orchards, and these must be seeded down and sometimes root-pruned to prevent disastrous blight.

Practically all parts of the state can produce good grapes, though the centers of commercial vineyards are largely confined to the regions surrounding Council Bluffs on the west and Des Moines in the central part. Concord, Moore Early and Worden comprise fully 90 per cent of the planting, the Concord proving most reliable, Moore Early generally most profitable an acre.

Next to sour cherry and hybrid plums, the most rapid advancement is now being made in the planting of the blackcap raspberries. About fifteen years ago, thousands of acres were devoted to this fruit throughout the south central belt of the state, but low prices, due to an undeveloped market and the general spread of the anthracnose fungus disease, discouraged fruit-growers. Plantations destroyed by the disease were not replanted, causing a decided decrease in raspberry-production. Prices have since been going steadily upward until now with prospect of netting from $200 to $350 an acre annually with favorable seasons and good care, rather extensive planting is again resumed. On account of the excellent outlet to the north for surplus fruit, besides a splendid home market, it is likely that Des Moines will remain the principal raspberry center. Cumberland first, with Gregg a close second, and Kansas for early fruit, constitute the bulk of the planting. Shallow cultivation and summer mulch to protect against drought at harvest time, bring best results.

The fruits which have been and are likely to remain most prominent commercially over the state are the apple, the cherry, grapes, strawberries, and raspberries. Almost without exception, the perishable fruits are grown in greatest volume near the large market centers of the state, the only prominent exception being in the case of cherries and grapes extensively grown for annual shipment to northern and northwestern markets, extending into Minnesota and the Dakotas. The three principal centers of commercial cherry- and grape-culture are: (1) along the Missouri River, on the west, from Sioux City down to the Missouri line; (2) along the Mississippi and some of its Iowa tributaries, from Davenport southward; and (3) in the vicinity of Des

Moines. Small-fruits, figured on the basis of actual consumption and based on an average for the state, will probably exceed in value all the tree-fruits combined, the small-fruits being limited to no particular area but successfully grown for home use and local market in all parts of the state.

The Atlantic seaboard, with its 200 years of seedling orchard production before budding and root-grafting became common practice, was enabled through necessity, by seedling selection, to develop its "apple kings" and other fruits, all specially adapted, by reason of such seedling selection, to the soil and climate of the region. The first surprise and disappointment came to the early settlers of Iowa when they discovered that the fruits, so desirable and profitable in the East, either winter-killed or proved quite barren in this region. The later introduction of pure Russian fruits under the auspices of a misguided state official, proved a complete failure with few exceptions. The shock horticulture received from these two experiences retarded the development of the pomology of the state. The introduction of budding and root-grafting by nurserymen in propagating all fruit-trees terminated compulsory seedling selection. Gradually, as the needs of this great inland prairie region of hot dry summers and fierce changeable winters were realized, enthusiastic and devoted breeders have been at work with the result that Iowa and her sister states are now experiencing a far greater degree of practical pomological development than any other region in the western hemisphere.

The rich soils and abundant rains during the growing season invite the extensive development of market-gardening. The fast-growing cities, the gradual westward trend of manufacturing, and the numerous canneries scattered over the state, offer a splendid and constantly increasing market. Heretofore the first impulse of practically every agriculturist was to devote himself wholly to corn, grain and live-stock, and it has been only in these limited areas where general agriculture could not be pursued with most satisfactory results, that commercial fruit-growing and market-gardening received deserved attention. Gradually, with the steady increase of land values, demanding more intensive farming, and the dissemination of the knowledge that one must conserve and husband the resources of the soil, fruit and vegetables are becoming more generally developed. The best fruit sections of the state are those most prominent in market-gardening because land values are the highest and modern economical methods have proved the need of constant cultivation leading to intercrops of vegetables of highest market values. The most important vegetable is the potato, successfully grown on new land in all parts of the state. Sweet corn is grown in small quantities in all sections to supply abundantly home needs and local markets, while in the vicinity of canning-plants, most numerous in the central and northern part of the state, many thousand acres are devoted to this product. Generally, beans, peas, and tomatoes are also grown rather extensively in the vicinity of the canneries. Onion-, celery- and watermelon-culture are advancing in importance, being rather general over the state in a limited way, though reaching a stage of considerable importance along the eastern border, centralizing in the vicinity of Muscatine along the Mississippi River.

The nursery business has had large development in the state of Iowa. At Shenandoah, near the southwest corner of the state, are two of the largest wholesale nurseries found in the West. Other important nurseries are carried on at Des Moines, Charles City and other places, while small establishments are found in almost every county.

Public-service agencies for horticulture.

The land-grant college in Iowa and the Iowa Experiment Station are located together at Ames and work in close harmony. At present there are eleven men on the horticultural staff of the College engaged in instruction work. The pomology section has one sub-station in connection with a leased orchard at Council Bluffs, where problems in orchard and soil management are especially studied. The number of horticultural bulletins is at present eight, all published within the last ten years.

The State College at Ames is the only school giving special instruction in horticulture. The State Teachers College at Cedar Falls gives horticultural work in connection with agriculture, but no special course in horticulture. At present, horticulture is taught in over 150 high-schools of the state. Beginning with the fall of 1915, similar instruction will be furnished in some 800 schools of the state, in compliance with a law lately enacted.

The State Horticultural Society receives from the state $4,000 annually for its use. It holds its annual meeting in December of each year and prints a report of its own proceedings, as well as of its four subordinate district societies.

The extension work in horticulture is handled through the division of agricultural extension of the Iowa State College. At the present time there are three men on the extension staff in pomology and truck crops. The work of these men is supplemented by the assistance of other members of the college and experiment station staffs and consists of farm institutes, short courses, orchard and garden demonstrations, farm tours, and so on.

The inspection service in Iowa is handled through the office of the State Entomologist and applies strictly only to injurious insects, though the nurserymen, in coöperation with the State Entomologist, have maintained inspection for injurious diseases.

A very important work not connected with state institutions has been conducted by C. G. Patten, assisted by support from the State Horticultural Society, the state and the general government. There are about 20 acres near Charles City thickly planted with cross-bred and selected stock, chiefly of apples, pears, plums and cherries, with more or less of many other kinds of fruits and plants. A number of apples originated at this experiment station have entered into general use in large sections. There has also originated at this station a new race of pears by crossing the Chinese sand pear with American sorts of better flavor. Several generations of trees are growing which are entirely hardy and blight-proof in the extreme north of the state, so that there is promise of plenty of good pears in the near future in the orchards of Iowa.

Statistics (Thirteenth Census).

The approximate land area is 35,575,040 acres. The land in farms is 95.4 per cent of the land area, or 33,930,688 acres. Of the land in farms 86.9 per cent, or 29,491,199 acres, are improved; 2,314,115 acres are in woodland; and 2,125,374 acres are classified as unimproved land in farms. The number of all the farms in the state in 1909 was 217,044, there being 156.3 acres in the average farm. [The area of Iowa is 56,147 square miles.]

The leading agricultural crops are the cereals and hay and forage. In 1909 the acreage devoted to cereals was 15,041,039, or 51 per cent of the improved land. The value of the cereal products for the same year was $230,205,315, which was 73.2 per cent of the total value of all crops. The acreage devoted to hay and forage was 5,046,185 in 1909 and the value of the products $59,360,225, which was 18.9 per cent of the total value of all crops. Sugar crops were raised to the extent of 7,276 acres, the production being valued at $208,283. The value of the forest products of the farms in 1909 was $3,649,032, which was 1.2 per cent of the total value of all crops.

Horticultural crops grown are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $4,650,875, as compared with $2,023,730, their value in 1899. The acreage devoted to vegetables, including potatoes and sweet potatoes and yams, was, in 1909, 252,243 and their value $12,021,408, thus making vegetables by far the most important of the horticultural crops grown in Iowa. Small-fruits decreased in acreage from 9,635 in 1899 to 7,211 in 1909, when the value of their products was $966,894. As an industry, the growing of flowers and plants and nursery products was of more importance than that of small-fruits. The value of flowers and plants and nursery products in 1909 was $1,503,305 as compared with $939,499, their value in 1899.

The total production of orchard-fruits in Iowa in 1909 was 7,234,168 bushels, valued at $4,283,873. Apples, the most important of the orchard-fruits, produced 6,746,668 bushels alone, which was more than nine-tenths of the total production. The value of the apples produced in 1909 was $3,550,729. Cherries, the next orchard fruit of importance, produced 260,432 bushels, valued at $455,022. The production of plums and prunes in 1909 was 158,036 bushels, valued at $192,421; that of pears, 44,449 bushels, valued at $58,777; that of peaches and nectarines 23,180 bushels, valued at $24,950. In addition, apricots were produced to the value of $942; quinces to the value of $681; and mulberries, to the value of $351.

The production of grapes for 1909 was 11,708,336 pounds, valued at $330,078. The number of grapevines of bearing age in 1910 was 1,983,465; those not of bearing age, 446,126.

The production of nuts in 1909 was 1,721,265 pounds, valued at $36,922. Most of the nuts were black walnuts and hickory-nuts. In 1909 the black walnuts produced 1,134,061 pounds, valued at $20,589, and the hickory-nuts, 539,203 pounds, valued at $15,251. Butternuts were produced to the amount of 37,931 pounds, valued at $758.

Strawberries are by far the most important of the small-fruits grown in Iowa, with blackberries and dewberries, and raspberries and loganberries ranking next. The acreage devoted to strawberries increased from 2,335 in 1899 to 2,917 in 1909, when the production was 5,330,105 quarts, valued at $479,511. The acreage of blackberries and dewberries increased during the same period from 1,719 in 1899 to 2,279 in 1909 when the production was 2,733,728 quarts, valued at $247,734. Raspberries and loganberries decreased in acreage from 3,394 in 1899 to 1,573 in 1909. In 1909 the production was 1,728,547 quarts, valued at $191,037. The same year the production of currants was 317,637 quarts, valued at $27,315; and that of gooseberries 233,544 quarts, valued at $21,251.

Of the vegetables, the potato is by far the most important. In 1909, 169,567 acres devoted to potatoes produced 14,710,247 bushels, valued at $6,629,234, more than half the value of all vegetables produced. Among the leading vegetables, other than potatoes, their acreage, and the value of the products were: sweet corn, 12,568 acres, valued at $219,220; cabbage, 2,789 acres, valued at $148,529; pop-corn, 5,345 acres, valued at $135,270; sweet potatoes and yams, 2,274 acres, valued at $125,763; onions, 849 acres, valued at $118,155; watermelons, 3,464 acres, valued at $112,217; and tomatoes, 2,055 acres, valued at $100,457. Other vegetables grown in Iowa in 1909 were asparagus, green beans, cantaloupes and muskmelons, celery, cucumbers, lettuce, green peas, radishes, and turnips.

The acreage devoted to the production of flowers and plants increased from 140 in 1899 to 361 in 1909, an increase of 157.9 per cent. The total area under glass in 1909 was 2,183,182 square feet, of which 1,870,845 were covered by greenhouses and 312,337 by sashes and frames. The value of the flowers and plants produced in 1909 was $657,393, as compared with $320,407, their value in 1899.

The acreage occupied by establishments producing nursery products was 3,430 in 1909, as compared with 2,905, the acreage in 1899, an increase of 18.1 per cent. The value of the nursery products in 1909 was $845,912, as compared with $619,092, the value in 1899.

C. L. Watrous.

Missouri.

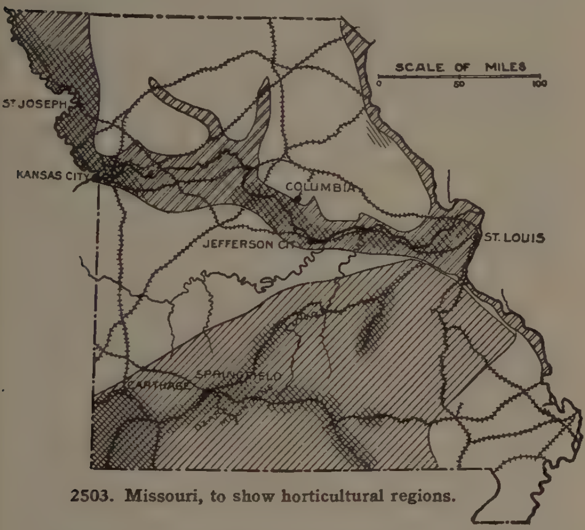
Its central position gives Missouri (Fig. 2503) a medium climate, favorable to the growth of a variety of horticultural products. The cosmopolitan character of its plants is indicated by the native flora. Northern, southern, eastern and western species blend and overlap here. The wild crab of the prairie states and the juneberries, capable of enduring the rigors of a northern winter, flourish here in the same forest with the more southern persimmon and the pawpaw. The northern grapes of the Labrusca type, like Concord, are among the standard varieties, while on the other hand tender varieties like Herbemont and the tender hybrids usually winter safely. The riparia group is native to the state, while the more tender *Vitis rotundifolia* of the Gulf region reaches splendid natural development in the southeastern part of the state. While the berries and small-fruits common to the northern states endure well the warmer climate of Missouri, the oriental persimmon, English walnut and *Poncirus* (*Citrus*) *trifoliata* are hardy in the southern part. The northern plum (*Prunus americana*) extends south into Missouri where it mingles in the same woodlands with the southern Chickasaw plum (*P. angustifolia*). These two have hybridized in nature, and some of these hybrids have found an important place in our list of cultivated American plums.

Missouri's central position is also favorable to the marketing of her fruit. Perishable fruits, such as berries and peaches, are shipped to nearly all of the principal markets east of the Rocky Mountains, from Boston and Baltimore on the east, Omaha, Denver and Pueblo on the west, and from St. Paul and Detroit on the north to Mobile, New Orleans and Galveston on the south. Some of the grain-raising, mining and grazing states of the west and northwest, where but little fruit is produced, furnish a growing market for Missouri fruit. The Mississippi and Missouri rivers, with their tributaries, touching the entire length and breadth of the state, furnish cheap freight rates north, south, and northwest, and direct railroad connections with the Gulf ports afford cheap shipment of apples to European markets.

The following figures give the average monthly rainfall in inches as recorded at Columbia by the United States Weather Bureau: January, 1.89; February, 2.57; March, 2.97; April, 4.52; May, 5.87; June, 4.56; July, 4.85; August, 2.81; September, 3.60; October, 1.40; November, 2.87 and December, 2.02. While these figures show the rainfall is ample (approximately 40 inches annually) and well distributed throughout the year, the records also show the percentage of sunny days in this immediate section is high. During August, September and October, especially, when most of the fruit is maturing, the average amount of bright sunlight is considerably higher than that of most of the orchard states. No doubt the intense sunlight and the proximity to the prairies are important factors in producing the rich color and high flavor of Missouri fruit, and may also account, in part at least, for its comparative freedom from many of the fungous diseases which are known to thrive best in a moist cloudy atmosphere.

The topography and soil of the state are both favorable to fruit-growing. The undulating areas, intersected by the Mississippi and Missouri rivers and their tributaries, are amply provided with both soil and atmospheric drainage. The more important fruit-soils include the deep, rich, loess formation (see Fig. 2503) forming the hills and tablelands overlooking the two great rivers of the state. Wherever this loess occurs, the world over, it is recognized as a typical fruit soil. The light, deep, brownish red clay loam of the Ozark uplift, containing sufficient sand and broken rock to afford excellent drainage, is also an important fruit-soil. The extensive swamp region in the southeastern part of the state is now being drained by the dredging of an extensive ditch system and is bringing under cultivation a large area of the very richest soil. This is becoming one of the most important vegetable-producing sections of the state. The growing of watermelons especially has already reached important development. Blodgett is said to be the largest watermelon shipping point in the United States. The higher second bottom-lands of the two great river-systems are also splendidly adapted to the production of orchards and of truck-crops.

The census for 1900 credited Missouri with over 20,000,000 apple trees in her orchards. This was 33⅓ per cent more than were reported for any other state. Something over 8,000,000 were reported in 1890, showing an increase of over 12,000,000 apples trees in a single decade. This was a larger number of apple trees planted in a single decade in Missouri than were growing in the year 1900 in any other states, except three. This enormous activity in apple-orchard development resulted in putting out some of the largest orchards in the world. Some of the Missouri orchards contain upward of 2,000 acres, a considerable number are of more than 1,000 acres in extent, and orchards of several hundred acres each are quite usual in almost any of the orchard districts of Missouri. This enormous planting in so short a period and largely in newly developed regions has resulted in some of the plantings going out on soil which has since proved to be unadapted to the industry. Many of the larger orchards put out in newly developed regions where insects and diseases had not had opportunity to get a foothold produced profitable crops early, but are too large to receive the care necessary to protect them from insects and fungous diseases which follow closely upon the march of orchard development. For that reason, some of the larger orchards of the state have perhaps not been so profitable as was expected. On the other hand, this extensive pioneer work in orcharding has been the means of shaping profitable orcharding of today. It has helped to map the successful orchard areas in contrast to those soils less adapted to the industry. It has shown the adaptation of varieties to the state and the local adaptation of special varieties to the various districts within the state. As a result, the conservative orchardist of today is profiting by the experience of the pioneers whose extensive efforts gave to the state the sobriquet of "The Land of the Big Red Apple."



2503. Missouri, to show horticultural regions.

The present status of orcharding in the state rests upon a sound commercial basis. The grower knows the adaptability of the different soil formations and of the various varieties. The present trend is toward the planting of moderate-sized orchards to the varieties which have been proved to be most profitable for the neighborhood, and to the adoption of modern methods of pruning, spraying, packing and marketing of fruit, which is resulting in substantial profit.

The state has a large and growing nursery interest. The loess soil along the two great rivers and the richer soils of the Ozark region produce especially fine nursery stock. At Louisiana is located one of the pioneer nurseries of the Mississippi Valley, which is now said to be the largest nursery enterprise in the world.

The Ozark section and river hills produce exceptionally fine yields and quality of tomatoes for canning purposes. Canning factories prosper in various parts of the state, the tomato being the leading product canned.

The southwest section of the state is a notable strawberry-producing region; Sarcoxie, Pierce City, Monett and other towns adjacent are leading strawberry shipping points. Some of these towns ship several hundred carloads annually.

About Canton, St. Joseph, and other points, extensive pickle-producing interests have developed. The production of cucumbers and other pickle-producing plants is becoming a growing industry. In the northwestern section of the state large quantities of cucumbers are grown for seed. About St. Louis and vicinity, the production of horse-radish is extensively developed. In St. Louis and Carroll counties, the production of early potatoes for July shipment has reached a prosperous development, and early potato-growing is rapidly taking its place in the agriculture of the state.

The floriculture interests of the state are large and increasing. St. Louis and Kansas City have extensive greenhouse enterprises, not only for local market, but for shipment. At Lee's Summit is one of the largest greenhouse plants in the country. Even in some of the smaller cities, the production of flowers under glass is in many cases more than supplying the local demand. Roses, carnations, violets, bulbous plants, and bedding plants are the leading crops, but many firms do a very general business in plant-production. The region is especially favorable for winter greenhouse work. The proportion of sunny days is unusually high as compared with other sections of the country in which floriculture has reached important proportions. Winter temperatures are not severe. The light snow and comparative freedom from ice obviates the difficulty experienced in many other sections.

Along the Missouri River hills are developed in the loess soil formation numerous grape- and wine-producing centers. Herman particularly possesses very extensive wine-cellars.

Within the past fifty years a notable number of varieties of fruit have originated within the borders of the state. It is interesting to note that while up to thirty years ago the varieties recommended by the state were mostly of Atlantic coast or European origin, the present list of commercial varieties very largely originated either in Missouri or adjacent territory. Some of these have been distinct additions in the way of local adaptation—for instance, the Ingram apple originated at Springfield, is the latest-blooming sort grown commercially in the state, escaping late spring frosts, and is perhaps the most important commercial variety for the southern and western slopes of the Ozarks. The amelioration of our native species of grapes has taken the attention of many prominent Missouri horticulturists. In this connection should be mentioned the work of Engelmann in the classification of the grape and the work in grape-breeding by Judge Miller, Jacob Rommel, Herman Jaeger and many others, including the contributions of Dr. Stayman, whose initial work began in Missouri. This state will be remembered as the home of the Soulard crab, and seedlings of this hybrid are now being grown which promise to bring its stock to an important place in our cultivated varieties.

While horticulture is already one of the leading interests of Missouri, the possibilities of the state in that direction have not yet been even approximated. While many of our pioneer orchards were located on soils and sites not well adapted to fruit, still only a small proportion of the soil which has been proved beyond a doubt to be splendidly adapted to profitable orcharding and berry-growing has as yet been cultivated. In recent years, however, steps in advance are rapidly being taken. The best growers are planting varieties of the finer types of dessert fruit, instead of clinging to the commercial varieties of mediocre quality which first made the state famous as an apple section. For the most part, men who are making money out of their orchards and fruit plantations today are those with smaller areas well cared for and whose enterprise has not come to notice outside the state. New varieties better adapted to local conditions are being originated. Our native fruits and nuts are receiving attention and improved varieties of these are already the result. One of the problems confronting the early orchardist was the fact of our comparatively mild but changeable winters. Northern varieties were often forced into early bloom before danger of spring frosts was over. Varieties like the Ingram apple mentioned above are now being introduced which possess a more persistent rest period and escape spring frosts. The horticulture of the state is rapidly rounding into a stable condition and bids fair to reach very important proportions.

Public-service agencies for horticulture.

The College of Agriculture was established in 1870, as a department of the State University at Columbia. Of the agricultural college staff five members devote their time to giving instruction in horticulture. In addition two or three special assistants, usually advanced students, are employed during the summer to conduct orchard demonstrations in spraying, pruning, harvesting, packing, and so on, in the various fruit-growing districts of the state.

The Experiment Station is also located at Columbia as a department of the State University. Four members of its staff devote their time to horticultural problems. Between forty-five and fifty horticultural bulletins have been published, giving the results of investigation work to date (1915). In addition a large number of circulars and press bulletins have been sent out.

The Missouri Fruit Experiment Station is located at Mountain Grove. It was established by legislative enactment in 1899. The working staff consists of a director and horticulturist, a pathologist and an entomologist. This institution is rendering splendid service to the horticultural interests of the state by conducting demonstration work in spraying, pruning and other phases of orchard-management in the fruit centers and also through investigation work which is being done at the station.

The Missouri Botanical Garden, located in St. Louis and richly endowed by the will of the late Henry Shaw, maintains a school for training students in horticulture. Five state normal schools, located at Cape Girardeau, Kirksville, Maryville, Springfield and Warrensburg respectively, give teachers courses in agriculture and horticulture. Lincoln Institute, a state school for negroes, located at Jefferson City, gives instruction in agriculture and horticulture.

The State Department of Education and the public schools early took a leading part in introducing the study of agriculture and of horticulture. The teaching of agriculture and horticulture is required in all the rural schools of the state. Legislative enactment provides state aid for high-schools which maintain specified equipment, grounds and courses of study in agriculture and horticulture. At present (1915) there are about 450 high-schools in the state which are fulfilling this requirement for state aid.

The Missouri State Horticultural Society, established in 1859, has held annual meetings for a period of more than fifty years. Fruit exhibits as well as papers and addresses by leading horticultural talent are a feature of these meetings.

The State Board of Horticulture was established by the state legislature in 1907 to promote the interests of fruit-growing in Missouri. In 1913 the Board published a census of all the commercial orchards of the state.

Several of the above agencies conduct extension work in horticulture. The Missouri Fruit Experiment Station conducts practical demonstrations. The department of horticulture at the State University gives extension instruction in horticulture through extension short courses. In coöperation with the county superintendents of schools, the University conducts boys' and girls' contests in such work as tomato-growing and potato-growing.

Statistics (*Thirteenth Census*).

The approximate land area in 1910 was 43,985,280 acres. The land in farms was 34,591,248 acres, or 78.6 per cent of the land area. Of the land in farms 24,581,186 acres were improved; 8,918,972 acres were in woodland; and 1,091,090 acres was other unimproved land in farms. The total number of farms in 1910 was 277,244. The average acreage a farm was 124.8. [The total area of Missouri is 69,420 square miles.]

The leading agricultural crops of Missouri are cereals, hay and forage, with cotton and sugar crops secondary in importance. The acreage of cereals was 10,423,745 in 1899 and 10,255,476 in 1909, when the value of the products was $147,980,414, which was 67.1 per cent of the total value of all crops. Hay and forage increased in acreage from 3,481,506 in 1899 to 3,628,348 in 1909, when the value of the products was $33,845,094. Cotton increased in acreage from 45,596 in 1899 to 96,527 in 1909, an increase of 111.7 per cent, when the value of the production was $3,978,295. Sugar crops increased in acreage from 30,997 in 1899 to 45,268 in 1909, when the production was valued at $1,039,168. The value of the forest products of farms was $8,406,823 in 1909, as compared with $4,442,131, their value in 1899.

Horticultural crops grown in Missouri are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $7,111,279, as compared with $3,278,840 in 1899. The acreage of small-fruits increased from 14,860 in 1899 to 17,009 in 1909, when the production was 23,696,221 quarts, valued at $1,761,409. In 1909, the total acreage of potatoes and other vegetables was 233,767 and their value $13,305,829. Excluding potatoes and sweet potatoes and yams, the acreage of vegetables was 129,570, and their value $8,268,281, the acreage and value being an increase of 11.5 per cent and 49.1 per cent, respectively, over the acreage and value in 1899. The acreage devoted to flowers and plants and nursery products decreased from 3,152 in 1899 to 2,842 in 1909, when the value of the products was $1,183,297.

The total production of orchard fruits in 1909 was 11,957,339 bushels, valued at $6,582,578. Apples contributed about five-sixths of this production, and peaches and nectarines most of the remainder, the production of apples being 9,968,977 bushels, valued at $4,885,514; and that of peaches and nectarines 1,484,548 bushels, valued at $1,110,550. The number of apple trees of bearing age in 1910 was 14,359,673; those not of bearing age 3,624,833; peach and nectarine trees of bearing age in 1910 numbered 6,588,034; those not of bearing age, 1,404,429. Other orchard-fruits produced in 1909 were: 123,314 bushels of cherries, valued at $222,510; 142,547 bushels of pears, valued at $148,789; 234,872 bushels of plums and prunes, valued at $211,472; and minor quantities of apricots, quinces, and mulberries.

In 1909, 17,871,816 pounds of grapes were produced, valued at $488,755. The grape-vines of bearing age in 1910 numbered 3,026,526; those not of bearing age 486,044.

The total production of nuts in 1909 was 2,823,368 pounds, valued at $39,746. The greater quantity of these were produced by black walnuts, the production in 1909 being 2,446,402 pounds, valued at $24,526. Pecans, next in importance, produced 147,420 pounds, valued at $10,467; hickory-nuts produced 210,228 pounds, valued at $3,633; and Persian or English walnuts, 5,791 pounds, valued at $618.

Strawberries are by far the most important of the small-fruits grown in Missouri, with blackberries and dewberries second in importance. The acreage of strawberries increased from 7,498 in 1899 to 9,048 in 1909, when the production was 15,171,034 quarts, valued at $1,122,784. The acreage of blackberries and dewberries increased from 4,441 acres in 1899 to 5,975 in 1909, when the production was 6,391,209 quarts, valued at $456,283. The production of raspberries and loganberries was 1,563,527 quarts, valued at $133,196; that of gooseberries, 470,029 quarts, valued at $39,941; that of currants, 91,207 quarts, valued at $8,312; and that of cranberries, 6,944 quarts, valued at $618.

The acreage devoted to the growing of potatoes in Missouri increased from 93,915 in 1899 to 96,259 in 1909, when the production was 7,796,410 bushels, valued at $4,470,135. The acreage devoted to the sweet potato and yam was 7,938, in 1909, a decrease of 19.4 per cent from the acreage in 1899. The production in 1909 was 876,234 bushels, valued at $567,413. The more important of the other vegetables were: 11,083 acres of tomatoes, valued at $322,426; 10,727 acres of watermelons, valued at $258,940; 2,858 acres of sweet corn, valued at $80,928; 959 acres of cabbage, valued at $79,707; 1,701 acres of cantaloupes and muskmelons, valued at $65,380; and 374 acres of horse-radish, valued at $62,694. Vegetables of minor importance produced in 1909 were asparagus, green beans, beets, cauliflower, celery, popcorn, cucumbers, lettuce, onions, green peas, green peppers, radishes, rhubarb and turnips.

The acreage devoted to the production of flowers and plants increased from 181 in 1899 to 383 in 1909, an increase of 111.6 per cent. The total area under glass was, in 1909, 2,812,221 square feet, of which 2,545,138 were covered by greenhouses and 267,083 by sashes and frames. The value of the flowers and plants produced in 1909 was $653,903.

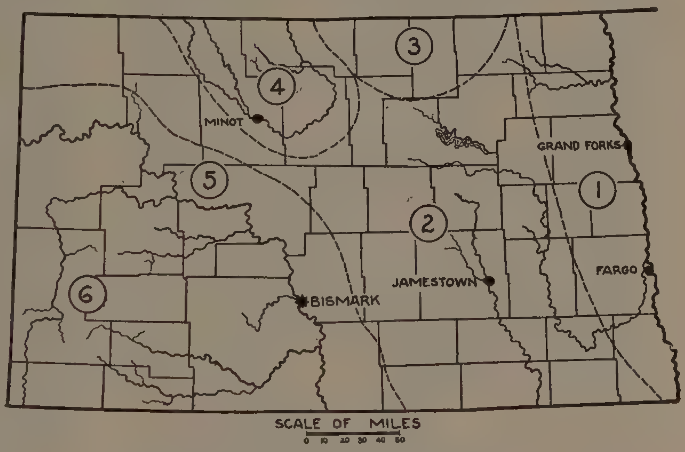
The acreage devoted to nursery products, however, decreased from 2,971 in 1899 to 2,459 in 1909, when the value of the products was $529,394, as compared with $349,449 in 1899.

J. C. Whitten.

North Dakota.

North Dakota (Fig. 2504) lies between latitude 46° and 49° north, and longitude 96° 25′ and 104° west. The special advantages of soil and climate for the production of grass and the small grains have given the state great agricultural prominence, but little has been done along horticultural lines. While it possesses undoubted possibilities along certain lines of fruit-production, and in the growing of certain vegetables can hardly be excelled, yet these things have always been considered incidental and not to be classed with the leading soil industries. North Dakota settlers, for the most part, did not come from fruit regions, and in no case have they occupied the land with other intention than to raise stock and grain. At the same time, as population increases and homes become established, there is the natural tendency to protect these homes with trees, ornament them with shrubs and flowers, and furnish the table with vegetables and fruit.

The distinctive regions of North Dakota are referred to as Red River Valley (Section 1), the Turtle Mountain country (3), the Devil's Lake region (2), the Mouse River country (4), the James River Valley (2), the Missouri slope (5) and the western range country (6), including the Bad Lands. The Red River Valley is a level plain from 20 to 30 miles wide on the North Dakota side and extending across the state north and south, thus embracing an uninterrupted area of some 6,000 square miles, all level and of great fertility. This is preëminently the wheat-belt of the state, and the character of the soil is such in both physical and chemical properties as to insure an excellent growth of such plants as are hardy and will mature within the season. The soil is a lacustrine deposit containing about 33 per cent of very fine sand, 55 per cent clay and silt, and 12 per cent organic matter and soluble salts. It is so rich in nitrogen and phosphoric acid as to be quite indifferent to fertilizers, even when applied to such garden vegetables as demand the most fertile soils. It rarely bakes under reasonable cultivation, is never lumpy and is very retentive of moisture. It is unusually well adapted to the cultivation of practically all vegetables, particularly celery and other plants requiring a deep, fine, easily worked soil.



2504. North Dakota, with the six areas.

This general type of soil is not confined to the Red River Valley, but is the predominating surface soil for most of the state lying east of meridian 101 and of considerable tracts still farther west. The subsoil in the Red River Valley lying under 3 or 4 feet of very dark loam is uniformly a soft yellowish clay extending to a great depth. Much of the subsoil outside of the valley is largely made up of firmly compacted sand, with a small percentage of clay. Such lands are not so good as those having the clay subsoil, but with the good surface soil which they support they are capable of producing large yields in seasons not too dry. They ar naturally not so well adapted to horticultural operations as are the lands having the clay subsoil.

Speaking in general, the soil lying west of the 100th parallel, also that of the Missouri slope, Turtle Mountain and Mouse River counties is all well suited to vegetable- and fruit-culture, though partial failure may result from short seasons. This is especially true upon the level, rich soil of the Red River Valley, which tends to prolong the growth of such plants as the grape and apple beyond the season in which they should mature. The more rolling surface of the land along the Missouri River affords opportunity to select favorable sites for fruit plantations, and there is doubtless some advantage in the soil itself. This is apparent in the cultivation of the grape, or such vegetables as the tomato, squash and melon. So far, attempts to grow fruit on the lighter and more rolling soils, avoiding the extremes, has met with reasonable success. On the heavier soils and level lands, success has been confined to the cultivation of such small-fruits as the currant, gooseberry, raspberry and American plum, and vegetables maturing not later than the earliest sorts of tomato or second-early sweet corn. In connection with the fact that attempts at apple-culture have generally been unsuccessful, it should be remembered that plants, as a rule, cannot make long jumps. The line of apple-culture is gradually moving northwest, the successful varieties being those, like the Wealthy and Patten Greening, that have originated in the newer places. A region so far removed from the apple districts as North Dakota must have time and opportunity to develop varieties of its own.

Removed from all influence of large bodies of water, North Dakota has a comparatively dry climate subject to considerable extremes of temperature. The mean annual rainfall at Fargo for the years 1892 to 1909 was 21.25 inches, distributed by seasons nearly as follows: spring, 6 inches; summer, 10.5 inches; fall, 3.75 inches; winter 1 inch. Most of the precipitation is in spring and summer, when it is most needed. The average rainfall for June is 4.17 inches. The fact that the larger part of agricultural lands in the state are absolutely flat, as near as land may be, and composed of a soil very retentive of moisture, makes what would otherwise be a light rainfall generally sufficient for ordinary needs. Farther west than Fargo, the rainfall gradually becomes less.

The temperature is very uniform throughout the state, with the general difference that the range country in the western part has milder and more open winters, and the higher altitude, as well as latitude, of the northern tier of counties gives them a shorter and cooler summer, more inclined to frosts. It is only in that section that corn has not been considered, so far, as a possible crop.

The winters are cold but dry and agreeable. An occasional winter with too much sunshine kills young trees of the thin-barked varieties through the process of desiccation. The springs are short, the warm days of summer coming very soon after winter and some time before the frost is out of the ground. In summer the days are long and sunny, with nights invariably cool. This condition gives the most perfect development of hardy vegetables, like the cabbage and celery, but retards the cucurbits and other semi-tropical species.

General settlement of what is now North Dakota did not begin till the building of the first railroad in 1873, and any effort to grow fruit has been made since that time. In 1874, Andrew McHench, of Fargo, made the first attempt at fruit-growing upon any extended scale. In that year he bought at a nursery in Minneapolis a carload of young apple and crab-apple trees of such varieties as the Wealthy, Hyslop and Transcendent, and the year following planted 7,500 root-grafts of these and other varieties. Though he obtained some fruit and at different times grew trees that were models of thrift and fruitfulness, yet the venture was not a success. The varieties that successfully resisted the cold winters succumbed to the blight shortly after they came into bearing. Other attempts by different men made along the Red River Valley since then have resulted similarly. In more recent years, with the elimination of the Transcendent which is especially subject to blight, efforts at apple-growing have been more successful. This has been especially true in the regions of the lighter soils in the southern part of the state. At Cogswell, Hankinson, Lisbon, and Edgeley, there are good bearing orchards of such varieties as the Hibernal, Duchess, Wealthy, Patten's Greening and Iowa Beauty. Any of the crabs are successfully grown, eliminating only those subject to blight. In many other parts of the state, younger orchards are coming on that promise as well as those already mentioned.

The only other tree-fruit hardy in North Dakota is the native plum (*Prunus americana*) and some of its hybrids. Of the pure species there are many varieties that are productive and suitable for home use and local markets but too soft for shipping. The De Soto, Surprise, Weaver, Wolf and Hawkeye, are among the varieties more commonly grown. The hybrids resulting from crosses between the American plum and the sand cherry and also between the American plum and the Japanese plum are all hardy and productive in North Dakota and many of them promise to be of value commercially as well as for home use.

Most commercial varieties of grapes find the seasons too short or the winters too cold, though the Moore Early can be grown in the southern part of the state. The Beta grape is being successfully grown in many parts of the state.

Currants and gooseberries find a congenial soil and climate in all parts of the state and the hardier varieties of raspberries do well when planted near a windbreak so that they will remain covered with snow.

Early attempts at strawberry-growing, before the days of windbreaks, were not very successful. As shelter has been provided and more vigorous varieties have been introduced, the strawberry is being commonly grown for home use. The introduction of the Senator Dunlap was the beginning of successful strawberry-growing in North Dakota.

There are but few vegetables that cannot be produced abundantly and cheaply. This is particularly true of celery, onions, parsnips, and the like, that require a deep, mellow soil. The earlier sorts of sweet corn and tomatoes can be successfully grown in most sections of the state. At the Experiment Station at Fargo, a yield of 1,000 bushels of ripe tomatoes has been secured in some seasons on 1 acre. The ease with which the soil is worked and the fact that no fertilizer is required reduces the cost of production to a minimum.

The horticultural progress of the state since 1900 has been due largely to the development of the nursery industry. This in the early settlement of the state consisted simply of the collection and sale of young seedling trees. These were gathered in great numbers from along the bed of the Missouri River, whose soft banks, always flooded in the spring, especially favored the germination of tree seeds. The cottonwood was the one most usually selected, although the box elder and ash were gathered to some extent. Most of the older groves in the state are from these Missouri River seedlings, the total number planted running into the millions. The supply of forest trees, as well as other nursery stock, is now furnished by the nurseries, of which there are four of considerable size and a number of smaller ones of more recent origin. One of these has devoted its attention largely to the growing of conifers and as a result has a fine stock of many thousands of such hardy species as the jack pine, western yellow pine, Douglas spruce, Black Hills spruce and Colorado blue spruce. At the present time, nursery sales consi chiefly of rapidly growing trees for shelter and windbreak purposes. The common white willow and its variety, the golden Russian willow, the laurel-leaf willow and a variety of the cottonwood, commercially known as Norway poplar, are the trees in greatest demand. The native ash and the box elder are also bought freely. The trade in fruit-trees and ornamentals is considerably less and is still largely furnished by outside nurseries. However, some of the local nurseries have blocks of hardy varieties of apples and plums running into thousands with business increasing rapidly.

Within the past ten years a few floral establishments have been built up in the larger towns and in all cases have met with marked commercial success. While none of them has over 50,000 square feet under glass, yet with the quality of stock produced and the high prices readily obtained the business is decidedly profitable. The growers claim a certain advantage in the bright, clear weather of autumn that gives them carnations and chrysanthemums of unsurpassed color and quality. The same applies to roses, except during December and January, when the short days do not furnish enough hours of daylight for the best results.

While the wild fruits occupy an inconsiderable part of the total area of the state, yet they are important in that they furnish thousands of families with their yearly supply of jellies and other fruit products. A list of the wild fruits in order of their importance would be about as follows: plum, buffalo berry (*Shepherdia argentea*), cherry (*Prunus demissa*), grape (*Vitis vulpina*) and juneberry (*Amelanchier alnifolia*). The red raspberry and strawberry are also found sparingly. The only plum in the state is *Prunus americana*, and this is found wherever other trees or shrubs grow. It is strongly variable in almost every character except fruitfulness, all forms being decidedly prolific. The fruit generally is of good quality, sweet and rich when ripe, but too soft to keep well. In a domestic way, wild plum jelly is recognized as a staple article of superior merit, and though the plums are abundant in most seasons, yet they readily bring $2 a bushel in the local markets. The improved strains of this plum, like the DeSoto, Weaver and Surprise, are being introduced and successfully cultivated. The buffalo berry is found from the James River westward, growing in thickets along streams and coulees. The bright red acid fruit is borne in the greatest profusion, but is rather difficult to gather, as it is sessile and thorns are plenty. It makes a clear jelly of reddish amber-color and delicate flavor. *Prunus pumila* is widely scattered but not abundant, and the fruit is used but little. In the western part of the state the juneberry produces abundantly a large fruit of rich flavor, but is more often used fresh from the bushes than in a culinary way. The rapid settling of the state has increased the demand for native fruits to such an extent that their value is being appreciated, and private ownership even in wild fruits is being insisted upon and recognized. This, of course, leads directly to the development and preservation of the better strains.

Among those influential in developing fruit-growing in North Dakota were Andrew McHench of Fargo and Col. R. H. Hankinson, of Hankinson.

Public-service agencies for horticulture.

The land-grant college of North Dakota was established at Fargo in 1890. There are three members of the horticultural staff.

The Experiment Station is also located at Fargo. There are two horticulturists on the staff. Several regular bulletins and also press bulletins have been issued on horticultural subjects. Within the last twelve years, there have been established from time to time five sub-experiment stations in the different parts of the state, where trials are being made to a limited extent with trees and fruits. At most of these stations, more or less encouraging results with both tree- and small-fruits have been obtained, and in some cases the yield has been such as to indicate commercial success, particularly with the Patten Greening apple and some of the varieties of the American plum.

In addition to these state experiment stations, there was established at Mandan, in 1912, a federal station known as the Northern Great Plains Experiment Station. One of the prominent objects of this station is to carry on trials with horticultural plants of all classes, and to develop fruits suited to the Great Plains region.

There are two special schools in the state teaching horticulture, the School of Forestry at Bottinean and the State Normal School at Valley City. Two terms of horticulture are also taught in most of the high schools.

The nursery inspection is conducted by the state.

Statistics (Thirteenth Census).

The approximate land area of North Dakota is 44,917,120 acres. The land in farms in 1910 was 63.3 per cent of the land area or 28,426,650 acres. Of this land in farms, the improved land numbered 20,445,092 acres; the woodland, 421,877 acres; and other unimproved land in farms 7,549,681 acres. The total number of farms of the state in 1910 was 74,360 and the average acreage to the farm was 382.3. [The total area of the state is 70,837 square miles.]

The leading agricultural crops produced in the state are cereals, flaxseed, and hay and forage. The acreage of cereals increased from 5,610,374 in 1899 to 11,887,141 in 1909, when the production was valued at $149,133,451, which was 82.6 per cent of the total value of all crops. Flaxseed increased in acreage from 773,999 in 1899 to 1,068,049 in 1909, when the production was 10,245,684 bushels, valued at $15,488,016. Hay and forage increased in acreage from 1,410,534 in 1899 to 2,864,218 in 1909, when the production was valued at $12,368,014. The forest products of the farms in 1909 were valued at $235,386, as compared with $112,807, in 1899.

Horticultural crops grown in North Dakota are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $9,702, as compared with $1,177 in 1899. Small-fruits increased in acreage from 67 in 1899 to 399 in 1909, when the production was 285,696 quarts, valued at $39,641. In 1909 the total acreage of potatoes and other vegetables was 67,450 and their value $3,148,304. Excluding potatoes, the acreage of other vegetables increased from 4,289 in 1899 to 13,383 in 1909, when the production was valued at $1,069,125. Flowers and plants and nursery products increased in acreage from 133 in 1899 to 476 in 1909, when the products were valued at $78,218.

The total quantity of orchard fruits produced in 1909 was 5,685 bushels, valued at $9,688, while that of grapes and nuts was entirely insignificant. The apple trees of bearing age in 1910 numbered 15,941; those not of bearing age 70,023, and the production in 1909 was 4,374 bushels, valued at $7,270. The plum and prune trees of bearing age in 1910 were 19,147; those not of bearing age 35,459, and the production in 1909 was 1,048 bushels, valued at $1,866. The cherry trees of bearing age in 1910 numbered 5,076; those not of bearing age, 21,484. The production in 1909 was 209 bushels, valued at $445. The production of peaches and nectarines, pears, apricots, and quinces was insignificant.

Currants are the most important of the small-fruits raised in North Dakota. The acreage of currants increased from 36 in 1899 to 138 in 1909, when the production was 97,598 quarts, valued at $12,128. Strawberries increased in acreage from 3 in 1899 to 88 in 1909, when the production was 66,028 quarts, valued at $10,445. Raspberries and loganberries increased in acreage from 12 in 1899 to 85 in 1909, when the production was 60,742 quarts, valued at $9,141. Gooseberries increased in acreage from 10 in 1899 to 86 in 1909, when the production was 56,804 quarts, valued at $7,332. Other small-fruits produced in 1909 were 3,404 quarts of blackberries and dewberries, valued at $470, and 1,120 quarts of cranberries, valued at $125.

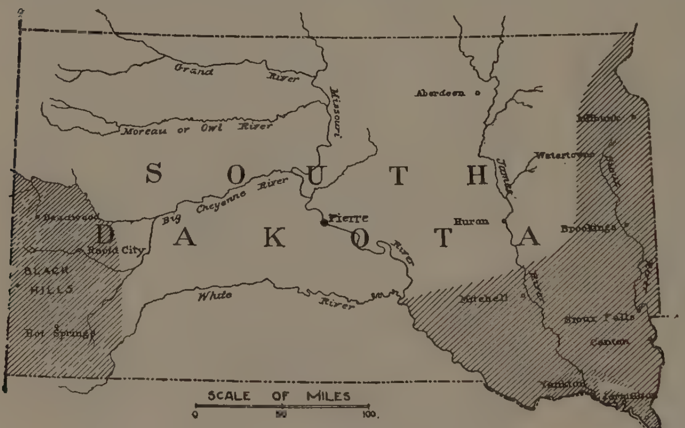
The acreage devoted to potatoes increased from 21,936 in 1899 to 54,067 in 1909, when the production was 5,551,430 bushels, valued at $2,079,125. The more important of the other vegetables produced were: 37 acres of onions, valued at $9,188; 109 acres of cabbage, valued at $8,724; 96 acres of watermelons, valued at $3,719; 141 acres of sweet corn, valued at $3,369; 88 acres of turnips, valued at $3,145; and 7 acres of celery, valued at $1,680. Vegetables of lesser importance, produced in 1909, were asparagus, green beans, carrots, cucumbers, green peas, and tomatoes.

There were 4 acres devoted to the production of flowers and plants in 1909 and the products valued at $47,221. The total area under glass in 1909 was 70,670 square feet, of which 48,150 were covered by greenhouses and 22,520 by sashes and frames. The area devoted to nursery products in North Dakota increased from 131 acres in 1899 to 472 in 1909, when the products were valued at $30,997.

C. B. Waldron.

South Dakota.

South Dakota (Fig. 2505) lies a little north of the center of the continent, between latitude 45° 57′ north, and 42° 28′ south and longitude 96° 26′ and 104° 3′ west of Greenwich. Its shape is approximately a rectangle. Its extreme length from east to west is 386 miles; extreme breadth north to south 240 miles; population (in 1910) 583,888. The Missouri River divides the state into two nearly equal portions. With the exception of a small area in the northeast corner, the southeast part is lowest and all the streams flow in that direction. The state may be divided into three sections: (1) the Black Hills; (2) the Tablelands; (3) the Eastern Section. The Black Hills in the southwestern part are outliers of the Rocky Mountains, and the extensive and very rich deposits of gold, silver, and other minerals are important sources of wealth. The Indians early knew of these gold deposits, but they were not known to white men until 1874. The Black Hills, so named by the Indians because of the heavy forests of pine and spruce covering the mountains, include an area of about 5,000 square miles. Considerable fruit is now being raised in this section under irrigation, as the local market is a profitable one, and it has been found possible to raise many varieties not hardy upon the open prairies of the state.



2505. South Dakota, to show horticultural adaptabilities.

The Tablelands comprise the entire section of the state west of the Missouri River, with the exception of the Black Hills. Five branches of the Missouri flow from the western part of the state across these lands from west to east. These are the White, Bad, Cheyenne, Moreau or Owl, and Grand rivers. The series of dry years 1910–11–12–13 show that exclusive grain-farming is not advisable, but the native grasses are very nutritious and stock-raising is profitable.

The Eastern Section contains three river valleys that cross it from north to south, viz., the eastern half of the Missouri, the James River Valley and the Big Sioux River on the eastern border. In the southern part, the valley of the Vermillion traverses the region between the Sioux and James. These river valleys are all very fertile and blend together as they reach the Missouri at the south. Diversified agriculture flourishes in these river valleys, especially in the southern and entire eastern part of this section. In the higher ground in the northern and western part, stock-raising and dairying are the main industries owing to the lesser rainfall. Since the defining of the artesian-well basin, general agriculture has been encroaching upon the grazing areas. This basin reaches from the Missouri River eastward to some distance beyond the James. The amount of this supply which can be used has been roughly estimated at 326,805,600,000 cubic feet annually, an amount of water sufficient to fill a river-bed a mile wide, 20 feet deep and nearly 600 miles long. When this water is more generally utilized, it is confidently believed that the market-gardening and fruit-growing area shown on the map will be enlarged and extended westward.

Horticulture in South Dakota is to a considerable extent still in the experimental stage. Most of the planting of orchard-fruits has been done since the last "crucial test" winter of 1884–5, hence it will be difficult to give a safe list until after the next test winter. A glance at the map will show that the state extends well below the north line of Iowa, and as a matter of fact, it is found that the South Dakota fruit list partakes of both Iowa and Minnesota in its characteristics. The southern tier of counties in the southeast corner of the state can raise varieties of the apple which are not at all hardy northward in the state. It is interesting to trace the orcharding belt along the great river from far down in Missouri northward between Iowa and Nebraska into South Dakota. In the Sioux and James river valleys considerable fruit is grown as far north as the Minnesota line. North of this the orchards are few and far between, the country being new, and grain-raising, stock-raising and dairying affording more profitable sources of income.

The state has been divided into four fruit sections by the State Horticultural Society since 1913, as follows: Northern District—this includes all north of a line running due east and west through Watertown; Central District—this district includes approximately all between two lines running due east and west through Sioux Falls and Watertown; Southern District—this includes all south of the north line of Iowa, which is approximately a line running due east and west through Sioux Falls; the Black Hills District—this includes the Black Hills counties in the southwestern corner of the state.

The largest old apple orchard in the state is in Turner County, consisting of 7,000 trees on about 132 acres. This orchard was planted in the early seventies and is still bearing. About 4,000 of the trees are

Wealthy and most of the remainder Oldenburg. Considerable trouble is experienced from root-killing of the common apple seedling stocks. In the northern part of the state, apple root-grafts root-kill every winter unless deeply mulched. The winter of 1898–9 will long be remembered as the "root-killing" winter by the fruit men of several northwestern states. Efforts are now being made to remedy this trouble by testing the Russian method of preventing root-killing; viz., the use of the pure Siberian crab (*Pyrus baccata*) as a stock. If the experiments are successful, apple-culture will be practicable on the most exposed prairies far up into the Canadian Northwest. In making up a list of apples for planting throughout the state, it will be a safe rule not to plant any variety less hardy than Oldenburg and Wealthy, especially if the planter desires a long-lived fruitful orchard and cannot afford to experiment.

Of plums, those of the *Prunus americana* type, such as De Soto, Wyant, Wolf, Terry and Wastesa, are the standard of hardiness and value for general cultivation. *Prunus americana* is indigenous throughout the state. In recent years, the list of plums has been largely increased by the advent of the hybrids of the native sand cherry and plum with the Japanese plum and Chinese apricot, *Prunus Simonii*, originated at the South Dakota Experiment Station. The main difficulty with plums hitherto has been the tender stocks upon which the hardy natives have been worked. Myrobolan, St. Julian, Marianna, Southern Chickasaw, peach, and other southern stocks all winter-kill, leaving the hardy top to die. Such trees are a snare to the prairie planter, and this fact is becoming more generally known. Trees worked on americana seedlings or trees on their own roots find favor, as no trouble is then experienced from root-killing. The western sand cherry (*Prunus Besseyi*), a native of the state, has been tested as a stock at the Experiment Station at Brookings, but it is of use only as a dwarf stock for amateur use, the trees being dwarfed and bearing fruit at an early age. It is of some promise as a dwarf stock for peaches, such trees being of suitable size for convenient covering in winter or for growing in boxes.

Of other orchard-fruits, pears, quinces, apricots and peaches find no place on the South Dakota fruit list. Cherries are grown to a small extent in the southern counties, but the crop is uncertain in most parts.

Some raspberries can be grown in the southern part with winter protection. Blackberries are not so hardy as raspberries. Strawberries are considerably grown in the southern part of the state, and irrigation is found profitable, as it insures a crop in dry seasons.

Grapes are grown to some extent in the southern part of the state, but northward suffer severely from winter-killing and are not on the fruit list recommended for that part of the state. The Beta, a hybrid of the wild grape, *Vitis riparia* (*vulpina*), of Carver County, Minnesota, with the Concord (*V. Labrusca*), was originated about 1870 by the late Louis Suelter, of Minnesota, and has been found to be much hardier than those of the Concord type and is now largely planted. It appears perfectly hardy without winter protection.

Fruit-breeding at the South Dakota Experiment Station has been carried on under the direction of the Department of Horticulture since 1895. Much work has been done in the breeding of hardy fruits. The frequent winter-killing of varieties brought from milder regions east and south seems to demand the creation of a new prairie pomology. Over 27,000 seedlings of various native fruits were raised at this station in 1889–1890. The wild fruits were crossed with tame whenever possible, but the main reliance was placed upon pure selection, acting upon the theory that "excess of food causes variation." The native species taken in hand in this work include the sand cherry, choke-cherry, pin-cherry, black currant, golden currant, gooseberry, grape, juneberry, plum, red raspberry, black raspberry, strawberry. With the apple, the main effort is to originate a good hardy long-keeping winter apple. Work with several Siberian fruits is also under way. Some of this material was picked up on tours of agricultural exploration to Siberia and adjacent regions. In this work, hundreds of thousands of seedlings have been discarded. Some have not proved amenable to improvement, such as the wild black currant, *Ribes floridum*, which has reached the fifth generation under cultivation without improvement in quality. The same may be said of the native gooseberry, *Ribes gracile*. Fully 100,000 seedlings of the native sand cherry, *Prunus Besseyi*, native especially of the dry uplands of the western part of the state, have been fruited, but only three varieties have been named, the Sioux, Tomahawk, and Champa, with fruit of good size and free from the native astringency. In five plant generations under cultivation, the fruit has been increased to 1 inch in diameter and of good quality. However, the plant is too small in stature, and propagation by budding is expensive; some are being raised by layering. However, the sand cherry displays marked adaptability to hybridization with many species. (See South Dakota Experiment Station Bulletins Nos. 108, 130, and 159.) When mated with the Japanese plum, a series of valuable hybrids have resulted, but hybrids with the peach and the sweet cherry and apricot of Europe are practically sterile. Mating with the purple-leaved plum of Persia, *Prunus cerasifera purpurea*, gives a beautiful purple-leaved shrub. The native plum, *Prunus americana*, is found to mate best with the Japanese plum, the latest result of which is the Waneta, with fruit 2 inches in diameter and weighing two ounces. The native plum is found to mate well with the sand-cherry, giving such hybrids as Sansoto and Cheresoto. The native plum mates best with the Chinese apricot, *Prunus Simonii*, giving fruits with remarkable shipping capacity and with the strong fragrance of the *Prunus Simonii*. Over 10,000 plum seedlings have been raised. The work with the native seedlings was checked with the advent of the hybrids which were found sufficiently hardy. Easily 1,000,000 trees of these new plums are now in the orchards and nurseries of the western states.

After raising 10,000 apple seedlings, none has been introduced with the exception of one crab-apple, the Amur, a seedling of *Pyrus baccata cerasifera*, introduced 1912.

In strawberries, the main work has been to combine the wild types as found in the Dakotas and the Canadian Northwest and Alaska with the standard American varieties and those imported from Europe. Out of 10,000 seedlings but two have been named, the South Dakota No. 1 and No. 2. The fruit is about 1 inch in diameter; the plants are hardy without winter-covering, but must be kept thinned, otherwise the fruit runs too small, as is the case of the wild strawberry from which they sprang.

Out of 13,000 raspberry seedlings, only two, the Sunbeam and Ohta, have been named and introduced. Improvement by pure selection of the wild raspberries of the Dakotas and the Canadian Northwest is slow work, but is not yet given up. The Sunbeam, introduced in 1906, is the first of the 7,000 first seedlings to receive a name. It is a seedling of the wild red raspberry from Cavalier County, North Dakota, near the Manitoba line, pollinated by the Shaffer. From the next 6,000 seedlings came the Ohta, introduced spring of 1912, which is a seedling of the wild red raspberry from Cavalier County, North Dakota, pollinated by Minnetonka Ironclad, a hybrid of the wild raspberry from Maple Plain, Minnesota, with either Turner or Cuthbert.

Pear-culture is at present a practical impossibility either from winter-killing, or from blight (*Bacillus amylovorus*). The work of breeding pears immune to blight is summarized in South Dakota Experiment Station Bulletin No. 159, April, 1915.

An effort has been made to improve the wild prairie rose of the Canadian Northwest, and the Siberian form of *Rosa rugosa*. Out of many seedlings, only one variety, the Tetonkaha, has been disseminated.

Floriculture is still in its early youth, there being but few greenhouses in the state. The rich soil makes it easy to raise large crops of vegetables, but so far, the trucking interests have assumed no importance, except near the larger towns. Agriculture has been extensive, rather than intensive. In a state yielding heavy crops of wheat and other cereals, with a soil so rich that commercial fertilizers are not thought of and barnyard manure so little considered that many farmers prefer to move their barns rather than their manure heaps, and with the burning of straw a common practice, the hoe is rarely seen; gang- and sulky-plows, self-binders and riding-cultivators are the more favored implements. In the course of time, with the increase in population, will come a change in methods. Eastern farmers and gardeners find that the soil and climate demand decided modifications of eastern practices.

Of conifers, the hemlock, white pine, balsam fir, arbor-vitæ and Norway spruce fail in the open prairie, while Jack pine, bull pine, Scotch pine, northern red cedar, western white spruce, and Colorado silver or blue spruce all do well in open exposure. Of deciduous trees, the native species, such as ash, elm, box elder, black wild cherry and hackberry, all do well. Cottonwood and willows do well on moist land. Considerable loss was experienced in the earlier planting from a failure to recognize the fact that species covering a wide geographical range vary greatly in hardiness and that the local indigenous form should be planted when possible.

Many of the hardy pioneer men and women have contributed to the horticultural interests of South Dakota. Among these may be mentioned: Aaron Carpenter, pioneer orchardist and nurseryman; H. C. Warner, who tested many fruits, trees and flowers; Col. C. W. Gurney, pomologist and nurseryman; and A. W. Krueger, for five years president of the State Horticultural Society.

Public-service agencies for horticulture.

The South Dakota College of Agriculture and Mechanic Arts is located at Brookings, and was established in 1881. There is one professor of horticulture.

The Experiment Station is also at Brookings and is in connection with the College. Of the 159 bulletins published by the Station (June, 1915), forty are on horticultural subjects.

The only special school teaching horticulture in the state is the College. However, some horticulture is taught in connection with agriculture in the public schools.

The South Dakota State Horticultural Society is composed of the amateur and professional fruitmen of the state, and was incorporated in 1890. By state law, this Society is made the Department of Horticulture for South Dakota.

Extension work in horticulture is conducted by the College in the form of farmers' institutes and the like.

No inspection service is provided for in fruit-grading. The Department of Entomology of the State College has charge of the inspection service for nurseries.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 49,195,520 acres. The land in farms was 52.9 per cent of the land area, or 26,016,892 acres. Of this land in farms, the improved land numbered 15,827,208 acres, the woodland 383,144 acres, and other unimproved land in farms 9,806,540 acres. The total number of farms in 1910 was 77,644, and the average acreage a farm was 335.1. [The total area of South Dakota is 77,615 square miles.]

The leading agricultural crops of South Dakota are cereals and hay and forage. The acreage devoted to the cereals increased from 6,211,223 in 1899 to 8,203,519 in 1909, when the production was valued at $98,953,050, which was 78.8 per cent of the total value of all crops. Hay and forage increased in acreage from 2,287,875 in 1899 to 3,435,656 in 1909, when the production was valued at $15,243,664. In 1909, from 518,566 acres, there were harvested 4,759,794 bushels of flaxseed, valued at $7,001,717. The value of the forest products of the farms in 1909 was $257,126, as compared with $106,284 in 1899.

Horticultural crops grown in South Dakota are fruits and nuts, small-fruits, potatoes and vegetables, and flowers, plants, and nursery products. The value of the fruits and nuts produced in 1909 was $215,639, as compared with $31,964, in 1899. Small-fruits increased in acreage from 161 in 1899 to 419 in 1909, when the production was 401,295 quarts, valued at $47,263. The total acreage of potatoes and other vegetables in 1909 was 65,209, and their value, $3,001,574. Excluding potatoes, the acreage of other vegetables increased from 7,954 in 1899 to 15,150 in 1909, when the production was valued at $1,033,163. Flowers, plants, and nursery products increased in acreage from 211 in 1899 to 418 in 1909, when the value of the production was $120,835.

The total quantity of orchard fruits produced in 1909 was 229,907 bushels, valued at $209,339. Apples contributed about five-sixths of this quantity, plums and prunes most of the remainder. The production of apples in 1909 was 191,784 bushels, valued at $158,729. The number of apple trees of bearing age in 1910 numbered 274,862; those not of bearing age, 460,547. The plum and prune trees of bearing age in 1910 numbered 268,268, and those not of bearing age, 172,186. The production in 1909 was 31,748 bushels, valued at $36,872. Cherry trees of bearing age in 1910 numbered 51,613; those not of bearing age, 76,293. The production in 1909 was 5,924 bushels, valued at $12,981. Other orchard-fruits produced in 1909 were 162 bushels of pears, valued at $447; 148 bushels of peaches and nectarines, valued at $167; and 120 bushels of mulberries, valued at $123. The value of the apricots and quinces was of little or no importance.

The production of grapes in 1909 was 144,634 pounds, valued at $4,789. The grape-vines of bearing age in 1909 numbered 38,647; those not of bearing age, 46,891.

The production of nuts in 1909 was 73,715 pounds, valued at $1,511. The only important nut in South Dakota in 1909 was the black walnut, the production of this alone being 72,659 pounds, valued at $1,490.

Of the small-fruits grown in South Dakota, strawberries are the most important, with raspberries and loganberries ranking next. The acreage of strawberries increased from 62 in 1899 to 226 in 1909, when the production was 238,164 quarts, valued at $26,764. Raspberries increased in acreage from 21 in 1899 to 66 in 1909, when the production was 60,285 quarts, valued at $8,703. Currants increased in acreage from 38 in 1899 to 67 in 1909, when the production was 52,951 quarts, valued at $6,021. Gooseberries increased in acreage from 25 in 1899 to 55 in 1909, when the production was 43,408 quarts, valued at $4,926. Other small-fruits produced in 1909 were 6,058 quarts of blackberries and dewberries, valued at $809; and 288 quarts of cranberries, valued at $25.

The acreage of potatoes increased from 33,567 in 1899 to 50,052 in 1909, when the production was 3,441,692 bushels, valued at $1,967,550. The more important of the other vegetables produced were: 175 acres of cabbage, valued at $13,759; 104 acres of onions, valued at $13,133; 579 acres of sweet corn, valued at

$12,018; 212 acres of watermelons, valued at $10,625; and 62 acres of tomatoes, valued at $4,335. Vegetables of lesser importance produced in 1909 were: asparagus, green beans, cantaloupes and muskmelons, pop-corn, green peas, and turnips.

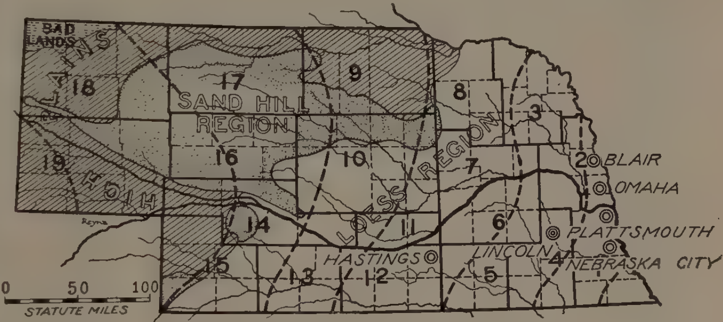
The acreage devoted to the growing of flowers and plants increased from 11 in 1899 to 19 in 1909. The total acrea under glass in 1909 was 101,460 square feet, of which 92,240 were covered by greenhouses, and 9,220 by sashes and frames. The value of the flowers and plants produced in 1909 was $50,008, as compared with $3,260, in 1899.

The acreage devoted to nursery products increased from 200 in 1899 to 399 in 1909, when the production was valued at $70,827, as compared with $12,866, in 1899.

N. E. Hansen.

Nebraska.

The state of Nebraska (Fig. 2506) presents a variety of horticultural conditions, owing to the varied topography, the diversity of soil, and the wide range of altitude and climate. The eastern part of the state is rolling prairie, the great loess plains, broken and almost rough, near the Missouri River. The soil is deep and fertile and the undulating surface amply provides both soil and atmospheric drainage. The central part of the state has a more uniform surface but is subject to a high rate of evaporation, owing to dry winds. In the west-central part of the state lie the sand hills where the soil is very light, though many fertile valleys lie between the hills, and the rate of evaporation is equally high. South of the sand hills are prairie lands or loess plains where irrigation is practised to some extent. South and west lie high prairies or the Cheyenne plains. Several extensive orchards are grown here under irrigation. To the north and west are the buttes and "bad lands." The elevation of the southeastern part of the state is 850 feet at its lowest point in Richardson County and averages 1,200 feet along the entire eastern part of the state close to the Missouri River, while the extreme western part exceeds 5,000 feet. The rainfall gradually decreases from east to west, as the elevation increases. Nebraska is fortunate in that the rainfall is greatest when most needed for agriculture, namely, April, May, June and July. Because of the great diversity of conditions, the State Horticultural Society has divided the state into nineteen districts, as indicated on the accompanying map, which are generally considered in making recommendations for fruit-culture.



2506. Nebraska, showing the various areas or districts.

Apples form the most important horticultural crop, but, except under irrigation, are grown commercially principally in the southeastern half of the state, known as the Great Loess region. However, commercial orcharding is gradually extending westward. Commercial orcharding under irrigation is being carried on in the central, southern, and western parts of the state, principally in Lincoln, Scott's Bluff and Red Willow counties.

District No. 1 is perhaps the best apple-growing region of the state. Here is the natural home of the Jonathan apple, where it attains its highest degree of excellence. Other standard varieties thrive almost as well. Perhaps more Ben Davis apples are shipped from this section than from any other part of the state. The rainfall is ample and well distributed throughout the year. The large amount of bright sunlight during the time when most of the fruit is ripening perhaps accounts for the high color, good quality and excellent keeping properties of Nebraska fruit. District No. 2 follows No. 1 so closely in amount and quality of apples grown that the region might well be known as one district, the chief difference being that the former has a rougher surface, higher altitude, and lies farther north, making injury from frost more liable. Districts Nos. 3, 4, 5, 6, 7, 8, 11 and 12, while not so favorably located, lie within the commercial apple district and produce immense quantities of excellent fruit. Districts Nos. 9, 10, 13 and 14 require careful cultural methods, but with proper care apples are grown successfully, though perhaps other farm crops, with live-stock, will give larger returns than commercial orcharding. However, the home orchard, well cared for, is one of the greatest assets of the farmstead.

Throughout the remainder of the state, much care must be exercised in the propagation of apples except under irrigation, although there are many thriving home-orchards. The dry seasons, prevailing light soil, and cold winters, especially in the northwestern part of the state, make winter-killing liable.

The Winesap is the favorite commercial variety the state over, with the Jonathan as a close second and Ben Davis third. The dry weather of the last three seasons, with the severe winter of 1911, and the severe attack of Illinois canker has proved fatal to many Ben Davis trees. The Jonathan apple is grown in the southern part of the state, where it has attained a world-wide reputation. Other varieties which thrive in this state are: Summer—Duchess, Yellow Transparent, Cooper's Early White, Coles Quince, Early Harvest, Sweet June, Red Astrachan, Chenango Strawberry, and Red June; autumn—Wealthy, Utter's Red, Maiden's Blush, Fulton Strawberry, Flora Belle, Plum Cider, Fameuse, Porter and McMahon's White; winter—Gano, Windsor, Grimes' Golden, Janet, Northwestern Greening, Black Twig, Ingraham, Missouri Pippin and Iowa Blush.

Pears are successfully grown throughout the southeastern part of the state, though few large commercial orchards exist. The trees are liable to winter-kill if planted too far north and west, while susceptibility to fire blight is the controlling factor in the southeast. The principal varieties are Kieffer, Bartlett, Sheldon, Flemish Beauty and Seckel.

Native plums thrive over the entire state while European and Japanese varieties do well in the eastern and southern parts. American varieties are, Wyant, Wolf, Wild Goose, Forest Garden and DeSota; European—Lombara, Shipper's Pride, Green Gage, Shropshire Damson; Japanese—Burbank, Abundance and Wickson.

Peach-growing, commercially, is confined to the southeastern part of the state, where excellent crops are occasionally produced. The greatest difficulty lies in the late frosts which sometimes destroy the crops, and the liability to winter-killing of the fruit-buds, though some peaches are raised every year. Alexander, Early Rivers, Triumph, Russel, Champion, Bokara, Crosby, Hill's Chili, Heath Cling, Solway and Wright are the principal varieties.

Cherries thrive over the greater part of the state and are remarkably free from insect and fungous injuries. Besides the native cherries, Early Richmond, Montmorency and English Morello are the leading varieties.

Grape- and small-fruit-growing is becoming one of the leading industries in the eastern part of the state, especially in Districts Nos. 1 and 2, where much wine is manufactured and immense quantities of fruit shipped out every year. The grape has been exceptionally free from insect and fungous enemies until very recently when black-rot and the grape root-worm have caused serious losses in some localities. The leading varieties are Concord, Worden, Moore Early, Niagara, Moore's Diamond, and Woodruff Red.

Raspberries and blackberries suffer from drought and winter-killing except in the region close to the Missouri River, and here they form an important crop. Red raspberries are very little grown, being subject to winter-killing except in the immediate vicinity of the rivers. Strawberries now form one of the most important small-fruit crops in the eastern part of the state, especially in Districts Nos. 1 and 2 where fruit of the highest quality is produced. Senator Dunlap, Splendid, Bederwood, Crescent, Gandy, August Luther, Klondike, July and Sample are the varieties principally grown.

The nursery interests of the state are very important. Seedlings of all the important fruit, forest and shade trees are grown in large quantities. Propagation of varieties is carried on by root-grafting, budding and hardwood cuttings. The nurseries of the state supply not only the home trade but have a large and well-established business in other states.

Vegetable-gardening has taken its rightful place with the other industries in Nebraska. Both vegetables grown in the field and under glass yield abundantly and are of excellent quality. More vegetable-gardening is done in District No. 2 than any other part of the state, although the irrigated lands in the Scottsbluff region are rapidly developing into a vegetable-producing section. Canneries are being established and the indications are that there will be a still more rapid increase in vegetable-growing in the near future. The beet-sugar factories afford a ready market for sugar-beets, the acreage of which is rapidly increasing. The acreage planted to potatoes each year is also rapidly increasing in spite of potato diseases and occasional droughts. Marketing associations are being formed at various points to facilitate the distribution. Early varieties are grown principally, the leading potato being the Early Ohio. Many acres of tomatoes are grown every year and sold to the canneries. All varieties of root crops do well throughout the state, but the cucurbits are grown with most satisfactory results only on sandy loam soil of the Platte River valley, and a few other particularly suitable locations. The growing of pure-bred garden seeds also receives a great deal of attention.

Ornamental gardening and floriculture are receiving their due share of attention throughout the state, especially about the cities. The excellent markets have made greenhouse work very popular and a large number of persons receive employment in this line.

Among the native wild fruits which are found abundantly along every stream, the following are the most common: Pawpaw (*Asimina triloba*), in the eastern part; late wild grape (*Vitis cordifolia*), over the entire state; early wild grape (*Vitis riparia*), over the entire state, the latter ripening much earlier than the former and being much more palatable; wild plum (*Prunus americana*), over the entire state; choke-cherry (*Prunus virginiana*), over the entire state; wild cherry (*Prunus serotina*), eastern part of state; sand cherry (*Prunus pumila*), very common in the central and western parts of the state on dry sandy lands; wild cherry (*Prunus demissa*), common throughout the region from "Long Pine" westward and is much more palatable than the choke-cherry; wild strawberry (*Fragaria virginiana* var. *illinoensis*),. very common wherever moisture is sufficient; wild red raspberry (*Rubus strigosus*), in the eastern part of the state; wild black raspberry (*Rubus occidentalis*), very common over eastern half of state; wild blackberry, very common over eastern half of state; wild crab-apple (*Pyrus coronaria*), eastern part of the state; juneberry (*Amelanchier canadensis*), in the eastern part of the state; wild gooseberry (*Ribes rotundifolium*), very common in the eastern part of the state; golden currant (*Ribes aureum*), very common; elder (*Sambucus racemosa*), very common; persimmon (*Diospyrus virginiana*), southeastern part; buffalo berry (*Shepherdia argentea*), along Platte River; red mulberry (*Morus rubra*), in the eastern part.

Early horticulture in Nebraska was very discouraging. Persons coming to Nebraska and not acquainted with conditions insisted on planting varieties of trees unsuitable to this region, because of their excellence on the old "home place," or, being entirely unfamiliar with the varieties, allowed some eastern nurseryman to choose for them. The results were such that further planting was discouraged. The deep fertile soils of Nebraska produced such abundant crops of corn and small grain that orchard-planting was retarded. The trees were as a rule set too close together, and in the rush of general farming, neglected. Young trees were set in sod and if they reached the age of bearing soon bore themselves to death. Added to this came the inroads of insects and fungous diseases. But here, as in the face of other great dangers, leaders were developed, men with courage and determination who have succeeded in overcoming many of the difficulties. Systematic spraying was commenced. Scientific pruning and cultural methods were developed.

Nebraska has awakened from her lethargy and has become a state of pioneers in horticulture. Amateur horticulturists are numerous and horticultural specialties are rapidly developing. Better methods have developed special crops. Canning factories have been established and plants for the handling of by-products, such as cider-mills, vinegar-factories, wine-presses, and the like are numerous throughout the state.

The present high rank of horticulture in Nebraska is due largely to the untiring efforts of the early pioneers who not only planted large numbers of fruit trees themselves, but encouraged and assisted others to do the same. Among these may be mentioned: W. J. Armstrong, of Otoe County; J. Sterling Morton, who besides fruit-trees planted trees and shrubs of every species and variety which he thought would thrive in the vicinity of Nebraska City; he was the originator of Arbor Day, and to him is due in a large part many of the beautiful plantings and groves of trees found in the state today; Oliver Harmon, who planted not only fruit-trees and vines but forest trees as well; J. H. Masters, who besides extensive plantings of fruit and forest trees, engaged heartily in beekeeping; Wm. Fulton, who planted an orchard near Nebraska City; Benton Aldrich, who planted apple and peach orchards in Nemaha County, near Auburn; Joseph Bennett; Bird Vowell, who planted orchards near Auburn; S. Barnard, who established a nursery and planted an orchard at Table Rock; R. W. Furnas, ex-Governor of Nebraska, who planted a large orchard near Brownville, and carried on many experiments; J. M. Russell, who planted a peach orchard near Wymore, and who, besides demonstrating that peaches could be grown in Nebraska, originated many excellent varieties.

Public-service agencies for horticulture.

The Land-Grant college of Nebraska was established at Lincoln in 1871. There are three teaching members of the horticultural staff.

The Experiment Station is also located at Lincoln. There are also two experimental substations, the North Platte Experimental Substation, 4 miles south of the city of North Platte, and the Valentine Experimental Sub-station, near the town of Valentine.

In addition to the work done at the College of Agriculture, horticulture is now being taught at the State Normal schools of Peru and Kearney, the School of Agriculture at Curtis, and in connection with agriculture in almost every high-school in the state.

Extension work is conducted in connection with the College, one man devoting his entire time to this work.

The Nebraska State Horticultural Society was organized in 1869, with J. H. Masters as first president. Local fruit-growers' associations have been formed in all the leading districts, and in 1912 the Eastern Nebraska Fruit-Growers' Association was formed. A uniform system of packing and grading has been adopted which, with the present shipping facilities, insures proper distribution and good prices for horticultural products.

Statistics (*Thirteenth Census*).

The approximate land area of Nebraska in 1910 was 49,157,120 acres. The land in farms was 78.6 per cent of the land area, or 38,622,021 acres. Of this land in farms 24,382,557 acres were improved; 803,206 were woodland; and other unimproved land in farms numbered 13,436,238 acres. The number of all the farms in 1910 was 129,678. The average acreage to a farm was 297.8. [The total area of the state is 77,520 square miles.]

The leading agricultural crops of Nebraska are cereals and hay and forage. The acreage of cereals increased from 12,071,703 in 1899 to 12,540,049 in 1909, when the value of the cereals produced was $153,666,652, or 78.3 per cent of the total value of all crops. The acreage occupied by hay and forage increased from 2,823,652 in 1899 to 4,520,034 in 1909, when the value of the hay and forage produced was $31,729,691, or 16.2 per cent of the total value of all crops. In 1909 sugar crops were produced, from 8,225 acres, to the value of $241,272, the acreage being a decrease, however, of 38.8 per cent from that of 1899. The forest products of farms in 1909 was valued at $795,053, as compared with $412,746 in 1899.

Horticultural crops produced in Nebraska are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $2,078,340, as compared with $761,053 in 1899. Small-fruits increased in acreage from 1,171 in 1899 to 1,411 in 1909, an increase of 20.5 per cent, when 1,594,421 quarts were produced, valued at $159,169. In 1909 the total acreage of potatoes and other vegetables was 147,594 and their value $5,931,738. Excluding potatoes and sweet potatoes and yams, the acreage of other vegetables increased from 34,532 in 1899 to 36,164 in 1909, when the value of the vegetable products was $2,118,393. Flowers and plants and nursery products increased in acreage from 1,680 in 1899 to 2,091 in 1909, when the value of the products was $909,221.

The total production of orchard fruits in 1909 was 3,572,253 bushels, valued at $1,932,124. More than nine-tenths of this quantity was produced by apples, and most of the remainder by peaches and nectarines and cherries. The apple trees of bearing age in 1910 were 2,937,178; those not of bearing age 967,133; and the production in 1909 was 3,321,073 bushels, valued at $1,612,765. Peach and nectarine trees of bearing age in 1910 numbered 1,188,373; those not of bearing age 263,882; and the production in 1909 was 110,180 bushels, valued at $91,129. Cherry trees of bearing age in 1910 numbered 494,468; those not of bearing age, 267,529; and the production of cherries in 1909 was 89,876 bushels, valued at $164,872. Other orchard-fruits produced in 1909 were: 6,700 bushels of pears, valued at $9,802; 41,910 bushels of plums and prunes, valued at $50,934; 864 bushels of apricots, valued at $1,229; 995 bushels of quinces, valued at $993; and 665 bushels of mulberries, valued at $400.

The production of grapes in 1909 amounted to 4,752,217 pounds, valued at $137,295. The grape-vines of bearing age in 1910 numbered 1,221,736; those not of bearing age, 380,788.

Nuts were produced in Nebraska in 1909 to the amount of 384,325 pounds, valued at $8,906. The black walnut is the only nut of importance, the production in 1909 being 381,968 pounds, valued at $8,740.

Of the small-fruits grown in Nebraska, strawberries are the most important, with blackberries and dewberries second. The acreage of strawberries increased from 369 in 1899 to 562 in 1909, when the production was 654,061 quarts, valued at $65,772. Blackberries and dewberries increased in acreage from 152 in 1899 to 428 in 1909, when the production was 501,872 quarts, valued at $46,648. The production of raspberries and loganberries was 265,183 quarts, valued at $29,841; that of currants 90,779 quarts, valued at $8,592; and that of gooseberries 82,086 quarts, valued at $8,259.

The acreage devoted to potatoes increased from 79,901 in 1899 to 111,151 in 1909, when the production was 8,117,775 bushels, valued at $3,785,224. The acreage of sweet potatoes and yams decreased from 551 in 1899 to 279 in 1909, when the production was 28,500 bushels, valued at $28,121. The more important of the other vegetables produced were 3,167 acres of sweet corn, valued at $46,208; 725 acres of watermelons, valued at $36,223; 2,167 acres of pop-corn, valued at $33,854; 348 acres of cabbage, valued at $27,144; 282 acres of tomatoes, valued at $21,012; and 163 acres of onions, valued at $18,659. Vegetable of lesser importance were asparagus, cantaloupes and muskmelons, celery, cucumbers, squash, and turnips.

The acreage devoted to flowers and plants increased from 86 in 1899 to 94 in 1909. The total area under glass in 1909 was 844,010 square feet, of which 790,305 were covered by greenhouses, and 53,705 by sashes and frames. The value of the flowers and plants in 1909 was $356,168, as compared with $142,636 in 1899.

The acreage devoted to nursery products increased from 1,594 in 1899 to 1,997 in 1909, an increase of 25.3 per cent. The value of the nursery products in 1909 was $553,053, as compared with $234,033, in 1899.

J. R. Cooper.

Kansas.

The commercial horticulture of Kansas (Fig. 2507) is in large part centralized in a few localities. Twenty-five counties produced about nine-tenths of the 10,000 carloads of apples sold in 1912. The last tenth is grown in many scattered localities that are especially suited for horticultural work, sheltered valleys where the soil is deep, rich and always moist. In nearly every one of the remaining eighty counties successful fruit and vegetable plantations may be found. Sixty counties contributed more than two carloads of peaches to the total of 1,300 carloads sold in 1912. Thirty counties contributed one or more carloads of strawberries to the total of 300 cars sold in 1913.

Two sections of the state have large areas of land particularly suitable for horticultural products. The northeastern counties have a considerable area of glacial soils that is well suited to fruit-growing and in which the area devoted to fruit may be expected to increase constantly. The Arkansas Valley has a large acreage of sandy loam underlaid with a porous clay subsoil which has proved to be well suited to fruit-growing. The inexhaustible supply of water which may be cheaply secured for irrigation by pumping has recently been utilized in commercial orchards and gardens and the possibilities of this region are not easily estimated.

A large proportion of Kansas will for long years to come be devoted to grain- and stock-farming. Thousands of acres well suited to fruit and truck crops are devoted to corn, wheat, alfalfa, and grass. Fruit- and truck-farmers may be found prospering near every city and large quantities of their products are shipped from many points in the northeast counties and the Arkansas Valley towns.

The early fruit-growers planted large numbers of varieties that proved to be poorly suited to Kansas climate. Such standard eastern varieties as Hubbardston, Northern Spy, Baldwin and Rhode Island Greening ripened prematurely and had to compete with the fall varieties. These have been dropped from the list of recommended varieties. In this era of elimination the varieties which have been retained are those that have generally proved productive and profitable. Grimes', Jonathan, Winesap, York Imperial, Stayman, Arkansas or Black Twig, can compete in any market for the highest prices.

In the northeastern counties, most of the orchards are kept in clover or orchard-grass much of the time, to prevent erosion. That these deep moist soils are well adapted to this system of management is indicated by the successful crops borne in seasons when the rainfall is much below the normal. In the Arkansas Valley clean cultivation and cover-crops are the rule.

The barrel is the favorite package and a large part of the crop finds a market in the cities and towns of the states north and east. Barreling in the orchard is a common method, and the fine autumn weather usually occurring in this section makes this an economical practice. The fruit from the Arkansas Valley orchards is graded more closely as a rule, and the grades, fancy and extra fancy, packed in bushel boxes for the southern and southeastern markets. The fruit below fancy grades usually has found a ready market in the "wheat country" of the central and western part of this state and the "cotton belt" of Oklahoma and northern Texas. Some of the more isolated orchards have sold their entire crop to the "wagon trade" from surrounding farm country. The fancy grades compete in any market with the best grown anywhere. Grimes, Jonathan, Rome Beauty, and Winesap are the quality apples of Kansas and nowhere do they reach a higher degree of perfection.

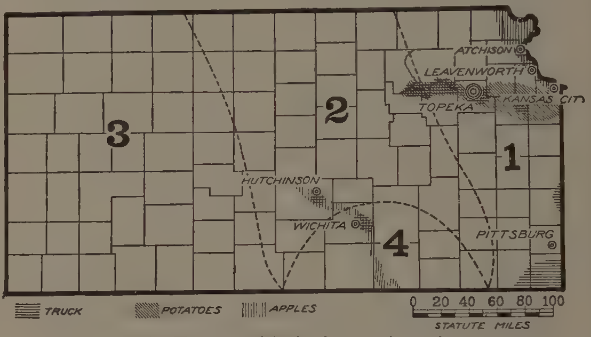
Early apples are increasing in favor with the Arkansas Valley growers. Good markets have been the rule, and this section can send good pie stock to market by July 1 and good dessert apples by July 15. Early Harvest and Red June have been largely replaced by Yellow Transparent, Cooper, and Wealthy. Maiden Blush is still in favor and Liveland Raspberry is being set in considerable numbers.

In spite of the erratic climatic conditions, peaches are grown in many counties. The Kansas grower sets peaches with the expectation that late frosts will injure at least half the crop in the northern half of the state and one-third in the southern half, but even with such losses occurring, when well cared for, peaches give good returns. Elberta has been more generally planted than any other variety, owing to its desirability as a shipper and canner, but many growers who supply local markets plant a number of varieties. Amsden, Champion, Greensboro, Triumph, Carmen, Mountain Rose, Crawford, Bonanza, Solway, Family Favorite, and Crosby have been generally successful. Many farmers still plant seedlings in a small way.

Sour cherries and the cultivated native plums are successfully grown in a variety of soils, but large plantings are seldom set. The Labrusca varieties of grape are particularly successful in the northeastern counties, and the vineyard acreage is increasing. In the southern counties the Labrusca varieties are to some extent being succeeded by some of Munsen's hybrids of *Vitis Lincecumii*.

The acreage of small-fruits has fluctuated in some sections, but the total acreage has steadily increased. Wathena and Troy in Doniphan County have made larger shipments than any other points, but large quantities are marketed locally by growers near the larger cities and towns.

Potatoes and sweet potatoes are shipped from the state in considerable quantities. The sandy soils of the Kansas and the Arkansas valleys produce most of the carlot shipments. Both Irish and sweet potatoes are grown for local market in most of the counties and a large part of the Irish potato crop is dug early and sold as new potatoes. The acreage devoted to sweet potatoes increases steadily. The northern and western markets seem to prefer the dry-fleshed potato from Kansas to the moister varieties of the South. The Yellow Jersey is the most widely grown, the short, well-shaped roots developing early giving the growers a chance at the early markets North and West, and a considerable part of the crop is dug and shipped for this early trade. This practice of selling early accounts, in a large measure, for the low-acre yields often reported by growers of Irish and of sweet potatoes, while the profit an acre compares well with other localities.



2507. Kansas, with the four main regions.

Several localities in southern Kansas have developed an extensive trade in vegetables with Oklahoma and Texas towns, shipping corn, tomatoes and melons south after their early truck crops have been marketed.

Watermelons are grown on a large scale in many localities. In earlier years the watermelon crop was uncertain owing to the injury from the melon louse, which infested fields where the crops were grown continuously for a number of years. With the general adoption of a reasonable rotation, Kansas is a regular factor in the late melon market. The difficulty of having the soil sufficiently rich for melons and not over strong for sweet potatoes is met by using corn or Irish potatoes or tomatoes between melons and sweet potatoes. Alfalfa is now being grown on soils that a few years ago were considered hopeless for that crop. Manure is an essential in getting alfalfa started in these sandy soils, but, once started, it yields well and the soil can be made ready for melons. One great value of alfalfa as a crop to precede melons is the comparative freedom from weeds.

Near Kansas City, Leavenworth, Atchison, Topeka, and Wichita, a considerable interest in cut-flower crops is being developed, and many of the smaller cities afford good support to local florists. Near the larger cities an increasing industry is the summer crop of cut-flowers. Peonies for the Memorial Day trade are gaining in favor and thousands of buds are held in cold storage for this demand. Gladioli and summer crops of roses usually prove fairly profitable.

The nursery business has long been important in this state. For years large areas of apple seedlings have been grown in the Kansas River Valley. The deep, strong soil produces a very high-grade stock and growers are improving their methods, generally using alfalfa in rotation chosen to secure the best possible condition of soil. The state ships many carloads of nursery stock other than apple stock and the trade increases steadily.

The forest tree nursery business has changed considerably in recent years. In the early days of the "Timber Culture Act," when a settler might secure a quarter-section of land for planting 10 acres of the tract to trees, any sort of tree seedling could be profitably grown. Those were the days of the enthusiasm for the "hedge fence," and millions of osage orange seedlings were grown. Today the hedge is in disrepute. The cost of careful maintenance is high in labor, and the cost of neglect is high in injury to the fields, and Kansas hedges are the victim of the stump-puller. The catalpa is still set for posts and poles, and is on a safer basis than in former years. The lesson of the worthlessness of all species except *Catalpa speciosa* was an expensive one. The fact that it is not well adapted to high dry soil has been demonstrated, as has its value for rich moist soil, and lands subject to overflow are being planted to catalpa and walnut. Many settlers who planted cottonwood as roadside trees thirty or more years ago are sawing lumber and finding that the cottonwoods pay rent for the land. The Kansas farmers are planting better trees than they did a generation ago. The box elder, soft maple, and poplars have given way to elms, hackberry, sycamore, oaks, walnut, and pecan in the eastern section, and the honey locust, elms, hackberry, osage orange, and Russian olive have proved valuable in even the drier soils. The red cedar is the only native evergreen, and since it has been shown that a two-year stratification or mechanical removal of the gummy coat makes its propagation fairly certain, it has been grown more largely than ever before. It is one of the most adaptable trees in the list, growing in every county in Kansas. The bull pine or western yellow pine, *Pinus ponderosa*, is well suited, and the Austrian and the Scotch pines are good trees for Kansas.

In the boom days of Kansas every citizen felt in duty bound to believe that every crop of the temperate regions could be grown here with less effort than elsewhere and that all the varieties of soil were equally fertile. The modern Kansan is learning that the great variety of soils and conditions gives opportunity for many lines of agricultural industry and that the welfare of the state is best secured by using crops best suited to soil and conditions. The men who have succeeded in the various lines of horticulture have done so by using the natural resources in a rational way. Some of the big orchards set in the early days on suitable soils have proved to be valuable properties, but careful work has been given them. Others set in a spirit of speculation with no investigation of soil suitability or with little idea of the value of varieties have not been particularly profitable.

Public-service agencies for horticulture.

The State Agricultural College is at Manhattan, and has from its earliest years maintained a Department of Horticulture. For some years the work in entomology was combined with that of horticulture and the two lines of work have always been closely associated. Experiments in the control of fruit insects were one of the first lines of activity undertaken when the Experiment Station was founded in 1887.

The Extension Division of the College has maintained a publicity bureau that has done much in getting buyers and producers of fruit into communication. The College renders considerable service in the matter of civic improvement, members of the staff visiting many localities delivering lectures, making suggestions and preparing plans for parks, cemeteries and the grounds for public buildings.

In several localities coöperative associations have been formed for the promotion of horticultural interests. The Wathena Fruit Growers' Association is the largest, shipping each season hundreds of carloads of fruit grown by its members.

The State Horticultural Society in its fifty years of service has accumulated a wealth of information that is proving to be a safe foundation for horticultural enterprises. There are a number of county and local horticultural societies which have served their communities faithfully and well.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 52,335,360 acres; the land in farms 43,384,799 acres, or 82.9 per cent of the land area. The improved land in farms was 29,904,067 acres, or 68.9 per cent of the land area in farms. There were 1,205,910 acres of woodland in the farms and 12,274,822 acres of other unimproved land in farms. The total number of farms in Kansas in 1910 was 177,841. The average number of acres to a farm was 244. [The total area of Kansas is 82,158 square miles.]

The leading agricultural crops of Kansas are cereals and hay and forage. Of the total value of all crops in 1909, 78.7 per cent was contributed by cereals and 14.9 per cent by hay and forage. The acreage of cereals increased from 13,326,940 in 1899 to 15,638,669 in 1909, when the value of the production was $169,109,449. Hay and forage decreased in acreage from 4,337,342 in 1899 to 3,957,745 in 1909 when the production was valued at $32,033,954. Broom-corn was produced to the value of $593,947 in 1909, and sugar crops to the value of $508,024. The value of the forest products of the farms in 1909 was $1,336,950, as compared with $837,997, their value in 1899.

Horticultural crops grown in Kansas are fruits and nuts, small-fruits in a limited amount, vegetables to quite a large extent and flowers and plants and nursery products. The value of all fruits and nuts produced in Kansas in 1909 was $1,136,977, as compared with $2,031,406 in 1899. The acreage occupied by the small-fruits decreased 7.3 per cent, from 5,824 acres in 1899 to 5,400 acres in 1900, when the production was 5,477,274 quarts, valued at $454,200. Vegetables, including potatoes, occupied, in 1909, an acreage of 132,665 and the value of their products was $6,808,653. The raising of flowers and plants and nursery products is of some importance in Kansas, 4,164 acres being devoted to them in 1909, with an output valued at $1,222,208.

The production of all orchard fruits was 58.8 per cent less in 1909 than in 1899. The total production of orchard fruits in 1909 was 1,447,849 bushels, valued at $944,631. Apples produced more than nine-tenths of this quantity, with cherries ranking next in importance. The apple trees of bearing age in 1910 numbered 6,929,673; those not of bearing age 1,116,316. The production in 1909 was 1,356,438 bushels, valued at $807,865. Cherry trees of bearing age in 1910 numbered 661,267; those not of bearing age, 237,051. The production in 1909 was 34,409 bushels, valued at $76,734. Quantities of other fruits grown in 1909 were 24,567 bushels of peaches and nectarines, valued at $23,418; 19,412 bushels of pears, valued at $21,543, and 12,250 bushels of plums and prunes, valued at $14,001. In addition, small quantities of quinces apricots and mulberries were produced.

The production of grapes declined from 15,786,019 pounds with a value of $297,000 in 1899 to a production of 6,317,684 pounds with a value of $184,673 in 1909. The number of grape-vines of bearing age in 1910 was 2,889,845; those not of bearing age numbered 343,002.

The production of nuts in Kansas is of minor importance. In 1909 the most important nut was the black walnut, of which 377,649 pounds were produced, valued at $6,033. The other nut of importance is the pecan, of which 20,583 pounds were produced in 1909, valued at $1,462. In addition, 3,950 pounds of hickory-nuts, valued at $107, and 275 pounds of chestnuts, valued at $19, were produced in 1909.

Blackberries and dewberries are the most important of the small-fruits raised in Kansas, with strawberries second in importance. The acreage of blackberries and dewberries increased from 2,044 in 1899 to 2,682 in 1909, when the production was 2,535,918 quarts, valued at $201,134. The acreage of strawberries decreased in the same period from 2,304 in 1899, to 1,719 in 1909, when the production was 2,119,048 quarts, valued at $178,094. The productions of other berries of importance in 1909 were: 616,035 quarts of raspberries and loganberries, valued at $56,446; 138,772 quarts of gooseberries, valued at $12,460; and 67,005 quarts of currants, valued at $6,023.

Among the vegetables, the potato is by far the most important. In 1909 the acreage devoted to potatoes was 79,025 from which were produced 5,647,049 bushels, valued at $3,471,488, more than the value of all the other vegetables. The more important of the other vegetables, their acreage, and value of their products in 1909 follow: sweet potatoes and yams, 4,883 acres, valued at $373,432; watermelons, 3,317 acres, valued at $131,527; tomatoes, 1,237 acres, valued at $84,937; sweet corn, 3,653 acres, valued at $75,499; cabbage, 1,007 acres, valued at $55,812; and onions, 243 acres, valued at $29,753. Other vegetables grown were asparagus, green beans, cantaloupes and muskmelons, pop-corn, cucumbers, lettuce, green peas, rhubarb, and turnips.

The acreage devoted to the growth of flowers and plants increased from 75 in 1899 to 161 in 1909. The total area under glass in 1909 was 781,498 square feet, of which 728,421 were covered by greenhouses and 53,077 by sashes and frames. The value of the plants and flowers produced in 1909 was $273,715, as compared with $79,765, their value in 1899.

The acreage devoted to the growth of nursery products increased from 3,449 acres in 1899 to 4,003 acres in 1909, an increase of 16.1 per cent. The value of the nursery products in 1909 was $948,493, as compared with $447,053 in 1899. ALBERT DICKENS.

SOUTH ATLANTIC STATES.

Delaware.

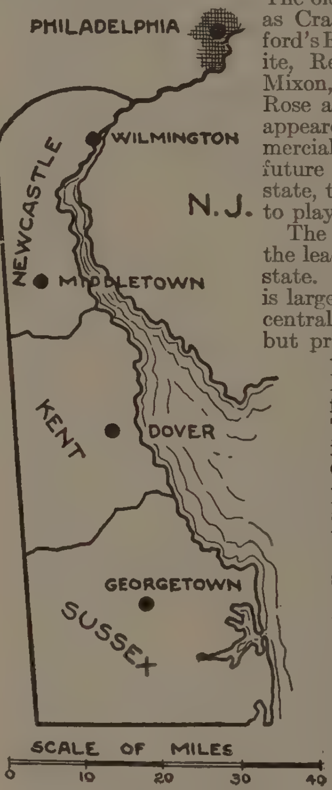
Geographically, Delaware (Fig. 2508) is divided into three counties, New Castle in the north, Kent in the center and Sussex in the south. Geologically, there are but two distinct regions, Piedmont, and Atlantic coastal plain. New Castle, the northern county, lies partially in the Piedmont region and partially in the coastal plain region, the northern portion being hilly and of a rolling topography and the remainder gently rolling with a gentle slope to south and east. The remainder of the state has no elevations of any consequence, the surface varying from slightly rolling in the north to flat, nearly level lands in the south. All along the eastern side of the state, many inlets and short navigable streams indent the coast. A narrow stretch of marshlands borders the coast from north to south. The greater part of the state lies below 100 feet above sea-level and the southern half lies below the 50 feet contour.

The soils of the state are well diversified; yet for the most part they are fertile and especially adapted to fruit- and vegetable-culture. The soil types of New Castle County vary greatly, while those of the other two counties are rather uniform. The principal soil types of Kent and Sussex counties are those of the Norfolk and Portsmouth series, viz., Norfolk loams and sands, and Portsmouth loams and sands.

The climate of the state is mild, the temperature, except in the extreme northern part, seldom falling below zero in winter. The close proximity of Delaware Bay on the east and Chesapeake Bay on the west has a decided modifying effect upon the climate. Injurious early fall frosts are practically unknown, while it is seldom that late spring frosts are limiting factors in crop-production. The rainfall is approximately 40 inches a year. The distribution of this rainfall varies from year to year, but it is not often that the state suffers from excessive droughts.

The leading horticultural crops are tomatoes, asparagus, apples, peaches, grapes, pears, strawberries, cantaloupes, watermelons, peas, sweet potatoes and white potatoes. There are many kinds of vegetables grown for the city markets, but the above-mentioned are the principal ones grown on a trucking scale.

Delaware was formerly noted for its peach-production, which industry began in 1832. The high-water mark in peach-production was probably reached in the late sixties and early seventies. With the advent of the yellows and other peach diseases, the industry began to decline and reached its lowest ebb about 1910. Since that time a new interest has been aroused, better methods of culture are being practised and the business is rapidly centering into the hands of specialists. During 1914 and 1915, thousands of young peach orchards have been planted. Varieties have been standarized and most of the old-time favorites have disappeared. The principal varieties grown are Elberta, Belle of Georgia, Champion, Carman and Frances. The old-time varieties, such as Crawford's Late, Crawford's Early, Moore's Favorite, Reeves Favorite, Old Mixon, Stump, Mountain Rose and Smock have disappeared from the commercial orchards. In the future horticulture of the state, the peach is destined to play an important part.



2508. Delaware, showing the three counties.

The apple is probably the leading tree-fruit of the state. The apple industry is largely centralized in the central part of the state; but practically one-half of the farming area of Delaware is suitable for apple-culture. The industry began in central Kent County only a comparatively few years ago and it was not until about 1900 that the apple crop of the state began to attract attention. Delaware is especially suited to the production of certain varieties of winter apples of high quality and the growers are specializing in those varieties. Early apples do well and a large and profitable business is carried on in growing Yellow Transparent, Early Ripe and Williams. The apple is destined to be a close rival of the peach and probably in a few years will surpass the latter in production and value. Unlike the peach industry, the apple industry has been in the hands of specialists from the very beginning and to this fact can be accounted its steady growth. The farmyard apple orchard plays but little part in the economics of Delaware apple-production. The principal varieties of late apples are Jonathan, Stayman, Paragon (Arkansas), Winesap, York Imperial, Nero, Rome and Grimes. Of these varieties, the Stayman is especially adapted to Delaware conditions.

LXXII. North American horticulture.—Peach orchard in eastern Maryland.

The grape industry as a commercial proposition is comparatively new. Although grapes have been grown in the northern part of Kent County since 1855, it is only within the last decade that grape-culture has come to occupy an important place in Delaware horticulture. The industry is centralized in two rather distinct regions, the older one near Clayton and Smyrna and a newer and what will probably prove to be a more extensive one, near Dover. The grape industry only awaits the advent of the grape-juice factory to bring it to its proper place among the horticultural products of the state.

Pear-production is on the wane. There are large plantings of Kieffer in Kent and southern New Castle counties; but of late years the pear crop has not proved very profitable. The old orchards have suffered from the pear-blight, leaf-spot and psylla. There are but few new plantings of pears being made and present indications (1915) are that the next decade will witness the passing of the pear industry. The northern part of New Castle County is especially adapted to the growing of varieties like Lawrence, Seckel, Duchess and Anjou.

As the next decade will probably witness the passing of the Kieffer pear, the past decade (1905–1915) has witnessed the passing of the plum. From 1895 to 1900, there were large plantings of Japanese plums made in the state. In 1899 there were 32,000 trees, while at the present time the plum crop is comparatively unimportant and the farmyard tree controls the output.

The strawberry is the most important horticultural crop grown in the state. Its cultivation is largely localized in Sussex County. There are two great strawberry districts in this county, one at Bridgeville in the western part and the other at Selbyville in the southeastern part. In the Selbyville district especially, strawberry-growing is the principal farm industry. The acreage in this district is constantly increasing. The agriculture of the Bridgeville district is more diversified and the strawberry-production, while great, is not so large as it was about 1912. This district has recently become a large producer of cantaloupes. The principal varieties of strawberries grown in the state are Gandy, Chesapeake, Superior, Klondyke and Parsons.

The tomato is king among vegetables in Delaware. With the exception of a small area in the northern part of New Castle County, tomatoes are grown for canning purposes over the entire state. In 1914 there were 150 canneries in operation in the state, all but two of them specializing in canning tomatoes. The principal varieties grown for canning purposes are Greater Baltimore, Success, Stone, Red Rock and Paragon.

Since 1911, the growth of the sweet potato industry in the state has been phenomenal. At the present time (1915), the principal sweet potato region is in the western part of Sussex County from Seaford southward through Laurel to Delmar. Seaford, Laurel and Delmar are the great sweet potato shipping centers.

The leading horticultural regions of the state are Kent County for apples and grapes; Kent and Sussex counties for peaches; Sussex County for strawberries, cantaloupes, sweet potatoes and watermelons.

While the climate and soil of the state are well suited to the production of the English walnut and chestnuts, the industry has not been developed. The ravages of the chestnut blight have practically destroyed the chestnut orchards and it is doubtful whether any new plantings will be made. Black walnuts grow naturally over a large part of the state. There are no cultivated orchards of this nut. A few pecans are grown, but the success of growing this nut in Delaware as a commercial venture has not as yet been demonstrated.

The census figures of 1909 regarding the greenhouse interests are misleading, as they show the industry of growing plants and flowers to be of more importance than it really is. There are but few florists' establishments within the state.

The appreciation of fine landscape effects is steadily growing in the state. There are several large estates near Wilmington that have been well developed, such as the numerous Du Pont estates lying between Wilmington and the Pennsylvania line. The smaller towns and villages have been awakened to the need of parks and playgrounds and the next decade ought to witness a better appreciation of the beautiful in nature.

Practically few of the many varieties of fruit grown in Delaware have originated within her borders. Possibly the only variety of national fame that Delaware can lay claim to is the Reeves Favorite peach.

Among those men who have helped to form the horticulture of Delaware, may be mentioned Joseph Carter, of Smyrna, who may be called the father of the grape industry in Delaware, and J. G. Brown, of Wyoming, who had great influence in establishing apple-growing in the state.

Public-service agencies for horticulture.

The land-grant college of Delaware is Delaware College located at Newark. This college was established in 1833, but it was not until the passage of the Morrill Act in 1862 that any provision was made for teaching agriculture. The horticultural staff consists of two men who also devote their time to the work of the Experiment Station.

The Experiment Station is closely connected with the College. Aside from the land devoted to experimental growing of crops, the Station has forty concrete tree pits that are used for investigational work in the plant-food requirements of peaches.

There are no special horticultural schools in the state, but horticulture is taught as a part of the agricultural work in all the graded schools.

Extension work is carried on through the state by the College and also to some extent by the State Board of Agriculture.

The State Board of Agriculture controls the nursery inspection and all public matters concerned with the enforcement of horticultural laws.

Historically, geographically and horticulturally, Delaware is closely linked with the "Eastern Shore," of Maryland. This close community of interest of the two states has been recognized in the Penisular Horticultural Society, whose membership is drawn not only from Delaware and Maryland but also from the "Eastern Shore" counties of Virginia. The Society has ever played a most important part in horticultural development of the two states, Delaware and Maryland.

Statistics (Thirteenth Census).

The approximate land area, according to the Census report of 1910, is 1,257,600 acres, of which 1,038,666 were in farms, or 82.6 per cent of the land area. The acreage of improved land is 713,538; that of woodland, 252,032, and other unimproved land in farms, 73,296 acres. The total number of farms in Delaware in 1910 was 10,836, the average acreage of which was 95.9 acres. [The total area of Delaware is 2,370 square miles.]

The leading agricultural crops are cereals and hay and forage. The land occupied by cereals in 1909 was 43.3 per cent of improved land, or 309,288 acres, as compared with the acreage in 1899, when it was 318,772. The value of the products in 1909 was $4,692,329. The acreage of hay and forage in 1909 was 80,669, as compared with 74,800 in 1899, showing an increase of 7.8 per cent. The value of hay and forage in 1909 was $1,174,473. The forest products sold from the farms in 1909 amounted to $346,062 in value.

The horticultural crops grown are vegetables, small-fruits, fruits and nuts, and flowers and plants, and nursery products. In 1909, the total acreage of vegetables, including potatoes, was 37,871 and their value

$1,832,699, as compared with an acreage of 32,007 in 1899, valued at $1,144,221. The value of the fruits and nuts grown in 1909 was $240,704 as compared with $295,518 in 1899. The acreage of small-fruits in 1909 was 8,687, a decrease of 18 per cent from 1899, when the acreage was 10,599. The value of the small-fruits in 1909 was $649,732. Flowers and plants and nursery products in Delaware increased in acreage from 204 in 1899 to 226 in 1909, when the value of their products was $110,486.

Of the orchard-fruits in 1909, the apples produced more than one-half of the total production, and pears most of the remainder. The number of bearing apple trees in 1900 was 429,753; those not of bearing age, 263,813. The production in 1909 was 183,094 bushels, valued at $115,371. The pear trees of bearing age in 1910 were 449,692; those not of bearing age, 90,917. The production in 1909 was 105,357 bushels, valued at $52,022. The peach and nectarine trees of bearing age in 1910 were 1,177,402; those not of bearing age, 212,117. The production in 1909 was 16,722 bushels, valued at $21,402. Other of the orchard fruits, their production and value in 1909 were: cherries, 2,634 bushels, valued at $4,850; quinces, 806 bushels, valued at $1,572; plums and prunes, 657 acres, valued at $540.

The production of grapes was 1,938,267 pounds, valued at $43,967. The grape-vines of bearing age from 1,309 farms reporting, in 1910 numbered 260,963; those not of bearing age from 265 farms reporting numbered 98,950.

The production of nuts is an unimportant industry. The production of all nuts in 1909 was 39,142 pounds, valued at $964, of which 35,200 pounds were black walnuts, valued at $581.

Strawberries are by far the most important of the small-fruits raised in Delaware, with blackberries and dewberries ranking next. In 1899, the acreage of strawberries was 6,344; in 1909 this acreage had increased to 7,194 and the production was 12,730,265 quarts, valued at $569,354. In the period from 1899 to 1909, the acreage of blackberries and dewberries decreased from 2,935 to 1,256. The production in 1909 was 1,403,977 quarts, valued at $61,817. In 1909, there were also produced 275,871 quarts of raspberries and loganberries, valued at $17,359; 12,123 quarts of gooseberries, valued at $908; and 2,973 quarts of currants, valued at $294.

Of the vegetables produced, potatoes and sweet potatoes were the most important individual vegetables. In 1909, from a reported acreage of 9,703, there were harvested 880,360 bushels of potatoes, valued at $453,400. In the same year, the production of sweet potatoes and yams from 5,229 acres was 733,746 bushels, valued at $276,679. The value of tomatoes produced from an acreage of 13,108, in 1909, was $583,639. Other vegetables produced in Delaware, their acreage, and the value of the products in 1909, follow: asparagus, 410 acres, value of product $39,097; cantaloupes and muskmelons, 1,163 acres, value of product $52,228; celery, 44 acres, value of product $12,394; sweet corn, 1,341 acres, value of product $35,073; green peas, 1,234 acres, value of product $42,780; watermelons, 859 acres, value of the product $26,343.

The growing of flowers and plants is quite an important industry in Delaware. In 1909, the value of the production from 44 acres was $71,429. The area covered by glass in 1909 was 244,827 square feet, of which 233,087 were covered by greenhouses and 11,740 by sashes and frames.

Concerning nursery products, the acreage increased 4.6 per cent from 1899 to 1909 or from 174 acres to 182 acres. The increase in the value of the nursery products for the same period increased 126.5 per cent, the value being given as $17,241 in 1899 and $39,057 in 1909.

C. A. McCue.

Maryland.

Maryland (Fig. 2509) consists naturally of three distinct regions known as: (1) the coastal plain; (2) the Piedmont region, or plateau; (3) the Appalachian region. The coastal plain rests on both shores of the Chesapeake Bay. The portion lying between the Bay and the ocean is known as the Eastern Shore. It is generally level, of low elevation and deeply indented with bays and estuaries. This portion west of the Bay becomes hilly as it recedes from the shore and approaches the Piedmont plateau. Its western boundary is approximately indicated by the Potomac River to Washington, and the Baltimore and Ohio Railroad as it passes from Washington through Baltimore to Wilmington.

The Piedmont plateau extends westward from the coastal plain to the base of the Catoctin Mountains in Frederick County. It is traversed by several ranges of hills. Some of these are of considerable height.

The Appalachian region forms the western part of Maryland and may be divided into three districts. The first or eastern part commences at the foot of the Catoctin Mountains. It is traversed by a number of ranges forming the Great Valley and the famous Middletown Valley noted for its beautiful landscape, fertile soil, and prosperous farms. The central district of this region is bounded on the east by North Mountain, and on the west by Willis Mountain near Cumberland. It is traversed by various intermediate ridges and comprises the greater part of Washington and Allegany counties. It is upon the slopes of these mountains that the largest and most extensive commercial orchards of the state are found. The western district contains the Allegany plateau and extends to the western boundary of the state. It contains a portion of Allegany County and all of Garrett County. It contains the great divide, from which the water runs partly to the Atlantic by way of the Potomac and partly to the Gulf of Mexico by way of the Monongahela, Ohio, and Mississippi.

The climate of Maryland varies in the different physical regions just described. Over the coastal plain the winters are short and mild. The snowfall is light and of short duration. The region is noted for its long growing season. In the Piedmont region the summers are cooler and the winters more severe, though severe weather seldom begins before January. In the Appalachian region the climate is more severe than in the other regions. The winters set in earlier and the snowfall is generally heavy.

The mean temperatures during January and June for the various sections are as follows: coastal plain, 35° and 73.5°; northern central, 30.7° and 72.8°; western Maryland, 30.5° and 70.3°; all Maryland, 32.8° and 72.5°.

Occasionally greater extremes are encountered than these figures would indicate. Sometimes the mercury goes to 98° or 100° in summer, and in winter a cold wave may cause it to drop below zero, but these extremes are of short duration.

Along the Atlantic coast and the shores of Chesapeake Bay, frosts do not occur between about April 5 and November 10, giving a period of safe plant growth of about 210 days. The length of this period decreases rapidly as the distance from the shore increases. In the central parts of the "peninsula" of the Eastern Shore, frosts do not disappear until about April 15, and reappear about October 22, giving a safe growth period of 190 days. On the western or windward side of the Blue Ridge Mountains, the frost-period extends into the first week of May and reappears in the fall about the first week in October, giving a safe growth period of about 160 days.

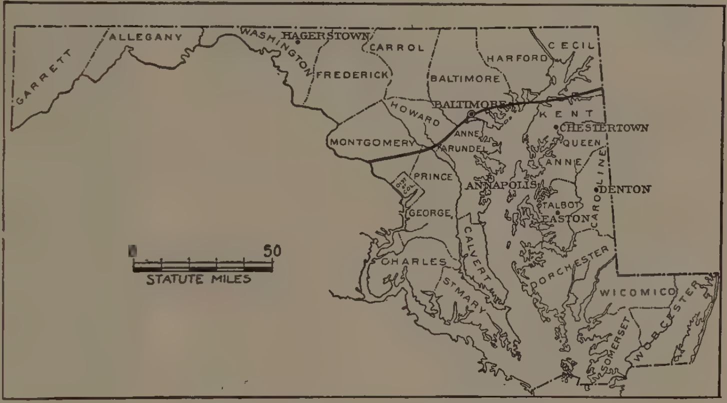
In Garrett County, forming the western part of the Appalachian region lying at 2,500 to 3,000 feet above sea-level, there is a marked shortening of the growth-period. Here injurious frosts extend into the early days of June and again set in about the middle of September. This gives only about 100 days of safe plant growth for the season in this region. Along the waters of Chesapeake Bay, in southern Maryland, the period of safe growth is more than again as long.

Over the coastal plain, the land is mostly light and largely dominated by the sassafras series of soils. The lighter of these soils are well adapted to early truck crops, while on their heavier sandy and gravelly loams peaches and apples thrive. In the northern tier of counties the soils are heavier and the agricultural interests are more diversified. The mountain slopes are well adapted to fruit-growing.

The transportation facilities, both land and water, are unsurpassed. Chesapeake Bay, with its numerous long, broad, navigable tributaries ramifying all parts of the state, gives Maryland a water-frontage larger that that of any other equal area. A large fleet of vessels is kept busy carrying produce from bay and river ports to Baltimore, Philadelphia, Washington, and other markets. Maryland is well supplied with railroads. Six distinct lines enter Baltimore. There are also a number of electric lines that carry freight. The Maryland State Roads Commission maintains an excellent system of state roads.

Climate, soil, transportation facilities with large markets near at hand, combine most efficiently to make Maryland a great horticultural region. Although small in area, it enjoys a remarkable range of soil and climatic conditions and because of this great range all of the horticultural products of the eastern United States can be grown with ease. In the entire region south of Baltimore, the growing of vegetables has assumed large proportions. The tomato is the most extensively grown vegetable crop of the state. In the production of tomatoes Maryland leads all other states. Potatoes, sweet corn, sweet potatoes, peas, cantaloupes, cabbage, beans and watermelons follow in the order named. Baltimore County leads in the production of early potatoes. Recently a rapidly increasing late potato area has developed in the higher altitudes of Garrett and Allegany counties. This region produces an excellent "seed" potato which has been found fully equal to the Maine-grown seed potatoes. These potatoes are now displacing the Maine-grown potatoes for planting purposes in the warmer regions of the state. Most of the sweet potatoes are grown on the light, warm, sandy soils of Anne Arundel County, although they are grown to some extent in every county of the state. Maryland ranks third in the Union in the production of spinach, green peas, and sweet corn, and sixth in the production of green beans and cantaloupes.

Strawberries stand out conspicuously among the small-fruit productions of Maryland. In the production of strawberries Maryland outranks every state in the Union, producing in 1909 nearly 30 per cent of all the strawberries grown in the United States. Strawberries thrive over the entire state but are most extensively grown in Anne Arundel, Wicomico, Somerset, Worcester and Caroline counties. In these counties, strawberries are produced in enormous quantities and during the picking season, which begins about May 12, special trains from these regions carry Maryland strawberries as far west as Chicago, and as far north as Montreal and Quebec. Anne Arundel also led in the production of blackberries and dewberries in 1909, but of late years the production of bush-fruits has been greatly on the increase in Washington and Allegany counties.



2509. Maryland, with the line of demarcation.

Maryland has long been famous as a peach-producing region. The first commercial orchard in the state was planted in 1800, in Anne Arundel County, 20 miles from Baltimore. The orchard was owned by Thomas Robinson. It contained 20,000 trees, and proved highly profitable. Other orchards soon followed; and soon peaches were grown on a large scale in Anne Arundel County. It is not known just when the first orchard was planted on the Eastern Shore. In 1830, a Major Philip Reybold planted an orchard of 6,000 trees in Kent County, and in the same year a Mr. Cassady planted 50,000 trees along the Sassafras River in Cecil County. Under the influence of the congenial soil and climate, with practically no enemies to contend with, the industry flourished and by 1865 the water fronts of Cecil, Kent, and Queen Anne counties presented the appearance of a continuous peach forest, extending inward for several miles. The peach industry of western Maryland is of comparatively recent origin. John A. Nicodemus planted the first orchard at Edgemont, in Washington County, and his orchard became the cradle of the industry in which many beginners received their first lessons in peach-growing. W. D. Hues also planted an orchard of 300 trees on the Blue Ridge Mountains, near Keedysville, in 1880. Keedysville is now a large shipping point for peaches. The first orchards were planted on the Blue Ridge; gradually they spread to lower levels and other ridges. The higher elevations, however, are considered the more desirable, as on the lower levels the crop is more frequently ruined by frosts.

This is a brief outline of the beginning of the peach industry in Maryland. For many years it dominated the fruit industry of the state. The comparative ease with which peaches were grown led many ambitious growers to plant larger areas than they could properly manage, and with the advent of the San José scale and the yellows, peach-curl borers, and other pests, many growers were forced to curtail their operations. This was more noticeable on the Eastern Shore than in western Maryland, where the plantings were more conservative and the orchards, on the whole, better managed. On the Eastern Shore, peaches were largely superseded by vegetable crops. At first, the cause of failure was attributed to a change in climatic conditions. This, however, is not the case, for under proper management and scientific methods peaches can now be grown on the Eastern Shore as well as formerly. Through the activities of the State Horticultural Department, in connection with the State Agricultural College, the growers have learned to overcome the inroads of scale, yellows, brown-rot, and other pests; and, since 1900, the planting out of peach, as well as other fruit-trees, has been on the increase. The following are among the leading commercial varieties grown: Greensboro, Carman, Mountain Rose, Champion, Elberta, Belle of Georgia, Heath Free, Reeves, Oldmixon, Chairs, Fox Seedling, Pickett Late, Stevens, Salway and Bilyeu.

The natural conditions for the production of apples are unsurpassed and the apple industry is growing steadily. On the Eastern Shore the early summer varieties thrive. Ripening as they do in June and early July, they bring high prices in the northern markets. The northern tier of counties have soil and climatic conditions favorable to the production of fall and winter varieties of the highest quality. Because of the great range of climate, a long list of varieties is available to select from. In western Maryland the best northern varieties like Spy, Tompkins King, Baldwin and Rhode Island Greening thrive on the higher elevations, while such excellent varieties as Grimes Golden, Jonathan, Winesap, Stayman Winesap, Paragon, Nero and Delicious can be grown to perfection in practically all parts of the state. At the present time the largest number of bearing trees are Ben Davis and York Imperial, but the planting out of these varieties has practically ceased. The present plantings are mostly Grimes, Jonathan Stayman, Winesap and Delicious. These varieties will soon be produced in large quantities. During the past ten years, large tracts of wild mountain land, considered worthless for agricultural purposes, have been converted into orchards. Some of these newly planted orchards are of considerable size. Near Cumberland on the Green Ridge Mountains and overlooking the Potomac River is probably located the largest single orchard project in the world. This project is converting 40,000 acres of wild mountain land into an apple orchard. Over 1,000,000 trees are already planted and the first plantings are now in bearing. This entire tract contains only three varieties, namely, Grimes, Jonathan, and Stayman Winesap. The largest full bearing apple orchard in the state is located near Hancock, in Washington County, and contains 900 acres. Orchards containing several hundred acres are common in this section. A large number of these newly planted apple orchards contain peaches as fillers.

Pears thrive throughout the state, and the planting of pear orchards has been on the increase. Kent and Anne Arundel counties lead in this industry.

Plums are grown only to a limited extent. They can be grown with ease but the other fruits are more profitable. Those grown are mostly of the Japanese and Wild Goose type. The production of sour cherries is on the increase.

In the production of grapes, Prince George's County leads. The production of grapes is steadily increasing throughout the state. Grapes ripen here at a time when the southern-grown grapes are off the market and before the northern grapes come on. The leading commercial varieties grown are: Moore Early, Concord, Niagara and Delaware. Besides these, Campbell Early, Lutie, Worden, Woodruff Red and Catawba are also grown in appreciable quantities.

The large fruit and vegetable industries have given rise to another large industry, namely, canning and preserving. According to the Twelfth Census, there were 468 such establishments, in 1909, turning out a product valued at $13,709,449. Of this amount, $12,538,862 was vegetables and fruits. Several of the larger plants continue to operate as fish and oyster canneries when the fruit and vegetable season is over. In canning, Maryland leads the other states. The tomato is the chief item. According to statistics compiled by the National Canners' Association, Maryland canned 41.6 per cent of all the tomatoes canned in the United States from 1908 to 1914.

The long growing season and the deep mellow soils make Maryland well adapted to production of nursery products. In 1914 there were fifty-two such establishments inspected by the State Horticultural Department. Most of these are small and are operated in connection with other farming operations. The number fluctuates from year to year. Some farmers grow a nursery crop only occasionally. The largest nursery in the state is located near Berlin, in Worcester County, and covers a tract of 2,500 acres devoted chiefly to the production of nursery products, fruit trees being the chief output. The second largest nursery is located near Baltimore and contains 1,200 acres.

Maryland abounds in beautiful scenery. The vicinity of Baltimore is surrounded by charming suburbs, beautifully landscaped and planted with trees, shrubs and flowers. Druid Hill Park, laid out by the Olmsted brothers, is one of the finest parks in the United States. The Green Spring Valley, north of Baltimore, is noted for its magnificent country homes and large estates.

One of the most influential horticulturists of Maryland was J. W. Kerr, a sketch of whose life will be found in volume III, page 1582.

Public-service agencies for horticulture.

The Maryland Agricultural College was established as a private institution in 1856, and opened for instruction in 1859. After Congress passed the Land-Grant Act in 1862 the General Assembly of Maryland formally accepted the grant and the Maryland Agricultural College was named as beneficiary. This made the College in part a state institution, and in the fall of 1914 it was entirely taken over by the state. The Agricultural College and Experiment Station are located at College Park. There are ten men on the staff of the College and Experiment Station devoting themselves to horticultural work.

Maryland has two horticultural societies; namely, the Peninsula Horticultural Society, founded in 1886, and the Maryland State Horticultural Society, founded in 1898. The object of both these societies is the promotion of horticulture in all its branches. Both societies receive some state aid. The Peninsula Society is primarily intended for residents of Delaware and the Eastern Shore of Maryland.

Statistics (Thirteenth Census).

The approximate land area of Maryland in 1910 was 6,362,240 acres. The land in farms numbered 5,057,140 acres, which was 79.5 per cent of the land area. Of the land in farms, 3,354,767 acres were improved; 1,467,333 acres were in woodland; and 235,040 acres was other unimproved land in farms. The number of all the farms in 1910 was 48,923. The average acreage to a farm was 103.4. [The total area is 12,327 square miles.]

The leading agricultural crops of Maryland are cereals, hay and forage, forest products of the farms and tobacco. The acreage of cereals in 1909 was 1,329,201, and the value of the products $21,908,730, which was 49.9 per cent of the total value of all crops. The acreage of hay and forage increased from 374,848 in 1899 to 398,842 in 1909, when the products were valued at $6,011,749, which was 13.7 per cent of the total value of all crops. The value of the forest products of the farms increased from $1,170,362 in 1899 to $2,349,045 in 1909. The acreage of tobacco in 1909 was 26,072, and the value of the production, $1,457,112.

Horticultural crops grown in Maryland are fruits and nuts, small-fruits, flowers and plants and nursery products, and vegetables. The value of the fruits and nuts produced in 1909 was $1,577,978, as compared with $1,311,386 in 1899. Small-fruits decreased in acreage from 17,522 in 1899 to 16,595 in 1909, when the value of the products was $1,227,548. In 1909 the total acreage of potatoes and other vegetables was 155,339, and their value $7,996,105. In 1899 the acreage was 133,344. Flowers and plants and nursery products increased in acreage from 1,449 in 1899 to 4,718 in 1909, an increase of 225.6 per cent, when the value was $1,053,901.

The total quantity of orchard fruits produced in 1909 was 2,577,359 bushels, valued at $1,517,400. Apples contributed nearly three-fourths of this quantity and pears, and peaches and nectarines most of the remainder. The apple trees of bearing age in 1910 numbered 1,288,482; those not of bearing age, 660,685. The apple-production in 1909 was 1,822,824 bushels, valued at $902,077. The peach and nectarine trees of bearing age in 1910 numbered 1,497,724; those not of bearing age 805,063. The production in 1909 was 324,609 bushels, valued at $361,617. Pear trees of bearing age in 1910 numbered 540,583; those not of bearing age 138,152. The production in 1909 was 367,359 bushels, valued at $168,561. In addition, there were produced in 1909, 42,315 bushels of cherries, valued at $60,121; 13,526 bushels of plums and prunes, valued at $16,192; 6,359 bushels of quinces, valued at $8,383; and 365 bushels of apricots, valued at $448.

The production of grapes is not of marked importance. In 1910 the grape-vines of bearing age numbered 138,801; those not of bearing age 44,690. The production in 1909 was 2,152,382 pounds, valued at $53,498.

The total production of nuts in 1909 was 318,148 pounds, valued at $5,687. Black walnuts and chestnuts contributed the greater part of this amount, the production of black walnuts in 1909 being 274,936 pounds, valued at $2,997; that of chestnuts, 24,842 pounds, valued at $1,439. There were also produced in 1909, 6,916 pounds of Persian or English walnuts, valued at $745; and 1,717 pounds of pecans, valued at $85.

Strawberries are the most important of the small-fruits, with blackberries and dewberries next in importance. The acreage of strawberries increased from 13,980 in 1899 to 14,292 in 1909, when the production was 23,611,095 quarts, valued at $1,070,072. In the same period the acreage of blackberries and dewberries decreased from 1,501 in 1899 to 1,180 in 1909, when the production was 1,372,164 quarts, valued at $68,817. The acreage of raspberries and loganberries decreased from 1,385 in 1899 to 846 in 1909 when the production was 959,369 quarts, valued at $67,516. There were also produced in 1909, 300,321 quarts of gooseberries, valued at $18,000; and 34,009 quarts of currants, valued at $3,138.

The tomato holds first place among the vegetables grown in Maryland. In 1909, it covered an area of 42,721 acres, and was valued at $2,037,634. Potatoes, sweet potatoes and yams are next in importance. The acreage of potatoes increased from 26,472 in 1899 to 39,299 in 1909, when the production was 3,444,311 bushels, valued at $1,782,954. The acreage of sweet potatoes and yams increased from 6,469 in 1899 to 7,956 in 1909, when the production was 1,065,956 bushels, valued at $483,751. Of the other vegetables produced in 1909, the more important were: 18,387 acres of sweet corn, valued at $386,277; 3,481 acres of cabbage, valued at $304,394; 3,516 acres of cantaloupes and muskmelons, valued at $246,333; 6,030 acres of green peas, valued at 220,709; 2,746 acres of green beans, valued at $153,013; 2,432 acres of watermelons, valued at $94,737; and 1,314 acres of spinach, valued at $80,653. Vegetables of lesser importance were asparagus, beets, cauliflower, celery, cucumbers, eggplant, horse-radish, kale, lettuce, onions, parsnips, radishes, rhubarb and turnips.

The acreage devoted to the production of flowers and plants increased from 174 in 1899 to 478 in 1909, an increase of 174.7 per cent. The total area of land under glass in 1909 was 2,175,584 square feet, of which 2,051,068 were covered by greenhouses, and 124,516 by sashes and frames. The value of the flowers and plants produced in 1909 was $597,001, as compared with $355,862 in 1899.

The acreage of nursery products increased from 1,275 in 1899 to 4,240 in 1909, an increase of 232.5 per cent. In 1909 the value of the nursery products was $456,900, as compared with $123,474 in 1899.

HERMAN BECKENSTRATER.

Virginia.

The state of Virginia (Fig. 2510) comprises six main physical or natural divisions known as the Tidewater, Middle, Piedmont, Blue Ridge, Valley and Appalachian regions. Each of these divisions has its own soil types and to a less extent its peculiarities of climate. These divisions consist of parallel belts of territory of the same general direction as the Alleghany Mountains.

The Tidewater division extends from the seashore to the head of tide and comprises about 11,350 square miles of territory. The highest elevation within this division is not more than 200 feet above sea-level. This district is traversed by numerous navigable rivers and its shores are indented by many estuaries and bays. The soil in this section is mostly drift from the more elevated part of the state and is usually light and easy to work. The climate is mild and somewhat more equable than the more inland sections of the state. The cheap transportation facilities furnished by the navigable waters, together with the mild climate and light soil of this section, has led to the development of truck-farming on an extensive scale. This constitutes the chief agricultural industry of the division. Parts of the three great truck regions of the Atlantic seaboard lie within this division of the state, namely, the Norfolk, Baltimore and Peninsula districts.

Middle Virginia is geologically the oldest region of the state and comprises 12,470 square miles of territory. It is, on the whole, more elevated than Tidewater but seldom exceeds an elevation of more than 500 feet. Horticultural crops are not extensively grown. Tobacco is the main crop, while corn and wheat succeed on the best types of soil. Bush-fruits do well in many parts of this district, while sections favored by good soil and proper elevation will produce good tree-fruits.

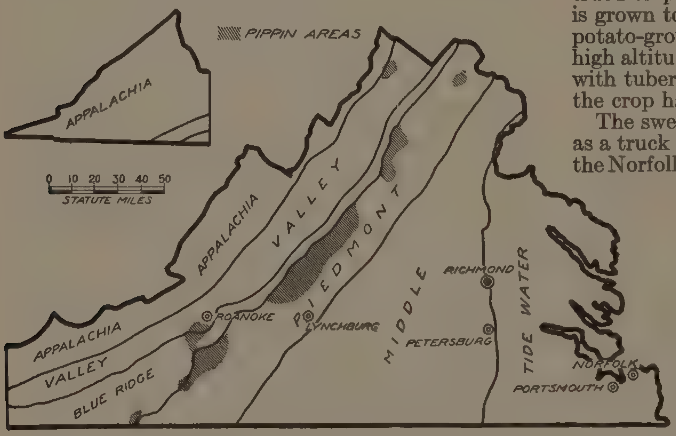
The Piedmont division of Virginia lies at the foot of the Blue Ridge and consists of a long, narrow belt of land varying in width from 30 to 40 miles and extending from the northern to the southern boundary of the state. It comprises 8,680 square miles of territory. The major part of this division varies in elevation from 500 to 1,000 feet above sea-level, although some of the detached mountain spurs lying within this district are much higher. The soils of Piedmont are highly variable but on the whole are well adapted to fruit-growing and grain-farming, while in the northern part of Piedmont, grazing is made possible by the presence of limestone soils and the natural growth of blue-grass.

The Blue Ridge division comprises the narrow range of the Blue Ridge Mountains. This division has a total area of 1,230 square miles. The northern two-thirds is rough and precipitous except in the mountain passes or gaps. The southern part, however, consists of a broad elevated tableland and includes the counties of Floyd, Carroll and Grayson. The soil of this part of the Blue Ridge section is not very different from that of Piedmont. Fruit-growing throughout the northern part of this section is confined largely to the mountain gaps and is of the same general character as that of Piedmont. Fruit-growing has not been extensively developed in the southern part of this section, owing to lack of proper transportation facilities. When this difficulty is met, there is likely to be a development in growing winter apples on a large scale, because of its high elevation.

The Valley section of the state lies northwest of the Blue Ridge and comprises a total area of 7,530 square miles. This is the best grain-growing section of the state. However, certain soils in this section are particularly adapted to the growing of apples and other fruits, and the development of commercial orcharding has been on a rather large scale. Frederick County, in the northern part of this valley, grows more fruit than any other one county in the state. Good fruit-land is to be found throughout this great valley. This division is divided into five subdivisions or minor sections by cross spurs which extend from the Blue Ridge to the Alleghany Mountains. Each of these minor divisions has its own particular types of soil. That part of the valley where fruit-growing is most highly developed extends from Staunton to the Potomac River. The part of this section which is drained by the waters of the Roanoke River appears to be especially adapted to canning crops. Botetourt County is noted for this industry. In the southwest, on the elevated land which divides the Holstein River district from the New River district, one will find large areas devoted to the growth of cabbage. The soil and climate of this elevated part of the valley seems admirably adapted to the production of this crop. The Valley division, as a whole, promises important development in fruit-growing and other horticultural industries.

The section of the state known as Appalachia lies to the northwest of the Valley and comprises a total area of about 5,700 square miles, consisting of large mountain ranges and narrow deep valleys. This part of the state is generally regarded as a grazing section, although there is much good apple and peach land to be found on the cross spurs and mountain slopes. Wherever good transportation facilities exist, profitable orchards are found. Much of this territory, however, remains undeveloped because of its inaccessibility.

The leading horticultural industries of the state are trucking and apple-growing. The Norfolk, Baltimore and Peninsula areas are especially adapted to the growth of truck crops and the development of trucking in this region has been on a large scale. Fruit-growing has been largely developed in the Piedmont, Blue Ridge and Valley sections of the state, while special phases of trucking have been developed in parts of the Valley section. Appalachia also offers good opportunities for fruit-growing, but the development of the industry there has not been rapid on account of the lack of good transportation facilities.



2510. Virginia, with the main geographical divisions.

The apple is the most important fruit crop of the state. Although this fruit has been grown commercially since colonial times, it is only in more recent years that the industry has assumed considerable proportions. Heavy plantings have been made during the last two decades and the annual yield of this crop is rapidly increasing. The apple succeeds on a commercial scale in the four western divisions of the state. Important apple-growing areas are to be found throughout Piedmont, while in many parts of the Valley and Appalachia it is extensively grown. The plantings in the eastern part of the state are primarily for home supply, but there is no reason why many localities in this part of Virginia cannot produce summer apples on a commercial scale. The leading varieties of commercial apples are York Imperial, Winesap, Ben Davis, Albemarle (Yellow Newtown), Arkansas, Grimes and Stayman Winesap.

The peach has long been regarded as an important fruit crop in Virginia, but it is only within recent years that its culture has assumed large proportions. At the present time the bulk of the peaches produced in this state is harvested from commercial plantings. The crop ripens in Virginia soon after the main crop of more southern districts is off the market, and is slightly ahead of the large orchards of West Virginia and Maryland. The peach grows to perfection throughout the state, wherever the frost factor can be safely ignored. The leading commercial varieties of this fruit are Carman, Hiley, Early Crawford, Elberta, Late Crawford, Smock, White Heath, and Bilyeu. The Elberta is planted more extensively than any other variety.

Other fruits, including the cherry, plum and grape, are important in certain restricted locations, but their cultivation is not general. Pear orchards have very generally proved unprofitable on account of the ravages of fire blight.

Small-fruits are grown in many parts of the state for local market, but their production with reference to northern markets is limited except in case of the strawberry, which is grown extensively in the trucking regions of the state and constitutes one of the most important sources of revenue.

Among the truck crops grown in the state, the potato sweet-potato and salad are the most important. The potato is grown almost entirely as a truck crop in Virginia, that is, early varieties are chiefly used and the crop is harvested before it is fully matured. Large areas in the Norfolk and Peninsular districts are utilized in the production of potatoes. The eastern part of the state is ideally adapted to the growth of this plant as a truck crop. In the western part of the state the potato is grown to some extent as a field crop, but this type of potato-growing is not extensive. A few localities with high altitude grow potatoes to supply the truck-farmers with tubers for seeding. When grown for this purpose the crop has generally proved rather profitable.

The sweet potato is next in importance to the potato as a truck crop. The great bulk of this crop is grown in the Norfolk and Peninsular areas. Sweet potatoes are not grown outside of Tidewater except in a small way for local market and for home use.

In addition to the crops mentioned above, other leading crops can be classed under one head as salads or pot-herbs. Spinach, kale, and lettuce are all grown on an extensive scale in the Norfolk district. Many growers confine their efforts largely to these crops. The profits are not great some years, but the grower who sticks to these crops year after year usually makes handsome profits in the long run.

Cabbage is another important truck crop of Virginia. It is grown for early market in the region around Norfolk, while it is grown very extensively for both early and winter markets in southwest Virginia. It constitutes the chief money crops in certain parts of Smyth and Wythe counties where it is grown on a large scale as a field crop.

The tomato is a very important crop in certain parts of the state. While it is grown extensively for general market in the principal trucking districts of the state, it is not a dominant crop in these sections. It becomes of primary importance in the canning districts, particularly in certain parts of Botetourt and Bedford counties, where the canning industry is firmly established.

In addition to trucking and apple-growing, which are the chief horticultural industries, grape-growing, small-fruit-culture and the nursery business have each received their share of attention. Grape-growing was once a thriving industry in the Charlottesville section of Piedmont but the industry has languished in recent years. It has been fully demonstrated, however, that the growing of table grapes is profitable in many parts of the state. There are several large nurseries and many small ones located in the state. Taken as a whole, the nursery business is of considerable importance. The state, also, has a number of large seed-houses and the growing of pedigreed seed is now important. The cut-flower industry has assumed considerable proportions near the large cities, while the same may be said for the forcing industry.

The development of fine country estates belongs chiefly to Colonial and ante-bellum days. However, many of these old estates have been preserved for the present generation, among which may be mentioned, Mount Vernon, Monticello and Montpelier. Throughout the state may be found less noted establishments which are, nevertheless, prized for their beauty.

The history of horticulture in Virginia is meagre. Beyond the fact that fruits and flowers have been prized from Colonial days, little is known of the evolution of the present horticultural industries. The strictly commercial phases of horticultural development are recent or are yet in their infancy.

Public-service agencies for horticulture.

The land-grant college of Virginia, known as the Virginia Polytechnic Institute, is located at Blacksburg in the southwestern part of the state. The State Experiment Station is a department of the College. The staff of the horticultural department consists of four horticulturists.

The inspection work for orchards and nurseries is administered by the Crop Pest Commission, which is directed by the same board as the Experiment Station. This office is essentially a department of the Agricultural College. Three trained officers devote practically their entire time to this work. There are also a large number of county inspectors engaged in orchard and nursery inspection under the direction of the Commission.

The Virginia State Horticultural Society is one of the influential agricultural associations of the state.

A Truck Experiment Station was organized in 1907 and located in the trucking district near Norfolk. This Station is supported and controlled conjointly by the United States Department of Agriculture, the Virginia Experiment Station, the State Department of Agriculture and the Southern Produce Exchange. Much valuable experimental and research work has already been carried out for the benefit of the trucking industry.

The State Department of Agriculture has its headquarters at Richmond, and devotes a considerable part of its efforts to the fruit-growing and trucking industries.

Statistics (Thirteenth Census).

The approximate land area of Virginia in 1910 was 25,767,680 acres. The land in farms was 75.7 per cent of the land area, or 19,495,636 acres. Of this land in farms, the improved land numbered 9,870,058 acres; the woodland, 8,414,680 acres; and other unimproved land in farms, 1,210,898 acres. The total number of farms in the state in 1910 was 184,018, and the average acreage to a farm, 105.9. [The total area of the state is 42,627 square miles.]

The leading agricultural crops of the state are cereals, tobacco, and hay and forage. The acreage devoted to the production of cereals decreased from 3,166,332 in 1899 to 2,841,114 in 1909, when the production was valued at $39,993,929, which was 39.8 per cent of the total value of all crops. Tobacco increased in acreage from 184,334 in 1899 to 185,427 in 1909, when the production was valued at $12,169,086. Hay and forage increased from 612,962 in 1899 to 773,577 in 1909, when the production was valued at $10,256,998. Forest products of the farms were valued at $10,118,851 in 1909, as compared with $3,797,116 in 1899.

Horticultural crops grown in Virginia are fruits and nuts, small-fruits, vegetables, including potatoes and sweet potatoes and yams, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $3,770,491, as compared with $2,755,487 in 1899. Small-fruits decreased in acreage from 8,796 in 1899 to 7,295 in 1909, when the production was 11,342,980 quarts, valued at $671,843. The total acreage of potatoes and other vegetables in 1909 was 252,119, and their value, $17,338,496. Excluding potatoes, and sweet potatoes and yams, the acreage of the other vegetables increased from 99,002 in 1899 to 124,354 in 1909, when the production was valued at $8,989,467. Peanuts increased in acreage from 116,914 in 1899 to 145,213 in 1909, when the production was 4,284,340 bushels, valued at $4,239,832. Flowers and plants and nursery products decreased in acreage from 1,343 in 1899 to 944 in 1909, when the production was valued at $522,480.

The total production of orchard-fruits in 1909 was 6,581,101 bushels, valued at $3,582,359. Apples contributed more than nine-tenths of this quantity, peaches and nectarines and cherries most of the remainder. The apple trees of bearing age in 1910 numbered 7,004,548; those not of bearing age, 3,435,591, and the production in 1909 was 6,103,941 bushels, valued at $3,129,832. Peach and nectarine trees of bearing age in 1910 numbered 1,585,505; those not of bearing age, 780,551. The production of peaches and nectarines in 1909 was 243,446 bushels, valued at $227,141. Cherry trees of bearing age in 1910 numbered 352,783; those not of bearing age, 83,323. The production in 1909 was 132,671 bushels of cherries, valued at $134,428. The production of other orchard-fruits in 1909 was: 74,486 bushels of pears, valued at $63,424; 22,597 bushels of plums and prunes, valued at $22,772; 3,443 bushels of quinces, valued at $4,037; and 515 bushels of apricots, valued at $723.

The production of grapes in 1909 was 4,108,694 pounds, as compared with 3,608,903 pounds, the production in 1899. The value of the grapes produced in 1909 was $156,266. The vines of bearing age in 1910 numbered 424,701; those not of bearing age, 136,026.

The production of nuts was 841,572 pounds, valued at $22,161. The nuts produced in 1909 were: 600,141 pounds of black walnuts, valued at $9,723; 210,364 pounds of chestnuts, valued at $9,686; 10,568 pounds of pecans, valued at $1,356; and 22,512 pounds of Persian or English walnuts, valued at $1,231.

Figs were the only tropical fruit of importance in 1909, the production being 234,057 pounds, valued at $9,652.

Strawberries are the most important of the small-fruits, with blackberries and dewberries ranking second in quantity and third in value, while raspberries and loganberries are third in quantity, but second in value. The acreage of strawberries decreased from 7,821 in 1899 to 6,606 in 1909, when the production was 10,761,381 quarts, valued at $626,649. Blackberries and dewberries decreased in acreage from 444 in 1899 to 344 in 1909, when the production was 273,551 quarts, valued at $16,485. Raspberries and loganberries decreased in acreage from 365 in 1899 to 276 in 1909, when the production was 257,322 quarts, valued at $24,853. Other small-fruits were: 23,447 quarts of gooseberries, valued at $1,909; 18,112 quarts of cranberries, valued at $1,050; and 8,127 quarts of currants, valued at $791.

The potatoes and sweet potatoes and yams rank far ahead of the other vegetables in importance. Potatoes increased in acreage from 51,021 in 1899 to 86,927 in 1909, when the production was 8,770,778 bushels, valued at $5,667,557. Sweet potatoes and yams increased in acreage from 40,681 in 1899 to 40,838 in 1909, when the production was 5,270,202 bushels, valued at $2,681,472. Other vegetables of importance were: 11,965 acres of tomatoes, valued at $495,773; 3,058 acres of spinach, valued at $489,170; 8,680 acres of cabbage, valued at $487,334; 1,766 acres of cucumbers, valued at $177,254; 2,867 acres of green beans, valued at $167,199; 3,159 acres of watermelons, valued at $136,898; 1,013 acres of kale, valued at $115,658; 969 acres of cantaloupes and muskmelons, valued at $83,148; 2,101 acres of sweet corn, valued at $73,050; and 787 acres of onions, valued at $59,524. Vegetables, the value of which was between $10,000 and $50,000, are as follows: asparagus, $31,205, eggplant, $20,430; lettuce, $24,187; radishes, $19,842; and turnips, $22,582. Vegetables of less importance are beets, parsley, pumpkins, rhubarb, rutabagas, and squash.

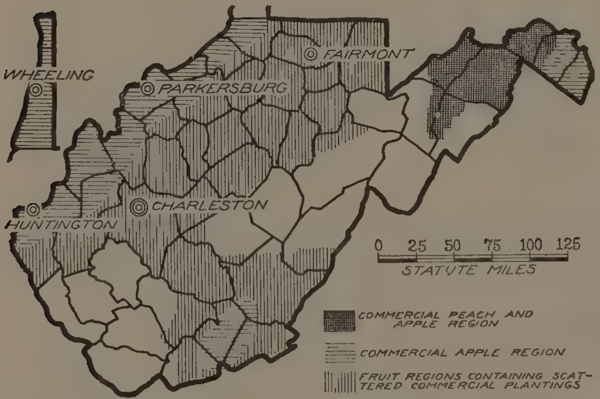
The acreage devoted to the production of flowers and plants increased from 143 in 1899 to 375 in 1909. The area under glass in 1909 was 1,413,170 square feet, of which 1,315,388 were covered by greenhouses, and 97,782 by sashes and frames. The value of the flowers and plants produced in 1909 was $362,488, as compared with $238,712 in 1899.

Nursery products decreased in acreage from 1,200 in 1899 to 569 in 1909, when the production was valued at $159,992, as compared with $214,988, the value in 1899.

H. L. Price.

West Virginia.

From a horticultural standpoint, West Virginia (Fig. 2511) presents many unique features and undeveloped possibilities. From the crest of the Alleghany Mountains to the waters of the Shenandoah River on the east and the Ohio River on the west, there is a difference in elevation of about 4,000 feet. The effect of this range in elevation is to furnish a climate with as much variation as might normally be found between Vermont and the Carolinas. As might be expected, the horticultural flora of the state is very extensive and the matter of varietal adaptation is one of great importance. The Baldwin and Northern Spy apples, when grown in Preston County at an elevation of 3,000 feet or more, are similar to the well-known New York and New England product, but when grown in the Shenandoah Valley they attain a very large size, ripen with the early fall varieties, are coarse in texture, poor in quality and can be kept only a few weeks even in storage.



2511. West Virginia, showing the regions of horticultural adaptabilities.

West Virginia has long been known as a producer of coal, oil, gas, and lumber, but in recent years the rapid development of the orchard industry has raised the state to a place of importance among the leading fruit-producing states. The Census report for 1910 indicated that West Virginia ranked twelfth among the states in the production of apples, and the government estimate for 1914 showed only seven other states exceeding West Virginia in the production of apples for that year. The peach industry is making similar gains, but is less extensive as a whole than the apple industry.

The horticultural industries of the state are unequally divided between fruit-growing and trucking, the former predominating. The leading fruits are the apple and peach, with the cherry forming a poor third. Pears, plums, grapes, and berries are grown in some sections to quite an extent, but the commercial plantings are somewhat scattered and the products are largely sold locally. The commercial apple districts are found in the eastern Panhandle, the northern Panhandle and along the Ohio River, and a small district is located near the southern boundary of the state. This does not mean that these are the only parts of the state producing apples, for scattering commercial orchards, many of them containing 100 acres or more, are found here and there in nearly every county. The peach industry, on the other hand, belongs to six counties of the eastern Panhandle, Hampshire, Mineral, Morgan, Berkeley, Hardie, and Grant. Outside of this region, with the exception of a few orchards along the Ohio River, the industry is purely local. The orchards of the state are all located upon rather rough mountain or hill land, with the exception of those in the Shenandoah Valley, where they are grown upon comparatively level or gently rolling limestone or shale soils.

The varieties of fruit vary somewhat with the section of state in which they are grown. In the Shenandoah Valley the York Imperial has long been the favorite. The "big, red, lopsided apple" finds a ready market in the southern and eastern cities and is also highly esteemed for export purposes. It sometimes scalds badly in storage, and more recent plantings have cut down the proportion of this variety. Next to the York Imperial rank the Ben Davis and its first cousin, the Gano, but these are planted in relatively small numbers at the present time. The Stayman Winesap, Arkansas (Mammoth Black Twig), Grimes, Winesap, Jonathan, Delicious, and Northwestern follow in about the order named. As one ascends the slope of the Alleghany Mountains, the Rome and Baldwin appear, while in the highest altitudes the Baldwin, Tompkins King, Rhode Island, Fallawater, and Northern Spy are found in abundance. Along the Ohio River and, in fact, over the entire western slope of the Alleghanies, the Rome finds a home perfectly adapted to its needs and consequently it is a ruling favorite in this whole region. Following the Rome, the other varieties are much the same as are found in the eastern Panhandle. Hancock County, at the northern extremity of the state, is peculiar in that it grows the Willow almost exclusively. This county early developed a system of common storage to which the long-keeping Willow was admirably adapted. The major part of the fruit from this county is placed in cellars, caves, and frame storage houses and is taken out in April and May in first-class condition for market. In the southern part of the state, the Stayman Winesap, Rome, York Imperial, Ben Davis, Grimes, and Jonathan are the best commercial varieties. In none of the regions are summer varieties grown extensively upon a commercial scale, although a few scattered plantings of Yellow Transparent may be found.

The peach industry is confined to a single section and embodies two very general soil types, chert and shale. The former is endowed with more abundant fertility and produces large, heavy-bearing trees. The shale soils require feeding but respond readily to applications of nitrate of soda or manure. The varieties are very much the same in all orchards and consist largely of the following: Carman, Champion, Belle, Elberta, Smock and Salway.

Peach- and apple-orcharding in West Virginia has developed along extensive rather than intensive lines. Individual growers frequently operate 200 to 300 acres.

while among the corporate holdings, orchards of 500, 600 and even of 1,000 acres may be found. These immense plants call for managerial ability of a high order and present problems involving finance, labor, culture, and marketing which are unknown to smaller growers. Thus far the labor problem has been met by utilizing the local population, but as more and more of the large orchards come into bearing it will be necessary to import many workers, particularly at harvest time. Inasmuch as the local labor is generally unskilled in harvesting and packing, it is the custom to employ experienced professional peach-packers who work northward after the crops are harvested in the more southern states. The barrel is the common package used for apples, but many growers are gradually introducing the box for such varieties as Grimes, Jonathan, Delicious, and Stayman Winesap. Early peaches, such as Carman, Champion, and Belle, are marketed in the Georgia carrier, while the Elberta, Smock, Salway, and other late sorts find a better sale in the Delaware sixteen-quart basket. There is also a tendency now to use the bushel basket for carefully graded late varieties. The methods of selling are unique in that there is a relatively small amount of fruit sold from the orchard or upon the tracks, the greater part being consigned to commission houses.

The trucking industry is at present confined to local areas along the Ohio and Big Kanawha rivers, to some of the "glade" lands on the higher elevations and to a small region in the eastern part of the state. The rich bottoms along the rivers furnish ideal locations for such an industry, while the numerous mining towns afford an almost unlimited market. It seems remarkable that with these advantages more persons have not taken up the work. The principal crops are early potatoes, watermelons, cantaloupes, tomatoes, cabbage, and sweet corn, while to a lesser extent are produced lettuce, spinach, kale, peppers, eggplant, onions, asparagus, and other vegetables usually found in this latitude. In Preston and other counties of a high altitude, where the "glade" lands are located, the midseason and late potatoes are grown. From these regions there has lately developed a promising trade in select seed-potatoes. Seed produced at an altitude of 2,500 or 3,000 feet has been found to equal and in some cases slightly excel the northern-grown seed in vigor and productiveness. This development is of special importance to the southern potato states which have been compelled to secure their seed from such distant points as Wisconsin, Michigan, New York, and Maine.

In the eastern Panhandle and principally in Morgan County, a tomato-growing and canning industry has developed. There are no canneries of great size but the work is done through a number of modest factories and private plants. Many of the orchardists make a practice of intercropping their young orchards for the first three years with tomatoes, thereby aiding materially in reducing the cost of bringing the orchard into bearing. Some of the orchard companies yearly plant from 50 to 100 acres of this crop and operate their own cannery.

As a specialized branch of horticultural industry, the nurseries about Point Pleasant and Mason should be mentioned. The rich loam of the second and third river-bottoms is well adapted to the production of young trees. The apple and peach are the principal fruits propagated, although the other fruits and some ornamentals are grown to a limited extent.

The commercial production of flowers is as yet practically undeveloped. The larger cities and towns are partially supplied by small local florists whose outfits are so small that frequent recourse must be had to outside sources to supply the trade. Coal and gas are plentiful and make a cheap fuel; markets are good and could easily be greatly extended; thus it would seem that a great opportunity is offered for extensive greenhouse development.

No account of West Virginia horticulture would be complete without some mention being made of the native fruits and nuts that abound in all parts of the state. Prominent among these is the native persimmon which may be found growing in all but the higher altitudes. This truly delicious fruit is held in high regard, but strange to say little or no attempt has been made to select and propagate the better strains, although the wild seedlings offer many promising variations. The same may be said of the pawpaw, clumps of which thickly dot the hillsides of the western and southern parts of the state. From early September until freezing weather begins, this aromatic fruit may be found bending the slender bush-like trees to the ground with the weight of its clusters of banana-shaped fruit. While the flavor of the pawpaw is not appreciated by all, it is nevertheless of some economic importance as evidenced by the fact that considerable quantities of the wild fruits are annually gathered and find a ready sale at about 50 cents a bushel. Huckleberries cover whole mountain sides and quickly take possession of forest clearings. Large quantities of this fruit, as well as the blackberry and dewberry, are picked and sold in the local markets. High in the mountain glades one is surprised to find the cranberry growing in abundance. One "cranberry glade" in Pocahontas County has 300 acres of this fruit. From one of the few "cultivated" bogs, fruit was sent to the St. Louis Exposition and won first honors. Thus far little or no attempt has been made to develop the industry. Among the nuts, may be found the chestnut, chinquapin, hickory, and black walnut. While all are relatively abundant, the chestnut is the only one of economic importance for its fruit. These nuts in some sections are gathered in great number and find a ready market. A few years ago several carloads would sometimes be shipped from one point, but now the demand for labor in other lines at that season of the year has cut down the harvest to only a vestige of its former importance.

In considering the men who were prominent in developing the horticultural interests of West Virginia, it is interesting to note that George Washington was one of the first if not the first fruit-grower of any consequence in the state. Records show that on March 18, 1774, he leased to one William Bartlett 125 acres of land "in the barens of Bullskin," a part of the present Berkely County. The guarantee was "to have and to hold for and during the lives of the said William Bartlett, Mary his wife, and Frederick their son, and the life of the longest liver of them." In addition to £6 annual rent it was agreed that Bartlett should leave a certain area of timber untouched, erect buildings, raise 10 acres of "English grass" and "that within seven years an orchard of one hundred winter apple trees at 40 feet distance every way from each other and that one hundred peach trees shall be planted on some convenient part of the said demised land and the same to be kept always during the continuance of said term, well pruned, fenced in and secured from horses, cattle and other creatures that may hurt, and if any of the said trees shall die, decay or be destroyed that others of the same kind shall be planted in their place, and the entire number thereof be kept up during the said term." Shortly after Washington's venture in the east came an important development in the Northern Panhandle. In 1786, Jacob Nessley purchased a tract of land bordering the Ohio River and cleared and planted 50 acres to apples and peaches. He grew seedling trees for the most part, although it is recorded that he had also some grafted stock. As his crop was devoted to the manufacture of fruit brandies, he was able to utilize the inferior seedlings to good advantage. As the direct result of his influence upon the locality, hundreds of acres of orchards have been planted and the Northern Panhandle grew famous for its production of winter apples. Long the foremost fruit region of West Virginia, it has only recently been surpassed by the still greater development in the Eastern Panhandle. As Jacob Nessley was the father of commercial fruit-growing in the Northern Panhandle, so was W. S. Miller in the Eastern Panhandle. In 1851, he planted 16 acres of apples, peaches and plums, and the close of the Civil War found him with 4,000 bearing peach trees upon his hands. As time went on the plantings increased until finally the aged pioneer had planted and matured upon his own farm over 4,000 apple and 25,000 peach trees, besides large numbers of plum, pear, quince and cherry trees.

Public-service agencies for horticulture.

The Land-Grant college of West Virginia is located at Morgantown. It was established in 1867 as "The Agricultural College of West Virginia." In 1868, however, this name was changed to "West Virginia University." The College of Agriculture was established in 1897. There are six members of the horticultural staff, who, together with one other man, also make up the horticultural staff of the Experiment Station.

The Experiment Station was established in 1887 at Morgantown as a part of the University.

There is a State Horticultural Society devoted to horticultural interests, with which are affiliated a number of county organizations.

Statistics (Thirteenth Census).

The approximate land area of West Virginia in 1910 was 15,374,080 acres. The land in farms was 65.2 per cent of this area, or 10,026,442 acres. Of this land in farms, the improved land numbered 5,521,757 acres; the woodland, 3,968,836 acres; and other unimproved land in farms, 535,849 acres. The total number of all the farms in 1910 was 96,685, and the average acreage to a farm, 103.7. [The total area of the state is 24,170 square miles.]

The leading agricultural crops are cereals, hay and forage, and tobacco. The acreage devoted to the production of cereals decreased from 1,307,428 in 1899 to 1,038,931 in 1909, when the production was valued at $15,997,700, or 39.6 per cent of the total value of all crops. Hay and forage increased in acreage from 601,935 in 1899 to 708,900 in 1909, when the production was valued at $7,492,747, or 18.6 per cent of the total value of all crops. Tobacco increased in acreage from 5,129 in 1899 to 17,928 in 1909, when the production was valued at $1,923,180. Forest products of the farms in 1909 were valued at $4,004,484, as compared with $2,632,980 in 1899.

Horticultural crops produced in West Virginia are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $3,149,122, as compared with $2,210,871 in 1899. Small-fruits increased in acreage from 1,994 in 1899 to 2,913 in 1909, when the production was 2,336,562 quarts, valued at $191,002. The total acreage of potatoes and other vegetables in 1909 was 88,224, valued at $6,968,618. Excluding potatoes, sweet potatoes and yams, other vegetables increased in acreage from 29,290 in 1899 to 43,524 in 1909, when the production was valued at $4,519,894. Flowers and plants and nursery products decreased in acreage from 586 in 1899 to 489 in 1909, when the production was valued at $157,645.

The total production of orchard-fruits in 1909 was 4,709,959 bushels, valued at $3,040,192. Apples contributed about nine-tenths of this quantity, and peaches and nectarines most of the remainder. Apple trees of bearing age in 1910 numbered 4,570,948; those not of bearing age, 2,772,025. The production of apples in 1909 was 4,225,163 bushels, valued at $2,461,074. Peach and nectarine trees of bearing age in 1910 numbered 1,424,582; those not of bearing age, 1,441,188. The production of peaches in 1909 was 328,901 bushels, valued at $368,584. Other orchard-fruits produced in 1909 were: 79,723 bushels of cherries, valued at $111,043; 32,948 bushels of plums and prunes, valued at $48,522; 29,916 bushels of pears, valued at $32,101; and 13,163 bushels of quinces, valued at $18,676.

The production of grapes in 1909 was 3,224,751 pounds, valued at $92,834. Grape-vines of bearing age in 1910 numbered 284,074; those not of bearing age, 76,465.

The total production of nuts in 1909 was 974,312 pounds, valued at $16,049. The more important of the nuts produced were: 878,215 pounds of black walnuts, valued at $11,430; 17,337 pounds of Persian or English walnuts, valued at $2,153; and 40,380 pounds of chestnuts, valued at $1,830.

Of the small-fruits grown in West Virginia, strawberries are the most important, the acreage decreasing, however, from 799 in 1899 to 709 in 1909, when the production was 812,049 quarts, valued at $74,778. Blackberries and dewberries increased in acreage from 367 in 1899 to 1,292 in 1909, when the production was 803,498 quarts, valued at $48,854. Raspberries and loganberries increased in acreage from 704 in 1899 to 847 in 1909, when the production was 648,174 quarts, valued at $60,749. Other small-fruits produced in 1909 were 34,009 quarts of currants, valued at $3,153, and 35,632 quarts of gooseberries, valued at $3,238.

The acreage devoted to the production of potatoes, the most important of the vegetables, increased from 30,123 in 1899 to 42,621 in 1909, when the production was 4,077,066 bushels, valued at $2,278,638. Sweet potatoes and yams decreased in acreage from 3,393 in 1899 to 2,079 in 1909, when the production was 215,582 bushels, valued at $170,086. The production of the more important of the other vegetables in 1909 was: 1,846 acres of tomatoes, valued at $87,386; 3,464 acres of green beans, valued at $60,156; 878 acres of sweet corn, valued at $37,449; 212 acres of cabbage, valued at $24,562; 473 acres of watermelons, valued at $21,059; 163 acres of turnips, valued at $4,809; 35 acres of onions, valued at $4,442; and 72 acres of green peas, valued at $2,053. Vegetables of less importance were asparagus, cantaloupes, celery, cucumbers, lettuce, and radishes.

The acreage devoted to the production of flowers and plants decreased from 39 in 1899 to 25 in 1909. The total area under glass in 1909 was 296,717 square feet, of which 272,182 were covered by greenhouses, and 24,535 by sashes and frames. The value of the flowers and plants produced in 1909 was $78,377, as compared with $44,384 in 1899.

Nursery products decreased in acreage from 547 in 1899 to 464 in 1909, when their value was $79,268, as compared with $61,700, in 1899. W. H. ALDERMAN.

North Carolina.

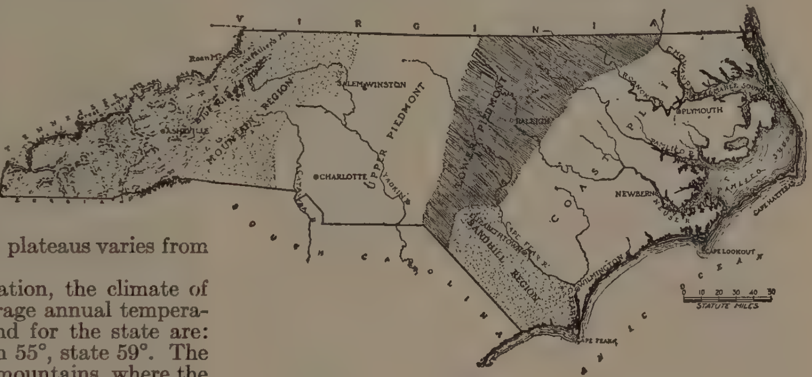
North Carolina (Fig. 2512) is a long, narrow strip of land in eastern United States, occupying a medial position between North and South. It extends 503 miles from east to west, with an average width of about 100 miles. Since the state extends from the surf of the ocean to the highest altitudes east of the Rocky Mountains, it has a very complex topography, a varying climate, a multiplicity of soil types and a consequent wide range of vegetable products.

North Carolina is divided into three parts, the Mountain region, the Piedmont and the Coastal Plain. The Coastal Plain begins at the Atlantic Ocean and extends inland a distance of about 150 miles. The land is extremely level, in most places not varying in elevation over a foot to the mile. Along the sounds and in the tide-water section there is from 4,000 to 5,000 square miles of swamp. A part of this area has been drained and is found to be extremely rich agricultural land.

About 100 square miles of the great Dismal Swamp lies within this state. Cleared parts of this region have become the richest agricultural and trucking land in the state. On its western border the coastal plain merges into the lower Piedmont region at an altitude of 150 to 200 feet.

The Piedmont region is a rolling hilly country comprising nearly one half of the state. It is gently undulating on its eastern border where it merges into the coastal plain, but assumes a bolder and more rugged aspect as it nears the Blue Ridge Mountains. It is the general farming section of the state.

The western, or mountain section of North Carolina is the most rugged and picturesque mountain region east of the Rockies. In this limited area all the ranges of the Appalachian system seem to have united and fused and then broken up in a confusion of lofty peaks with a labyrinth of intervening valleys. Within a range of 50 to 100 miles there are forty-three mountain peaks, 6,000 feet and upward in altitude. Several rivers which empty into the Atlantic Ocean or into the Gulf of Mexico find their sources in this high region. In all this maze of mountains, the Great Smokies form a continuous range on the west and make a natural border between North Carolina and Tennessee. The Blue Ridge with its subsidiary ranges and outlying spurs forms the eastern border of this region where it drops abruptly about 1,500 feet to the Piedmont plateau. These two general ranges are connected by many spurs and cross-ranges. The general altitude of the mountain valleys and elevated plateaus varies from 2,000 to 3,000 feet.



2512. North Carolina, showing the main divisions.

On account of its southern location, the climate of North Carolina is mild. The average annual temperatures for the different sections and for the state are: coast 61°, Piedmont 59°, mountain 55°, state 59°. The summers are warm, except in the mountains, where the altitude gives a cool climate like that of the northern states. Snow seldom falls and never lasts more than a few days. In the coastal section the winters are so mild that truck crops, such as spinach, kale, onions, cabbage, peas and lettuce are extensively grown in the open without protection during the winter season. The average annual precipitation for the state is 52 inches, for the coast 51, for the Piedmont 49, for the mountains 57. The rainfall is well distributed throughout the growing season, making irrigation unnecessary. The average length of the growing season as ascertained by the Weather Bureau records varies from 250 days near the coast to 200 in the central Piedmont and 180 to 190 in the mountains. In the coastal section, this long season permits the maturing of subtropical crops, such as cotton, peanuts and sweet potatoes, and gives the trucker a succession of two, three and even four crops a season.

The soils of the coastal region are of light sandy texture and are mostly underlaid with clay. They are classified by the Bureau of Soils as the Portsmouth, Norfolk and Orangeburg series. They vary from sand to sandy loam and fine sandy loam. These soils warm up quickly, are easy of cultivation and are therefore valuable for trucking purposes. In the swamp areas the soil is a rich black vegetable mold, varying from 2 to 6 feet in depth.

The Piedmont soils are of the Cecil clay series in which the clays predominate. Toward the east they are more or less blended with the sandy types of the coastal plain. The Piedmont clays are strong soils of friable texture and respond readily to cultivation. They are especially valuable for general farming and are capable of producing a wide variety of crops.

The mountain soils belong to the Porter and Toxaway series. The Toxaway soils which are of an alluvial nature are found in the valleys and bottom lands, while the Porter types are characteristic of the mountain slopes. In high mountain coves is found the Porter black loam, a soil much renowned for the production of fruit of the very finest quality.

On account of the wide range in altitude, the numerous soil types and the varied climatic conditions, the native flora of North Carolina is extremely rich and varied. Botanists from all over the world have studied the flora of this region, because within a few miles can be found the flora of the north overlapping with the subtropics, while the dense jungle of swamp and coastal vegetation lies within a day's travel of the alpine species of the mountains. In the southeast are found the palmetto, live-oak and cypress festooned with Spanish moss and intertwined with smilax and jessamine; a little farther up brings the long-leaf and numerous other species of pines, the gums and various species of oaks and hickories, while in the mountains are found huge timber trees of northern white pine, spruce, balsam and hemlock and dense thickets of laurel and rhododendron. A survey of the native fruit-bearing plants of the state shows eighteen families including thirty-nine genera and upwards of 330 species. The non-fruit-bearing plants and general flora run into great numbers of species.

The nurseries of the mountain region make a specialty of native ornamentals and alpine plants which are shipped in large quantities to all parts of the country. This region is one of the chief sources of supply for medicinal herbs which are gathered by the mountain people and shipped out in immense quantities by wholesale dealers of crude drugs. Cultivated ginseng is a considerable article of commerce. The great bulk of peach seed used by nurserymen all over the country is produced in this region.

The greatest horticultural industry in North Carolina is truck-growing. Its mild southern climate, light friable soils and accessibility to large markets makes eastern North Carolina an ideal section for trucking, especially during the winter and early spring months. In the market, North Carolina truck comes intermediate between Charleston and Norfolk. Early Irish potatoes make the largest tonnage, going north in early spring by boat and trainloads. The crop comes off the land sufficiently early to give place to corn, cotton and other farm crops. In the mountains the late varieties of potatoes are grown in considerable quantities, and marketed during the fall and winter. Early cabbages of the Wakefield type are extensively grown in the east in the winter and early spring and, like potatoes, are followed by a variety of truck or farm crops. The late, heavy types of cabbage are grown in summer in large quantities in the rich valley lands of the mountains. The sweet potato is grown in greater or less acreage on almost every farm in the state. The total of this production is a very large item amounting to about 8,000,000 bushels, one-seventh of the total crop of the United States.

Watermelons and cantaloupes are extensive truck crops in the sand-hill section of the state. The plantings of some of the larger growers run into hundreds of acres. In the shipping season, trainloads of refrigerator cars of melons and cantaloupes go north daily.

The growing of the head types of lettuce has become a considerable industry in North Carolina. The early crop is grown under cotton covers and the later ones in the open field. The lettuce crop is usually followed on the same land by radish, cucumbers or beets. Snap beans and English peas are much used as early spring catch-crops before the general summer farm crops. A considerable industry has developed in some localities in the production of very early corn for northern markets, before the northern crop comes in.

The strawberry is so extensively grown in North Carolina as to be considered a regular field crop. At Chadbourn, Mt. Tabor and other points along the Coast Line Railroad, the production of strawberries is so great that the large northern markets have found it to their advantage to send their agents to buy on the track as the cars are loaded. During the season, solid trainloads of iced cars of berries leave the strawberry section of North Carolina daily. The dewberry is also rapidly becoming a commercial fruit crop of importance, the output ranging in the neighborhood of 300 cars a season.

In the last decade, North Carolina has made rapid development in the commercial culture of apples. The high altitude combined with rich mountain soils and bright but cool climate make fruit of high color and a fine quality. Standard northern varieties are grown as well as many of southern origin. On many mountain slopes, owing to favorable air-drainage, thermal belts or zones are found where orchards have a high immunity to injury by cold. For this reason the commercial orchards are located mostly on the high sloping sides of the mountains. Commercial orchards vary in size from a few hundred up to as high as 50,000 trees. (See Volume I, page 322.)

The peach orchards of North Carolina are situated mostly in the sand-hill section, but there is a general exodus of peach-growing to the higher lands of the foothills and mountain spurs where thermal conditions give a greater exemption from frost. North Carolina peaches are of high color and excellent quality. They go to market about ten days later than the Georgia crop and nearly two weeks earlier than the northern peaches.

The grape in North Carolina is represented by two different types,—the muscadines, which are native of the coastal region, and the labruscas or "bunch grapes," which are grown mostly in the Piedmont and mountains. The Scuppernong, a white variety of the muscadine or rotundifolia type, is found as a domestic fruit on almost every plantation in eastern Carolina. Like the fig, it has proved to be almost an ideal home fruit for the South. It will stand almost any kind of neglect and almost unfailingly produces an abundant crop of very excellent fruit.

Some very large vineyards of Scuppernong grapes have been developed for wine purposes, but in the face of an increasing temperance sentiment the industry is not enlarging. At the horticultural branch experiment station, at Willard, an extensive experiment with muscadine grapes is being conducted by the State Department of Agriculture and Experiment Station in coöperation with the Division of Pomology of the National Department of Agriculture. The most promising varieties of the rotundifolia species from Virginia to Texas have been collected and are being tested. Breeding work is under way to develop varieties of this species that will be valuable for dessert and market purposes. When given careful tillage and an especially thorough spraying, the "bunch grapes" produce very fine fruit.

The "paper-shell" pecan is rapidly coming into prominence in eastern North Carolina as an orchard crop. Orchards of budded pecan trees of standard varieties are being planted every year and the earlier plantings are coming into bearing. Seedling groves are being top-worked to named varieties. In the Piedmont section, plantings are being made of English walnuts.

Public-service agencies for horticulture.

The Land-Grant college of North Carolina commonly known as the "College of Agriculture and Mechanic Arts," is located at West Raleigh. The institution was established in 1889. The teaching work in horticulture is carried on by one professor and one instructor.

The North Carolina Agricultural Experiment Station was established originally as a division of the State Department of Agriculture, in 1877. In 1887 the Station became a department of the College and was conducted jointly by the College and the Department of Agriculture from 1887 to 1907 with the exception of three years. The branch experiment stations, or test farms, are located so as to represent the major soil types, the climatic conditions and the principal agricultural and horticultural industries of the state. The Pender station is located at Willard, 33 miles north of Wilmington. It represents the great trucking industry of the state. The Edgecombe station, situated near Rocky Mount, is located to represent the northeastern coastal section and the soils of that region. The experiments are principally with corn, cotton and peanuts. The Iredell station, located at Statesville, represents the Cecil clay soil type and the crops of the Piedmont region. The Swannanoa station is located in the mountains near Asheville at an altitude of 2,200 feet. It represents the principal soil types and crops of the mountain region. The Transylvania station is located so as to represent the best conditions for commercial apple-culture. It has a wide range in altitude and soil conditions. The Granville station, located at Oxford in the old bright tobacco belt, has been equipped for experimental work in the culture and curing of tobacco. The Black Land station is located at Wenona and represents the muck soils of the swamp areas, of which there are between 2,500,000 and 3,000,000 acres in the state. There are five members of the horticultural staff of the Experiment Station. Forty-four bulletins on horticultural subjects have been issued.

There are no special schools in the state devoted to horticulture, but horticulture is taught in connection with agriculture at the new agricultural high-schools. Horticulture is not taught in the public schools, except occasionally in the form of nature-study or school-gardens.

North Carolina has a well-equipped State Department of Agriculture, divided into twelve divisions. The Department issues a monthly series of bulletins of which thirty-three have been on horticultural subjects.

The work done by the State Horticulturist in addition to that in connection with the Experiment Station and test farms is largely in the nature of extension or development work. A coöperative investigation was begun in 1912 with the National Weather Bureau to study the phenomena known as "thermal belts" or "frostless zones," found so commonly in the mountains of North Carolina. Observing stations have been located at different altitudes and on varying slopes and exposures at seventeen places in the mountains.

The newly organized Division of Markets is forming coöperative associations for the better distribution and marketing of fruits, vegetables and other products.

The inspection of nurseries for San José scale and other injurious pests is under the control of the Entomologist of the State Department of Agriculture.

Statistics (*Thirteenth Census*).

The land area of North Carolina in 1910 was approximately 31,193,600 acres. The land in farms was 71.9 per cent of the land area, or 22,439,129 acres. Of this land in farms, the improved land numbered 8,813,056 acres; the woodland 12,451,739 acres; and other unimproved land 1,174,334 acres. The total number of farms in the state in 1910 was 253,725, and the average acreage to the farm 88.4. [The total area is 52,426 square miles.]

The most important of the agricultural crops grown in North Carolina are cereals and cotton. The acreage of cereals decreased from 3,794,064 in 1899 to 3,250,870 in 1909, when the production was valued at $37,848,797, which was 26.5 per cent of the total value of all crops. Cotton, including cotton-seed, increased in acreage from 1,007,020 in 1899 to 1,274,404 in 1909, when the value of the production was $50,483,345. In the same year the production of tobacco from 221,890 acres was valued at $13,847,559. The value of the forest products of the farms in 1909 was $11,364,134, as compared with $4,915,991 in 1899.

Horticultural crops grown in North Carolina are fruits and nuts, small-fruits, potatoes, sweet potatoes and other vegetables, and flower and plants and nursery products. The value of the fruits and nuts produced in 1909 was $3,635,425, as compared with $1,470,735 in 1899. There was a decrease in the acreage of small-fruits from 6,837 in 1899 to 6,701 in 1909, when the production was 12,827,427 quarts, valued at $853,076. The acreage of potatoes and other vegetables increased from 156,947 in 1899 to 212,710 in 1909, when the production was valued at $12,585,018. Excluding potatoes, the acreage of other vegetables increased from 64,598 in 1899 to 95,980 in 1909, when the production was valued at $6,496,308. The acreage of flowers and plants and nursery products decreased from 1,210 in 1899 to 861 in 1909, when the production was valued at $393,963.

The total production of orchard-fruits in 1909 was 6,324,301 bushels, valued at $3,248,036. Apples produced about three-fourths of this quantity and peaches most of the remainder. The apple trees of bearing age in 1910 numbered 4,910,171; those not of bearing age, 1,835,337, and the production in 1909 was 4,775,693 bushels, valued at $2,014,670. Peach trees of bearing age in 1910 numbered 2,661,791; those not of bearing age 861,042, and the production in 1909 was 1,344,410 bushels, valued at $1,041,767. Other orchard-fruits produced in 1909 were: 84,019 bushels of pears, valued at $81,347; 61,406 bushels of plums and prunes, valued at $45,274; 53,788 bushels of cherries, valued at $60,453; 3,435 bushels of mulberries, valued at $3,065; 1,125 bushels of quinces, valued at $1,017; and 425 bushels of apricots, valued at $443.

The production of grapes in 1909 was 15,116,920 pounds, valued at $336,083. The grape-vines of bearing age in 1910 numbered 411,278; those not of bearing age, 120,208.

The production of nuts in 1909 was of comparatively little importance, there being only 1,244,629 pounds produced, valued at $28,535. While the black walnut is the most important nut, there being 1,081,480 pounds of them produced in 1909, valued at $16,138, as compared with 74,861 pounds of pecans, valued at $8,194; it is interesting to note that the pecan trees of bearing age in 1910 numbered 6,876 while those not of bearing age numbered 20,781. In 1909 there were also produced in North Carolina 73,303 pounds of Persian or English walnuts, valued at $3,686.

Tropical fruits are of little importance in North Carolina, the total value of those produced in 1909 being $22,771, of which $22,632 were contributed by 660,624 pounds of figs.

Strawberries are by far the most important of the small-fruits, with blackberries and dewberries ranking next. The acreage devoted to strawberries decreased from 5,616 in 1899 to 5,420 in 1909, when the production was 10,313,361 quarts, valued at $712,126. The acreage of blackberries and dewberries increased from 1,073 in 1899 to 1,233 in 1909, when the production was 2,464,065 quarts, valued at $136,609. Other small-fruits produced in 1909 were: 37,764 quarts of raspberries and loganberries, valued at $3,388; 5,831 quarts of gooseberries, valued at $536; 5,382 quarts of currants, valued at $400; and a small amount of cranberries.

The acreage devoted to the growth of the sweet potato increased from 68,730 in 1899 to 84,740 in 1909, when the production was 8,493,283 bushels, valued at $4,333,297. Potatoes increased in acreage from 23,619 in 1899 to 31,990 in 1900, when the production was 2,372,260 bushels, valued at $1,755,413. Peanuts formed a considerable industry in 1909, the acreage having increased from 95,856 in 1899 to 195,134 in 1909 when the production was 5,980,919 bushels, valued at $5,368,826. The production of the more important of the other vegetables was: 5,825 acres of watermelons, valued at $179,238; 2,256 acres of cantaloupes and muskmelons, valued at $163,902; 1,371 acres of cabbage, valued at $132,715; 2,387 acres of green beans, valued at $61,100; 835 acres of green peas, valued at $31,032; and 359 acres of tomatoes, valued at $22,562. Other vegetables produced were asparagus, beets, sweet corn, cucumbers, lettuce, onions, green peppers, and turnips.

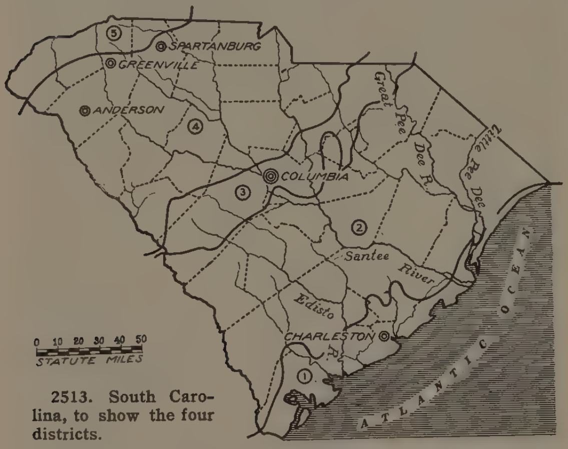
The acreage devoted to the production of flowers and plants, increased from 61 in 1899 to 107 in 1909. The total area under glass in 1909 was 193,139 square feet, of which 176,853 were covered by greenhouses, and 16,286 by sashes and frames. The value of the flowers and plants produced in 1909 was $126,995. The acreage devoted to nursery products, however, decreased from 1,149 in 1899 to 754 in 1909, when the value of the nursery products was $266,968. W. N. Hutt.

South Carolina.

South Carolina (Fig. 2513) ranks thirty-eighth in land area among the states and territories of continental United States. Rising from the sea-level to an altitude of 3,436 feet in the northwestern part of the state, and combining as it does different types of soil and conditions of climate, it possesses wonderful horticultural possibilities. The horticultural interests receiving greatest attention are trucking and fruit-growing, although the plant trade business and the production of cut-flowers is now coming into prominence. With its splendid water-power, numerous manufacturing centers have sprung up, and such communities offer good local markets for horticultural products.

Horticulturally, the state is divided into five regions, namely: the Coastal, Pine, Sand Hill, Piedmont and Mountain regions. The Coastal region, embracing in addition to the narrow strip along the coast a number of islands, has a remarkably mild climate which permits the growing of subtropical fruits, such as the fig and the more hardy citrous fruits. The fig, particularly, grows to perfection in this locality, and its production for preserving purposes is on the increase. Pecans and strawberries are also grown extensively here. The fine sandy loam soil, with the water-table only a few feet below the surface, furnishes ideal conditions for both these crops. There are individual growers that have hundreds of acres planted to pecans and about 1,000,000 quarts of strawberries are shipped annually from this region to northern markets. This region is especially adapted to commercial vegetable-growing. The products come in just after the Florida crops are off, which eliminates competition and gives the growers an open market. The principal vegetables grown are asparagus, beans, cabbage, cucumbers, lettuce, green peas and potatoes. The islands along the coast are famous for the production of cabbage plants. Four million or more packages of cabbage plants are shipped out from here annually to all parts of the United States.

The Pine Belt is primarily a farming section with large plantings of cotton, corn, oats and other general farm crops. The region is mostly flat with an average slope of 3½ feet to the mile in the southeastern part, where there are numerous fresh-water swamps, and a slope of about 5 feet to the mile in the northwestern part. It extends across the state parallel to the Coastal region, having a varying width from 50 to 80 miles. Although general farming interests are of chief importance in this region, there are a few horticultural crops that are proving remunerative. A considerable area is devoted to the growing of cantaloupes and watermelons, which are shipped to the northern markets. In some counties, asparagus is also grown as a commercial product. Rotundifolia grapes, Japanese persimmons and figs grow luxuriantly in this region, but they have received little attention in a commercial way.



2513. South Carolina, to show the four districts.

The Sand Hill region comprises an area of about 30 to 40 miles in width, stretching through the central part of the state from the Savannah River to the North Carolina line. Being for the most part a chain of hills with deep sandy soil, this region is remarkably well adapted to the growing of peaches, Labrusca grapes and dewberries. All of these fruits attain high quality and color here and ripen early. The Mayflower variety of peaches is ready for market by the last of May. The Delaware is the most largely grown of all the varieties of grapes because of its good shipping quality and splendid flavor, but the Brighton, Niagara, and Concord varieties are grown considerably for the local markets. Dewberries, ripening the earliest of all the berries, bring good prices on the local as well as more distant markets. The largest peach-growers of the state are in this region, individual growers in some cases having as many as 20,000 to 30,000 trees. A great many young orchards, varying in size from 100 to 5,000 trees, have recently been set. There are no commercial plum orchards in this region, although varieties of the Japanese and Wild Goose types of plums do well. This region is also well adapted to the growing of early vegetables, and market-gardening is being carried on rather extensively in areas adjacent to the larger towns.

The Piedmont region includes all of the northwestern portion of the state except parts of the counties of Oconee, Pickens, Greenville and Spartanburg, which lie in the extremely northwestern corner of the state and make up the mountain region. The elevation of the Piedmont region varies from 400 feet in the southeastern portion to 900 feet in the northwestern portion. There is magnificent water-power in the many streams which have been utilized in manufacturing interests, creating a large mill population and making a good field for the market-gardener. Probably the leading fruit of commercial importance in this section is the peach, which does well on the elevated areas. All the summer varieties of apples do well here and a few of the winter varieties, as the Winesap, Delicious, Yates, and Ben Davis, but there are few commercial plantings of importance. The canning industry has reached considerable proportions in this section, both fruit and vegetables being used in canning. The principal fruits that are canned are peaches, apples and blackberries, while the chief vegetables used are tomatoes, snap beans and corn.

The Mountain region occupies the northwestern corner of the state, including the greater part of Oconee, Pickens, Greenville and a small part of Spartanburg counties. The soil on the mountainsides is in most cases very fertile and the elevation is from 1,000 to nearly 3,500 feet, which makes this region particularly well adapted to the growing of those fruits that require a high altitude. Apples do especially well here, and almost all the leading commercial varieties are grown. They produce heavy crops, and in color, flavor, and keeping quality are not surpassed by the apples of any section in the eastern part of the United States. It has long been known that in this part of South Carolina excellent winter apples could be grown, but it is only during the past fifteen years that commercial apple-growing has come into prominence. There are now a large number of orchards containing from a few hundred to thousands of bearing trees. The varieties most largely planted are Stayman Winesap, Red Winesap, Rome Beauty, Virginia Beauty, Delicious, and Kinnard. The box is gradually replacing the barrel as a shipping package. A few years ago almost the entire bulk of the apple crop that was not sold on the local markets was marketed in barrels, but the growers being quick to observe the advantages of the small package have discarded the barrel and adopted the Standard apple-box. There are several box-making plants in the vicinity of the larger growers that have an output of more than a thousand boxes a day. In a few instances the growers own and operate their own box-making plants. The large amount of timber land in this region, with the splendid water-power, makes it possible to operate such plants at comparatively small cost. Aside from the commercial orchards now in bearing, there are a number of young orchards from one to five years old, and it will be only a short time before the face of these hitherto wooded hills will be covered by wealth-producing orchards. Other fruits that thrive in this region, but fail to do well in other sections of the state, are the sweet cherry, red raspberry, currant, and gooseberry. There are at present no commercial plants of importance of these fruits, although the home gardens produce them in abundance. Cabbages, onions, and potatoes are grown extensively in this region for the fall and winter trade. They are sold locally and to some extent shipped to the southern cities. The tomato is also grown extensively in some sections of the Mountain region for canning purposes. In a few instances large areas have been devoted to this crop for marketing in the Gulf States during the early fall. All vegetables and small-fruits may be grown successfully in this region.

It may be seen, therefore, that the horticultural products are extremely varied. From the seashore to the mountains, there are sections peculiarly adapted to particular horticultural interests; yet, taking the state as a whole, with the exception of the few subtropical fruits that do well in the Coastal region, all the principal fruits of the temperate zone may, if given proper care, be grown in every part of the state.

For instance, in the home orchards throughout the state may be found almost every manner of fruit. Also are found numerous fruits, such as the blackberry, dewberry, huckleberry, chickasaw and wild goose plums and the sour cherry growing luxuriantly in the wild state.

Among the former prominent horticulturists in South Carolina may be mentioned Meggot, a Huguenot, who is recorded as having obtained a grant of money from the legislature of South Carolina about the year 1800 for the development of the grape industry; Nicholas Herbemont, of Columbia, the originator of the Herbemont grape; J. F. C. DuPre, the first Professor of Horticulture of Clemson Agricultural College and the first Horticulturist of the South Carolina Experiment Station; James Stanley Newman, the first Professor of Agriculture of Clemson Agricultural College and also at one time prominent in horticultural affairs in Georgia and Alabama (see Volume III, page 1589).

Public-service agencies for horticulture.

In South Carolina the principal source of agricultural information is the Clemson Agricultural College, at Clemson College. This is the state's agricultural and mechanical institution. It was incorporated in 1889, but did not open until 1893. There are five on the horticultural staff at this time.

The South Carolina Experiment Station is a department of Clemson College. It is located at the college and there are two substations, one at Summerville, in the Coastal region, and one at Florence, in the Pee Dee region. The establishment of another substation in the Sand Hill region is contemplated. The station workers in horticulture are three in number. Fourteen bulletins on subjects related to horticulture have been published.

Some elementary instruction in horticulture is given at the Winthrop Normal and Industrial College (female), Rock Hill, and at the Colored Normal and Industrial Agricultural and Mechanical College, at Orangeburg. Among the public schools of the state there are about a hundred which are teaching agriculture under the direction of the extension division of Clemson College. In these schools horticultural instruction is given, and a considerable number of them have 1-acre orchard demonstration plots. The teaching of agriculture in the public schools of the state is spreading rapidly.

The extension division of Clemson College has two horticulturists working over the state throughout the year. The work has concerned itself largely with building up commercial orcharding in the state. The peach and the bunch grape are the fruits most generally grown on a commercial scale. Attention has been given to the question of marketing the fruit. Much has been done to encourage home orchards and in most of the counties there have been established model 1-acre demonstration orchards. There have been campaigns for the establishment of home gardens, especially fall and winter gardens. Canneries have been encouraged and the state is well up in the canning club work for girls. The extension division at Clemson College also employs an agent in marketing, who devotes part of his time to bettering market conditions for horticultural products.

A rigid inspection service is maintained by the State Crop Pest Commission, whose executive officers are the plant pathologist and entomologist of Clemson College. They inspect nursery stock and importations of nursery stock, and in other ways prevent the spread of noxious insects and diseases.

Statistics (*Thirteenth Census*).

The approximate land area of South Carolina was reported in 1910 as 19,516,800 acres. The land in farms as 69.2 per cent of the land area, or 13,512,028 acres. Of this land in farms, the improved land numbered 6,097,999 acres; the woodland, 6,339,142 acres; and the other unimproved land in farms, 1,074,887 acres. The number of all the farms of the state in 1910 was 176,434, and the average acreage to the farm was 76.6. [The total area is 30,989 square miles.]

The leading agricultural crops of the state are cotton, including cotton seed, and cereals. The acreage devoted to the production of cotton increased from 2,074,081 in 1899 to 2,556,467 in 1909, when the production was valued at $96,381,067, which was 67.9 per cent of the total value of all crops. The cereals decreased in acreage from 2,251,050 in 1899 to 1,955,695 in 1909, when the production was valued at $25,434,539. Hay and forage increased in acreage from 106,124 in 1899 to 209,767 in 1909, when the production was valued at $3,189,122. Tobacco increased in acreage from 25,993 in 1899 to 30,082 in 1909, when the production was valued at $2,123,576. The value of the forest products of the farms in 1909 was $4,153,092, as compared with $1,915,280 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was $1,121,662, as compared with $360,515 in 1899. Small-fruits increased in acreage from 591 in 1899 to 856 in 1909, when the production was 1,408,099 quarts, valued at $113,254. In 1909 the total acreage of potatoes and other vegetables was 109,482 and their value $6,922,021. Excluding potatoes, the acreage of the other vegetables increased from 40,771 in 1899 to 51,994 in 1909, when the production was valued at $3,705,991. Flowers and plants and nursery products decreased in acreage from 112 in 1899 to 44 in 1909, when the production was valued at $56,503.

The total production of orchard-fruits in 1909 was 1,132,668 bushels, valued at $956,376. Peaches and nectarines contributed more than half this quantity, and apples most of the remainder. The production of peaches and nectarines was 643,040 bushels, valued at $557,303. The number of trees of bearing age in 1910 was 1,336,142 and those not of bearing age, 349,790. Apple trees of bearing age in 1910 numbered 581,767; those not of bearing age, 269,044. The production in 1909 was 362,800 bushels, valued at $276,410. The production of the other orchard-fruits was as follows: 65,680 bushels of pears, valued at $67,685; 48,754 bushels of plums and prunes, valued at $37,555; 10,987 bushels of cherries, valued at $15,880; 504 bushels of apricots, valued at $620; 534 bushels of quinces, valued at $587; and 369 bushels of mulberries, valued at $336.

The production of grapes in 1909 was 2,016,506 pounds, valued at $88,620. Grape-vines of bearing age in 1910 numbered 79,708; those not of bearing age, 19,704.

Nuts were produced in 1909 to the amount of 376,013 pounds, valued at $26,888. The production of the various nuts was 159,823 pounds of pecans, valued at $20,442; 185,252 pounds of black walnuts, valued at $3,672; and 28,160 pounds of Persian or English walnuts, valued at $2,583. Of the tropical fruits, 975,136 pounds of figs were produced, valued at $49,169.

Of the small-fruits, the strawberries are the most important of those grown in South Carolina. Strawberries increased in acreage from 499 in 1899 to 815 in 1909, when the production was 1,337,208 quarts, valued at $108,938. Blackberries and dewberries decreased in acreage from 39 in 1899 to 38 in 1909, when the production was 64,754 quarts, valued at $3,710. Other small-fruits produced were 4,955 quarts of raspberries and loganberries, valued at $477; 999 quarts of currants valued at $102; and 183 quarts of gooseberries, valued at $27.

Concerning the potatoes and other vegetables in

South Carolina, the sweet potato increased in acreage from 48,831 in 1899 to 48,878 in 1909, when the production was 4,319,926 bushels, valued at $2,606,606. Potatoes increased from 8,068 in 1899 to 8,610 in 1909, when the production was 782,430 bushels, valued at $609,424. Of the other vegetables the more important were: 1,828 acres of cabbage, valued at $270,675; 5,051 acres of watermelon, valued at $146,418; 1,773 acres of asparagus, valued at $138,317; 962 acres of cucumbers, valued at $115,247; 1,732 acres of beans, valued at $109,865; 977 acres of cantaloupes and muskmelons, valued at $58,490; 49 acres of lettuce, valued at $26,499; and 146 acres of tomatoes, valued at $12,633. Vegetables of lesser importance were beets, carrots, sweet corn, onions, green peppers, radishes, and squash.

The acreage devoted to the production of flowers and plants in South Carolina decreased from 28 in 1899 to 23 in 1909. The total area under glass in 1909 was 74,318 square feet, of which 66,242 were covered by greenhouses and 8,076 by sashes and frames. The value of the flowers and plants produced in 1909 was $52,094, as compared with $7,920 in 1899.

The acreage devoted to nursery products decreased from 84 in 1899 to 21 in 1909, when the value of the nursery products was $4,409, as compared with $4,416, their value in 1899.

C. C. Newman.

Georgia.

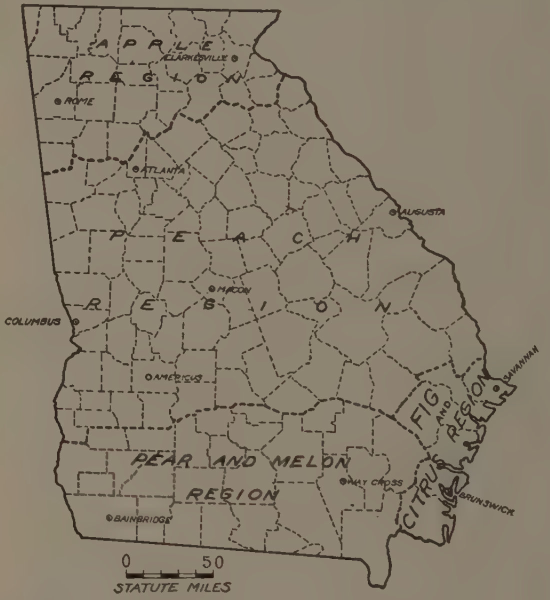
Georgia (Fig. 2514), one of the original thirteen colonies, is located in the southeastern part of the United States just north of Florida. It is the largest state east of the Mississippi. It extends from 30° 31′ 39″ N. on the south to 35° on the north, and its greatest breadth is found between 81° W. on the east and 85° 53′ 38″ on the west. From Savannah to Brunswick the boundary is the Atlantic Ocean, and from the coastal islands to some 30 or 40 miles inland the territory is practically at sea-level, the soil being alluvial and sandy; the climate here is subtropical, and such plants as the palmettos, figs, olives, and citrus flourish.

From the coast section along the Florida border, west to the Alabama line and as far north as Columbus, Macon and Augusta, through which cities the fall line passes, is found the great Atlantic Coastal plain. This section of the state is known as South Georgia; it has an elevation from the sea-level to 500 feet, the average being around 250 feet. The soil is mostly sandy, underlaid with clay, with an occasional outcropping of the underlying clay. This is a great cotton, melon and peach section. North of the fall line to Cartersville and Gainesville is found the Piedmont plateau. The country is very hilly and broken, the elevation being from 500 to 1,000 feet. The soil is mostly red clay, producing cotton, peaches and grapes. From Cartersville east and to the northern border of the state is located the mountain section. This region is rugged and broken, starting with an elevation of 1,000 feet on its southern border and reaching 5,000 feet in the north-central part. Here the apple attains perfection, and peaches do extremely well. The native forests contain such trees as the hemlock, white pine, and tulip tree. From Cartersville north and west is found the Appalachian Valley region. This is comparatively small in extent, is hilly and rugged, the elevation being from 500 to 1,200 feet. In all other parts of the state the geological features are comparatively simple, but here they are mixed and intricate. The apple and peach succeed well in this section. The extreme northwestern corner of the state dips into the Cumberland plateau, which section, however, is so small as to be practically negligible in a study of Georgia.

From the rice- and palmetto-covered islands of the coast, through the vast cotton fields, peach orchards and long-leaf pine forests, to the rhododendrons and white pines that cover the mountains in the northern parts, one passes through eight of the nine climatic belts represented in the United States. The mean temperature of the mountains runs from 40° to 60°; that of the Piedmont plateau from 60° to 65°; and that of the Coastal plain from 60° to 70°. Zero temperatures have been reported from nearly all parts of the state, but from the southern parts such reports are exceedingly rare. The maximum summer temperatures will run from 95° to 102°, the latter, however, being the great exception. The rainfall reaches a maximum of 71.7 in the northeastern corner of the mountain section and a minimum of 39.4 inches in Swainsboro, a little southeast of the center of the state: the average is 49.3 inches. This variety of climates, coupled with a great diversity of soils, proves the horticultural possibilities of Georgia to be little less than marvelous.

The Horticultural Society has divided the state into four sections, following to some extent the geological divisions:

1. The Mountain region takes in all the mountain section, the Appalachian Valley, the Cumberland Plateau, and a small strip of the Piedmont Plateau. This region is particularly adapted to the apple and late peach; quinces, cherries, currants, gooseberries, and other fruits of like climatic requirements also do well here, though they are not as yet of commercial importance. Cauliflower, celery and many other vegetables can be raised in this section, and a trade is growing up in late tomatoes and beans. The leading horticultural interests of the mountains at the present time are apples and peaches.



2514. Georgia, with the fruit and melon districts.

2. The Middle region, the largest division of the state, takes in most of the Piedmont Plateau and the northern half of the Coastal Plain. It is in the south-central section of this division that the mammoth peach orchards of the state are located. The Japanese plum, as well as other types, used to be extensively grown in this section, but the trees proved to be so susceptible to "plum wilt" and various other diseases and insects that the industry has fallen to a low ebb. Grapes of the Labrusca and rotundifolia types do exceptionally well in central Georgia; apples do fairly well in the northern part of this division, and melons prosper in the southern part. Figs, pecans, and most vegetables,

especially the sweet potato, thrive throughout this whole section; there is, however, little trucking, except for local markets.

3. The Southern region takes in the lower half of the Coastal Plain, and extends across the whole state from the Okeefeenokee Swamp, west. This region is especially noted for its melons, pecans, and Kieffer pears. Some trucking for early market is done and the industry is growing. Figs grow exceptionally well in this section, and there are numerous citrous trees in the southern tier of counties that have produced fruits for some years past without protection.

4. The Coast region takes in the tier of counties along the coast, and extends from South Carolina to Florida; it is the smallest section of the state. Figs are here found at their best, and various citrous fruits grow well on the islands; at one time the indigo and olive were cultivated on these same islands, but now their culture has been abandoned. Trucking is followed in this region for the northern market, strawberries, onions, cabbage, potatoes, tomatoes, and peas being the main crops.

Georgia is the mother state of the Elberta peach, the Belle, Waddell, and several others of commercial importance. Fifty-five apples have originated within its borders, the most prominent of which are the Yates, Terry, Shockley and Nick-a-jack. The LeConte is its addition to the list of pears; it has added the Georgia Giant, the Atlanta, the Senator and others to the pecans, and its best-known melon is the Georgia Rattlesnake.

At the present time the greatest horticultural industry in the state is the peach business, and second to that come the melons. The apple industry is rapidly coming to the fore, and in several sections specialized trucking interests are growing up. Georgia is well infested with diseases and insects, and consequently, the growers find that constant spraying is essential to success. For several years orchards have been sadly neglected, mainly because they were larger than could be well taken care of, but that time is now past, and improved methods are rapidly taking their proper places.

There has been a slight decrease in the number of peach trees during the last decade; those removed, however, were old or neglected trees, which materially reduced the yield to a tree. The peach crop of 1908 was the largest in the history of the state, being about 7,000 carloads. In 1909 the crop was 904 carloads, and in 1910 the state shipped 6,289 carloads. The apple industry is rapidly increasing, thousands of trees being planted every year. The pecan interests are also enlarging; although the Census shows only 75,519 bearing trees, there are, young and old, 400,000 or more now growing in the state.

Small-fruits are not of so much importance, strawberries being the most widely grown.

The trucking interests are on the increase, proportionally as the pine forests of the southern part of the state are cleared up and settlers take charge of the warm sandy lands.

One of the promising new vegetable industries is the raising of asparagus, which is being carried on around Fort Valley and Marshallville. The raising of early truck in the southern parts of the state is now a well-established business, and a late truck industry is growing up in the mountain sections of the north. This latter interest is going hand in hand with the apple business.

The nursery interests of the state are fairly large, but only some three or four concerns have attained any great prominence.

Probably the two best-known horticultural products are the Georgia peach and the Georgia watermelon. The introduction of the refrigerator car made the conversion of cotton fields into peach orchards a possibility. Cheap lands and cheap labor combined with a favorable climate helped in the planting of the enormous orchards that the state is noted for. The industry has now undergone the extensive stage and is rapidly becoming intensive. The melon business seemed to be natural to the soil and climate; it has attained vast proportions and is becoming more remunerative through the use of better methods.

Pecan-growing is now one of the most important new industries of the state; there are several instances on record where bearing orchards have been sold for as much as $1,000 an acre. The apple orchards in the northern part of the state are vying with the pecans in public interest; lands in the mountains that could be purchased for $1 to $5 an acre twenty years ago are now being sold for $25 to $100 an acre for apple purposes. Numerous large orchards have been planted, but most of the plantings are small and are being brought into bearing along the most improved lines.

Horticultural collections and parks are scarce, those worthy of note being the Nurseries and Evergreen Collection of the Fruitland Nursery Company, near Augusta. The Ferrell Gardens, at LaGrange, are of particular interest, as they are the only remaining specimen of the old colonial landscape architecture. The Payne and Wade estates, near Thomasville, are magnificent examples of present-day landscape gardening, the former being noted for its collection of azaleas.

Georgia has been fortunate in having a great many individuals who have bent their efforts toward advancing horticulture long before this matter was taken up and given serious consideration by the authorities and the powers of the state. Some of these men are: Jarvis Van Buren, a native of Clarksville, who was especially interested in the dissemination of the apple in that section; James Camak, a native of Athens, who, with Van Buren, revised and published the second edition of "Gardening for the South," which was written by Wm. N. White, a sketch of whose life may be found in Volume III, p. 1602. P. J. Berckmans probably stands out as one of the greatest advancers of southern horticulture. He was a man of international reputation. A fuller discussion of his life may be found in Volume III, p. 1565. Jas. B. Hunnicutt, the author of "Agriculture for the Common Schools," and for a long time editor of the "Southern Cultivator," is also a man whose life work was mainly given for the advancement of Georgia's agriculture, but his paper always carried a horticultural section in which he was particularly interested.

Public-service agencies for horticulture.

The Land-Grant College of Georgia was opened in 1872 as a subdivision of the University of Georgia in Athens. In 1906 the Conner bill was passed by the Legislature of Georgia reorganizing this institution. The reorganization took place in 1907. At the time of the reorganization the department of horticulture in the old College of Agriculture had one instructor in charge with very meager equipment. At the present time the department consists of three faculty members. The department of horticulture is also represented in the graduate school of the University of Georgia.

The Georgia Experiment Station was originally located in Athens in 1888; in 1889 it was removed from under the Board of the University of Georgia and placed under a special Board appointed by the Governor and located at Experiment, two miles from the city of Griffin. At present the Station has one horticulturist, and there are twenty acres devoted to orchard and truck plats, there being approximately 325 varieties of fruits and the like represented. The strictly horticultural publications of the Station are thirty-two to the present date.

In the educational system of Georgia there are Congressional District Agricultural Schools. At the present time eleven districts have these institutions in operation. They are really secondary agricultural schools and horticulture is taught. The North Georgia Agricultural College, subdivision of the University of Georgia, located at Dahlonega, also offers instruction in horticulture. The general agriculture required in the grammar schools has some horticultural instruction, but this is mostly elementary and curtailed in its extent. There are no private schools offering courses along this line within the state and none offering work for a degree except the Georgia State College of Agriculture, of the University.

The extension work in horticulture is carried on directly through the department of horticulture of the Georgia State College of Agriculture. The special extension work along horticultural lines at the present time consists in the running of coöperative experiments in various sections of the state on the different horticultural crops; the organization of small truck and fruit coöperative associations; the assisting of the various demonstration agents, many of whom are located in sections directly interested in horticulture. The department is also making efforts to facilitate and help in the landscaping of the school buildings of the small towns and rural districts. The time of one man is devoted absolutely to the extension work and when necessary other members of the department assist in the extension movement.

There is no state board of horticulture in Georgia. In 1897 an act was passed by the Legislature establishing the State Board of Horticulture and Pomology, but in 1898 this act was amended, changing this Board into the State Board of Entomology. This Board instituted a State Department of Entomology and appointed a State Entomologist.

The regulations of the State Board of Entomology require that nurseries be inspected annually for the various diseases and pests that are on their prescribed list. It also requires that every plant of any kind that is shipped into or from the state of Georgia must have an inspection tag of the Board of Entomology attached thereto.

In 1876 P. J. Berckmans founded the Georgia State Horticultural Society, at Macon. This organization has persisted until the present time.

Statistics (*Thirteenth Census*).

The approximate land area of Georgia, according to the census of 1910, is 37,584,000 acres, of which 71.7 per cent, or 26,953,413 acres are in farms. Of this farm land, 45.6 per cent, or 12,298,017 acres are improved; 13,002,741 acres are in woodland; and 1,652,655 acres are classified as other unimproved land in farms. The number of all the farms in 1910 was 291,027. The average acreage to the farm was 92.6. [The total area is 59,265 square miles.]

The leading agricultural crops are cotton, cereals, forest products of farms, sugar crops and hay and forage. In 1909 the value of the cotton crop, including cotton seed, was $149,937,058, or 66.2 per cent of the total value of all the crops. The cotton crop in 1909 occupied 39.7 per cent of the improved land area, or 4,883,304 acres, as compared with 3,513,839 acres in 1899. The cereals occupied 3,906,703 acres in 1909 or 31.8 per cent of the improved land area, and the production of cereals was valued at $42,405,019, which was 18.7 per cent of the total value of all crops. The value of the forest products of the farms was $8,938,390 in 1909 as compared with $3,217,119, their value in 1899. The acreage of sugar crops in 1909 was 52,707; in 1899 it was 37,609 and the value of the sugar crops in 1909 was $2,689,056, as compared with $1,731,296, their value in 1899. Hay and forage increased in acreage from 137,312 in 1899 to 253,157 in 1909, an increase of 84.4 per cent. The value of the hay and forage produced in 1909 was $4,056,907, thus making hay and forage above the sugar crops in point of value.

Horticultural crops grown in Georgia are fruits and nuts, vegetables, including potatoes and sweet potatoes and yams, peanuts, small-fruits, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was $3,143,114, as compared with $673,189, their value in 1899, showing an increase of 366.9 per cent in value. In 1909 the total acreage of vegetables was 187,328 and their value $10,614,601. The production of peanuts was 2,569,787 bushels, from a reported acreage of 160,317, and their value was $2,440,926. Small-fruits decreased in acreage from 1,634 in 1899 to 988 in 1909, and the value of their products in 1909 was $111,754. The growing of flowers and plants and nursery products is of some importance in Georgia. The acreage increased from 1,034 in 1899 to 1,646 in 1909, an increase of 59.2 per cent. The value of the flower and plant and nursery products in 1909 was $637,860.

The production of orchard-fruits in 1909 was 256.8 per cent greater than in 1899, the total quantity produced in 1909 being 3,670,830 bushels, valued at $2,930,793. Peaches and nectarines contributed about two-thirds of this quantity and apples and pears most of the remainder. The production of peaches and nectarines in 1909 was 2,555,499 bushels, as compared with 259,728 bushels, the production in 1899, and their value in 1909 was $2,182,613. The production of apples in 1909 was 895,613 bushels, valued at $555,744; that of pears 149,667 bushels, valued at $134,604. The production and value of the other orchard-fruits in 1909 follow: plums and prunes, 60,845 bushels, valued at $46,366; cherries, 4,979 bushels, valued at $7,199; quinces, 2,021 bushels, valued at $2,272; mulberries, 1,766 bushels, valued at $1,449; and 440 bushels of apricots, valued at $546.

In 1910, the number of grape-vines of bearing age in Georgia was 277,658; those not of bearing age 38,233. The production of grapes in 1909 was 2,767,366 pounds, valued at $99,216; the production in 1899 was 8,330,485 pounds.

The value of all nuts produced in 1909 was $61,106. The production was 845,553 pounds. The leading nuts grown, their production and value for 1909 follow: pecans, 354,046 pounds, valued at $47,845; black walnuts, 427,607 pounds, valued at $8,598; and 56,585 pounds of Persian or English walnuts, valued at $4,161. Other nuts growing in Georgia are hickory-nuts, hazel-nuts, Brazil-nuts, Japan-nuts, chestnuts, beech-nuts, almonds and others.

The tropical fruits produced in Georgia in 1909 were valued at $51,999. The most important of these, their production, and value were figs, producing 1,183,494 pounds, valued at $50,326, and pomegranates, producing 27,365 pounds, valued at $920.

Strawberries are by far the most important of the small-fruits raised in Georgia. In 1909 the production, from 890 acres reported, was 1,157,472 quarts, valued at $101,161. The production of blackberries and dewberries was 67,285 quarts, valued at $5,594; that of raspberries and loganberries, 33,928 quarts valued at $4,663. Other small-fruits of minor importance are currants and gooseberries.

Of the vegetables in 1909 the sweet potatoes and yams were by far the most important. The production of sweet potatoes and yams from a reported acreage of 84,038 was 7,426,131 bushels, valued at $4,349,806. The production of potatoes from a reported acreage of 11,877 was 886,430 bushels, valued at $684,427. The area of other important vegetables grown in 1909 and the value of their products follow: watermelons, 16,298 acres, valued at $410,147; cantaloupes and muskmelons, 3,022 acres valued at $209,161; green beans, 1,484 acres, valued at $102,488; tomatoes, 756 acres, valued at $57,270; cabbage, 806 acres, valued at $57,191; and turnips, 445 acres, valued at $29,470. Vegetables of less importance grown were asparagus, beets, sweet corn, cucumbers, lettuce, onions, green peas, green peppers, and squash.

The acreage occupied by the flower and plant industry in Georgia in 1909 was 144 acres and the value of the products $271,427. The area of land under glass was 867,222 square feet, of which 741,672 square feet were covered by greenhouses and 125,550 square feet by sashes and frames.

The area on which nursery products were grown in 1909 was 1,502 acres, an increase of 56.9 per cent since 1899, when the area was 957 acres. The value of the nursery products in 1909 was $366,433, as compared with $172,143, the value of the nursery products in 1899.

T. H. McHatton.

Florida.

The history of horticulture in Florida (Fig. 2515) dates from the earliest settlements, and even prior to that period the aborigines carried on a desultory plant-growing. The peculiarity of the soil, however, prohibited the extension of this work except in a few isolated places. It was necessary to introduce commercial fertilizers before horticulture could make rapid progress in this state. Up to the time of commercial fertilizers, it was thought that the hammocks were the only places capable of raising fruit, the remainder of the arable land being so sandy and wanting in plant-food that remunerative crops could not be grown on it excepting after it had been "cow-penned."

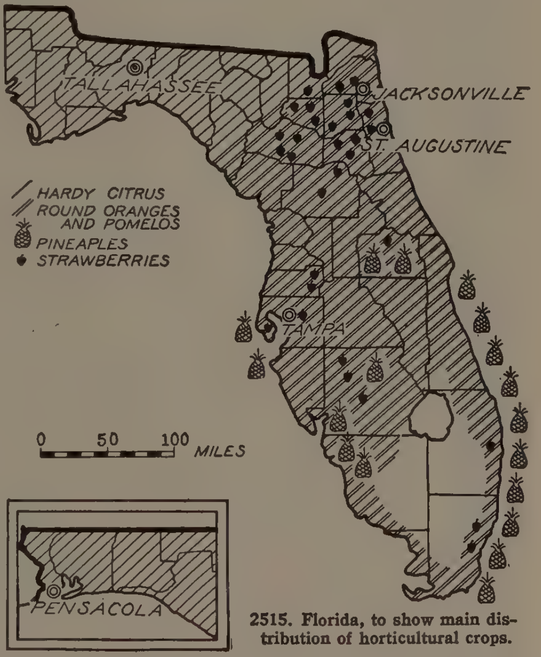
Such a soil, containing often over 90 per cent sand and insoluble matter, at first sight would seem to be absolutely worthless for horticultural purposes, but with the advent of the new horticulture it becomes the ideal soil. It is a lodgment for plants in which occurs no material that will prove deleterious to the crop, and all that is necessary is to add to it the material that will cause the plant to grow to the necessary size and produce fruit of the desired quality. Beautiful thin-skinned oranges grow only on land properly fertilized and not on soil impregnated with great quantities of organic nitrogen, i.e., fertile lands.

In building up the land from the ocean bed, referring especially to peninsular Florida, the wind and waves have sorted the particles to some extent and have elevated various parts more than others. The separation of the larger particles of sand from the finer, with a porous substratum, has produced what is called a "scrub." The railroad surveys indicate that the maximum elevation in peninsular Florida is about 300 feet. Thus it happens that, although this land is thirsty, it is rarely or never spent of its capillary moisture. The areas of scrubs may vary in size from a few acres or even less to many thousands, but they are always sharply defined, having a specialized flora. The soil in a hammock is of a finer texture and is not infrequently underlaid by clay. It often occurs that land of this texture is only a few feet above sea-level, or it may be elevated and rolling, but is always covered with a good growth of hardwood or of cabbage palmetto, or both. This class of land has long been desirable for horticultural purposes, and is still regarded as valuable. These regions are more or less isolated, and vary in extent. Such land usually contains sufficient fertility to raise several crops of vegetables. Flat woods land is usually level, varying in fertility from 96 per cent of sand and insoluble matter to that which will produce a crop of tomatoes. This class of land comprises about seven-tenths of the land of the peninsula. With proper treatment it raises good crops and is capable of remarkable improvement. The characteristic plant of this land is the long-leaved pine.

The foregoing discussion relates to the state independent of latitude and climate. The state is also divided into four regions, according to climate and latitude: (1) western Florida, that part of the state lying west of the Aucilla River; (2) eastern Florida, that part of the state lying between the Aucilla River and a line drawn from the mouth of the St. John's River to Cedar Keys; (3) central Florida, that part of the state lying between eastern Florida and southern Florida; (4) southern Florida, including the counties of Brevard, St. Lucie, Palm Beach, Dade, Monroe, Lee, DeSoto and Manatee.

Citrous fruits develop best on hammock and rolling pine land, preferring the cabbage palmetto hammocks or a hammock containing a mixture of palmetto and hard wood. The lime alone does well on the shell and coquina lands of southern Florida. The rough lemon stock is preferred in southern Florida, especially on the higher sandy lands. For western Florida the Satsuma orange is the best variety. For eastern Florida varieties that mature their fruit before Christmas may be planted. In central Florida all the varieties of Citrus do well, especially toward the south and in protected localities.

Peaches grow in all sections, preferring hammock or rolling pine land or even level pine land if perfectly drained, but the varieties best adapted to different regions vary considerably.



2515. Florida, to show main distribution of horticultural crops.

Plums, as a whole, are adapted only to western and eastern Florida, preferring hammock and rolling pine land. Burbank does well in the western section. In the eastern section Terrill, Botan and Burbank do well.

Of the pears, Kieffer, LeConte, and Smith do well in western and eastern Florida on hammock or rolling pine land.

Grapes grow rapidly, but need careful attention to be kept in good bearing condition for a period of years. Hammock land is preferable for them. The native varieties grow to an immense size and produce great quantities of fruit with minimum attention. Of *Vitis rotundifolia*, the Scuppernong and Thomas grow luxuriantly in all sections. Flowers grows well in western and central Florida.

The kaki, Japanese persimmon, needs good hammock land or well-drained high, or more or less undulating, rolling pine land. It is better adapted to western, eastern and central than to southern Florida.

Under favorable conditions, Jennings and Red Astrachan apples may be fruited in western Florida; Santa Fé apricot in western and eastern Florida. Figs do fairly well for home use and for canning or candying in eastern and central Florida. They need a compact, fine-textured soil.

Mulberries will grow on hammock or good quality of rolling pine land in all sections of the state. The following varieties have given good crops: Downing, Hicks and Stubbs. Pomegranates make a more or less ornamental fruit. Acid, Purple and Sweet do well in western, eastern and central Florida.

Pecans are adapted to various kinds of soils, especially from central Florida northward and westward. The best agricultural lands such as are considered the most suitable for the growing of cotton are best adapted to pecan-growing. The best stock on which to grow pecans is the pecan seedling. Much time and money has been lost in attempting to bud native species of hickory already established in the hammocks to pecans. While it is possible to secure good bearing trees in this way, it is usually financially unsuccessful. Leading varieties are the Curtis, Frotscher, Russell, Stuart, and Van Deman.

The growing of strawberries is controlled largely by efficient and reasonable transportation. If the crop cannot be placed upon the market promptly it is worthless. Probably nine-tenths of the fields of the state are planted on moist flat woods land, or what is locally known as gall-berry flats. Such land is cleared and thoroughly drained by means of open ditches. On such land strawberries begin to ripen in January and continue until May or June if properly cultivated, though the season of profitable shipment rarely extends beyond the middle of April. Especially prepared refrigerator cars are now carried by some railroads on express trains. The plants are usually set out every year, in August, September and October, and bear a good crop the following spring. The most successful strawberry growers continue to cultivate a part of the old field to secure new plants to be used the following fall for planting out the new field.

Pineapples find their most congenial habitat on spruce pine land. Soil from pineapple fields contains a large percentage of sand and insoluble matter,— as high as 98 per cent. The land must be well drained, free from any standing water, even during the rainy season. The most extensive pineapple area is located on the sand hills near the coast. The character of the vegetation and physical condition of these hills or dunes is essentially that of the scrub land of the interior. The slat sheds or pineapple sheds, which are constructed to afford a half shade, serve a good purpose in summer as well as in winter. In summer the slats reduce the amount of sunshine that reaches the plants and consequently the intensity of heat, though probably not the total warmth. In winter they interfere with rapid radiation, which would occur as the result of a sudden freeze or of a frost. The slat shed is a simple structure, the essential part of it being the roof or covering, which is made of boards or slats fastened so as to leave an opening between the boards or slats equal to the space covered by them. These vary in size from a common plastering lath to boards 4 inches wide. The height of the covering above the ground varies from 6 feet to rarely more than 10. The most extensive fields are located in southern Florida. Smaller areas have been planted in central Florida; nearly all of these are protected by sheds, some of the sheds being so constructed that the roof may be closed completely. The islands or keys underlaid with coralline limestone form one of the most suitable habitats for this plant, while the low, fertile islands or keys are worthless for a pineapple plantation. Red Spanish is cultivated more extensively than all the other varieties combined. It is a hardy variety, and one suited to extensive planting with a minimum amount of attention. For extensive culture, Egyptian Queen, Porto (Puerto) Rico and Ripley Queen do well generally. Smooth Cayenne is promising, because not spiny.

Bananas are cultivated only for local markets, but form a source of considerable revenue to a number of plantations. The land best adapted to them is a low, moist hammock or a bay head, especially such soil as is composed largely of muck. Baraçoa (Red Jamaica), Cavendish, Golden, Hart's Choice and Orinoco ("horse banana") are leading varieties in southern Florida.

The guava has attained considerable importance, though as yet it is not cultivated extensively. Plantations exist in various parts of the state, but the greater quantity used in canning and for jelly is collected from trees grown without cultural attention. Nearly all of the fruit is from seedlings that have originated from scattered seeds. Well-drained fertile soils are favorable locations, but the guava adapts itself to almost all classes of cultivated soil. The sweet varieties are preferred for dessert, while the sour kinds produce the largest amount of jelly. The total amount of jelly and other guava products produced in the state will amount to many carloads annually. The Cattley and Strawberry guavas, while more cold-resistant and delicious as fresh fruit, are less popular than the varieties derived from the American species.

Mangoes are being grown extensively for the northern markets. They are now being fruited in the southern part of central Florida. The large extension in production of this fruit, however, will take place throughout southern Florida, mainly toward the southward. Orchards of considerable size are being planted to budded varieties from India together with budded varieties that have originated in Florida. Some of these varieties that have originated in Florida from the seed of Indian varieties, appear to have better fruiting qualities than their parents. Good citrous soil is preferred for growing mangoes. The same cultural care that proves best for citrous fruits is also applicable to the mango. The fertilizer requirements of the mango are very similar to those of Citrus. Among the old seedling varieties, No. 11 is a favorite on the east coast, while seedlings belonging to the Bombay group appear to be more frequently planted on the west coast. Among the budded Indian varieties, Mulgoba has been most extensively planted. It has, however, proved disappointing in its productiveness, though the fruit has no superior. Sandersha has become well established. Cecil, belonging to the Cambodiana group is very productive and a favorite. A large number of varieties in the form of inarched trees, have been imported. These are now fruiting and in the course of the next decade or two there will be considerable opportunity for selection from the best of these.

Coconuts are confined to southern Florida and along the seacoast. While the trees continue to grow when transplanted to the higher lands, they need the low, moist lands of the coast for fruiting and for highest development.

The avocado is a salad fruit of American origin, having been cultivated by the Incas, by whom it was called "ahuacatl." Up to twenty years ago, little effort had been made toward propagating improved varieties of this fruit. With the settlement of extreme southern Florida came a rapid development in its propagation by budding. This is carried on almost as easily as in the case of citrus. A careful survey of the trees fruiting in south Florida in 1903 showed that about 3 per cent of the seedling trees bore commercially profitable crops. Budded varieties of the avocado may now be secured from the leading nurserymen in southern Florida. The range of bearing trees is northward to the southern part of central Florida. The leading varieties

LXXIII. North American horticulture.—An orange grove in Florida.

are Trapp for December and January fruit; Baldwin and Early for July fruit; Pollock for large mid-season fruit; and Family for a succession of fruits from the latter part of July until into October. The bulk of the seedling fruits mature from the latter part of July until the middle of October. The hard-shelled Guatemalan fruits introduced by the Department of Agriculture, ripen in February and March. The small Mexican avocados that produce bluish fruits are hardy to the northern limits of central Florida, but are not commercially valuable.

Almost the entire list of vegetables given in the seed catalogues may be grown in all parts of the state. The industry has now developed until it is competing closely for first place with citrous fruits. Originally the hammocks were preferred for the main production of truck crops. In more recent years and with the advent of extensive drainage systems, the level lands composing the flat-woods and drained areas have been planted to vegetables extensively. Watermelons, cantaloupes and cucumbers are grown mainly on the hammock or high pine land. Cabbage, cauliflower, beets and similar vegetables are most largely grown on the heavier, more compact soils. Celery is grown most extensively on level tracts, much of which were formerly under water. These tracts permit sub-irrigation, which may be cheaply carried out in the areas of artesian flow. Vegetables are now produced to greater or less extent on almost every character of soil in the state, including even some spruce-pine land, some of which by means of commercial fertilizers has been made productive of truck crops.

Truck-growing can be developed extensively only where an abundance of skilled or fairly skilled labor can be commanded at critical periods. As truck-growgrowing does not employ the grower's attention for more than six months in the year, this labor must be able to find additional employment in some other way. Various centers have specialized on trucking; the Hastings center in north Florida makes a specialty of Irish potatoes; Sanford specializes on celery; the Manatee River region produces truck in general; the Biscayne Bay region produces truck for the midwinter and early spring markets.

Among the prominent horticulturists of Florida, not now living, were: Dudley W. Adams, organizer of the Florida State Horticultural Society; E. H. Hart, introducer of many ornamental and useful plants; H. G. Hubbard, who gave special attention to citrous insects; F. W. Inman, organizer of the Florida Citrus Exchange; C. T. McCarty, who at the time of his death owned the largest pineapple plantation in the world; A. H. Manville, practical horticulturist; T. W. Moore, author of "Orange Culture for Florida;" E. O. Painter, who did valuable work in connection with the Horticultural Society; Rev. Lyman Phelps, by some called "the father of chemical fertilizing for citrous fruits in Florida"; Stephen Powers, editor of "The Florida Fruit Grower;" Pliny Reasoner (see Volume III, page 1593); and Denis Redmond, writer on horticultural subjects.

Public-service agencies for horticulture.

The Land-Grant college of Florida was established in 1883, when a site for it was selected at Lake City. In 1903 the name "Agricultural and Mechanical College" was changed by the Legislature to the "University of Florida," and in 1905 the Agricultural College was relocated at Gainesville. There is one professor of horticulture.

The Experiment Station was established in 1887 in connection with the Agricultural College at Lake City. It was removed to Gainesville on January 1, 1907. In 1906, a separate staff was appointed who were relieved from all teaching duties, thus giving their entire time to investigational work. Eleven of this staff are devoting their time to problems connected with horticulture. About seventy-five horticultural bulletins have been issued.

An Agricultural and Mechanical College for negroes is also maintained, in which horticulture is taught.

Extension work in horticulture is carried on in connection with the college and the county agents. In twenty counties, girls' canning clubs have been organized in connection with the public schools.

In 1911, the office of State Inspector of Nursery Stock was established. This office is filled by the professor of entomology.

Statistics (Thirteenth Census).

The approximate land area of Florida is 35,111,040 acres, of which 5,253,538 are in farms, or 15 per cent of the land area. Of the farm land, 1,805,408 acres, or 34.4 per cent, are improved; 3,007,638 are in woodland; and 440,492 acres are classified as other unimproved land in farms. The number of all the farms in the state in 1910 was 50,016. The average size of a farm was 105 acres. [The total area is 58,666 square miles.]

The leading agricultural crops grown are cereals, hay and forage, cotton (including cotton seed), and tobacco. The cereals in 1909 occupied 650,486 acres, which was 36 per cent of the improved land occupied, and the value of cereal products was $6,175,973, or 17.1 per cent of the total value of all crops. Hay and forage in 1909 occupied 54,729 acres, an increase in acreage of 148.8 per cent as compared with 1899, when the land occupied by hay and forage was 21,994 acres. Value of the hay and forage products, in 1909, was $847,485. Cotton (including cotton seed) occupied 263,454 acres in 1909, which was 14.6 per cent of the improved land area. The value of the cotton products in 1909 was $5,481,407, which was 15.2 per cent of the total value of all crops. The acreage of tobacco in 1909 was 3,987 acres, an increase of 93.9 per cent as compared with 1899, when it was 2,056 acres. The value of tobacco in 1909 was $1,025,476. The value of forest products from the farms in 1909 was $2,375,882, as compared with the value in 1899, when it was $648,412.

Horticultural crops grown in Florida are fruits and nuts, vegetables, peanuts, flowers and plants and nursery products, and small-fruits. The value of fruits and nuts grown in 1909 was $7,410,166, as compared with $1,203,373 in 1899. The acreage devoted to vegetables, excluding potatoes, sweet potatoes and yams, in 1909 was 57,600 as compared with 1899, when it was 26,762. The value of the vegetable products in 1909 was $6,314,313 as compared with $1,954,802, in 1899. The acreage of peanuts in 1909 was 126,150, from which were harvested 2,315,089 bushels, valued at $2,146,862. In 1909, 2,280 acres were occupied by plants and flowers and nursery establishments, an increase of 222 per cent as compared with 1899, when the number of acres thus occupied was 708. The value of these products in 1909 was $547,280, as compared with 1899, when their value was $163,557. The acreage of small-fruits in 1909 numbered 1,356 acres which produced products valued at $302,383.

The total quantity of orchard fruits produced in 1909 was 235,188 bushels, valued at $232,203. Peaches and nectarines and pears are the more important of the orchard-fruits. In 1909 the production of peaches and nectarines was 114,998 bushels, valued at $128,029; for the same time the production of pears was 98,223 bushels, valued at $80,119. Other orchard-fruits and their production and value for 1909 follow: plums and prunes, 17,169 bushels, valued at $18,976; apples, 3,405 bushels, valued at $3,849; mulberries, 924 bushels, valued at $671; cherries, 374 bushels, valued at $448; quinces, valued at $103, and apricots valued at $8.

The production of grapes in 1909 was 1,086,344 pounds, valued at $38,357. The value of the grapes produced in 1899, 1,684,700 pounds, was $56,420, showing a considerable decrease in value for the period.

The production of nuts in 1909 was 382,535 pounds, valued at $47,456. The pecan was by far the most important nut, the production in 1909 being 307,632 pounds, valued at $43,962. The production of Persian or English walnuts was, in 1909, 28,575 pounds, valued at $2,018; that of black walnuts 42,573 pounds, valued at $766; and 17,012 coconuts valued at $501.

The most important fruits produced in Florida are the tropical fruits, valued in 1909 at $7,092,150. More than half this value is contributed by oranges, and most of the remainder by pomelos (grapefruit) and pineapples. In 1909, 4,852,967 boxes of oranges were produced, valued at $4,304,987. The production in 1899 was 273,295 boxes. The production of pomelos, or grapefruit, in 1909 was 1,061,537 boxes, valued at $1,907,816; that of pineapples, 778,644 crates, valued at $734,069. Other tropical fruits of importance, their production, and value in 1909 were: tangerines, 34,871 boxes, valued at $64,082; lemons, 12,367 boxes, valued at $13,753; limes, 11,302 boxes, valued at $12,457; guava, 258,709 pounds, valued at $7,604; figs, 474,287 pounds, valued at $20,886; mangoes, 5,278 boxes, valued at $5,739; bananas, 10,048 bunches, valued at $5,638; avocados, 4,920 crates, valued at $10,100; and also kumquats to the value of $2,768; and Japanese persimmons, valued at $2,066.

Of the small-fruits raised in Florida, strawberries are the only one raised on a considerable scale. The total acreage, production, and value of small-fruits in Florida in 1909 was: 1,356 acres; 2,396,573 quarts; and $302,383. Of strawberries alone, there were 1,343 acres, which produced in 1909, 2,383,397 quarts, valued at $301,056. Blackberries and dewberries contributed $1,287 toward the total value of small-fruits; raspberries and loganberries $25; and currants $15.

Of the vegetables grown in 1909, the most important in value were the tomato, sweet potatoes, yams, and potatoes. The product from 12,338 acres of tomatoes in 1909 was valued at $1,839,233. The production of sweet potatoes and yams in 1909 was 2,083,665 bushels, valued at $1,231,238; the production of potatoes was 856,967 bushels, valued at $839,691. Other leading vegetables were: 5,013 acres of green beans, valued at $483,927; 3,028 acres of cabbage, valued at $434,558; 3,408 acres of cantaloupes and muskmelons, valued at $230,009; 825 acres of celery, valued at $417,578; 2,086 acres of cucumbers, valued at $354,770; 1,450 acres of lettuce, valued at $343,456; 296 acres of green peppers valued at $94,246; and 17,711 acres of watermelons, valued at $394,567. Other vegetables of less importance grown in Florida are asparagus, beets, cauliflower, sweet corn, eggplant, okra, onions, green peas, squash and turnips.

The acreage devoted to the production of flowers and plants in 1909 was 49; in 1899 it was 45 acres. The value of the products from flowers and plants was $69,106 in 1909; the value from these products was $41,417 in 1899. The total area under glass in 1909 was 711,787 square feet. Of this, 568,190 were covered by greenhouses and 143,597 by sashes and frames.

The acreage used in the production of nursery products was 2,231 in 1909, as compared with 663 in 1899, showing an increase in acreage of 236.5 per cent. The value of the nursery products in 1909 was $478,174, as compared with $122,140 in 1899.

P. H. Rolfs.

EAST SOUTH CENTRAL STATES.

Kentucky.

The state of Kentucky (Fig. 2516), while its interests have not been largely directed, in the past, toward the field of horticulture, is nevertheless, in its various parts, admirably adapted to nearly all the fruits and vegetables of the temperate zone, a fact which during the past decade or more, has been increasingly recognized. Its agriculture has been primarily concerned with the practices of general farming and live-stock production rather than with the more intensive requirements of fruit- and truck-growing.

Before the Civil War, the people of wealth and culture, in common with those of other classes, lived chiefly in the country rather than in the towns, which were small and comparatively unimportant. There are evidences yet remaining, in numerous old and stately country homes, surrounded by magnificent trees and old-fashioned gardens, to bear witness to the high appreciation of the people of those early days for the amenities of rural life. Even today, though the movement toward the town is here, as elsewhere, apparent, Kentucky is practically a rural community. With the exception of Louisville, all of its cities are still of modest size, the interests of whose people are closely interwoven with those of the country districts round about.

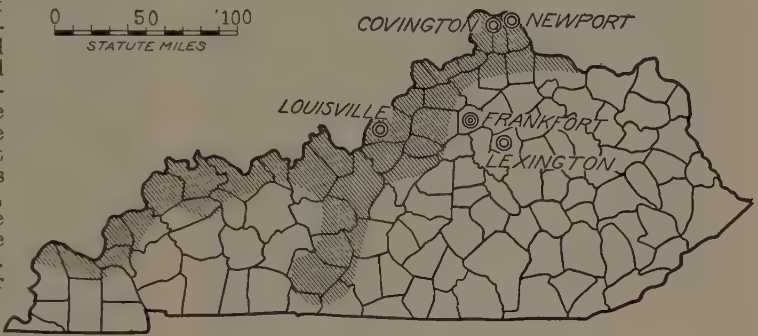
In the early years, therefore, there was little to stimulate the growth of commercial horticulture, but with the steady advance in fruit-growing throughout the country, and particularly as a result of better transportation facilities for perishable products, there have been developed, in recent years, several fruit- and vegetable-growing areas in which these industries have assumed extensive proportions. Broadly speaking, these areas may be said to include a more or less continuous band of territory of varying width, along the northern boundary of the state bordering the Ohio River down to its confluence with the Mississippi. A second region of horticultural importance includes a belt of counties lying to the south and southwest of Louisville, extending as far as Warren and adjacent counties in the southern part of the state.

Among the more notable of these centers of fruit-production is the Henderson apple district including Henderson and parts of the neighboring counties which have proved to be peculiarly adapted to the production of the Winesap apple. This variety has been more extensively planted in this section than any other kind, and being held in cold storage until the later winter months when other varieties of high quality have become scarce, finds a ready market at good prices, much of the product being shipped to southern cities. The interests of the community being centered largely upon this one fruit, there has naturally developed an organization for coöperation which has resulted in great economies in the purchase of spraying material and other supplies, though not as yet, in marketing the crop.

In this same region, also, along the bottom-lands more or less subject to annual overflow from the Ohio River, there is the promise of a new industry for this latitude in the growing of select varieties of the pecan. Upon both the Indiana and Kentucky shores of the Ohio, in this locality, are numerous groves of native pecan trees of great size, vigor, and productiveness. Here and there individual trees of great merit have been discovered which produce nuts of high value, from the standpoint of flavor, thinness of shell, size, and continuous productiveness. Some of these have been propagated by specialists who have discovered new and simpler methods for their multiplication, and are now being offered by nurserymen along with choice varieties of apples and peaches. Thoughtful students of this subject predict that here in Kentucky, as well as in the South, there is to be a large and important development of this horticultural industry.

Another fruit industry has sprung up during the past eight years in the strawberry-growing district in and around Warren County, with Bowling Green as its center. Here there is maintained a strong coöperative organization which has been so efficiently managed for the benefit of the growers that the strawberry area has increased from 55 acres the first year, to over 1,000 in 1914, with a large increase in prospect. After trials with various standard sorts, the Aroma has proved to be the most valuable kind for the soil and market conditions of this district, and is now grown almost exclusively, being shipped in carlots to many northern and eastern cities at prices which, upon the average, have proved very satisfactory to the producer. The yield is about 150 crates (24 quarts) an acre, although occasional yields of 200 crates are found, while a yield as high has 250 crates has been produced in a very few instances.

The county of Jefferson, containing the largest city of the state, Louisville, is the center of a district which is horticulturally important for both its fruit- and truck-growing interests. Owing to the proximity of the city, market-gardening has naturally extended to large proportions. Peaches and other orchard-fruits are profitably grown, but the district has become particularly noteworthy for two specialized industries, the growing of onion sets and second-crop potatoes. While a considerable area of early potatoes is produced under ordinary methods, the growing of the second crop is a unique industry which had its beginning in 1882, and has developed gradually until, in 1914, there were about 11,000 acres planted in the crop, giving a total yield of about 700,000 barrels. The second crop is planted between July 15 and August 1, and harvested in October. There are two coöperative organizations in the county which market most of the crop. A portion of the crop is held each year in cold storage for seed purposes. The varieties chiefly grown are the Carman No. 3, and to a less extent, the Irish Cobbler as seed stock for the usual first crop.



2516. Kentucky, with the horticultural parts.

In the hill country to the south and southwest of Louisville, apple- and peach-growing has for years been an important business, while to the northeast the peach orchards of Trimble County have for twenty years and over been a prominent feature. Throughout much of the fruit area mentioned, as in other parts of the state, the most favorable results are secured when advantage is taken of elevated locations, and of the cold-air-drainage resulting from the numerous deeply eroded river-channels.

In the vicinity of Cincinnati, Ohio, the fruit- and vegetable-growing interests are of considerable importance, although the conditions for market-gardening have resulted in a greater development of that business upon the northern than upon the Kentucky side of the Ohio River.

About two-fifths of Kentucky, comprising the entire eastern end of the state, is a mountainous country, rich in coal and other minerals, in which agriculture is confined, for the most part, to a few staple farm crops, which are produced, in many cases, by primitive methods, and with scanty returns. With the penetration of many new railroads into the heart of this vast area, and the opening of extensive mining enterprises, there is coming a fresh realization of its great fruit-growing possibilities. Here and there enterprising individuals have established orchards and gardens, thus showing the possibility of producing the fruits and garden products abundantly. For most of these products, there is an eager home market in the growing mining towns, and when the home demand is supplied, there are now numerous outlets to the larger markets of the cities.

The larger part of the public park areas of the state are located in Louisville, which now has a valuable series of such parks comprising a total of over 1,500 acres which, since their establishment about 1890, have been vigorously developed under the direction of the most skilful landscape architects. Until recent years, the small cities of the state, on account of their moderate size, have not so keenly felt the need of such public recreation grounds, but with added growth, they are now, for the most part, realizing this need and taking steps to supply it. The cities of Lexington, Owensboro, Covington, Henderson, Paducah, and others have already acquired, and have in use, various tracts of land to serve as a nucleus for further developments in this direction.

Of other public grounds in which the work of the landscape horticulturist is manifest, the two cemeteries, Cave Hill, of Louisville, and that of Lexington are perhaps the most notable examples in the state. The former comprises an area of about 300 acres, and is situated upon a beautiful tract of land, elevated 100 feet above the Ohio River. It contains several beautiful lakes, and is especially rich in its collections of aquatics. The cemetery at Lexington contains over 160 acres, and was established in 1849. It was exceptionally fortunate in being under the same superintendent, the late Charles S. Bell, from the beginning through a period of fifty-six years, and in having the landscape method of treatment followed from the first. Among many interesting horticultural features, the most notable today are the magnificent old bur oaks, white elms, and other trees, many of which are from 3 to 5 feet in diameter.

There is not yet full appreciation among Kentuckians of the remarkable resources in trees, shrubs, and herbaceous plants growing within the borders of the state, a flora so rich and varied that a fully satisfying scheme of landscape planting might anywhere be developed with access only to the native species. The widely varying conditions of soil, altitude, and climatic conditions, ranging from the high uplift of the Alleghanies in the east to the low bottom lands lying along the Ohio and Mississippi rivers in the west, have resulted in a natural assemblage of many of the finest tree and shrub species growing in North America. A list of the woody plants of Kentucky recently issued by the botanical department of the State Experiment Station (Bulletin No. 169) records the presence in Kentucky of twelve species of the Coniferæ, ten of willows, six of ash, seven hickories, nineteen oaks, five elms, and four magnolias. In addition to these, there are numerous other species in great profusion, including such interesting and valuable kinds as the tulip poplar (tulip tree), sycamore, the butternut and black walnut, sweet gum, cypress, the rare and beautiful yellow-wood (cladrastis), holly, dogwood, and red-bud, together with the rhododendrons, laurels, and numerous other shrubs of smaller stature.

Among the wild fruits and nuts, the black walnut is probably the most widely distributed and attains a large size in Kentucky, having long been the source of a valuable timber-supply. The nuts, while occasionally quoted in the general markets and extensively gathered for local consumption, have been prevented from coming into wide popularity because of their heavy shell and rather strong flavor. A fresh interest in this nut tree has been awakened through recent occasional reports of successful attempts to grow certain varieties of the English or Persian walnut by grafting them upon the common species. The shellbark and other hickory-nuts are produced freely in all parts of the state. The chestnut is also widely distributed, but is more abundant in the less fertile parts of the state.

Among other wild fruits of interest from the horticultural standpoint may be mentioned the persimmon and papaw, both of which grow commonly over most parts of the state, and are offered for sale to a limited extent in the late autumn months. As trees of both these species are sometimes found possessing fruits with fewer seeds, improved flavor, or other favorable variations, there is reason for expecting that much improvement may ultimately be secured.

Nurseries are scattered over most parts of the state, there being about forty in all, varying from extensive business enterprises with many employees to the little plot of an acre or less that is usually conducted by an orchardist for the propagation of a few trees for his own use.

Except in the larger cities and towns, commercial greenhouses are few, although in the hands of a number of enterprising individuals the results of growing both vegetables and flowers under glass have been very successful, and shipments of such greenhouse products are often made to other states. With a superabundant supply of valuable coal, there must inevitably come a better appreciation of the abounding opportunities for the development of such undertakings.

Public-service agencies for horticulture.

In common with other states, Kentucky enjoys the advantages of a College of Agriculture and Experiment Station, both of which are established as departments of the State University at Lexington. Horticultural education is given due recognition in its agricultural courses, and through coöperation with its Extension Division, with the State Board of Agriculture, and with the newly organized agency of County Advisers, is being effectively carried to the people.

The two state normal schools, located at Richmond in the east and Bowling Green in the west, are both actively engaged in promoting horticultural education.

The State Horticultural Society has had a long and varied history of over sixty years, being established in 1850. Never a large organization, and without financial aid from the state or other external sources, it has exerted an influence, with its little band of enthusiastic supporters, far out of proportion to its membership.

All the nurseries of the state are subject to annual supervision by the inspector of the State Experiment Station as a safeguard against the dissemination of dangerous insects and fungous pests.

Statistics (Thirteenth Census).

The approximate land area of Kentucky in 1909 was 25,715,840 acres. The land in farms was 22,189,127 acres or 86.3 per cent of the land area. The improved acreage in farms numbered 14,354,471; the acreage in woodland 6,951,626; and other unimproved land 883,030. In 1910 there were 259,185 farms in the state, the average acreage being 85.6. [The total area is 40,598 square miles.]

The leading agricultural crops of Kentucky are cereals, tobacco and hay and forage. In 1909 the production of cereals, from an acreage of 4,323,702, was valued at $60,738,651, which was 43.7 per cent of the total value of crops. The tobacco produced from 469,795 acres for the same year was valued at $39,868,753; and the hay and forage produced from 966,377 acres was valued at $10,306,344. While the value of the cotton produced in 1909 was only $246,614, the acreage increased from 2,396 acres in 1899 to 7,811 in 1909, an increase of 226 per cent. In 1909 there were also produced sugar crops to the amount of $1,420,504. The value of the forest products of farms was $7,843,142 in 1909, as compared with $4,179,480, in 1899.

The horticultural crops grown are fruits and nuts, small-fruits in limited amounts, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was $4,661,634, as compared with $2,064,360 in 1899. The acreage of small-fruits decreased from 6,126 in 1899 to 4,387 in 1909, when the production was 4,972,702 quarts, valued at $357,597. In 1909 the total acreage of potatoes and other vegetables was 182,639 and their value $11,850,994, a decided increase over acreage and value in 1899. The raising of flowers and plants and nursery products was important, 791 acres being devoted to them in 1909, and the output valued at $508,372.

The total quantity of orchard-fruits produced in 1909 was 9,447,858 bushels, valued at $4,506,950. Apples contributed more than three-fourths of this quantity and peaches and nectarines most of the remainder. The production of apples in 1909 was 7,368,499 bushels, valued at $3,066,766. The number of apple trees of bearing age in 1910 was 5,538,267; those not of bearing age numbered 2,106,297. The production of peaches and nectarines in 1909 was 1,623,379 bushels, valued at $1,062,138. The number of peach and nectarine trees of bearing age in 1910 was 2,245,402; those not of bearing age, 1,110,744. The more important of the other orchard fruits produced in 1909 were: 251,536 bushels of pears, valued at $187,951; 139,346 bushels of plums and prunes, valued at $102,446; 52,163 bushels of cherries, valued at $74,340; and 11,537 bushels of quinces, valued at $11,757.

The number of grape-vines of bearing age in 1910 was 605,002; those not of bearing age, 77,626. The production in 1909 was 3,680,182 pounds, valued at $137,326. The production of grapes in 1899 was 5,134,215 pounds.

Of the nuts grown in 1909, the black walnut is by far the most important. The production of black walnuts was 793,970 pounds, valued at $11,384; that of pecans, 28,577 pounds, valued at $2,887; that of Persian or English walnuts, 35,825 pounds, valued at $1,499; that of chestnuts 16,619 pounds, valued at $714; and that of hickory-nuts, 71,347 pounds, valued at $735.

Blackberries and dewberries are the most important of the small-fruits raised in Kentucky, with strawberries and raspberries ranking second and third, respectively. The acreage of blackberries and dewberries increased from 1,024 in 1899 to 2,141 in 1909, when the production was 2,165,547 quarts, valued at $137,250. The acreage of strawberries decreased from 4,128 in 1899 to 1,553 in 1909, when the production was 2,114,929 quarts, valued at $159,765. In 1909 the production of raspberries was 558,529 quarts, valued at $50,472; that of gooseberries 118,338 quarts, valued at $8,661; and that of currants 15,159 quarts, valued at $1,429.

Of the vegetables grown in Kentucky the potato is the most important. In 1909 the production from 55,750 acres was 5,120,141 bushels, valued at $2,724,043. The acreage devoted to the sweet potato and yam produced, in 1909, 1,326,245 bushels, valued at $839,454. The acreage of all the other vegetables in 1909 was 115,007, and their value $8,287,497, both acreage and value being an increase over 1899. The more important of the other vegetables grown in 1909 were: 1,959 acres of onions, valued at $200,317; 3,574 acres of tomatoes, valued at $128,017; 5,041 acres of green beans, valued at $94,663; 1,690 acres of watermelons, valued at $70,144; 738 acres of cabbage valued at $63,288; 1,103 acres of sweet corn, valued at $35,758; and 594 acres of cantaloupes and muskmelons, valued at

$35,172. Other vegetables grown were asparagus, beets, celery, cucumbers, kale, lettuce, rhubarb, spinach and turnips.

The acreage devoted to the production of flowers and plants increased from 132 in 1899 to 249 in 1909, an increase of 88.6 per cent. The area under glass in 1909 was 1,363,002 square feet, of which 1,276,823 were covered by greenhouses and 86,179 by sashes and frames. The value of flowers and plants produced in 1909 was $392,409, as compared with $262,288 in 1899.

The acreage devoted to nursery products, on the other hand, decreased from 837 in 1899 to 542 in 1909, when the value of the products was $115,963, as compared with $114,749 in 1899. C. W. Mathews.

Tennessee.

The horticultural products of Tennessee (Fig. 2517) are greatly diversified on account of the varied soil and climatic conditions. A knowledge of the natural divisions of the state is essential to a thorough understanding of its adaptability to the various branches of horticulture.

The Unaka region, on the eastern border, contains about 2,000 square miles. A few of the peaks are over 6,000 feet above sea-level, and the average elevation is 3,000 feet. The soil is gravelly and thin, but contains areas that are fairly productive. Apples are grown to a limited extent.

The valley of East Tennessee is the next division. It contains 9,200 square miles and an average elevation of 1,000 feet. The soils are generally well adapted to fruits. Records taken at Knoxville during a period of forty-four years show an average annual rainfall of 48.73 inches. Strawberries are extensively grown for northern markets in Hamilton, Rhea, Roane, Blount, and Knox counties; commercial peach orchards in Rhea, Roane, Washington, and Bradley counties; there are few large apple orchards, but farm orchards indicate success in commercial orcharding.

A thousand feet above the valley of East Tennessee lies the Cumberland Tableland, containing 5,100 square miles. This section, for the most part, is poor, the soils being sandy and thin. There are, however, areas of land which produce fruits and vegetables of the highest quality. An apple and peach orchard of over 400 acres in Morgan County is the largest in the state. Irish potatoes of superior quality are an important crop in Cumberland County, and, with proper fertilizing, can be grown with profit in all parts of the plateau. The climate is particularly healthful.

West of the Cumberland Tableland is the Highland Rim, surrounding the Central Basin. The Rimlands have an area of 9,300 square miles and an average elevation of nearly 1,000 feet. This territory possesses a great variety of soils, some of which are highly fertile and well suited to orcharding. Numerous streams cut the land into valleys, which are generally deep and narrow.

The Central Basin, in which Nashville is situated, contains 5,450 square miles, with numerous elevations of 200 to 300 feet above the general level. The soil is fertile and well adapted to small-fruits and vegetables. The average rainfall at Nashville is 49.53 inches. The largest commercial apple orchards of the state are located in this section, in Maury and Williamson counties.

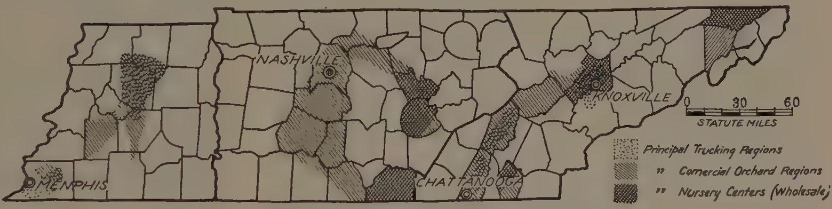
The next natural division is the valley of the Tennessee River. It has an elevation of about 360 feet and an area of 1,200 square miles.

The Plateau, or Slope, of west Tennessee is the most important horticultural region commercially in the state. It contains 8,850 square miles and has an average elevation of 500 feet. The soils are generally light, fertile and easily cultivated, but demand careful treatment to prevent serious damage by washing. There are extensive commercial orchards of apple and peach in Haywood, Weakley, Gibson, and Madison counties, but the principal horticultural products are truck crops of strawberry, tomato, early and second-crop Irish potato, lettuce, cabbage, pepper, and sweet potato. Humboldt is the principal center of the trucking industry, which is rapidly developing.

The last natural division, the Mississippi bottoms, has an area of 950 square miles and an average elevation of 295 feet. It is little used for horticultural purposes.

The possibilities of Tennessee for the cultivation of fruits and nuts are evidenced by the profusion of these products in a wild state. Wild strawberries are found thoroughly distributed. Blackberries thrive everywhere. In favorable localities they attain a very large size, surpassing in this respect some of the cultivated varieties. Wild blackberries are marketed in large quantities in many sections, but only the earliest named varieties are desirable for shipment. Red and black raspberries grow in most parts of the state; and in some sections the best of the wild blackcaps, when transplanted to the garden, give better results than any of the cultivated varieties. In cultivation, the raspberry succeeds best when heavily mulched. Wild grapes abound throughout the state. Plums are also found in profusion; and the Wild Goose variety is said to have originated in Tennessee. Other wild fruits are: dewberries, cherries, crab-apples, juneberries, pawpaws, persimmons, and huckleberries.

Of the nuts, chestnuts are most plentiful, especially in the hilly and mountainous sections. The chinkapin flourishes in east Tennessee. Black walnuts are exceedingly numerous. Hickory-nuts are common throughout the state. Pecans are native along the streams, attaining great size in the Mississippi bottoms, but the thin-shelled named varieties have not been generally successful. Hazel-nuts, and butternuts, or white walnuts, are also plentiful.


NASHVILLE
KNOXVILLE
MEMPHIS
CHATTANOOGA
0
30
60
STATUTE MILES
Principal Trucking Regions
" Comercial Orchard Regions
" Nursery Centers (Wholesale)

2517. Tennessee, marking the horticultural areas.

Some of the native seedling fruits are highly valued, especially apples, peaches and strawberries. Many well-known varieties introduced from other states are not satisfactory. This is especially true of winter varieties of the apple, of which the introduced kinds are not so well adapted to the climate and soils as those of local origin. This fact is becoming well established among practical horticulturists. It is only a few years since orchardists were planting varieties of winter apples originated in the North. After repeated failures to get first-class fruit of good keeping qualities, they have begun to use native seedling varieties. Some of them will doubtless be largely cultivated in the future. A few native varieties of winter apples have gained considerable popularity among commerical orchardists. The fruits of these sorts have commanded remunerative prices in competition with apples shipped from the North. Owing to the great diversity of soils and exposures in this state, it is very important to select varieties that are adapted to the conditions where the trees are to be planted. The fact that a desirable apple has been originated in east Tennessee is no proof that it will succeed well in all parts of this political division. On the contrary, it is likely to give good results only in certain soils and on certain exposures that are requisite for its proper growth and fruitfulness.

All the classes of fruits commonly grown in the northern half of the United States are produced in Tennessee for home and commerical purposes. Strawberries are shipped more largely to distant markets than any other fruit. The area in peaches is increasing rapidly. Summer apples are shipped from several sections.

Of the vegetables, tomatoes and Irish potatoes are the most important commercially. The following counties have been active in producing and shipping fruits and vegetables: Gibson, Weakley, Madison, Haywood, Shelby, Maury, Williamson, Lincoln, Hamilton, Rhea, Roane, Morgan, Bradley, Washington, and Knox. Peanuts are grown largely in Perry, Humphreys, Benton, Decatur, Hickman, and Wayne.

Many locations in East Tennessee are peculiarly well adapted to the culture of grapes. This is shown by the large exhibits of fine grapes made at the fall horticultural meetings. The local markets are well supplied with home-grown grapes during their season.

Such fruits as Japanese persimmon and English walnut have not been generally successful, though occasional trees that are healthy and productive are known in the state. The Paragon chestnut is a promising variety grafted on native stock. These fruits, and thin-shelled pecans, while offering little to the practical orchardist, are of interest to the amateur. The currant and gooseberry succeed only in the high mountains of east Tennessee, and in favored localities on the Cumberland Plateau.

The nursery business is extensively developed in Tennessee, the apple, peach, pear, and cherry being largely propagated. There are 695 nursery firms listed in the office of the State Entomologist, and about one-third of them are wholesale growers. The largest nursery interests are in Franklin, DeKalb, Warren, Bradley, Knox, and Sullivan counties.

The climate of Tennessee, with moderate temperature and abundant rainfall, is favorable for the growth of ornamental plants, and landscape gardening may be extensively developed in all parts of the state, the principal drawback being the difficulty of maintaining a luxurious growth of lawn grasses. In west Tennessee, Bermuda is more largely used than any other grass. Kentucky blue-grass is most successful in the Central Basin and can be well grown throughout middle and east Tennessee by the free use of lime and fertilizers.

No state in the Union, with the possible exception of North Carolina, has a greater number of indigenous woody plants. Among native deciduous trees the following are adapted to street, lawn and park planting: large trees—white elm, winged elm, sweet gum, black gum, black locust, honey locust, silver maple, scarlet maple, sugar maple, white ash, blue ash, bald cypress, shagbark hickory, pecan, basswood (linn), beech, gray birch, chestnut, catalpa, hackberry, black wild cherry, black walnut, Kentucky coffee tree, cucumber tree, tulip (poplar), sycamore, and the following oaks: black, willow, pin, red, Spanish, scarlet, post, chestnut, white; small trees—juneberry, sourwood, silver bell, hornbeam, water beech, Hercules' club, buckthorn, red-bud, yellow-wood, fringe, wild plum, wild crab-apple, flowering dogwood, umbrella tree, witch hazel, hawthorn, black haw, red mulberry, sassafras, hop tree. The following native shrubs are of value for ornamental planting: bladder-nut, stewartia, callicarpa, calycanthus, yaupon (deciduous holly), flame-colored azalea, pinxter flower, mock-orange, meadow-sweet, nine-bark, red ozier dogwood, flowering raspberry, elderberry, sumach, Carolina rose, pink-flowering locust, spice bush, waahoo, strawberry tree, coral-berry. Kalmia, rhododendron and leucothoë occur abundantly in the mountain sections, but they cannot be well grown in the lowlands. Of native conifers the shortleaf pine, Jersey pine, pitch pine, red cedar and Carolina hemlock should be extensively planted, though seldom used in landscape work, with the exception of the red cedar. Holly is indigenous along the streams, and is largely used in ornamental planting. Difficulty is experienced with the more common coniferous forms, such as are listed by nurserymen, except in the mountains. In the lowlands, the spruces and firs, and the white, Scotch and Austrian pines are short-lived, though sometimes growing vigorously to an age of fifteen to thirty years. Junipers, thuyas, retinosporas and arbor-vitæs are extensively planted and give satisfaction when skilfully cared for. Among broad-leaved evergreens, holly, *Magnolia grandiflora*, several varieties of box, abelia, mahonia, *Elæagnus Simonii*, and a few other forms grow well in almost all parts of the state. *Azalea indica* and *A. amœna* have been planted in city gardens, but have not proved successful. All the common hardy flowering shrubs grow luxuriously throughout Tennessee. In almost all parts of the state all classes of roses can be grown in gardens except the more tender teas. In the southwest part of the state such tender varieties as the Marechal Niel grow well with a little protection.

Hardy herbaceous plants are largely grown in Tennessee gardens, and their popularity is rapidly increasing. Among plants of this class, the following are recommended for all parts of the state: narcissus, tulip, hyacinth, *Lilium tigrinum*, *L. candidum*, *L. speciosum*, *L. auratum*, *L. Martagon*, lily-of-the-valley, German iris, Spanish iris, Japanese iris, peony, phlox, foxglove, pinks, bleeding heart, delphinium, Japanese anemone, chrysanthemum, funkia, rose mallow and mallow hybrids, candytuft, bluebells, columbine, gaillardia, oriental poppy, hollyhock, platycodon, Shasta daisy, golden glow, baby's breath, small-flowered double sunflower, hybrid pyrethrum, yellow and orange hemerocallis.

Among climbing plants, the best for covering walls in Tennessee are English ivy, Boston ivy, and *Evonymus radicans;* for porches and pergolas, grapes, Virginia creeper, trumpet creeper, Chinese trumpet creeper, Chinese wistaria, Japanese wistaria.

Public-service agencies for horticulture.

The University of Tennessee was established at Knoxville, in 1794, and the College of Agriculture, as a department of the University, accepted the provisions of the first Morrill land-grant in 1868–9. The professorship in horticulture was established in January, 1900. Until 1915 the professor of horticulture also served as horticulturist of the Experiment Station. The Experiment Station is also at Knoxville in connection with the college. To date thirty-three bulletins on horticulture, insects and plant diseases, have been issued by the Experiment Station.

Courses in horticulture are offered in the four normal schools of the state and as a part of the agricultural teaching in the county high-schools. Gardening is taught in many of the city schools.

The Division of Extension of the College of Agriculture has a specialist in horticulture and makes demonstrations in fruit- and truck-growing.

Thr work of inspecting nurseries is conducted by the State Department of Agriculture. The headquarters of the inspector are at the University.

Statistics (Thirteenth Census).

The approximate land area of Tennessee in 1910 was 26,679,680 acres. The land in farms was 75.1 per cent of the land area, or 20,041,657 acres. Of this land in farms, the acreage of improved land was 10,890,484; that of woodland 8,007,733; and other unimproved land in farms, 1,143,440. The number of all the farms in 1909 was 246,012, and the average acreage a farm 81.5. [The total area is 42,022 square miles.]

The leading agricultural crops of the state are cereals, cotton (including cotton seed) and hay and forage. The acreage devoted to the production of cereals decreased from 5,055,328 in 1899 to 4,136,647 in 1909, when the production was valued at $55,302,278, which was 45.8 per cent of the total value of all crops. Cotton, including cotton seed, increased in acreage from 623,137 in 1899 to 787,516 in 1909, when the production was valued at $20,682,187. Hay and forage increased in acreage from 645,617 in 1899 to 1,052,816 when the production was valued at $12,617,538. Tobacco increased in acreage from 71,849 in 1899 to 90,468 in 1909, when the production was valued at $5,661,681. The value of the forest products of the farms in 1909, was $8,510,710, as compared with $5,086,624 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, potatoes and other vegetables, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $3,562,668, as compared with $1,606,054 in 1899. Small-fruits decreased in acreage from 12,944 in 1899 to 12,539 in 1909 when the production was 13,895,493 quarts, valued at $923,613. The total acreage of potatoes and other vegetables in 1909 was 167,234, and their value $10,430,975. Excluding potatoes, the acreage of other vegetables increased from 74,408 in 1899 to 100,055 in 1909, when the value of the production was $7,015,686. Flowers and plants and nursery products increased in acreage from 2,978 in 1899 to 4,215 in 1909, when the production was valued at $1,042,282.

The total production of orchard-fruits in 1909 was 6,484,550 bushels, valued at $3,459,077. Apples contributed nearly three-fourths of this quantity, and peaches and nectarines most of the remainder. The production of apples in 1909 was 4,640,444 bushels, valued at $2,172,475. The apple trees of bearing age in 1910 numbered 4,838,922; those not of bearing age, 2,117,246. The production of peaches and nectarines in 1909 was 1,579,019 bushels, valued at $1,055,379. Peach and nectarine trees of bearing age in 1910 numbered 3,163,737; those not of bearing age, 1,190,727. The production of the other orchard-fruits in 1909 was: 139,093 bushels of plums and prunes, valued at $86,743; 83,557 bushels of pears, valued at $78,448; 36,303 bushels of cherries, valued at $60,294; 4,421 bushels of quinces, valued at $4,045; and 1,677 bushels of apricots, valued at $1,657.

The production of grapes in 1909 was 1,979,480 pounds, valued at $85,423. The grape-vines of bearing age in 1910 numbered 338,758; those not of bearing age, 76,040.

The total production of nuts in 1909 was 783,570 pounds, valued at $14,041. Black walnuts were the most important of the nuts, the production in 1909 being 708,627 pounds, valued at $9,194. The production of the other nuts in 1909 was: 25,581 pounds of pecans, valued at $2,566; 16,409 pounds of chestnuts, valued at $1,127; and 23,246 pounds of hickory-nuts, valued at $566.

The value of the tropical fruits produced in Tennessee in 1909 was $4,127. Figs, the most important of the tropical fruits, were produced to the amount of 68,535 pounds, valued at $4,070.

Of the small-fruits grown in Tennessee, strawberries are the most important, with blackberries and dewberries ranking next. The acreage of strawberries decreased from 11,548 in 1899 to 10,761 in 1909, when the production was 12,339,584 quarts, valued at $835,739. Blackberries and dewberries increased in acreage from 733 in 1899 to 1,514 in 1909, when the production was 1,316,100 quarts, valued at $65,476. Other small-fruits produced were: 222,331 quarts of raspberries, valued at $20,931; 13,740 quarts of gooseberries, valued at $1,205; and 3,726 quarts of currants, valued at $261.

The acreage devoted to the production of potatoes in Tennessee increased from 27,103 in 1899 to 40,963 in 1909, when the production was 2,922,713 bushels, valued at $1,790,233. Sweet potatoes and yams increased in acreage from 23,374 in 1899 to 26,216 in 1909, when the production was 2,504,490 bushels, valued at $1,625,056. Peanuts decreased in acreage from 19,534 in 1899 to 18,952 in 1909, when the production was 547,240 bushels, valued at $386,765. The production of the more important of the other vegetables in 1909 was: 5,803 acres of tomatoes, valued at $426,714; 2,398 acres of watermelons, valued at $105,001; 2,300 acres of green beans, valued at $68,536; 1,189 acres of cabbage, valued at $64,714; 1,456 acres of cantaloupes and muskmelons, valued at $41,691; 807 acres of turnips, valued at $29,853; 235 acres of onions, valued at $15,068; 139 acres of asparagus, valued at $13,003; and 365 acres of sweet corn, valued at $11,246. Vegetables of minor importance in 1909 were beets, popcorn, cucumbers, lettuce, green peppers, rhubarb, and squash.

The acreage devoted to the production of flowers and plants increased from 140 in 1899 to 239 in 1909. The area under glass in 1909 was 1,236,874 square feet, of which 1,079,374 were covered by greenhouses and 157,500 by sashes and frames. The value of the production in 1909 was $344,579, as compared with $175,979 in 1899.

The acreage devoted to the production of nursery products increased from 2,838 in 1899 to 3,976 in 1909, when the value of the nursery products was $697,703, as compared with $474,133 in 1899.

Charles A. Keffer.

Alabama.

Alabama (Fig. 2518) has many natural features which promise eventually to make it a very important horticultural state. The varied classes of soils, the range in elevations from coastal to semi-mountainous and the different climates between the extreme southern and the extreme northern parts of the state, provide conditions under which many of the fruits of the subtropics and of the temperate zones may be grown very successfully. The average rainfall for the state is 55 inches, most of this falling in the winter months. The average maximum temperature approximates 85° in the summer months and it is seldom that the temperature in the winter falls below 18° F.

Within recent years, hundreds of northern settlers have located in the state and many of these have taken up fruit- and vegetable-growing on an extensive scale; at present the influence of this movement is greater in the more southern counties. Large tracts of freshly cut-over lands are being rapidly developed by different land companies and are being planted principally in pecans and Satsuma oranges.

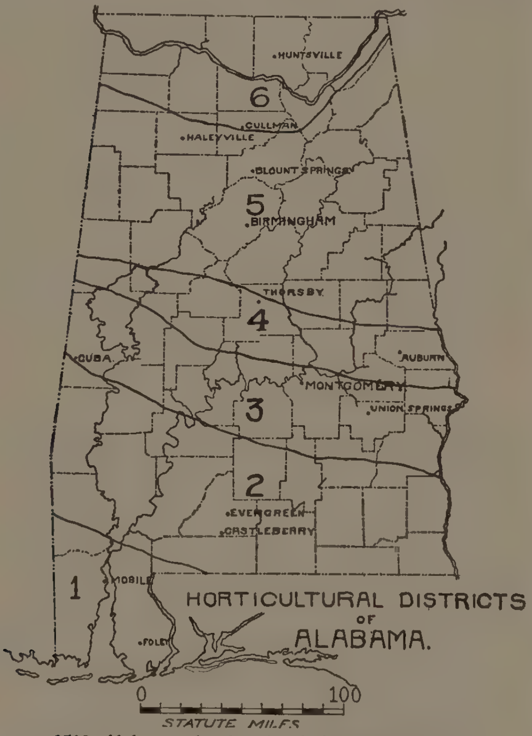
There are several large greenhouse establishments in the state, the largest of these being at Montgomery. The area of glass is being rapidly increased in Mobile and Birmingham and the smaller cities.

Beautiful out-of-door roses bloom in the spring and fall months and practically every home has its rose-garden. The climate being comparatively warm during ten months of the year furnishes rare opportunities for lovers of flowers.

The principal fruit- and vegetable-growing sections of the state are largely separated, and may be divided into six sections as shown on the map (Fig. 2518).

The light sandy loams of the Gulf section—Lower Coastal Plain (Fig. 2518, Area No. 1)—are particularly adapted to the growing of early spring vegetables for northern shipment. Mobile cabbage has become popular in the northern market and is, perhaps, grown more extensively in both Baldwin and Mobile counties than any other vegetable crop. In 1910, 714 cars of cabbage were shipped north from Mobile. As a rule, soils upon which cabbage is grown contain very little humus and as a result, considerable quantities of commercial fertilizer are used. The average cabbage-grower, under present conditions, realizes a very small net profit on his cabbage acreage. With scientific management the business should pay. There are many farms on which the percentage of clay is high and when cover-crops are grown on these soils some excellent crops have been produced.

Among other important vegetables grown in the Gulf region are snap beans, cucumbers, English peas, radishes and sweet potatoes, the latter being an important crop. Sweet potato yields average from 200 to 600 bushels an acre, and the average net return is 40 cents a bushel.



2518. Alabama, showing the six leading divisions.

The storage of large quantities of sweet potatoes under the old method is not always successful. The newer method of storage in connection with fire-curing is usually completely successful. At Summerdale in Baldwin County, a canning factory put up 1,000,000 cans in 1911. This industry is receiving considerable attention at present. The Nancy Hall, Dooley, and Early Triumph varieties are commonly grown.

Tomatoes have not been grown on a commercial scale successfully as a rule. "Wilt" and "blossom-end rot" are two diseases that are difficult to control and both are prevalent in the Gulf region. Also the Texas crop is on the market before the Alabama crop and prices are low when the latter comes on.

Watermelons are grown principally for the local market, although many cars are shipped North. They are planted about March 5 in the Gulf region and mature May 1.

Peaches have been successfully grown in the Gulf region, but there are only one or two commercial peach orchards now being operated. Elsewhere in the state are extensive commercial orchards; one at Atmore embraces 225,000 trees; another at Union Springs contains 1,000 acres. There are also large peach orchards at Blount Springs, Gadsden, and Alexander City. Brown-rot, San José scale, the plum curculio, and the peach tree-borer are the chief pests. San José scale has frequently done great damage before the grower became aware of the nature of the trouble. In this region peaches begin to ripen May 20 and the season extends to August 1 in the northern part of the state.

Japanese persimmons and some of the Japanese plums thrive in the Lower Coastal Plain. The work of the Department of Agriculture and of the Alabama Experiment Station in successfully ripening Japanese persimmons artificially, will give an impetus to the planting of this beautiful and splendid fruit. Persimmons properly ripened are little known outside of the Gulf states. Artificial ripening is chiefly of advantage in shipping the persimmons. They ripen naturally in October and November.

Figs, particularly the domestica group, are grown successfully over most of the state; they are seldom winter-killed and a few old trees will produce from six to ten bushels of fruit, and with the introduction of canning factories this fruit is being more widely exploited. It is difficult to ship the fresh fruit to the North but it has been accomplished successfully. There is a splendid market for the preserved product.

Grapefruit, guavas and so-called "native" sweet oranges are grown successfully in the extreme southern part of Baldwin and Mobile counties, but it is doubtful whether grapefruit will ever be grown on a large scale very successfully. A few ponderosa lemons are also planted about homes. Kumquats offer commercial possibilities and are being planted in a limited way. The fruit makes a delicious marmalade and preserve.

With the introduction of the Satsuma orange, many large nurseries have been established in the vicinity of Mobile, and this promises to be a center for this industry owing to the favorable soils and proximity to the extensive new plantings. Plantings now embrace about 1,500,000 trees, covering 10,000 acres, chiefly in Mobile and Baldwin counties.

The sand pear, although considered by many quite worthless, finds a ready market and is being grown successfully in this coastal section. It is resistant to blight and produces enormous yields.

A few of the early apples, such as Red June, Red Astrachan and Yellow Transparent, can be grown in a small way successfully even as far south as Mobile.

Both the bunch and muscadine grapes do well in the vicinity of Mobile, one instance being known at Flomaton where a grower netted $600 from one acre of bunch grapes.

In the past few years, there has been an immense increase in the planting of pecans, principally in the territory southward of Montgomery. The varieties in favor are Schley, Stewart, Frotscher, Delmas, Moneymaker, President, and others. There are now planted in the state, chiefly in the southern counties, between 250,000 and 300,000 pecan trees. These are grafted trees mostly.

The Upper Coastal Plain (Fig. 2518, Area No. 2) has not been an important section from a horticultural standpoint up to the present. The southwestern section is rapidly developing as a stock-raising region. Pecans are also being planted extensively there. At Evergreen and Castleberry there are large acreages of strawberries, and these towns are famous for the quality of berries they ship North each season. Berries are ready for market from April 1 to 10.

At Evergreen there is a rather novel horticultural industry. Carloads of southern smilax, commonly called "bamboo vine," are gathered in one-mule wagons by both whites and negroes, and are brought into warehouses and sold to shippers, much as cotton is sold. The smilax is carefully packed into light wooden boxes and shipped to northern cities. The season for shipping this evergreen comes just before Christmas, and holly is also gathered at the same time and shipped North.

In the Black Belt section (Fig. 2518, Area No. 3), a heavier type of soil is found. A few attempts at fruit-growing have been made but none of importance. There are splendid opportunities for small-fruit culture and vegetable-growing. Pecans thrive in this soil. In Sumter County there are many successful truck-growers, and this section ranks second to Mobile as a producer of early vegetables. There is a large fruit-farm in the vicinity of Union Springs in Bullock County where the possibilities of commercial fruit-growing have been demonstrated.

The Central Sandy Region (Fig. 2518, Area No. 4) is not adapted to commercial horticulture, although some excellent peaches are being grown in it. The Experiment Station is located at Auburn in the eastern part of the area. In parts of Lee, Chambers and Tallapoosa counties, fine bunch grapes can be grown.

The Mountain Region (Fig. 2518, Area No. 5) contains such diversified conditions of soil and elevation that it is difficult to describe specific features for the entire region. The counties of Blount, Cullman, Winston and Walker are especially adapted to fruit-growing and there are many large and successful orchards in these counties. On the elevated sites, the danger from frost is eliminated and the strong soils produce firm and beautifully colored fruit. The Elberta peach crop follows the Georgia crop and the market prices are generally good. Many fine apples are also grown, among which might be mentioned the varieties, Black Twig, Champion, Hackworth, Winesap, Shockly, Yates, Black Ben, Ben Davis, Delicious, Grimes Golden, and others. There are successful apple orchards at Ft. Payne and Gadsden. In the vicinity of Cullman, many fine apples are shipped North. The large settlement of Germans at this place has become famous for its successful farms, both general and horticultural. These farmers grow early varieties of sweet potatoes and the town is noted for its production of early strawberries. None of these farmers grows over 5 acres of strawberries, most of them less, but they are well organized and managed and receive maximum net returns. Excellent cantaloupes are shipped from Blount County every season.

The Tennessee Valley Region (Fig. 2518, Area No. 6) is perhaps the most beautiful and most fertile region of the state. At present it is "land poor," in other words, the plantations are too large for successful agricultural operations. The principal horticultural industry in this section is the large wholesale nursery business conducted in and about Huntsville. Owing to the original cheapness of the land and its peculiar adaptability to the growing of nursery stock, 2,500 acres are devoted to this work each year. The fruit-trees which are grown in the order of their importance are: peaches, pears, apples, cherries and plums. More land is now being devoted to ornamental stock than heretofore.

Among the men, no longer living, who have been especially influential in building up horticultural interests, may be mentioned W. F. Heikes. For many years prior to his death, he was in charge of the Huntsville Wholesale Nurseries, one of the largest nurseries in the South. From the time of the organization of the State Horticultural Society, until his death, Mr. Heikes was president of that organization. (See Volume III, page 1578.)

Public-service agencies for horticulture.

The Alabama Polytechnic Institute, which corresponds to the agricultural and mechanical colleges of other states, is located at Auburn. It was established in 1872. The duties of teaching and experimentation are, in most cases, performed by the same men.

The horticultural staff of the College and Station at present consists of the Professor of Horticulture and Horticulturist; an associate in horticulture, a field agent in horticulture, for experimental work only; and a graduate student assistant in horticulture. The equipment for College and Station consists, aside from the usual classrooms, offices and barns, of storage-rooms and a battery of two greenhouses connected with an extensive workroom, and canning equipment.

Elementary agriculture, which is a required subject in the public schools of Alabama, includes a small amount of work in horticulture. Horticulture is taught as a distinct subject in the ten agricultural schools of secondary grade, and in the state high-schools.

Extension work in horticulture is given in connection with other work at farmers' institutes, movable schools of agriculture and home economics, and in special meetings for the promotion of horticultural interests.

The Horticulturist of the Experiment Station is ex-officio Secretary of the State Board of Horticulture and State Horticulturist. This Board, under the horticultural law amended in September, 1915, is authorized to make quarantine regulations with reference to insects and diseases attacking fruit-trees and other plants.

The State Horticultural Society has been influential in fostering an interest in horticulture. It was founded in 1903. The Gulf Coast Horticultural Society, organized in 1914, a branch of the State Society, is devoted to the citrous interests and questions connected with the specialized horticulture along the Gulf coast of Alabama and similar sections of the neighboring states. A citrous exchange, modeled in a general way after the Florida Citrous Exchange, was organized in 1915 to market coöperatively the citrous and pecan crops. A similar oganization to handle truck crops was created shortly afterward. Both organizations have their headquarters in Mobile.

Statistics (Thirteenth Census).

The land area of Alabama, is 32,818,560 acres, of which 63.2 per cent or 20,732,312 acres are in farms. Of this farm area, 46.8 per cent or 9,693,581 acres are improved, 9,444,764 acres are woodland and 1,593,697 acres are classified as other unimproved land in farms. The number of all the farms in 1909 wers 262,901, and the average acreage to a farm 78.9. [The total area is 51,998 square miles.]

The leading agricultural crops are cotton, cereals, hay and forage, and forest products. Of these, cotton was the most important in 1909, producing about three-fifths of the total value of crops. The acreage of cotton in 1909 was 3,730,482 as compared with an acreage of 3,202,135 in 1899, showing an increase of 16.5 per cent. The value of cotton products in 1909 was $87,008,432. The land occupied by cereals in 1909 was 2,844,824 acres. In 1899 the area of cereals was 3,088,454 acres, showing a decrease of 7.9 per cent. The value of the cereal products in 1909 was $30,927,210. The acreage of hay and forage in 1909 was 238,656 with the products valued at $3,357,132. In 1899 there were 85,353 acres of hay and forage, showing an increase in the past decade of 179.6 per cent. The value of the forest products in 1909 was $6,308,151, as compared with $2,494,452 in 1899, showing an increase of 152.9 per cent in value.

The leading horticultural crops are vegetables, fruits and nuts, flowers and plants and nursery products. In 1909 the total acreage of potatoes and other vegetables was 150,567 and their value $9,842,784. The acreage of potatoes, sweet potatoes and yams in 1909 was 81,099. Their value in 1909 was $4,463,207. The acreage in 1899 was 60,370, showing an increase of 34.3 per cent. The acreage of other vegetables also showed an increase of 24.4 per cent during the same period. In

1909 there was an acreage of 69,468, with products valued at $5,379,577. The acreage in 1899, was 55,822. The value of the fruits and nuts in 1909 was $2,024,001; in 1899 the value was $573,763, showing an increase in value of 252.8 per cent. The acreage devoted to flowers, plants and nursery products was 3,199 in 1909 and 1,091 in 1899, an increase in acreage of 193.2 per cent. The value of flowers, plants and nursery products in 1909 was $427,296.

The total quantity of orchard-fruits produced in 1909 was 2,475,540 bushels, valued at $1,818,508. Peaches and nectarines contributed considerably more than one-half of this quantity, there being 1,416,584 bushels produced from 3,177,331 trees of bearing age. There were also 838,866 trees not of bearing age. The number of apple trees of bearing age in 1910 was 1,468,436; those not of bearing age, 737,689. The production in 1909 was 888,396 bushels of apples, valued at $620,745. The number of pear trees of bearing age in 1910 was 142,300; those not of bearing age, 99,170. The production of pears in 1909 was 100,041 bushels, valued at $86,866. The production of plums and prunes amounted to 61,712 bushels, valued at $45,039; that of cherries 3,588 bushels, valued at $4,873; that of quinces 2,740 bushels, valued at 2,944; that of mulberries 1,527 bushels, valued at $1,210, and of apricots 952 bushels valued at $950.

The production of grapes in 1909 amounted to 1,723,490 pounds, valued at $81,386. In 1910 there were 287,431 vines of bearing age and 77,105 vines not of bearing age.

The leading nuts produced are pecans, black walnuts, and Persian or English walnuts. The number of trees in 1910 were as follows: pecans, 44,683 of bearing age, 125,734 not of bearing age; black walnuts, 3,228 of bearing age, 1,753 not of bearing age; Persian or English walnuts, 3,022 of bearing age, 4,180 not of bearing age. The value of the nut products in 1909 were: pecans, $30,540; black walnuts, $3,447; English or Persian walnuts, $3,557. Almonds were also produced to the value of $51.

The tropical fruits grown are figs, oranges and pomegranates. In 1910 the number of fig trees of bearing age was 52,731; those not of bearing age, 33,893; orange trees of bearing age, 2,599; not of bearing age, 17,386; pomegranates of bearing age, 1,672; not of bearing age, 3,552. The value of figs in 1909 was $80,960; of oranges, $3,663; of pomegranates, $617. Pomelos (grapefruit) were also produced to the value of $359.

Of the small-fruits grown in Alabama, strawberries are by far the most important. The production, from 1,167 acres in 1909 was 1,848,537 quarts valued at $160,026. The acreage in 1899 was 607. The production of blackberries and dewberries in 1909 was 44,594 quarts valued at $3,726; 10,546 quarts of raspberries and loganberries with a value of $1,380; 2,452 quarts of gooseberries with a value of $177. The value of the currants and cranberries grown was $64 and $10, respectively.

The leading vegetables, their acreage, and value in 1909 were as follows: green beans, 842 acres, valued at $62,691; cabbage, 1,366 acres, valued at $208,754; tomatoes, 566 acres, valued at $47,322; watermelons, 4,708 acres, valued at $135,200. Other vegetables grown in Alabama were cantaloupes, muskmelons, sweet corn, cucumbers, onions, green peas, radishes, and turnips.

Alabama ranks fifth in the production of peanuts. The acreage increased from 78,878 in 1899 to 100,609 in 1909, an increase of 27.6 per cent. The production in 1909 was 1,573,796 bushels and their value $1,490,654.

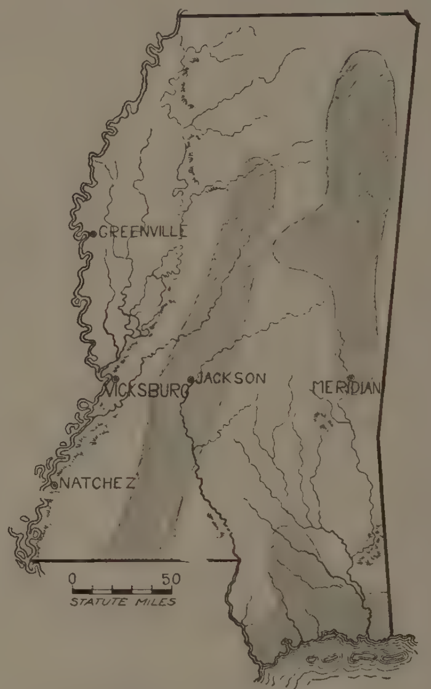
The area of land under glass in 1909 devoted to flowers and plants was 463,575 square feet, of which 435,400 were covered by greenhouses and 28,175 by sashes and frames. The value of flower and plant products in 1909 was $168,239.

The value of the nursery products in 1909 was $259,057.

P. F. Williams.
J. F. Duggar.

Mississippi.

Mississippi (Fig. 2519) extends about 325 miles from north to south and 175 miles from east to west. The surface is mostly undulating, with few abrupt hills, and the highest part of the state, the northeastern section, is less than 1,000 feet above the sea-level. It has an annual rainfall of about 45 inches in the northern part, the amount increasing to about 60 inches in the extreme south. The winter temperature is rarely as low as zero in any part of the state, while the extreme summer heat rarely reaches 100° in the northern part; near the Gulf coast 95° is the usual limit. The first frosts usually occur in November, and spring frosts are rare after the middle of March



2519. Mississippi, with the main areas.

The soil is extremely variable. The western part of the state, known as the Yazoo and Mississippi Delta, has one of the richest alluvial soils in the world, and one well suited for the growing of vegetables, besides cotton and corn, which grow to perfection here. The north-central part of the state consists largely of yellow clay hills, not very fertile and liable to serious injury from erosion, but with very fertile valleys between them, while the northeastern section has a strong lime soil which is very productive. Nearly all of the southern half of the state has a sandy loam soil underlaid with clay at a depth of a few inches, making those lands among the most desirable for the cultivation of either fruits or vegetables.

Although both fruits and vegetables are grown for export in all parts of the state, there are three districts in which horticultural work is specially prominent. These are the northeastern district, covering the territory along the Mobile and Ohio Railroad from Booneville south to Starkville and Meridian; the central district, covering the territory along the Illinois Central Railroad from Grenada south to Brookhaven; the Gulf-coast district, covering the territory along the Louisville and Nashville Railroad from Bay St. Louis east to Orange Grove; and along the Gulf and Ship Island road from Gulfport to Hattiesburg.

Peaches are grown more extensively than any other fruit, and are shipped to northern markets from nearly or quite every county in the state. The long growing season enables the trees to come into bearing rapidly, and a small crop of fruit is usually gathered the second year from planting, while the trees often continue fruitful from fifteen to twenty years. Although the trees themselves are never injured by cold, the fruit crop is occasionally cut short by spring frosts following warm winter weather, which sometimes brings the trees into bloom before the end of January. The early fruit is ready for market about the last of May, and shipments continue from that time until August, or later. Elberta, Mountain Rose, Georgia Belle, Lilly Miller and Chinese Cling are among the more popular varieties.

Pears grow well in all parts of the state, and, until about 1895, were planted more widely than any other fruit-trees, but since that time the blight has been so widespread and so severe that very few new orchards have been planted. Fully nine-tenths of the trees are either Le Conte or Kieffer, the latter being the more resistant to blight. In recent years the Sand pear, which does not blight in Mississippi, has been extensively planted and is the most prolific fruiter known.

Apple trees make a fair growth and bear well for some years, but become less vigorous with age, and are shorter-lived than in more northern latitudes. Nearly all varieties ripen during the summer and fall, and very few, even of the "long keepers," can be preserved through the winter. The fruit always commands a high price in the local markets, which makes the trees profitable, even though they last but a few years. Considerable fruit, mostly Early Harvest and Red June, is shipped from the northeastern district, but no other part of the state produces enough for a home supply.

Plum trees are of uncertain value. The Wild Goose and the Japanese varieties are the more common sorts, and while some trees and some orchards may grow well and bear heavily for many years, most of them succumb after producing two or three crops. Cherries are rarely successful. Figs are grown very commonly for home use in the central part of the state, and in the Gulf coast district are an important market crop. The fig does not succeed under orchard conditions, but a few trees grown near the house do well, and many of the older trees produce 1,000 pounds or more of fruit annually, and this finds a ready market at the canning factories. The Celeste is the common variety, and the demand for the fruit at 4 cents a pound is far in excess of the supply. Oranges are grown along the Gulf coast, but even there the winters are occasionally so cold as to make them unprofitable.

Oranges are being planted extensively along the Gulf coast, especially the Satsuma, a kid-glove variety of Japanese origin, which has proved hardy, producing regular and abundant crops, the trifoliata being used as a stock for grafting. This variety of orange has withstood cold as low as 12° above zero. It is found that it grows and bears equally well, if not better, on the Gulf coast of Mississippi than in its native home. Several million trees of this orange have been planted in the last ten years, and the output has attained to considerable proportions.

Pecans of the paper-shell kind are cultivated extensively throughout the state, especially in the southern tier of counties, Jackson, Harrison and Hancock fronting immediately on the Gulf. Some years ago, some exceedingly large pecans of very thin shell and of a delightful flavor were found growing in Jackson County in the vicinity of Ocean Springs, and Pascagoula in Jackson County. These nuts attracted considerable attention and many nurserymen on the Gulf coast grafted from these varieties and extensive planting of them was immediately begun. Many large groves are now established on the coast, especially in Jackson County, and the trees bear enormous crops, some of them reaching a capacity of 225 pounds per annum. Grafting-wood from these trees has been taken extensively to other states, in which the soils are adapted to this nut. There are many groves along the Gulf coasts of Missisisippi now of 100 to 1,000 acres and the industry promises to be very extensive and profitable to those who engage in it. There was shipped from the Pascagoula district in 1914 more than 200,000 pounds of paper-shell pecans and half as many from the Ocean Springs district.

Grapes grow and bear as well as it is possible for them to do in any part of the country. The long season for growth develops very strong vines which are never injured by the cold of winter, and the latest ripening sorts have ample time for maturing. The early varieties ripen about June 20 in the Gulf coast district, and about July 10 in the northeastern district, and nearly all the crop is gathered by August 1. This early ripening of the fruit enables the grower to secure high prices for his early shipments, but a crop which matures in the heat of midsummer cannot be kept profitably, even in cold storage, but must be marketed at once, regardless of price. Champion, Ives, Delaware, Niagara, Perkins and Herbemont are among the more popular varieties. The Scuppernong (*Vitis rotundifolia*) is a valuable native grown in all parts of the state for home use and for the manufacture of wine, but is not a shipping variety.

Among the small-fruits, strawberries are the most important, being grown by thousands of acres. They are grown more extensively in the central district than elsewhere, though there is a considerable acreage in the northeastern district also. In the Gulf coast district the plants grow well and bear abundantly. Klondyke and Lady Thompson are the favorite varieties. Shipments begin about the first of April, and the bulk of the crop is gathered in the next six weeks, though occasional shipments are made in every month of the year.

Blackberries and dewberries grow spontaneously in all parts of the state and have proved profitable in cultivation, the Lucretia, Dallas and other hybrids being the favorite varieties. Neither currants nor gooseberries do well in any part of the state, as they make a new growth and come into bloom soon after the fall rains begin, and soon become so weakened as to be worthless. Raspberries do well when planted on soils containing sufficient moisture, but are seldom grown for market excepting in the northeastern district. Turner is the favorite variety, and the blackcaps are rarely seen.

The growing of early vegetables for northern market is followed more extensively and is more generally profitable than is the growing of fruits. Field plantings of radishes, peas and other hardy sorts begin in January. Shipments begin by the first of March and continue until the melon crop is harvested in July. The first crop of Irish potatoes, mostly Early Ohio and Triumph, is ready for market in May, and in August a second crop is often planted which matures in November, when it finds a ready home market, or is left in the ground until early spring, when it is placed on the northern markets as "new potatoes just received from Bermuda," and brings a high price. The second crop, however, is uncertain, as it is difficult to secure a prompt growth if seed from the early crop is used, and it is often impossible to secure northern seed so late in the season. Sweet potatoes are grown in all parts of the state, and are shipped from July until March. Asparagus is a profitable early crop which is grown largely in the central district, and seems wholly free from rust or other diseases. Rhubarb is unable to endure the heat of the long summer, and the roots soon decay. Beans, beets, cabbages, peas, radishes and turnips are all grown so largely as to be shipped in carload lots from a number of towns in the northeastern and central districts. The crop grown more widely than any other is the tomato, which is grown in all parts of the state, and which is shipped by the carload to all parts of the country from Boston to St. Paul, Omaha and Denver. Many single growers ship by carlots, and in June from ten to twenty cars are shipped daily from Crystal Springs, which is south of Jackson, with nearly as many from Madison Station and Booneville, besides smaller shipments from many other points. In 1911 more than 1,000 carloads of vegetables were shipped from Crystal Springs, the shipments ranking in importance in the order named, viz., tomatoes, cabbages, beans, carrots, peas, turnips, beets.

From the central district, shipments are made about as follows: Beans, May 10 to June 10; beets, April 20 to June 15; cabbage, May 1 to June 5; carrots, April 20 to June 10; melons (Gem), June 20 to July 20; peaches, June 1 to August 1; peas, March 25 to April 25; potatoes, Irish, May 10 to June 15; radishes, March 1 to April 15; squash, summer, May 15 to June 15; strawberries, April 1 to May 10; turnips, March 20 to May 15; tomatoes, May 25 to July 4; watermelons, July 1 to August 1.

There are a number of canneries in the state, the most successful being those at Booneville and Biloxi, but ordinarily growers find it more profitable to ship products to northern markets than to sell at prices which canners can afford. Partial reports from other points indicate that shipments, in carlots, amount to not less than 8,000 cars annually, in addition to nearly as much more which is shipped in small lots. The northeastern and central districts ship principally to northern markets, while the Gulf coast district finds its markets in Mobile, New Orleans, and on the many foreign vessels loading in Ship Island harbor. Nearly the entire business has been developed in the last twenty-five years, and each succeeding year shows a marked increase in its volume. New localities are being opened, the work is constantly better organized, and, with the increase of the business, the markets are becoming more steady, prices more uniform, and the profits more satisfactory than in the early days. The business has by no means reached its full development, and will not do so for years to come.

Among the men who have been influential in establishing horticultural industries in Mississippi was the late W. R. Stuart, of Ocean Springs, to whom much of the present volume of the pecan interest is due, a development that promises much for the state.

Public-service agencies for horticulture.

The land-grant college of Mississippi was established at Agricultural College in 1880. The institution is near Starkville, in the northern half of the state. At the present time (1915) there are four members of the horticultural staff.

The central Experiment Station is located at Agricultural College and there are three branch stations at Holly Springs, McNeil, and Stoneville. Two of these branch stations are carrying on experimental work in horticulture. Seventeen horticultural bulletins have been issued.

The nurseries of the state are inspected each year by the entomologist of the Experiment Station.

Statistics (*Thirteenth Census*).

The approximate land area reported in 1910 was 29,671,680 acres, of which 62.5 per cent is in farms. The improved land in farms, numbered 9,008,310 acres; the woodland in farms, 7,883,558 acres; and the other unimproved land in farms numbered 1,665,665 acres. The total number of farms in Mississippi in 1910 was 274,382. The number of acres in the average farm was 67.6. [The total area of Mississippi is 46,865 square miles, by the latest calculations.]

The leading agricultural crops in Mississippi are cotton (including cotton seed), cereals, hay and forage, and sugar crops, and also forest products of the farm. Cotton is by far the most important of the farm crops. The acreage increased from 2,897,920 in 1899 to 3,400,210 in 1909, when the value of the production was $96,353,433, or 65.4 per cent of the total value of all crops. Cereals decreased in acreage from 2,372,065 in 1899 to 2,270,503 in 1909, when the value of the products was $26,864,772. Hay and forage increased in acreage from 99,261 acres in 1899 to 229,705 in 1909, an increase of 131.4 per cent, when the value of the products was $3,363,647. The value of the products from 42,731 acres devoted to sugar crops amounted to $1,851,178. The value of forest products of farms in 1909 was $6,602,943, as compared with $3,023,626 in 1899. Among crops with no acreage reports, the miscellaneous crops had a value in 1909 of only $5,740 and in 1899 of $2,845; seeds had a value of $1,047 in 1909 and $1,185 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, vegetables, including potatoes and sweet potatoes and yams, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $1,579,752, as compared with $497,779 in 1899. The acreage occupied by small-fruits decreased from 1,549 in 1899 to 836 in 1909, when the production was 1,407,301 quarts, valued at $107,171. In 1909 the total acreage of potatoes and other vegetables was 125,610 and their value $9,483,576. Excluding potatoes and sweet potatoes and yams, the acreage of vegetables was 61,223 and their value $5,868,275. Flowers and plants and nursery products increased in acreage from 243 in 1899 to 572 in 1909, when the value of the production was $175,267, as against $58,212 in the year 1899.

The production of orchard-fruits in 1909 was 1,634,305 bushels, an increase of 167.5 per cent over 1899. Peaches and nectarines, and apples produced most of this quantity. The number of peach and nectarine trees of bearing age in 1910 was 1,726,298; those not of bearing age, 724,895. The production in 1909 was 1,156,817 bushels, valued at $925,288. The number of apple trees of bearing age in 1910 was 427,652; those not of bearing age, 425,323. The production in 1909 was 265,841 bushels, valued at $213,714. Pears and plums and prunes were of relative importance in 1909, there being produced 101,288 bushels of pears, valued at $96,777, and 101,974 bushels of plums and prunes, valued at $79,971. There were also produced in Mississippi, in 1909: 2,819 bushels of cherries, valued at $3,749; 2,277 bushels of apricots, valued at $2,510; 2,725 bushels of quinces, valued at $2,863; and 564 bushels of mulberries valued at $634.

The grape-vines of bearing age in 1910 numbered 77,012; those not of bearing age, 34,870. The production decreased from 1,070,625 pounds in 1899 to 760,563 pounds in 1909, when it was valued at $44,262.

The total production of nuts in 1909 was 866,504 pounds, valued at $90,885. Pecans are by far the most important of the nuts, producing in 1909, 637,293 pounds, valued at $79,936. In addition, 66,492 pounds of Persian or English walnuts were produced, valued at $6,949, and 151,406 pounds of black walnuts, valued at $3,700.

Tropical fruits were produced in 1909 to the value of $119,129. Figs are the most important, there being produced in 1909, 1,949,301 pounds of figs, valued at $107,609. Oranges are apparently increasing since the number of orange trees of bearing age in 1910 was 10,452, and those not of bearing age, 38,637. The production of oranges in 1909 was 3,779 boxes, valued at

$8,684. The number of grapefruit (pomelo) trees of bearing age in 1910 was 1,001; those not of bearing age 1,978. The production in 1909 was 1,368 boxes, valued at $2,345.

Strawberries are by far the most important of the small-fruits in Mississippi, although the total acreage of all small-fruits decreased from 1,549 in 1899 to 836 in 1909. Considering strawberries, the acreage decreased from 1,383 in 1899 to 772 in 1909, when the production was 1,345,013 quarts, valued at $101,882. The other small-fruits produced were: 53,735 quarts of blackberries and dewberries, valued at $4,531; 7,806 quarts of raspberries and loganberries, valued at $673, and minor quantities of currants and gooseberries.

The acreage of sweet potatoes and yams increased from 38,169 in 1899 to 56,045 in 1909, when the production was 4,427,988 bushels, valued at $3,073,290. The acreage devoted to the production of peanuts increased from 5,853 in 1899 to 13,997 in 1909, an increase of 139.1 per cent. The production in 1909 was 284,791 bushels, valued at $317,236. The acreage devoted to potatoes increased from 6,370 in 1899 to 8,342 in 1909, when the production was 644,742 bushels, valued at $542,011. Of the other vegetables grown in Mississippi, the more important were: 3,651 acres of tomatoes, valued at 401,984; 1,396 acres of cabbage, valued at $98,244; 1,794 acres of watermelons, valued at $86,973; 1,052 acres of green beans, valued at $43,925; 194 acres of radishes, valued at $30,216; 435 acres of green peas, valued at $18,342; and 234 acres of turnips, valued at $15,987. Vegetables of minor importance were asparagus, beets, cantaloupes and muskmelons, carrots, sweet corn, cucumbers, lettuce and onions.

The acreage devoted to the production of flowers and plants decreased from 62 in 1899 to 39 in 1909. The total area under glass in 1909 was 216,937 square feet, of which 201,622 were covered by greenhouses and 15,315 by sashes and frames. The value of the flowers and plants produced in 1909 was $100,321.

There was a marked increase in the acreage devoted to nursery products—from 181 in 1899 to 533 in 1909, an increase of 194.5 per cent. The value of the nursery products in 1909 was $74,946, as compared with $31,305 in 1899.

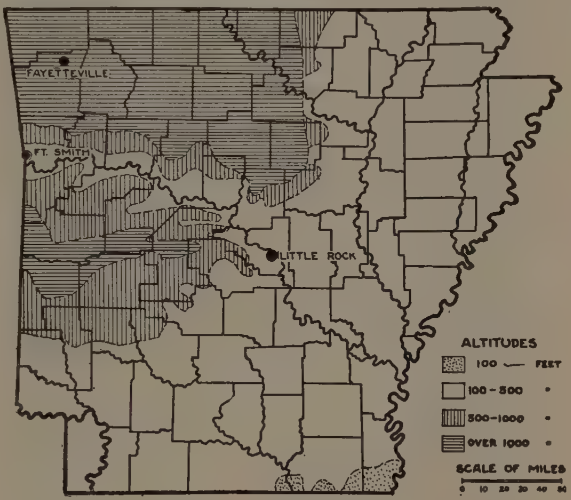
S. M. Tracy.
F. H. Lewis.

WEST SOUTH CENTRAL STATES.

Arkansas.

Differences in altitude give the state of Arkansas (Fig. 2520) two general types of climate and agriculture. The northwestern two-fifths of the state has a north-temperate climate and is adapted to practically all the crops usually grown some hundreds of miles northward. In the southeastern three-fifths of the state, climatic conditions are subtropical, cotton being the leading farm crop, while corn and rice are also grown extensively. A line drawn from the northern part of Sevier County to Arkadelphia, thence past Little Rock, a little to the northward, and thence to Mammoth Springs in northern Arkansas separates in a general way the two divisions. The division line represents a general elevation of 500 feet. Northwestward the general elevation soon increases to 1,000 feet, with here and there points and ridges rising a few hundred feet higher. The Boston Mountain, a ridge running eastward along the southern border of Washington County and extending into Searcy County, presents an elevation of about 2,000 feet. This barrier has a marked effect on the climate north of it, making the conditions like those of regions many miles farther north. Southward the slopes descend into the Arkansas Valley and into a truly southern climate. Between Fayetteville and Van Buren, a distance of about 60 miles, there is a difference of ten to twelve days in the earliness of the season. In Pope County, Mount Magazine (height, 2,850 feet) is said to be the highest point between the Alleghany and Rocky Mountains. The Ozarks of northwestern Arkansas enter the state from Oklahoma and Missouri. In central-western Arkansas, the broken elevated area consisting of a series of ridges running in an easterly and westerly direction is known as the Ouachita Mountains. In general, the main hills or ridges and valleys in the hill country of Arkansas have an easterly and westerly direction. They represent the work of erosion, although the Ozark region as a whole is part of an uplift and one of the oldest parts of the continent.

The surface in general of the highland is rolling, partly tableland, rough in places with small prairies here and there. The average elevation of the Ozark portion of the state is about 1,000 feet above sea-level. Some of the valleys are narrow, others broad, miles in extent and of great fertility. On some of the hills the soil is thin and poor, sometimes very rocky; again it is fertile and deep. North slopes, as a rule, are more fertile than the southern. There are various types of soil from sandy to clayey loam, cherty soils and the rich brown loam known as "pawpaw" soil with redclay subsoil overlying limestone. Clarksville silt loam and Clarksville stony loam are common types of upland soil in northwestern Arkansas. The valleys also range from sandy alluvial loam to clayey and heavy black soils very rich but sometimes needing drainage. In their natural condition the hills and valleys are covered with the various kinds of forest growth characteristic of the northern woods, contributing to the mildness and healthfulness of the climate.



2520. Arkansas, to show horticultural parts.

The winters are short and summers long. The mean temperatures for January and July, respectively, at Fayetteville are 37.59° and 77.03°, and at Little Rock, 40.8° and 80.3°. The rainfall is ample and ordinarily well distributed throughout the year. The average for the state is 50.5 inches. It is somewhat less in northwest Arkansas, being 45.6 at Fayetteville and reaching 63.2 inches at Hot Springs. Irrigation is not necessary. Proper tillage may be made to conserve the supplies of moisture sufficiently for bountiful yields under all ordinary conditions. The average snowfall in the hill country is nine inches; southward it varies from three to five.

The southeastern half of the state is in reality a part of the low level and fertile Atlantic coastal plain and is similar to Louisiana. The surface is rolling, varying from 100 to 500 feet in elevation. Much of the land, especially along the Mississippi, is low-lying and subject to inundation from the Mississippi River. In this part of the state are numerous lakes, bayous and swamps. There are about 6,000,000 acres of these lower-lying lands, of abounding fertility, needing only drainage to make them among the most productive in the world. Along the lower valley of the Arkansas the soil grades into black sandy and "buck-shot," the richest soils of the state. Along the southern border of the Ozarks and Ouachita elevations is a belt which, while belonging to the highland area, represents an intermediate zone between that and the lowland country of the state. It is especially adapted to growing peaches.

In the lower parts of the state there are also locations affording air-drainage and soils suited to commercial peach-growing. On the whole, however, this region will be found best adapted to truck-farming. Some crops, like onions, spinach, and kale, may be planted here in the fall months. Figs, Japanese persimmons, pecans, and some varieties of grapes offer good opportunities, while selected varieties of most north-temperate fruits may be grown successfully for home use.

The principal horticultural industry is the production of winter apples. The leading counties are Benton, Washington and Madison in northwest Arkansas. Transportation facilities have been an important factor in stimulating development. Other counties in the Ozarks equally good for fruit lack railroad transportation and for this reason are less developed horticulturally. Quantities of second-grade apples go to driers or are converted into vinegar. Some fifty-six varieties of apples have originated in Arkansas, some of them being of great commercial value, not only in this state, but elsewhere. A recently introduced variety is the King David which originated in 1903 near Durham, Washington County. Formerly about 95 per cent of plantings were Ben Davis. More recently there has been a noticeable tendency to plant varieties of better quality. Leading winter varieties of apples at present are Ben Davis, Gano, Black Ben, Winesap, Jonathan, Arkansas, York Imperial, Grimes Golden, Ingram, Givens, Collins, Beach, Stayman's Winesap, Delicious and King David.

For the past several years, increased attention has been given summer apples. These are grown with success southward as well as in the hill country. Leading varieties are Maiden's Blush, Duchess, Horse, Buckingham, Summer Champion, Red June, Red Astrachan and Yellow Transparent. While an excellent market variety, the last is very subject to "twig-blight," especially in the lower part of the state.

Second only to the apple-orchard interests is the commercial production of peaches. To S. B. Wing and his brother belong the credit of having shipped the first carload of Elberta peaches out of Arkansas. Thus began the commercial peach industry which has assumed such vast proportions in the state in the past ten years. The Elberta is not so reliable in the higher districts as in some of the counties lying along the southern slopes of the Ozarks and Ouachita Mountains. Here the air-drainage, soil and other conditions are such as to be especially favorable for almost annual crops and peaches of splendid color and quality. The record in Crawford County is about seven crops in ten years. In 1911, orchards in Pike and Sevier counties were practically the only peach orchards in the United States which produced crops. The fruit from these orchards brought probably the highest prices on record for peaches in carlots. The two first cars shipped to New York brought $2,080 a car, and later averaged $1,500 a car. Extensive peach-orchard interests have in recent years developed rapidly in Pike County. Commercial plantings are chiefly Elbertas. The shipping season follows that of Texas and Georgia when the markets are slack, which proves to be a great advantage. Very early peaches for shipment have not proved profitable. Northwest Arkansas will have to find a variety hardier in bud than Elberta. Champion, Carman, Slappy, Belle of Georgia, Madison County Mammoth, General Lee, Crosby, and possibly some others are much more reliable varieties for northwest Arkansas, although not so satisfactory for shipment as the Elberta.

Pears are not receiving much attention on account of their susceptibility to "fire blight." Kieffer, Garber, LeConte, Winter pear (Sand pear), Seckel and Duchess are among the varieties least susceptible to blight.

Cherries are of comparatively little commercial importance at present. The sour cherries are the most satisfactory. There are but few large cherry orchards in the Ozark region. Leading varieties are English Morello, Early Richmond, Montmorency and May Duke.

Plums were represented in 1909 by 731,276 bearing trees. Leading varieties are Burbank, Red June, Gold, Wild Goose, Poole's Pride, Damson, German Prune.

Pecan trees are found growing wild in abundance in the cotton section of the state, especially in river-bottoms. The interest in pecans has rapidly increased in the past three or four years. Some recent single plantings contain as high as 400 acres of grafted trees. Some pecans are being grafted on the common hickory. Such trees are known to thrive and bear as well as on their own roots. The Schley and Moneymaker are known to do well in the state.

English walnuts are receiving practically no attention. How well they would succeed remains to be determined. The black walnut and hickories are common growing wild and occasionally large sweet chestnut trees are found, although the chinquapin is much more frequent. Some attempts have been made to use the latter as a stock for the sweet chestnut with good success, especially in the case of the large Japan chestnut.

Grapes thrive in Arkansas. The output of vineyards at present is used chiefly for wine. The Cynthiana, a variety of native origin, is the most highly valued wine-grape. Saline County some years ago was an important grape- and wine-producing county, the industry being conducted chiefly by German citizens. Owing to state laws against the sale of alcoholic drinks, the industry declined. At present the law allows the producer to sell native wine in quantities of not less than five gallons, not to be consumed at the place where sold, nor sold in the localities having the "five-mile" law or local prohibition. The bottling of unfermented grape-juice offers excellent opportunities. Grapes receive special attention at Tontitown, Altus, Silver Springs, Highland and other points. In the past few years extensive plantings have been made at some points southward. Joseph Bachman, of Altus, has been the originator of several varieties of great merit (Sunrise, Banner, Stark's Star and others).

Strawberries have been commercially grown in a large way for many years in northwest Arkansas, as well as in counties southward. George P. Murrell, of Austin, shipped the first crate of strawberries to St. Louis some forty years ago. Mr. Bauer, of Judsonia, was also one of the pioneer growers. About 1893, C. H. Gregory commenced the strawberry industry in Crawford County, and it has extended northward along the Frisco and Kansas City Southern Railroads in northwest Arkansas and has become one of the most important branches of fruit-growing in the Ozarks. Leading varieties at present are Excelsior, Klondyke and Aroma.

Blackberries are canned extensively and grown throughout the state for home use. While shipped to some extent, they are not important as a commercial crop. Currants seem not to thrive. Of gooseberries, Smith and Houghton only prove satisfactory, and these only in the mountain region.

In the west where irrigation is necessary, orchards are planted in the valleys. In the Ozarks where the rainfall is ample for the needs of crops, apple and other fruit trees are planted mainly on the slopes and higher lands where, owing to air-drainage, the fruit is less subject to damage by spring frosts than in the valleys. Although there is a critical frost period the latter part of April, properly located and cared-for orchards escape injury except occasionally. A typical Ozark orchard of 40 acres under good care has borne during the past seventeen years fourteen good crops of apples, two light crops, and has had but one total failure. Another apple orchard has had in seven years six fair to large crops and but one very light crop. Experiments indicate that orchard-heaters are not necessary in well-located and well-cared-for apple orchards in the Arkansas Ozarks except occasionally, or at intervals of four or five years. Like spraying, it is a kind of insurance and some growers have provided heaters for a part of their orchards as a safeguard against the occasional frost-damage. The higher parts of the state are not so well suited to the Elberta peach as lands southward on the southern slopes of the highlands where the elevation ranges from 300 to about 800 feet. In both sections peaches are damaged more frequently by winter injury to the flower-buds than by spring frosts. Orchard-heaters are practical and successful in raising the temperature in the orchard sufficiently, under usual conditions, to save the crop, but careful attention to location, air-drainage, and proper care are more important.

Many of the fruit and other trees planted are purchased from nurseries outside the state, and planters have suffered frequent loss from trees proving untrue to name, infested with San José scale and diseased by crown-gall. In 1911 only twenty nurseries in the state called for official inspection. The growing of ornamentals is represented in the state by a few nurseries only. There is an extensive greenhouse establishment at Little Rock and several smaller establishments which at other points supply the local demand. The forcing of flowers and vegetables under glass receives but little attention and only for the supply of local trade at a few of the large towns.

Tomatoes are grown extensively throughout the state; string beans also, for shipment and canning. Asparagus thrives throughout the state. Onions have not received much attention commercially, probably because Texas has the advantage in earliness and produces such large quantities. Rhubarb is grown and shipped to a limited extent in northwest Arkansas. It does not succeed southward. Melons are an important commercial crop. Both the watermelons and cantaloupes grown are of high quality. Many hundreds of carloads are shipped northward in their season, from a few shipping-points. The Arkansas Gems reach the markets some weeks in advance of the well-known Colorado melons. Watermelons evidently were introduced into the state at a very early day, since it is said that the Indians treated to watermelons the remnants of La Salle's band when they were passing through the state in 1687.

Irish potatoes are grown extensively throughout the state. Red Bliss is the leading variety grown. Early Ohio, Irish Cobbler, Sunlight and Burbank are also grown. In 1909, counties leading in production were: Sebastian, 101,328 bushels; White, 91,231 bushels; Washington, 67,739 bushels; Pulaski, 62,253 bushels; and Crawford, 46,492 bushels.

Sweet potatoes find congenial conditions in all parts of the state and yield well under fair treatment, yields ranging from 200 to 600 bushels an acre.

Many of the orchard-owners have evaporators for utilizing the second-grade apples. Towns in the several orchard districts have one to several evaporating plants of large capacity which make a business of producing evaporated apples. Culls, cores and peelings are converted into vinegar.

Before the National Pure Food Law was passed (1906), little cider vinegar was produced in a commercial way. At present there are large and well-equipped plants at Rogers, Siloam Springs and other points. There are also large apple-brandy distilleries at Rogers and Bentonville, the latter being the largest in the world.

Home canners have become common in connection with fruit-growing and truck-gardening in order to utilize surplus fruit for home use and local markets. There are large well-equipped central plants at Prairie Grove, Bentonville, Fayetteville, Decatur and some other points.

Public-service agencies for horticulture.

Horticultural instruction is given as a part of the Agricultural College work at the State University at Fayetteville. It is also provided for in each of the four Agricultural High Schools by legislative enactment in 1907, and opened for instruction two years later. These schools are located at Russellville, Jonesboro, Monticello, and Magnolia. Extension work is carried on by the college.

There are local horticultural societies at a number of points where such interests are important or being developed. Springdale and Bentonville have very successful societies. The latter has been in existence for many years, and is well known beyond the confines of the state for its useful work.

Coöperative fruit-marketing associations exist at most of the important shipping-points. These, when independent, compete with each other more or less by shipping to the same markets. The Ozark Fruit-Growers' Association is a general organization formed in 1904 to handle the output of the numerous local associations of the Ozark region.

The Arkansas State Horticultural Society was organized in 1879. Among the original organizers, S. H. Nowlin, W. S. Thomas, E. F. Babcock, Jos. W. Vestal, W. K. Tipton have all rendered valuable services to horticulture. Judge I. B. Lawton, for years secretary of the Benton County Horticultural Society, also deserves special mention. Recently the fruit-growers of northwest Arkansas have organized "The Northwest Arkansas Fruit Growers' Society," as a branch of the State Society. The sweet potato growers have also organized a society as a branch of the State Society.

Statistics (*Thirteenth Census*).

The approximate land area is 33,616,000 acres of which 51.8 per cent, or 17,416,075 acres, are in farms. The percentage of the farm land that is improved is 46.4, or 8,076,254 acres. The farm land in woodland is 8,511,510 acres, and the unimproved land in farms numbers 828,311 acres. There are 214,678 farms in the state, the average size of which is 81.1 acres. [The total area of Arkansas is 53,335 square miles.]

The leading agricultural crops are cereals, hay and forage, cotton, and forest products. In 1909 the value of the cereals was $31,262,922. The acreage was 2,564,898 in 1909, a decrease of 13.9 per cent since 1899, when it was 2,980,684. The acreage of hay and forage, in 1909, was 435,915, an increase of 82.1 per cent over the acreage in 1899, when it was 229,426. The value of the hay and forage products in 1909 was $4,887,139. In 1909 cotton contributed 52.9 per cent of the total value of all crops. The value of cotton products in 1909 was $63,155,683. The acreage of cotton in 1909 was 2,153,222, as compared with 1,641,855 in 1899, an increase of 31.1 per cent. The value of the forest products in Arkansas for 1909 was $6,914,262.

The leading horticultural crops are fruit, vegetables, small-fruits, nuts, flowers, plants and nursery products. In 1909 the value of the fruits and nuts was $3,142,891; of vegetables, $7,641,102; of small-fruits, $601,722; and of flowers, plants and nursery products $352,000.

The principal orchard-fruits are apples and peaches, which in 1909 produced more than one-half of the total quantity of orchard-fruits. The number of apple trees of bearing age in 1910 was 7,650,103; the apple trees not of bearing age numbered 3,940,089. The quantity produced in 1909 was 2,296,043 bushels, valued at $1,322,785. The peach trees that were of bearing age in 1910 numbered 6,859,962; those not of bearing age, 2,884,927. The production of peaches was 1,901,647 bushels, valued at $1,502,996. The production of the other orchard fruits and their value in 1909 is as follows: pears, 37,547 bushels, valued at $38,140; plums and prunes, 194,649 bushels, valued at $137,003; cherries, 5,993 bushels, valued at $8,424; apricots, 1,067 bushels, valued at $1,091; quinces, 680 bushels, valued at $751.

Of nuts the pecans and black walnuts were the most prominent, there being 249,955 pounds of pecans produced in 1909, valued at $17,603; and 514,273 pounds of black walnuts, valued at $7,795. In 1910, the number of pecan trees was 13,958, while the number of black walnut trees was 9,104. In addition to the pecans and black walnuts, Arkansas produced, in 1909, 15,436 pounds of Persian or English walnuts, valued at $1,384, and 3,330 pounds of almonds, valued at $622.

The only tropical fruit of any significance is the fig, of which 80,707 pounds were produced in 1909, valued at $5,953.

The production of grapes in 1909 amounted to 2,593,727 pounds, valued at $97,985, a decrease from 3,621,100 pounds, valued at $104,803 in 1899.

Of the small-fruits, strawberries are by far the most important, with blackberries and dewberries ranking next. The total acreage of small-fruits in 1909 was 8,032; and in 1899, 10,819, a decrease of 25.8 per cent. The production in 1909 was 8,965,572 quarts, as compared with 14,098,000 quarts in 1899. The acreage of strawberries in 1909, was 7,361, producing 8,259,240 quarts, valued at $549,041. The acreage of blackberries and dewberries was 525; the production 587,977 quarts, valued at $40,843. The production of other small-fruits in 1909 are as follows: 96,414 quarts of raspberries, valued at $9,766; 18,168 quarts of gooseberries, valued at $1,630; 3,201 quarts of currants valued at $390; and 288 quarts of cranberries, valued at $26.

In 1909 the total acreage of potatoes and other vegetables was 112,358 and their value $7,643,102. The production from 29,719 acres of potatoes in 1909 was 2,096,893 bushels, valued at $1,439,991. The production from 22,388 acres of sweet potatoes and yams for the same year numbered 1,685,308 bushels, valued at 1,359,669. Other vegetables, excluding potatoes, sweet potatoes and yams, occupied an area of 60,251 acres in 1909, compared with 45,355 acres in 1899, and the value of their products was $4,843,442 in 1909, as compared with $2,245,587 in 1899. The more important of these vegetables in order of value are watermelons, cantaloupes and muskmelons, tomatoes, turnips, cabbage and onions.

The value of the flowers and plants in 1909 was $153,421. The area under glass, devoted to this industry, was 235,134 square feet, of which 224,150 square feet were covered by greenhouses and 10,984 square feet by sashes and frames. The increase in the value of the flowers and plants was 494 per cent, from 1899 to 1909.

The nursery products, in the period from 1899 to 1909 decreased 39.2 per cent in acreage but increased 51.5 per cent in value. The acreage in 1909 was 528; in 1899, 868. The value of the nursery products was $198,579 in 1909, and $131,045 in 1899.

Ernest Walker.

Louisiana.

Louisiana (Fig. 2521) is situated at the extreme lower limit of the great Mississippi system, bordering on the Gulf of Mexico. These bodies of water have an important bearing upon the climate, and make it possible to grow some of the subtropical fruits. The prevailing wind is from the south, somewhat cool and always laden with moisture, and the southern part of the state, being only about 30 feet above the sea-level, receives the heaviest rainfall, 70 inches, while the northern part which is more elevated and farther from the Gulf, has an annual rainfall of 45 to 50 inches. This, as a rule, is well distributed throughout the state, the seasons of greatest drought being early spring and early autumn. The highest recorded summer temperatures run from 98° along the Gulf coast, to 102° in the northern part of the state, while the average winter temperature is 56°.

Occasionally a northwestern blizzard reaches down into the state, causing a heavy fall in temperature, accompanied with sleet, and once in a long time, snow. The lowest recorded temperature on this account was 9° in 1895, and 13 inches of snow. This was an occurrence unheard of by the oldest inhabitants. These occasional blizzards have forced the culture of tropical fruit down to the section immediately bordering on the Gulf. As the soil has such an important bearing upon the character of the fruit, a rough classification of the different kinds is here given.

1. The sandy hills and uplands occupy the northwestern part of the state along with a section in the eastern part, south of the state of Mississippi, constituting about one-half the total area of the state. The lands are characterized by sandy soils, with pine and oak forests, and produce the best stone-fruits and berries.

2. The bluff lands occupy a broken strip, running parallel with the Mississippi, from 30 to 50 miles from its western bank, and disappear near the Gulf in what are known as "islands," such as "Avery's Island" and "Jefferson's Island." There is also another section of these lands on the east bank of the river immediately south of the Mississippi state line. These lands are characterized by a yellow clay loam, very fertile, and by forests of magnolias, gums, oaks, and the like. They produce some of the stone-fruits well, and an abundance of pecans, berries and figs.

3. The prairie lands occupy a part in the central southwestern part of the state, are treeless, low and are also known as rice lands. The soil is poor but improves with cultivation, and gradually the planting of figs, pears, peaches, plums and grapes have been extended.

4. The alluvial lands make up all the other parts of the state not mentioned, including the river-bottoms. The soil is generally dark, ranging from black to light red, very fertile and abounding in an abundant growth of timber. They produce the heavy yields of cotton and corn in the northern part, and the sugar-cane, oranges, lemons, persimmons, figs and bananas, as well as other tropical fruits, in the southern part.

5. The pine flats are found in the western and extreme eastern parts of the state where the hill lands merge into an extended area of level lands which in turn are gradually depressed to the Gulf marshes. This area is naturally wooded with dense forests of long-leaf pine. The soil is not very fertile, but when properly drained and fertilized becomes an excellent soil for strawberries and some small-fruits. Trucking is also highly developed in some parts of the pine flats.

The leading varieties of vegetables are grown in every section of the state, and the home garden furnishes an abundant supply during all seasons of the year, under proper management. Those vegetables most popularly grown for home consumption are as follows: Asparagus (on the sandy soils only), artichokes (both Globe and Jerusalem), beans, beets, cabbage, carrots, collards, corn, cress, cucumbers, cashaw (pumpkin), endive, egg-plants, kohlrabi, leek, lettuce, melons, mustard, okra, onions, parsley, peas, peppers, Irish potatoes (two crops), sweet potatoes, radishes, spinach, tomatoes, turnips and rutabagas. Occasionally there is found the vegetable pear (*Sechium edule*), martynia, brussels sprouts, celery, chervil, garlic, kale, salsify, parsnips, cauliflower, and field pumpkins. Most of these vegetables may be sown several times during the year. Celery and cauliflower, however, are sown early in August in order to mature by the Christmastide.

The commercial truck sections are found in various sections of the state. Along the Illinois Central Railroad a direct line to Chicago from New Orleans, which runs through the warm sandy pine lands, the most extensive truck-farms are to be seen. The vegetables grown are radishes, carrots, beans, cabbage, Irish potatoes, tomatoes, peppers, eggplants, and cauliflower. Hundreds of carloads of these vegetables are sent to the central, northern, and eastern markets during the months of March, April, and May. This section is also one of the largest producing areas of strawberries in the United States. Tangipahoa Parish alone has over 15,000 acres and ships 1,200 to 1,500 or more cars annually. The Klondyke is the variety universally planted. It is a wonderful shipper and is found on the market as far east as Boston, as far north as Canada, and even as far west as Seattle. The value of this crop alone runs into millions of dollars.

On the same railroad, a little above New Orleans, is Kenner, which is noted in the North for its "bunch crops," such as shallots, carrots, beets, turnips, radishes, mustard and spinach. The rich alluvial lands of this section produce these crops to perfection. They are packed in sugar barrels with crushed ice. Quotations on Kenner vegetables are usually above the average on account of their excellent quality and solid pack. Cabbage, lettuce, and snap beans are also extensively grown and shipped from this point.

The largest truck section of the state is found in the vicinity of New Orleans. This city is also the distributing point for large quantities of vegetables grown along the river and bayous southward. Thousands of cars move over the many trunk lines to the North, East, and West. Shallots, turnips, beets, radishes, carrots, mustard, and spinach are extensively grown and shipped in sugar barrels; also lettuce, endive, cabbages, cucumbers, eggplants, peppers, beans, and many other vegetables adapted to the alluvial soils. In this section are found the large commercial orange groves of the state. (See *Orange-culture in Louisiana*, p. 2374.)

Along Bayou Lafourche from Donaldsonville to Lockport, Creole onions are extensively grown as well as Irish potatoes. This section is beginning to plant large quantities of Snowball cauliflower.

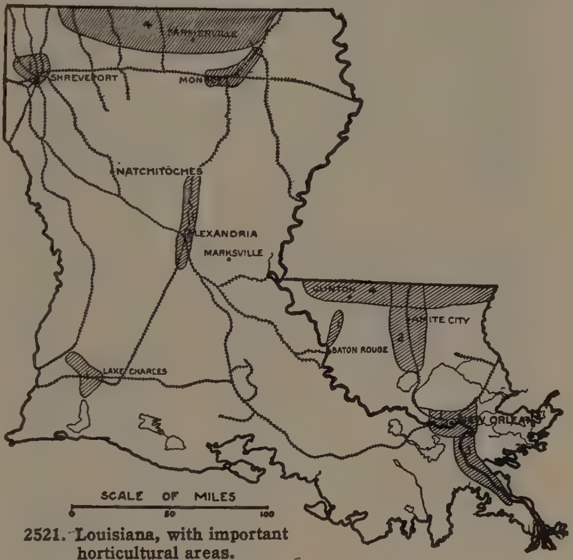
Alexandria is the center of the Irish potato industry. Trainloads of early potatoes from this point move northward during late April and early May.

Early tomatoes are extensively planted at Norwood along the Yazoo & Mississippi Valley Railroad. The warm rolling sandy loams of this section produce a very early fruit of high quality. A very successful coöperative canning factory is being operated to utilize surplus vegetables that cannot be shipped. Hundreds of acres of Cayenne peppers are grown in this vicinity and the product is dried and ground by a local factory.

The varieties of these vegetables grown for the northern markets are as follows: The Acme and Beauty tomatoes, the Chartier radish, the New Orleans Market eggplant, the Peerless and Triumph Irish potatoes, the New Orleans Market and White Spine cucumbers, the Drumheads, Flat Dutch, Succession, All-Seasons and Nonesuch cabbages, the Italian and Bermuda type of onions, the First-and-Best and Alaska peas, the Early Mohawk and Valentine beans. In the northern part of the state large quantities of Irish potatoes are grown, and oftentimes the second crop is very profitable. The first crop is planted in January or February and harvested in May and June. The seed for the second crop is prepared for planting by special treatment, consisting of gradually exposing the tubers to the light and moisture, which matures them and excites the eyes into growth. As soon as this is accomplished they are ready for planting, which is usually during August. They are harvested in November.

Upwards of 5,000,000 bushels of sweet potatoes are grown annually, the varieties best known being Pumpkin, Nancy Hall, Triumph, Creole, California, Bermuda, Red and Yellow Nansemond, Hayman, Providence, Yellow Jersey, Southern Queen and Vineless. The last variety is one of the most desirable of the newer sweet potatoes.

The culture of fruit, other than oranges and strawberries, has been neglected in great measure. Apples do fairly well only in the northern part of the state, the desirable varieties being Smith, Horse, Red June, Mangum, Early Harvest, Cullasaga and Shannon. Grapes are grown but sparingly, as the long, warm, moist season offers the best conditions under which the grape diseases develop, and the daily rains hinder the use of fungicides; however, in the northern and southwestern parts of the state the following varieties have been found desirable: Champion, Diamond, Eaton, Niagara, Concord, Delaware, Brighton, Sweet Mountain, Herbemont and Jacques. Only the Chinese type of pears is at all grown, as it offers more resistance to the blight than the others. The desirable varieties are LeConte, Kieffer, Smith, Garber, Dai Dai, Golden Russet and Mme. Von Siebold. The European varieties of plums do not succeed, but many of the American and Japanese sorts do well. The desirable varieties are Burbank, Abundance, Satsuma, Kelsey, Chabot, Wild Goose, Robinson and a few others. The fig is grown universally in all sections of the state, the best varieties being Celeste, Brunswick, White Ischia, Magnolia, Angelique, Lemon, Mission and Reine Blanche. The Japan persimmons are being set extensively, using chiefly the Hyakume, Kurokume, Nero Zami, Hachiya, Tsuru and Among. These fruits are large, showy, and will stand transportation well. The Elberta, Sneed, Peen-to (in the south) and Chinese Cling peaches prevail.



2521. Louisiana, with important horticultural areas.

The other fruits, grown in a limited way, are quinces, goumi, blackberries, dewberries, a very few raspberries, pomegranates, bananas, jujubes and pawpaws. There are a few other tropical fruits that are grown only for specimens.

Louisiana abounds in beautiful flowering shrubs and wild flowers. The planting of all kinds of ornamentals is very extensive, roses bloom throughout the season, and the camellia finds a congenial home throughout the southern part of the state. In and around New Orleans the finest ornamental plantings will be found.

Although quantities of nursery stock are grown in Louisiana, many trees, vines, shrubs, cuttings and seeds are brought from other states and from abroad. Several kinds of ornamental plants are imported mainly from Europe, these being handled chiefly by florists in New Orleans. Some florists specialize in growing certain ornamentals, and have built up a large trade with such plants as roses, ferns, orchids and cape jessamines, shipping numbers of them to northern points. Outside of New Orleans, but few florists do anything more than a local business.

Besides ornamental plants, including shade trees, the principal nursery stock produced in the state consists of deciduous fruit- and nut-trees, citrus and fig varieties, and strawberry and grape-vines. Of the deciduous fruits, peach is the leading one, being most generally grown in the northern uplands. While blight is a serious drawback to pear-growing, yet the Kieffer succeeds well on nearly all kinds of soil. Plums and rarely apples are planted in home yards, and sometimes the quince may be seen. The mulberry is a common tree, being valued mostly for its shade, while poultry or hogs are usually allowed to feed on its fruit. Excepting the Japanese walnut and chestnut, of which few trees are known to be of bearing age, the pecan is almost the exclusive nut produced as a crop. Numbers of trees grow practically wild as seedlings, yet the select varieties have been widely planted in both yards and orchards, some of the latter covering extensive areas. The chief nurseries supplying all of these desirable trees and other plants in general are located in the northwestern part of the state. The largest producer of stock owns a place near Shreveport and makes large shipments into adjoining states. A great abundance of young pecan trees have been propagated in nurseries on or bordering the alluvial lands along the Mississippi and lower Red River. The propagation of citrous stock is practically confined to the orange belt comprising the delta and inner coastal lands. In the southwestern section about Lake Charles, the fig has proved to be a profitable crop, the Magnolia making a choice preserve, and nurseries and orchards have been planted with this kind of growth in particular. The pomegranate occasionally occupies a place in the yard also. Strawberry plants are sold by most of the leading crop-producers in Tangipahoa Parish, the main region in which the fruit is grown, but deliveries are generally local. A very few growers in the central and southwestern parts attempt to sell plants from their fields. In the north central sections, grape-culture has showed possibilities of expansion, and the established vineyardists supply stock from their nurseries. Blackberries and dewberries run wild to such an extent that little demand is made for these plants.

Public-service agencies for horticulture.

The Louisiana State University and Agricultural and Mechanical College at Baton Rouge has a department of horticulture and forestry with one professor in charge. The Agricultural Experiment Stations of the University (founded 1887) have one member of the staff at Baton Rouge who conducts the investigations and extension work with truck crops, and another member engaged in horticultural investigations at the North Louisiana Experiment Station, Calhoun.

The Louisiana Industrial Institute, at Ruston, the Southwestern Louisiana Industrial Institute, at Lafayette, and the State Normal, at Natchitoches, as well as the agricultural high-schools, offer horticultural instruction in connection with the general agricultural courses.

The entomologist of the experiment stations inspects the nurseries of the state and imported plants for dangerously injurious insects, diseases and other pests.

Statistics (Thirteenth Census).

In 1910 the approximate land area of Louisiana was 29,061,760 acres. Of this acreage, 35.9 per cent or 10,439,481 was land in farms. Of the land in farms, 5,276,016 acres were improved; 4,316,561 acres were in woodland; and 846,904 was the acreage of other unimproved land in farms. The number of all the farms in 1910 was 120,546, the average acreage being 86.6 to a farm. [The total area is 48,506 square miles.]

The leading agricultural crops of the state are cereals, cotton, sugar crops, and hay and forage. The cereals are by far the most important. In 1909, the acreage devoted to cereals was 1,938,357 and the value of cereal products, $24,786,984, or 32 per cent of the total value of all the crops. The acreage occupied by cotton decreased from 1,376,254 in 1899 to 957,011 in 1909, when the value of the cotton produced was $20,274,747. The acreage of sugar crops increased from 277,903 in 1899 to 331,375 in 1909, when the value of the products was $17,787,054. Hay and forage increased in acreage from 97,136 in 1899 to 180,811 in 1909, an increase of 86.1 per cent, when their value was $2,433,101. The value of the forest products of the farms was $3,584,340 in 1909, as compared with $1,381,867 in 1899.

Horticultural crops of the state are fruits and nuts, potatoes and other vegetables, small-fruits, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $714,269, as compared with $291,587 in 1899. In 1909 the total acreage of potatoes and other vegetables, the most important of the horticultural crops, was 114,829, as compared with 63,098 in 1899, and their value in 1909 was $6,282,904. Small-fruits increased in acreage from 1,408 in 1899 to 3,587 in 1909, when their value was $486,988. Flowers and plants and nursery products increased in acreage from 365 in 1899 to 729 in 1909, an increase of 99.7 per cent, when their value was $213,855.

The total quantity of orchard-fruits produced in 1909 was 392,607 bushels, valued at $314,027, an increase over the value and production in 1899. In 1909 the most important of the orchard-fruits were the peach and nectarine which contributed about three-fourths of the production; pears, apples, and plums and prunes producing most of the remainder. The number of peach and nectarine trees of bearing age in 1910 was 903,352; those not of bearing age, 316,132. The production in 1909 was 290,623 bushels, valued at $228,084. The pear trees of bearing age in 1910 numbered 57,630; those not of bearing age numbered 38,242. The production in 1909 was 35,554 bushels, valued at $31,069. The number of apples trees of bearing age in 1910 was 93,304; those not of bearing age numbered 96,544. The production in 1909 was 33,875 bushels, valued at $28,744. The production of plums and prunes for the same year was 31,473 bushels, valued at $24,641. Small amounts of cherries, quinces, apricots, and mulberries were also produced.

The grape-vines of bearing age in 1910 numbered 31,041; those not of bearing age numbered 20,936. The production in 1909 was 106,595 pounds, valued at $6,099, as compared with $5,927, their value in 1899.

The total production of nuts in 1909 was 796,925 pounds, valued at $73,169. The most important of the nuts are the pecans. In 1910 the pecan trees of bearing age numbered 36,527; those not of bearing age, 119,547. The production of pecans in 1909 was 723,578 pounds, valued at $70,635; that of Persian or English walnuts, 15,173 pounds, valued at $1,446; that of black walnuts, 54,624 pounds, valued at $970; and a small amount of almonds.

Tropical fruits increased in value from $8,727 in 1899 to $320,974 in 1909. The most important of the tropical fruits is the orange, of which, in 1909, there were produced 149,979 boxes, valued at $222,339. The number of orange trees of bearing age numbered 266,116 in 1910; those not of bearing age, 155,016. The fig trees of bearing age in 1910 numbered 71,464; those not of bearing age, 102,043. The production of figs in1909 was 2,025,308 pounds, valued at $87,009. Other tropical fruits produced were: 3,340 boxes of mandarins, valued at $5,945; 1,781 boxes of pomelos (grapefruit), valued at $4,069; 303 boxes of lemons, valued at $713; and 300 boxes of tangerines, valued at $500.

Of the vegetables grown in Louisiana, the sweet potato and yam are of most importance. From an acreage of 56,953, in 1909, there were produced 4,251,086 bushels, valued at $2,357,729. The production of peanuts from 25,020 acres was 412,037 bushels, valued at $422,232; the production of potatoes from 19,655 acres was 1,183,525 bushels, valued at $924,311. Other vegetables produced were: 1,962 acres of cabbage, valued at $208,678; 2,909 acres of onions, valued at $147,377; 515 acres of lettuce, valued at $94,321; 1,278 acres of watermelons, valued at $69,386; and sweet corn, 1,218 acres, valued at $62,060. Vegetables of less importance were green beans, beets, cantaloupes and muskmelons, carrots, cucumbers, okra, parsley, green peas, green peppers, radishes, spinach, tomatoes and turnips.

The acreage devoted to the production of flowers and plants increased from 89 in 1899 to 227 in 1909. The total area under glass in 1909 was 347,473 square feet, of which 260,711 were covered by greenhouses and 86,762 by sashes and frames. The value of the products in 1909 was $126,212, as compared with $76,628 in 1899.

The acreage occupied in the production of nursery products increased from 276 in 1899 to 502 in 1909, an increase of 81.9 per cent. The value of the products for the same time increased from $63,593 in 1899 to $87,643 in 1909.

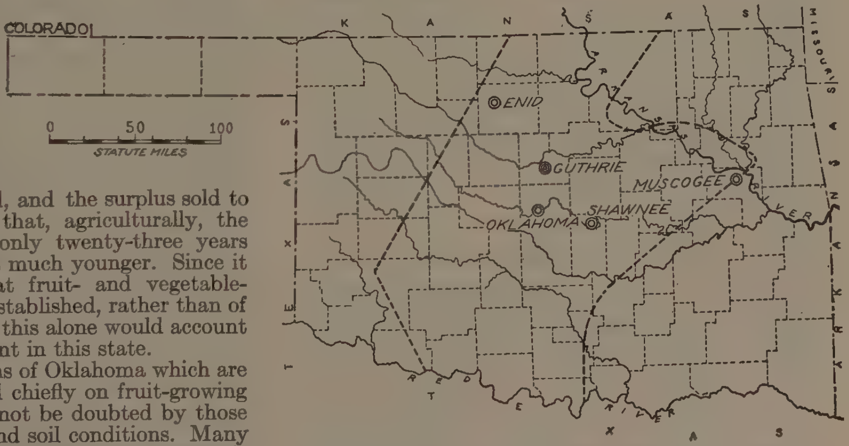
George L. Tiebout.†

Oklahoma.

At present, the horticulture of Oklahoma (Fig. 2522) is but poorly developed. The reason for the state being backward in fruit-growing and vegetable-raising is because of the short length of time since the commonwealth was first settled. The first part of Oklahoma was thrown open to settlement in 1889. Other sections adjoining were opened to entry from time to time until 1908, when the old territory of Oklahoma was combined with Indian Territory to form the present state. Even today, much of the Indian land is still held in reserve, but is gradually being allotted, and the surplus sold to white settlers. This means that, agriculturally, the oldest part of Oklahoma is only twenty-three years old, and that the remainder is much younger. Since it is a well-recognized fact that fruit- and vegetable-growing are industries of old established, rather than of young pioneer neighborhoods, this alone would account for the lack of this development in this state.

That there are many sections of Oklahoma which are destined eventually to depend chiefly on fruit-growing as a means of livelihood will not be doubted by those who investigate its climatic and soil conditions. Many neighborhoods in those parts of Arkansas, Missouri, and eastern Kansas which lie contiguous to Oklahoma are notably well adapted to fruit-growing, and there is every reason for presuming that neither soil nor climate varies materially on crossing the state line. Many of the fruit sections of Oklahoma are embraced in the old Indian Territory, and are consequently the newest part of the state.

It is manifest from the above statements that no Census reports of crops produced in this state are of any present value, except that of 1910, and that this is only of limited application.



2522. Oklahoma, showing horticultural divisions of the state.

There is little question but that Oklahoma is on the southern border of the apple-growing region. While one would not wish to say that it is impossible for market varieties to be produced which will be adapted to this southern country, they are unknown today. The pressing need of the apple-growers is for later and better-keeping varieties. Sorts like the Ben Davis, Jonathan, Missouri Pippin, and other standards of Kansas, Missouri and Illinois, ripen in late September or early October there, but in Oklahoma they are fully mature in early September. At this time the weather is still very warm and decay will frequently set in at once. This means that the Oklahoma grower must either depend on cold storage from the start or else confine himself wholly to the local market. On this account, apple-growing has hardly reached a commercial phase in any part of Oklahoma, although there is no question but that there are certain neighborhoods in the eastern part of the state which are very well adapted to the production of this fruit.

Commercial peach-growing is much more promising than the growing of any other fruit. It is difficult to say exactly where the peach districts are. In very favorable years, good crops of this fruit are secured in sections well into the western part of the state. These western neighborhoods, however, are not as certain producers of peaches as those farther east. It is probable that the eastern and southeastern part of Oklahoma comprises most if not all of the sections which are so well adapted to peach-raising that this will become the predominant industry. This is not only because this region has the characters that adapt it to the growing of peaches, but also because it has not the characters which make it good for general farming. For it has been observed everywhere that no country goes into fruit-raising so unreservedly as those which cannot make a good living any other way. Much of the land in the eastern part of Oklahoma belongs to what is known as the Ozark country. These Ozarks are a rough tableland, characterized generally by a rather thin soil. This thinness of soil, combined with the roughness, puts the grain-raiser at a disadvantage as compared with the raiser of fruit. This is the newest part of Oklahoma and much of it is still in the hands of the Indian owners, and some of the most interesting orchards belong to these people. It only needs the presence of experienced fruit-growers to change many of these neighborhoods from poor one-horse grain- and pig-farming sections to profitable fruit-raising districts. Unfortunately, during the last few years, when this country has been settling, fruit-raising has been so profitable in other states that there has been but little inducement for experienced growers to come into Oklahoma. Most of the peach-growers here at present have picked up the business, and have acquired such knowledge as may be gained by experience alone, without any training, and without learning the details of the business in some other section. This means that there is no system either to the methods of raising or of marketing peaches in this state at present. Some orchards are cultivated, but more are not cultivated. The same thing is true of all other peach-orchard operations. In marketing there is the same lack of uniformity. Peaches are shipped in all sorts of receptacles, from the four- and eight-basket crate to a bushel basket. The flaring top basket of the East is practically never seen.

Pears do not seem to be a very promising commercial proposition, except possibly in the southern and eastern counties. The reason for this is generally blight and lack of fruitfulness. There are many neighborhoods in which, in most years, pears may be raised for home use or local market with considerable success.

The status of plum- and prune-raising is practically the same as that of pears. The European or domestica plums do not seem to be well adapted to the mid-western conditions. The native varieties do well, but are not well adapted to commercial uses on account of their softness and a lack of demand on the part of the public. From the standpoint of home consumption, however, the plum is well to the front. Trees of the native varieties thrive, and in spite of the depredations of curculio and black-knot, usually bear. On account of their early fruiting, they are usually the first fruit that the new settler secures for his table. This is particularly true of the *Prunus Watsonii*, or sand-hill plum, a dwarf species inhabiting the western part of the state.

Cherries are raised only for home use, and in most years hardly enough for that. The cherry is rather exceptional in that the middle counties of the state appear to suit this tree better than those of the east. In Oklahoma, however, as in most other states, the cherry is one of the favorite yard trees, and there is probably more of this fruit raised than the Census figures would indicate.

The apricot is in much the same condition as the cherry. The central and south-central counties, although there are few or no apricot orchards, raise much of this fruit in yards and roadsides. The apricot is a much surer crop in this state than in any of the northern states, and the trees seem resistant to all the vicissitudes of our seasons.

Grapes are raised to a considerable extent for home eating, but there are practically no commercial vineyards. Although the grape is found native in nearly every part of the state, it is confined chiefly to the streams, and it by no means necessarily follows that the cultivated uplands are adapted to this fruit. That the common commercial varieties, composed, as they are, chiefly of Labrusca blood, suffer from the heat and droughts of our season, is unquestioned. In spite of this, the most commonly raised varieties belong to this Labrusca class. This is probably owing to the Oklahoma public having become accustomed to the taste of these grapes, and hence preferring them to the fruit from the stronger vines of the æstivalis and riparia class.

While the development of strawberry-growing is very small, there is every reason to believe that this will eventually become a large industry in the eastern and northeastern parts of the state. This part of the commonwealth has a climate and soil which is almost identical with the nearby strawberry regions of Missouri.

Blackberries and dewberries do very well in Oklahoma, and the only reason that there are not more commercial plantings is on account of the lack of insistent demand for the fruit. The dry winters of the prairies winter-kill the vines somewhat, but they are a comparatively sure crop, even in this part of the state.

Raspberries, currants, and, to a considerable degree, gooseberries, are apparently not adapted to the climate here. Most of the growers have abandoned these fruits, and many of them report absolute failure, after repeated efforts.

The growing of pecans is attracting very much interest in the state, chiefly on account of the immense profits reported from the South, and the fact that the trees grow wild over a large part of the state. So far as tested, the named Gulf coast sorts have proved tender to our winters, although not nearly all of these Gulf coast varieties have been tested. At present there is considerable money being made in some neighborhoods by selling the fruit from the wild trees, and some of the growers have been cutting out the trees bearing the smaller and poorer nuts and retaining those bearing the larger and thinner-shelled nuts. There is considerable overflow land in the state which seems to suit pecans particularly well, and to be adapted to but little else. It is probable that pecan-growing will occupy a prominent place in the ultimate agriculture of the state, although it will be slow in coming.

Of vegetables, there are only two grown in this state in sufficient quantities to attract the attention of the census enumerator and deserve mention here. They are the potato and the sweet potato. Although both these vegetables are raised more or less all over Oklahoma, they become commerical propositions only in the lighter soils, contiguous to the Canadian and Arkansas rivers. The growing of potatoes is chiefly the producing of early potatoes for the late June and July market. During the last few years, owing to the very high prices asked for the northern potatoes shipped into Oklahoma in the fall, the Oklahoma growers have been striving to raise late potatoes as well. In many sections, the growers raise two crops a year, digging the first crop about the first of July, when the second crop is at once planted. The yields here are not nearly so large as in the northern potato regions, but the prices are very much higher than are ever known in that section. The growing of early potatoes is an apparently stable industry, for there are few other parts of the South so favorably situated for producing early potatoes as the above-mentioned parts of Oklahoma. The growing of late potatoes, however, depends apparently on the railroads. As long as rates remain so high that fall potatoes from the North bring over $1 a bushel in this state, there will be a profit in raising them in Oklahoma. This is true in spite of the fact that analyses have shown that our southern-grown potato is not so rich in starch as those from farther north. On occasional years, early hot winds will seriously damage this crop.

There is no doubt of the adaptability of sweet potatoes to the climate of this state, and to much of the soil. Perhaps it is partly on account of the large contingent of northern farmers that the growing of sweet potatoes is not a more prominent industry than it is. The acreage of this vegetable is much less than of Irish potatoes. The sweet potato sections are practically the same as for the potato, except that the Red River Valley is also a contributing factor. The price of sweet potatoes, in the towns of Oklahoma, is usually good at all seasons. But few of the growers are familiar with any reliable methods of keeping the potatoes, so that generally the supply is confined to the fall months. Sweet potatoes are nearly, if not quite, immune to all the vicissitudes of the Oklahoma climate, but commercially they are confined to the sandy bottoms.

There are many other vegetables which grow well enough in this state to be promising commercial undertakings, but they have not yet been tested in any except the most primitive way. Some of these are muskmelons, watermelons, onions, peanuts, and possibly beans. Here, as with potatoes, the railroad factor has been an important one. This and other difficulties in marketing are preventing a greater development of these industries.

Public-service agencies for horticulture.

The Land-Grant college of Oklahoma, known as the Agricultural and Mechanical College, was established in 1890 at Stillwater, in Payne County. There are three members of the horticultural staff.

The State Experiment Station is also at Stillwater, and is run in connection with the College. There are two members on the horticultural staff. Between twelve and fifteen bulletins and circulars have been issued on horticultural subjects.

There are no schools in the state giving particular attention to horticulture. A few schools are teaching a limited amount of horticulture along with the agricultural work.

Inspection of nurseries is conducted by the State Nursery and Orchard Inspector, who is the entomologist of the Experiment Station.

Statistics (*Thirteenth Census*).

The approximate land area of Oklahoma in 1910 was 44,424,960 acres. The land in farms was 65 per cent of the land area, or 28,859,353 acres. Of this land in farms, 17,551,337 acres were designated improved land in farms; 3,568,910, woodland; and 7,739,106 as other unimproved land in farms. The number of farms in Oklahoma in 1910 numbered 190,192, 151.7 being the average acreage to a farm. [The total area is 70,057 square miles.]

The leading agricultural crops of the state are cereals, cotton, including cotton seed, hay and forage, and broom-corn. The acreage devoted to cereals increased from 4,431,819, in 1899, to 8,248,653 in 1909, when the production was valued at $71,798,662. Cotton, including cotton seed, increased from an acreage of 682,743, in 1899, to 1,976,935 in 1909, when the production was valued at $41,187,408. Hay and forage increased in acreage from 1,095,706, in 1899, to 1,347,598 in 1900, when the production was valued at $9,638,648. Broom-corn increased in acreage from 12,763, in 1899, to 216,350 in 1909, when the production was valued at $2,559,235. The value of forest products of the farms in 1909 was $1,602,720, as compared with $456,240 in 1899.

Horticultural crops grown in Oklahoma are fruits and nuts, small-fruits, potatoes and other vegetables, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $1,127,710, as compared with $518,502, in 1899. Small-fruits increased in acreage from 1,388, in 1899, to 2,745 in 1909, when the production was 2,310,367 quarts, valued at $202,291. The total acreage of potatoes and other vegetables in 1909 was 88,362, and their value, $4,210,844. Excluding potatoes, the acreage of other vegetables increased from 33,463, in 1899, to 51,011 in 1909, when the production was valued at $2,610,239. Flowers and plants and nursery products increased in acreage from 813, in 1899, to 897 in 1909, when the production was valued at $263,968.

The total quantity of orchard-fruits produced in 1909 was 1,137,288 bushels, valued at $943,464. Apples contributed nearly two-thirds of this quantity, and peaches and nectarines most of the remainder. The apple trees of bearing age in 1910 numbered 2,955,810; those not of bearing age, 2,060,384. The production in 1909 was 742,182 bushels, valued at $573,076. The number of peach and nectarine trees of bearing age in 1910 numbered 4,783,825; those not of bearing age, 2,574,680. The production in 1909 was 357,644 bushels, valued at $326,315. The production of plums and prunes was 25,916 bushels, valued at $28,134; that of pears, 7,450 bushels, valued at $9,248; that of cherries, 2,372 bushels, valued at $4,393; that of apricots, 1,123 bushels, valued at $1,270; and that of quinces, 601 bushels, valued at $1,028.

The production of grapes in 1909 was 3,762,727 pounds, valued at $122,045. The production in 1899 was 6,344,031 pounds. The grape-vines of bearing age in 1910 numbered 2,388,213; those not of bearing age, 447,489.

The total production of nuts in 1909 was 1,019,238 pounds, valued at $62,168, as compared with 45,330 pounds produced in 1899. The production in 1909 consisted of 894,172 pounds of pecans, valued at $59,481; 94,659 pounds of black walnuts, valued at $1,591; 6,700 pounds of Persian or English walnuts, valued at $489; and 21,250 pounds of hickory-nuts, valued at $485.

Blackberries and dewberries are the most important of the small-fruits, with strawberries second in importance. The acreage of blackberries and dewberries increased from 683, in 1899, to 1,792 in 1909, when the production was 1,366,497 quarts, valued at $119,654. The acreage of strawberries increased from 626, in 1899, to 825 in 1909, when the production was 830,404 quarts, valued at $71,296. Raspberries and loganberries increased in acreage from 43 in 1899, to 85 in 1909, when the production was 74,104 quarts, valued at $6,851. Other small-fruits produced were 31,024 quarts of currants, valued at $3,559, and 8,276 quarts of gooseberries, valued at $923.

The acreage of potatoes increased from 15,360, in 1899, to 32,295 in 1909, when the production was 1,897,486 bushels, valued at $1,250,052. Sweet potatoes and yams increased in acreage from 3,576, in 1899, to 5,056 in 1909, when the production was 359,451 bushels, valued at $350,553. Other leading vegetables produced in 1909 were: 5,923 acres of watermelons, valued at $165,725; 386 acres of onions, valued at $29,143; 655 acres of cantaloupes and muskmelons, valued at $23,438; 315 acres of tomatoes, valued at $19,295; 548 acres of sweet corn, valued at $9,138; 137 acres of cabbage, valued at $9,510. Vegetables of less importance were green beans, pop-corn, green peas, and rhubarb.

The acreage devoted to the production of flowers and plants increased from 9, in 1899, to 40 in 1909. The area under glass in 1909 was 158,515 square feet, of which 148,737 were covered by greenhouses, and 9,778 were covered by sashes and frames. The value of the flowers and plants produced in 1909 was $92,016, as compared with $6,644 in 1899.

Nursery products increased in acreage from 804, in 1899, to 857 in 1909. The production in 1909 was valued at $171,952, as compared with $103,264 in 1899.

N. O. Booth.

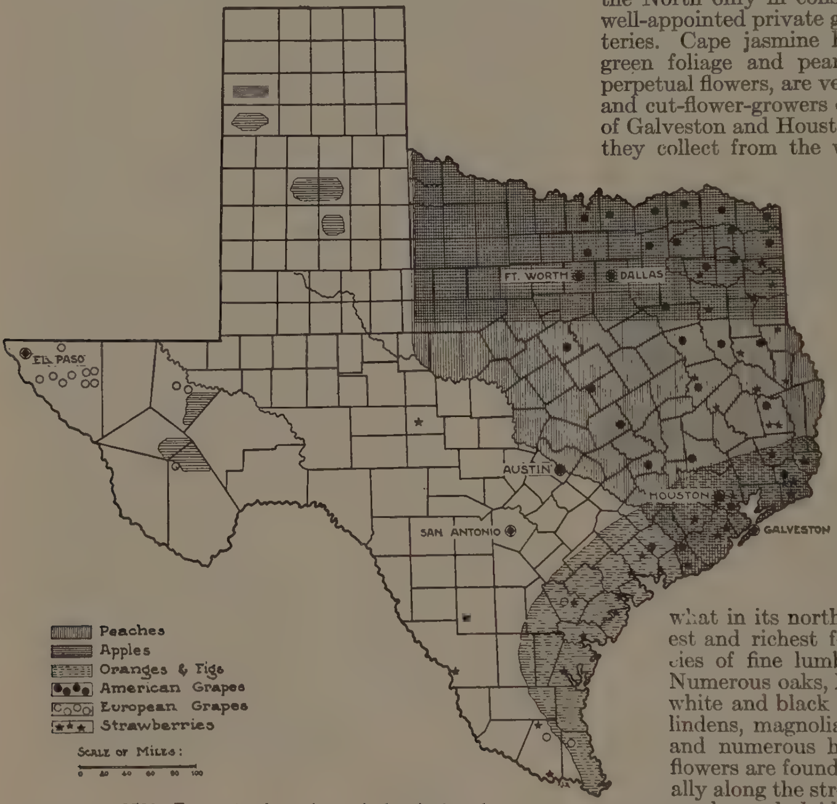
Texas.

Texas (Fig. 2523) extends in north latitude from 26° to 36½°, and in west longitude from 93½° to 106½°. Its altitude varies from sea-level, for over 400 miles along the Gulf coast, to 9,000 feet in Mt. Guadalupe, west of the Pecos River. It has a greater area of arable land in proportion to its entire area than any other state in the Union, except, perhaps, Illinois and Iowa. In 1912 it had about 4,000,000 population, but its rich soils and other natural resources can sustain, in comfort, a greater population than has Germany. There are no less than eleven rivers wending their way through the state, or by it, from northwest to southeast, the shortest of which is at least 400 miles long. It has no lakes worthy of mention, but has connected large bays, or sounds, land-locked by long islands, next the Gulf, along its entire coast, navigable for sloops and steamboats. The climate is healthful and invigorating.

The climatic belts of the state are distinctly marked and extremely different in character one from another They may be designated as follows

(1) The Gulf Coastal Plain; (2) The East Texas Forest region; (3) The Red River Valley; (4) The Black Waxy Prairies; (5) The Brown or Chocolate Plains; (6) The Staked Plains; (7) The Pecos Valley; (8) The Rio Grande Valley; (9) The Mountain region.

The Gulf Coastal Plain, extending out 50 to 75 miles from the Gulf of Mexico, varies in altitude from a few feet along the low sandy beach, to 50 and rarely 100 feet inland. Its surface in places is timbered with live-oak and pine, but mostly it is a level, black-sandy prairie. The streams are bordered in southeastern Texas with timber and undergrowth of many species, including the grand magnolia, holly, palms and many other beautiful flowering trees, shrubs, and perennial herbs. The rainfall in the southwestern extension of this belt is much less than in the eastern, where it averages about 50 inches annually, and the growth and cultural conditions vary accordingly. In trucking, celery, cabbage, strawberries, tomatoes and melons are the leading items. On the southern end of Padre Island, near Brownsville, bananas, oranges and pineapples are grown to some extent. Oranges were successfully grown and fruited along the Gulf coast for several years, but in November, 1911, a severe freeze occurred, before the wood was ripe, and killed all the trees back to the hardy trifoliata stock, where not protected by a mound of soil. Those mounded-up were uninjured below the soil, and made fine growth the summer following. This promised to be an important industry in southern Texas, but will be checked somewhat in its progress by this disaster. To permit of mounding-up safely, growers recommend budding and grafting not over 2 or 3 inches above ground, but never below, as the Satsuma would get onto its own root, and be more tender. Figs flourish everywhere in the coast country. The canned-fig industry is developing and promises to become very profitable. Dewberries grow to perfection, and wild varieties are marketed in considerable quantities. The Le Conte, Kieffer, and Garber pears do better in this region than elsewhere. Some of the Chinese Cling group of peaches, also the Honey and Peen-to types, succeed well. Japanese plums, persimmons, and various American and foreign grapes also succeed, the latter requiring to be grafted on phylloxera-resistant roots, which are found in the numerous wild vines of the state.



2523. Texas, to show the main horticultural areas.

Ornamental horticulture, in all its branches, is here characterized by a profusion and luxury of growth in foliage and flower of a semi-tropical nature. Ever-blooming roses continue to flower most of the winter. Broad-leaved evergreen trees and shrubs, known in the North only in conservatories, are here seen in all well-appointed private grounds, and in parks and cemeteries. Cape jasmine hedges, with their dark glossy green foliage and pearly white, camellia-like, sweet perpetual flowers, are very popular. Commercial plant- and cut-flower-growers do a good business in the cities of Galveston and Houston. During the winter holidays they collect from the woods great quantities of long ("Spanish") moss, holly, magnolia, mistletoe, palmetto, smilax, and the like, and ship to northern cities for decoration purposes. In May and June they send to northern florists great numbers of cape jasmine and magnolia flowers.

The great East Texas Forest region lies just north of the eastern end of the Coastal Plain, the city of Beaumont being situated in its southern extremity. Extending westward from the Sabine River on the east to the Navasota River on the west, over 150 miles, and northward to Red River about 300 miles, narrowing somewhat in its northern parts, is one of the grandest and richest forests in America. Three species of fine lumber pines are most abundant. Numerous oaks, hickories, elms, maples, beeches, white and black walnuts, gums, poplars, pecans, lindens, magnolias, holly, persimmons, sassafras, and numerous handsome shrubs and perennial flowers are found almost everywhere, but especially along the streams. The soil is generally very sandy, underlaid with red and yellow clay, and well adapted to fruits of almost all kinds. The altitude varies from 100 to 600 feet. The rainfall is ample—from 40 to 60 inches annually—and the climate is very mild. Owing to the great lumber-mill interests and lack of market facilities, nearly all horticultural pursuits have been overshadowed until recently. But at Palestine, Tyler, Troupe, Longview, Nacogdoches and some other points, large commercial peach orchards, berry plantations and canneries have been in very successful operation for a number of years and these interests are rapidly increasing. Railway facilities are growing, and altogether east Texas has a very bright horticultural future. Trucking of nearly all kinds, and fruit-growing, with berries, peaches, plums, apples (especially in northern parts), and pears, could hardly ask for better natural conditions.

The Red River Valley is a long extension to the westward—some 250 miles—of the soil, climatic and forest conditions of east Texas, excepting the pines, gums, and some other trees in its western parts. But, as the Red River runs eastward in a broad, deep, heavily timbered valley, its southern bluffs, some 5 to 10 miles wide, enjoy peculiar immunity from late frosts. Here apples flourish about as well as in northern Arkansas, and peaches have not failed entirely in fruit in almost forty years.

With the exception of a few of the tenderer shrubs, everything is grown here as well as in east Texas, and apples, grapes and some other fruits grow better and acquire higher color and flavor, owing to a less humid atmosphere. In this belt belong the cosmopolitan little cities of Texarkana, Paris, Sherman, Denison and Gainesville, in which are found many beautiful residences and grounds, many orchards, vineyards, and berry plantations. Railway facilities are excellent, and good markets lie in every direction. Trucking also is extensive. Cut-flower and general nursery business flourish in the places named.

Similar conditions prevail in some parts of the Trinity River Valley as along Red River, especially about Dallas and Fort Worth; also on the Brazos at Waco, but more of the southern type. These three cities nestle in the heart of the next great division.

The Black Waxy Prairie region of Texas lies next to east Texas on the west and to the Red River Valley on the south, extending west to about 98° and south to within 150 to 100 miles of the Gulf, a broken irregular arm of the east Texas region extending southwestwardly between it and the Coastal Plain. This region has an altitude in its southern parts of 400 to 500 feet and rises in the northwest to 1,000 feet or more. The rainfall varies from 50 inches or more in its eastern parts to 30 inches in the western parts. The foundation is white chalky lime-rock, the soil very black, sticky and exceedingly rich, highly adapted to grains, grasses and cotton, but not suitable for most fruits. The stone-fruits and blackberries do best. Onions are largely grown in Collin County of which McKinney is county-seat. Most shrubbery does well. The Bermuda-grass flourishes in Texas wherever grass can grow and is the almost exclusive lawn-grass. Very handsome yards are made by some of the farmers and many who live in the towns and cities; but most farmers in Texas have done little or nothing to beautify their homes horticulturally.

The Brown, or Chocolate Plains region of Texas, devoted principally to grazing and small grains, lies to the westward of the Black Land Region, is about 200 miles wide by 600 long, extending from Oklahoma on the north to the Rio Grande on the south, running from 1,000 feet altitude on the south and east to 3,000 feet on the west, where it ends suddenly against the cliffs of the still higher Staked Plains region.

Horticulture is in its infancy in all this vast semi-arid, high, rolling prairie country, and can do little without irrigation. Yet many wealthy stockmen there have beautiful grounds surrounding their homes, and grow their home supplies of very fine fruits. Of commerical horticulture there yet is none. The same may be said of the Staked Plains region, but its soil is dark rich loam, the country almost a dead level, except where cañons have cut into it, its altitude from 3,500 to 4,500 feet, its climate dry and very salubrious. Irrigation-horticulture in a small way is sustained from driven wells, which strike plenty of water at 10 to 30 feet. Stock-grazing is the chief commercial occupation, small grain coming next. Five or six counties northwest from Austin, in the central parts of the Chocolate Belt, are very broken, hilly and picturesque, well adapted to fruits. Nearly every home there is supplied with fruits.

The Pecos Valley lies just west of the Staked Plains, and east of a spur of the Rocky Mountains. In places it is irrigated, as at Roswell and Carlsbad, New Mexico, and Pecos City and Stockton, Texas. Commercial fruit-growing is considerable in this valley, especially at Roswell and Pecos City. At the latter place is a vineyard of 40 acres of the vinifera varieties, planted twenty years, doing finely on their own roots and very profitable, as the fruit goes to market in northern cities before any grapes are ripe in California. The Stockton region is largely irrigating and planting vinifera grape, pears, alfalfa and so on.

The Rio Grande Valley is much warmer in the same latitude than the Pecos Valley, otherwise the horticultural conditions are much the same. At El Paso and Ysleta, a little way south on the Texas side, considerable quantities of vinifera grapes of table varieties are grown under irrigation and shipped to other parts of Texas and to northern cities in August and September. Pears and plums are also grown to some extent. Farther down on the Rio Grande, at Del Rio, Eagle Pass and Laredo, grapes, figs and onions are considerably grown and shipped to the larger Texas cities and the North. The grapes are of the Old World varieties, and ripen in June; consequently they have no competition and bring fine prices. The conditions are such that immense quantities of as fine grapes of this class can be grown in this part of Texas as in the best regions of California, and the cost of getting to market is not more than half as much. Undoubtedly the triangular region between San Antonio, Laredo and Del Rio will in the near future have extensive commercial vineyards of vinifera grapes.

A vast mountainous and dry-plains region extends from the Pecos to the Rio Grande, devoted to goats, sheep and cattle; yet at Fort Davis, on a beautiful mesa, some 5,000 feet altitude, among mountains 2,000 to 4,000 feet higher, are a good many very beautiful homes, and fruits do finely, as there is sufficient rainfall and the air is very pure, so that diseases are almost unknown.

The Spanish taste in home grounds among the wealthy of southwestern Texas, who are chiefly stock-growers and merchants, is sometimes seen. It consists of a plaza, or open square in the center of the residence, having fountains (where water is to be had abundantly), and borders, beds and vases of rare tropical and subtropical flowers, shrubs and fruits. Around this highly artistic garden the house is built, often of adobe, sometimes of stone, cut and carved, in large rooms adjoining and opening into each other, all on the ground-floor and one large door opening out to the street or small front yard from a big hall, sometimes having grand arches and marble columns. No windows are in the outside walls, except perhaps in the front, the rooms all being lighted from within the plaza. Thus great seclusion is secured and a perpetual conservatory scene is had from every room. Paved walks, usually covered, run around the plaza next the rooms and similar walks cross through the plaza. This style has given way to American styles. The plaza-park prevails also in the finer hotels, as seen in some at San Antonio; and these, on an enlarged scale at various places in the denser parts of the city, give a very refreshing appearance. In the central and western parts of the state the northern and eastern style of park, cemetery and private grounds decoration is mostly copied, as is also the architecture. Some very creditable examples are seen in Dallas, Waco, Austin, Paris, Sherman, Gainesville, Fort Worth and other places.

There are numerous small, and a few fair-sized nurseries scattered over the state. Plant and cut-flower business is developing rapidly in the larger cities.

Seed business is almost entirely commercial or jobbing, few being engaged in growing seeds of any kind as a business, and the supply comes from northern and eastern growers except the grains.

The following persons, now deceased, have occupied a prominent place in the development of Texas horticulture: T. V. Munson, Denison; H. M. Stringfellow; Wm. Watson; A. M. Ramsey, Austin; C. Falkner, Waco; E. H Adams, Bonham; J. C. Newberry, Pilot Point; J. T. Whitaker, Tyler.

Public-service agencies for horticulture. (E. J. Kyle.)

The legislature of Texas, in an act approved April 17, 1871, provided for the establishment of the Agricultural and Mechanical College of Texas, which was located at College Station in Brazos county. The College was formally opened for the reception of students October 4, 1876. The Horticultural Department of the College now has four members on its instructional staff.

The Federal Experiment Station is located at College Station. The horticultural work in the Station is in charge of two men. The Station has published twenty-nine horticultural bulletins and two circulars.

Elementary courses in horticulture are taught in a number of high-schools in the state. There is a considerable amount of extension work done by members of the horticultural teaching staff and members of the extension service. Some of the societies advancing the cause of horticulture in Texas are the Texas State Horticultural Society, Texas Nut-Growers' Association and Texas Nurserymen's Association. There are also several local horticultural societies and many fruit- and truck-growers' associations for commercial purposes.

In the State Department of Agriculture at Austin, considerable time is devoted to the inspection of nurseries, and the eradication of insect pests and diseases.

Statistics (*Thirteenth Census*).

The approximate land area of Texas in 1910 was 167,934,720 acres. The land in farms was 67 per cent of this area, or 112,435,067 acres. Of this land in farms, the improved land numbered 27,360,666 acres, the woodland 27,658,413 acres, and other unimproved land in farms 57,415,988 acres. The number of all the farms in 1910 was 417,770, and the average acreage to a farm 269.1. [The total area is 265,896 square miles].

The leading agricultural crops of Texas are cotton, including cotton seed, cereals, and hay and forage. The acreage devoted to the production of cotton increased from 6,960,367 in 1899 to 9,930,179 in 1909, when the production was valued at $188,673,954, which was 63.3 per cent of the total value of all crops. Cereals decreased in acreage from 6,932,791 in 1899 to 6,716,304 in 1909, when the value of the production was $67,109,923. Hay and forage increased in acreage from 938,024 in 1899 to 1,311,967 in 1909, when the production was valued at $12,824,433. The value of the forest products of the farms in 1909 was $8,925,662, as compared with $3,520,033 in 1899.

Horticultural crops grown in Texas are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $1,824,543, as compared with $1,563,745, in 1899. Small-fruits increased in acreage from 3,904 in 1899 to 5,053 in 1909, when the production was 6,182,742 quarts, valued at $480,331. The total acreage of potatoes and other vegetables in 1909 was 202,792, and their value $12,122,255. Excluding potatoes and sweet potatoes and yams, the acreage of the other vegetables increased from 111,899 in 1899 to 124,690 in 1909, when the production was valued at $8,099,306. The acreage of flowers and plants and nursery products increased from 2,260 in 1899 to 4,182 in 1909, when the production was valued at $1,727,470.

The total production of orchard fruits in 1909 was 1,090,233 bushels, valued at $1,060,998. Peaches and nectarines contributed about two-thirds of this quantity, and apples, pears, and plums and prunes most of the remainder. The peach and nectarine trees of bearing age in 1910 were 9,737,827; those not of bearing age, 2,958,813; and the production in 1909 was 729,631 bushels, valued at $703,649. Apple trees of bearing age in 1910 numbered 1,138,852; those not of bearing age, 1,127,573, and the production in 1909 was 168,008 bushels, valued at $160,655. Pear trees of bearing age in 1910 numbered 558,478; those not of bearing age, 448,899, and the production in 1909 was 110,967 bushels, valued at $114,279. Plum and prune trees of bearing age in 1910 numbered 1,020,339; those not of bearing age, 327,765, and the production in 1909 was 75,222 bushels, valued at $77,925. Other orchard-fruits produced in 1909 were: 1,839 bushels of apricots, valued at $2,364; 1,635 bushels of mulberries, valued at $723; 1,869 bushels of quinces, valued at $740; and 1,062 bushels of cherries, valued at $663.

The production of grapes in 1909 was 1,802,618 pounds, valued at $78,325. The grape-vines of bearing age in 1910 numbered 712,201; those not of bearing age, 297,869.

The production of nuts in Texas in 1909 was 5,945,932 pounds, valued at $562,542. The pecan is by far the most important nut, the production of pecans alone being 5,832,367 pounds, valued at $556,203. The other nuts produced were: 40,658 pounds of Persian or English walnuts, valued at $3,703; 16,932 pounds of almonds, valued at $1,618; and 55,446 pounds of black walnuts, valued at $995.

Tropical fruits were produced in Texas in 1909 to the value of $122,678. Figs and oranges contributed the greater part of this quantity. Fig trees of bearing age in 1910 numbered 230,171; those not of bearing age, 585,396. The production of figs in 1909 was 2,411,876 pounds, valued at $97,078. Orange trees of bearing age, in 1910 numbered 42,384; those not of bearing age, 867,407. The production of oranges in 1909 was 10,694 boxes, valued at $22,090. Other tropical fruits produced were: 1,175 bushels of Japanese persimmons, valued at $2,136; 488 boxes of pomelos (grapefruit), valued at $866; and 224 boxes of lemons, valued at $469.

Of the small-fruits produced in Texas, strawberries are by far the most important, with blackberries and dewberries ranking next. The acreage of strawberries increased from 1,361 in 1899 to 2,161 in 1909, when the production was 4,207,056 quarts, valued at $334,651. Blackberries and dewberries increased in acreage from 2,394 in 1899 to 2,773 in 1909, when the production was 1,868,119 quarts, valued at $138,557. The other small-fruits produced in 1909 were: 97,652 quarts of raspberries and loganberries, valued at $6,302; 4,873 quarts of currants, valued at $496; and 5,042 quarts of gooseberries, valued at $325.

Of the vegetables produced, the sweet potatoes and yams, the potato, and peanut are the most important. The acreage of the sweet potato and yam decreased from 43,561 in 1899 to 42,010 in 1909, when the production was 2,730,083 bushels, valued at $2,197,799. Potatoes increased in acreage from 21,810 in 1899 to 36,092 in 1909, when the production was 2,235,983 bushels, valued at $1,825,150. Peanuts increased in acreage from 10,734 in 1899 to 64,327 in 1909, when the production was 1,074,998 bushels, valued at $1,075,110. Other vegetables of importance, that were produced in 1909, were: 5,170 acres of onions, valued at $820,972; 6,035 acres of tomatoes, valued at $597,038; 18,466 acres of watermelons, valued at $539,313; 4,462 acres of cabbage, valued at $382,349; 1,784 acres of beans, valued at $95,474; 1,685 acres of cantaloupes and muskmelons, valued at $83,363; and 1,256 acres of cucumbers, valued at $52,667. Turnips were produced to the value of $39,290; green peppers, to the value of $18,807; green peas, to the value of $17,685; sweet corn, to the value of $13,882; beets, to the value of $9,420; and asparagus amounted to $5,372 in value. Vegetables of still less importance were carrots, cauliflower, pop-corn, eggplant, lettuce, okra, pumpkins, radishes, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 167 in 1899 to 335 in 1909. The total area under glass in 1909 was 986,070 square feet, of which 907,615 were covered by greenhouses, and 78,455 by sashes and frames. The value of the flowers and plants produced in 1909 was $474,360, as compared with $120,249 in 1899.

The acreage devoted to nursery products increased from 2,093 in 1899 to 3,847 in 1909, when the value of the nursery products was $1,253,110, as compared with $314,511 in 1899.

T. V. Munson.

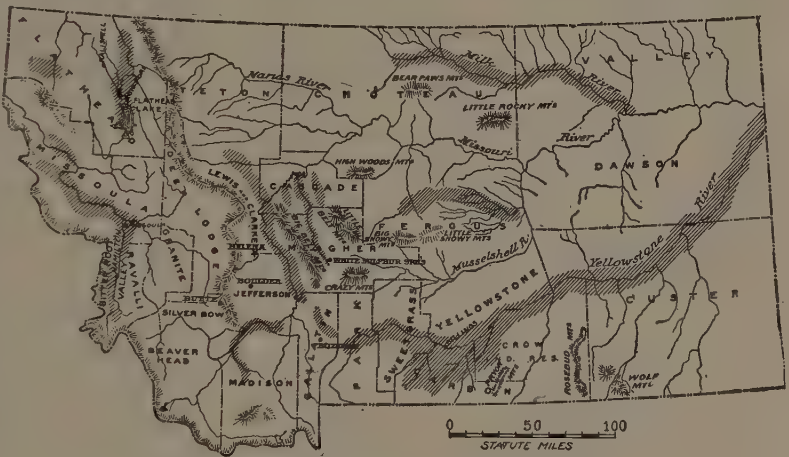
MOUNTAIN STATES.

Montana.

Montana (Fig. 2524) is the third largest state in the Union, Texas and California being first and second respectively. The eastern part of Montana is undulating plains country, with a mean average altitude of 2,800 feet above sea-level. In a mountainous state covering over 145,000 square miles, there are possibilities for great local variations, and Montana is not an exception. From east to west the average length is 535 miles, while from north to south it measures 275 miles. Of the land surface, about 30,000,000 acres are mountainous. The forest reserve embraces over 20,000,000 acres, including some which have agricultural possibilities. About 6,000,000 acres of the tillable lands are under irrigation, or are possible of irrigation, and about the same acreage is possible of cultivation under the dry-farming system.

Along the southern boundary, about 125 miles west of the state line, are the Wolf Mountains; west of these the Rosebud and Pryor mountains; toward the northern boundary and 175 miles west of the state line are the Little Rockies; west of these the Bear Paws; while dotted over the eastern and central part of the state are the Moccasins, and the Big and Little Snowies, the Belts, the Highwoods, and the Crazies. These, with the exception of the Belts, are isolated from other mountains, or detached spurs from the main range, and abound in the exceptional advantages which arise from good soil, favorable exposure, and convenient means for irrigation. About the center of the southern state line the main range of the Rockies is encountered. This range traverses the state from this point in a northwesterly direction. The summits of the main range vary from 7,500, to 10,000 feet above sea-level, and present mighty barriers to the winter storms which sweep over the country to the east and south of Montana, often bringing intensely cold weather in their wake. The climate of the state is also sensibly affected by chinooks, those much misunderstood currents of warm air which rob winter of its terrors in regions visited by them. The botanist and horticulturist have much to learn, as yet, concerning the effect of altitude upon plant growth. In a general way, it is supposed that 9,000 feet is the so-called limit of timber, although, as a matter of fact, it often happens that above this point the crowns of the mountains are composed of living rock devoid of soil and other needed adjuncts of tree growth. Illustrations of the unwillingness of plant growth to be circumscribed by altitudinal lines are found in the city of Denver, which lies 5,000 feet above sea-level. There many trees have been successfully transplanted from their natural habitat at sea-level along the shores of Puget Sound to a point nearly a mile aloft, and into a climate as naturally dissimilar as could well be found. In Cheyenne, Wyoming, there is a luxuriant development of the black locust at an elevation of 6,100 feet. This is a tree that has to be most carefully handled to avoid winter-killing in Minnesota, 5,500 feet nearer sea-level.

In the sugar-beet chart of the Department of Agriculture, a great variation of altitude will be found. It is designed to show the extent of the country in the United States adapted to beet-culture. This starts at the Atlantic coast at sea-level, extending due westward to the limit of Wisconsin. From there it jumps to Colorado, California, and also embraces the Yellowstone Valley, which is one of the most prolific sections in the beet area, considering tonnage and sugar-content. One of the largest sugar-beet factories in the United States is located at Billings, which is the largest city in the Yellowstone Valley.



2524. Montana, with regions best adapted to horticulture.

Horticulturally, Montana presents conditions for the growing of a large list of fruits, excepting the citrous and other subtropical fruits. Some scientific experiments have been conducted to determine the species adapted, and much is now being done to determine the varieties of species best suited to Montana's conditions. Observation teaches that all western sections should be carefully studied regarding the presence of alkali, as fruit-trees will not thrive in alkali soil. It is not usually a hard matter to determine such conditions, as irrigation or natural water-fall brings the salts to the surface where they rapidly crystallize. On the benches near the mountains, which are the desirable fruit-lands, alkali is seldom found.

The natural conditions for fruit-growing in Montana have been such that if trees were planted, a bountiful harvest, in due time, was assured, but with the evolutionary changes of conditions which always follow development, today the degree of success is measured by the skill and aptitude of the grower. Water for irrigation is to be found in abundance. Under irrigation, during the growing season, the moisture-content of the soil is under absolute control, which, combined with the bright sun and the clear atmosphere, makes for a strong normal growth, and by proper regulation of cultivation and irrigation, this growth is properly matured and ripened for the winter.

The lay of the valleys between the mountain ranges, and the frequency of the cañons which open out upon the benches and plains below, create air-currents which are almost a guarantee against frost-injury. These currents can be noticed long distances from the mouths of the cañons, and especially on the benches. They also prevent frosts, which gives the fruit more time for maturity than in the open country, or on level areas.

Pioneer orcharding was started with many obstacles.

Trees were freighted long distances, which made prices almost prohibitive. Seeds were brought across the plains and planted, and, when the trees were of sufficient size, cions came by mail and were grafted into them. In 1864, trees were planted in the Missouri Valley by John G. Pickering, some of which are still bearing. There are bearing orchards in Madison, Clarks Fork, Flathead, and other valleys, that were planted in the early seventies. In 1864, T. W. Harris planted the first apple tree in the Bitter Root Valley, on the bench tributary to Three Mile Creek. He brought the tree by horseback from Walla Walla, Washington. In 1870, the Bass Brothers planted the first commercial orchard in the valley near Stevensville, and in 1898 they marketed about 10,000 boxes of Transcendent crabs. The first McIntosh Reds were planted near Stevensville by Amos Buck in 1877; these trees are still strong, healthy, and productive. This variety early demonstrated its adaptability to Montana conditions, and has proved very remunerative. Early recognizing this fact, and the high quality it develops in Montana conditions, D. E. Bandman planted one of the first commercial orchards near Missoula which consisted of 1,500 McIntosh Reds, and a few other mixed sorts.

The Bitter Root Valley has a mean altitude of 3,300 feet. It is about 100 miles long, lying in the southwestern part of the state, east of the Bitter Root Range. It varies in width from 1 to 20 miles, and is traversed its entire length by the Bitter Root River which empties into the Missoula River near Missoula. The bitter-root flower is very abundant in the Bitter Root Valley and the Missoula Valley. This valley has seen the greatest horticultural development of any section in the state, the Flathead Valley ranking next in order of development; after which come the Missoula Valley, the Plains Valley, the Yellowstone, including its tributary Clarks Fork, Jefferson and South Boulder. The Bitter Root Valley represents as many orchard acres as do the other sections combined. It has a soil especially adapted to apples, cherries, pears, plums, and small-fruits, while in some favored locations grapes and peaches thrive. Sweet cherries, particularly the varieties Bing, Lambert, and Royal Ann, develop a high degree of perfection. The soil is a decomposed granite with a liberal amount of loam, and almost a total absence of alkali. To one unfamiliar with the formation it seems a gravelly, stony, almost worthless combination, but when the cultivator is put into action, water and systematic operations applied, its productive powers are wonderful. The benches, which are the desirable fruit areas, are so fertile that there is a tendency for an overgrowth of tree, and abnormal fruitage. The soil has a liberal mixture of clay, but not sufficient to cause it to bake after irrigation. The orchardists of the Bitter Root Valley have learned that excessive watering has injured more trees than has any other operation. The theory advanced that fruit grown under irrigation is inferior to that grown with a natural rainfall has long since been exploded. The necessary amount of moisture, which can be absolutely controlled under irrigation, coupled with the clear atmosphere, and bright sun, develops a color, and with that goes quality unexcelled. Such conditions can only be found in similar altitudes under irrigation, or systematic frequent, cultural methods. The orchards in the Bitter Root Valley range in size from the home orchard, consisting of about 100 trees including many varieties, to commercial orchards of 100 to 2,000 acres each containing only a few varieties. Many of the large tracts are subdivided. During the past five years, the orchard development has been very rapid, there being an average of 1,000,000 trees planted annually. Varieties in the orchards planted by the pioneers were principally the hardy sorts, as hardiness was considered to be the necessary element of the tree. This filled the valley with apples of an inferior quality, but later developments demonstrated the fact that the conditions were favorable for the growing of higher grade fruit, hence the young orchards are planted with up-to-date, standard varieties.

Some varieties of grapes are proving very satisfactory in the state, and the time is near at hand when Montana grapes will occupy a prominent place in her list of fruits.

Although there is none of the nut-bearing trees indigenous to Montana, yet black walnut, butternuts, English walnuts, chestnuts, filberts and hickories thrive when planted in the state, and where sufficiently old they are producing annual crops of nuts.

Small-fruits are grown in all parts of the state with unparalleled success. Every ranch home in the state can be supplied with small-fruits from the home patch, if the proper varieties are selected and given good care.

Great success has been achieved in the growing of vegetables wherever it has been tried. In all of the newly settled parts of the state, as well as in the older developed valleys, wherever locations are carefully selected for the orchard and garden, fruits and vegetables can be grown to supply the home needs, and in the valleys especially adapted in the different parts of the state, commercial enterprises are profitable.

The growing of the smaller vegetables, such as peas, beans, and the like, is being stimulated by the establishment of canning factories. A very large one, located at Bass Spur in the Bitter Root Valley, is handling peas, beans, pumpkins, squash, tomatoes, and all of the different fruits. The cantaloupe and watermelon industry is becoming a prominent factor in the Yellowstone Valley near Billings. Cucumber-growing for pickles is a leading branch of the vegetable-growing in the Yellowstone Valley. A pickle factory at Billings consumes the product from a large acreage.

The growing of vegetable seed is becoming one of the leading industries in some parts of the state. Seed pea-growing has been especially remunerative in valleys where tried. The growing of alfalfa seed is a leading enterprise in many of the dry-land sections in the eastern part of the state. Montana alfalfa seed always stands foremost in the markets.

A rapidly growing demand for the winter flowers to supply the Pacific coast trade has induced the leading florists in the important cities to increase their output until it has become one of the leading branches of the florists' trade. New plants have been built for this purpose and many of the older ones have been enlarged.

There is a great increase in the demand for ornamentals in the cities and towns, and also in the country districts. Some of the nurserymen are catering to this branch of trade almost exclusively, only growing fruit-trees sufficient to supply local demands.

Bees and honey are profitable side issues with many farmers and fruit-growers. Good honey always finds a ready market and the quality of Montana honey is unsurpassed. In the extensive alfalfa and orchard sections, bees find extensive range for ideal feeding-grounds. Good prices are always paid for Montana comb or strained honey.

Among those influential in developing Montana horticulture may be mentioned Daniel Bandmann of Missoula, one of the early planters of McIntosh Red apples, and M. H. Pierce of Plains, one of the pioneer planters of the commercial orchard in Montana.

Public-service agencies for horticulture.

The Land-Grant college of Montana is located at Bozeman, and was established in 1893. There are two members of the horticultural staff.

The Experiment Station is located at Bozeman and there is also a sub-station at Victor in the Bitter Root Valley. About thirty horticultural bulletins have been issued.

The Extension Department of the College holds schools in different sections of the state. There is no horticulture taught in the public schools.

The inspection services come under the direction of the State Board of Horticulture, through the State Horticulturist. The fruit sections are divided into districts and an inspector is provided for each district.

Statistics (*Thirteenth Census*).

The approximate land area of Montana in 1910 was 93,568,640 acres, including 115,840 acres in Yellowstone National Park. The land in farms was 13,545,603 acres, or 14.5 per cent of the land area. Of these 13,545,603 acres in farms, 3,640,309 were improved; 595,870 were woodland; and 9,309,424 were other unimproved land in farms. The total number of farms in 1910 was 26,214. The average acreage to a farm was 516.7. [The total area is 146,997 square miles.]

The leading agricultural crops are hay and forage, and cereals. The acreage devoted to hay and forage increased from 875,712 in 1899 to 1,135,376 in 1909, when the value of the production was $12,344,606, which was 41.5 per cent of the total value of all crops. The acreage of cereals increased from 254,231 in 1899 to 635,807 in 1909, when the value of the cereals produced was $12,251,345, or 41.2 per cent of the total value of crops produced. Sugar crops increased in acreage from 2 in 1899 to 8,821 in 1909, when the value of the products was $547,178. The value of forest products in farms in 1909 was $541,800, as compared with $176,134 in 1899.

Horticultural crops produced are fruits, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of fruits produced in 1909 was $609,095, as compared with $59,587 in 1899. Small-fruits increased in acreage from 554 in 1899 to 562 in 1909, when the production was 766,791 quarts, valued at $86,586. In 1909 the total acreage of potatoes and other vegetables was 28,010, and their value $2,227,736. Excluding potatoes, the acreage of vegetables increased from 4,272 in 1899 to 7,300 in 1909, when the value of the production was $928,906. Flowers and plants and nursery products increased from 79 acres in 1899 to 361 acres in 1909, when the value of their products was $279,028.

The total quantity of orchard-fruits produced in 1909 was 591,088 bushels, valued at $609,078. Apples contributed more than 95 per cent of this quantity, the production being 567,054 bushels, valued at $566,938. The number of apple trees of bearing age in 1910 was 696,753; those not of bearing age, 1,308,066. The cherry trees of bearing age in 1910 numbered 19,938; those not of bearing age, 24,237. The production in 1909 was 7,497 bushels, valued at $17,985. The pear trees of bearing age in 1910 numbered 10,297; those not of bearing age, 12,806. The production was 7,543 bushels, valued at $12,008. Plums and prunes of bearing age in 1910 numbered 21,140; those not of bearing age 15,001; and the production in 1909 was 8,777 bushels, valued at $11,642. Peach and nectarine trees of bearing age in 1910 numbered 538; those not of bearing age, 3,386; and the production in 1909 was 128 bushels, valued at $235. Apricots were also produced in 1909 to the value of $269.

Grapes are of comparatively no importance, as are also nuts, there being a production of grapes valued at only $17, while no value was placed upon the small quantity of nuts produced.

Strawberries are by far the most important of the small-fruits, with raspberries and loganberries second in importance and currants, third. The acreage devoted to the strawberry decreased from 281 in 1899 to 265 in 1909, when the production was 406,038 quarts, valued at $46,870. The acreage of raspberries and loganberries increased from 80 in 1899 to 113 in 1909, when the production was 165,473 quarts, valued at $19,732. Currants decreased in acreage from 120 in 1899 to 115 in 1909, when the production was 123,031 quarts, valued at $12,195. There were also produced 36,321 quarts of blackberries and dewberries, valued at $4,020 and 35,896 quarts of gooseberries, valued at $3,765.

The acreage devoted to potatoes increased from 9,613 in 1899 to 20,710 in 1909, when the production was 3,240,696 bushels, valued at $1,298,830. The more important of the other vegetables produced in 1909 were: 359 acres of cabbage, valued at $56,210; 119 acres of onions, valued at $15,310; 164 acres of sweet corn, valued at $13,692; 11 acres of celery, valued at $4,800; 34 acres of rutabagas, valued at $3,960; and 69 acres of turnips, valued at $3,858. Vegetables of less importance produced in 1909 were green beans, beets, cantaloupes and muskmelons, carrots, cauliflower, horseradish, tomatoes, and watermelons.

The acreage devoted to the production of flowers and plants increased from 17 in 1899 to 20 in 1909. The total area under glass was 308,939 square feet, of which 289,024 were covered by greenhouses and 19,915 by sashes and frames. The value of the flowers and plants produced in 1909 was $104,601, as compared with $33,630 in 1899.

The acreage devoted to nursery products increased from 62 in 1899 to 341 in 1909. The value of the nursery products in 1909 was $174,427 as compared with $17,825 in 1899.

M. L. Dean.

Idaho.

The state of Idaho (Fig. 2525), lying west of the Rocky Mountains, is of vast extent and wide diversity of topography. It has a range north and south of approximately 485 miles, extending from the 42nd to the 49th parallels of latitude. Its breadth east and west, at its widest point, is about 310 miles. Taking the state as a whole, the altitude ranges from that of central and northern Indiana to more than 5,000 feet above the highest peaks of the Appalachian system.

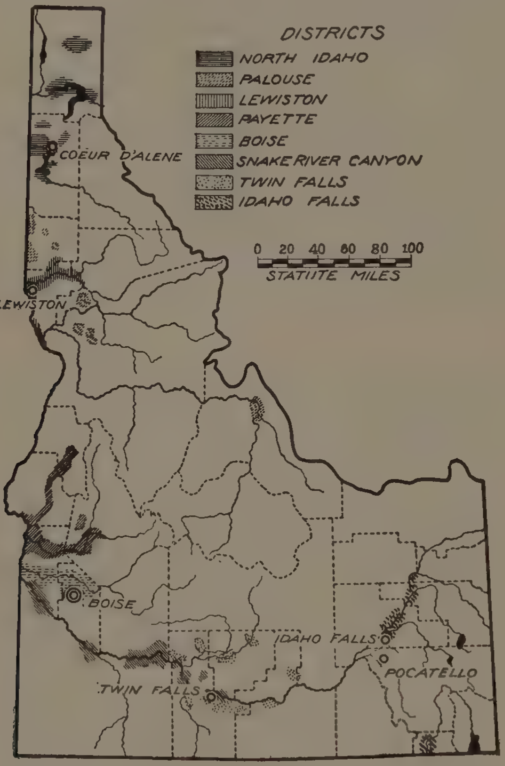
Some of the salient features of Idaho are its sage-brush plains, high snow-capped mountains and timbered plateaus. Along the eastern border of the state lie the Cœur d' Alene, Bitter Root, Cabinet and many other ranges of mountains. The Owyhee Mountains lie in the southwest corner and their lateral spurs extend almost to the Snake River. The native vegetation of the whole of the southern part of the state, as far north as the middle of Washington County, is sage-brush. This entire area is a vast agricultural region, having at the present time 1,843,039 acres of irrigated lands. South Idaho is an arid region, the rainfall for that part of the state being from 8 to 15 inches. The timbered plateau extends over most of the northern and central parts of the state. The principal trees found in this area are yellow pine, red fir, and white pine. The northern part of the state is humid, the annual precipitation varying from 20 to 25 inches. The agricultural lands lie mostly near the western border. The state is entirely drained by the Snake River and other tributaries of the Columbia.

The development of the fruit industry in Idaho is interesting. In the year 1836, H. H. Spaulding started an orchard on the Clearwater River, a few miles above Lewiston, at a place now known as Joseph. Later plantings were made in the southern part of the state in the year 1862. Two small orchards were set out on the Snake River near the Brown Lee country. Small plantings were also made on the Payette River in 1863 and near Boise in 1865. From these small plantings, the fruit industry has developed until now there are over 120,000 acres planted to orchards.

Owing to differences in altitude and climatic conditions, the state may be divided horticulturally into several distinct districts.

The North Idaho or Panhandle district includes the timbered territory of northern Idaho and especially the country around Cœur d'Alene, Hayden Lake, Pend Oreille Lake, Sandpoint, Bonners Ferry, Clarks Fork, Rathdrum, and Post Falls. It includes all of Bonner County and parts of Kootenai, Shoshone, Latah, Clearwater and Idaho counties. It is a large district and there is considerable variation in the conditions in different parts of it.

The soils of the northern part of the state vary in texture from silt loams to sandy loams and in color from red to black. The climate is mild in summer and not severe in winter. The elevation varies from 1,500 to 2,500 feet. The annual precipitation is from 20 to 25 inches and is sufficient to mature horticultural crops although irrigation is practised in several localities.



2525. Idaho, with most important horticultural parts.

While a large number of varieties of apples are grown in this district, the Wagener is apparently the leader. Northern Idaho is, however, much more of a natural pear than apple district. The growers have less trouble with blight than in some other sections of the state. This is not a peach nor a grape district and practically none of these fruits is grown. In favored localities, a few early peaches, such as Hale Early, and early grapes such as Moore Early, might be grown. All sour cherries do well, and in parts of the district excellent sweet cherries are raised. All the other small- and tree-fruits are grown successfully. Some growers report that loganberries cannot be raised, while others state that they do very well.

The local conditions, such as soil, air-drainage, elevation and slope are important considerations in the establishment of an orchard in this district.

The Palouse district includes all of the typical rolling wheat-growing region, known as the "Palouse country." The commercial orchards are mostly located around the towns of Viola, Moscow, Potlatch, Genesee and Princeton. As conditions are very similar on the "Camas prairie" which lies in Idaho, Lewis, Clearwater, and Nez Perce counties, it is also included in the Palouse district. The larger plantings of fruit on "Camas prairie" are found in the vicinity of the towns of Grangeville, Cottonwood, and Nez Perce.

Irrigation is not necessary in this district, the rainfall being from 20 to 25 inches, which is sufficient to grow crops successfully, although a good dust-mulch is essential in order to obtain size of fruit. The deep, friable soils are of basalitic formation, very fine in texture, and hold moisture remarkably well. The elevation varies from 2,000 to 3,500 feet.

The proper choice of a site is very essential to successful orcharding. The orchard should be located on a slope and the lower side should be at a somewhat greater elevation than the bottom of the valley. This insures air- as well as good soil-drainage. As cold air settles to the lower levels, low places are subject to frost and for that reason low-lying basins or pockets should be avoided for orchard purposes.

Experiments have shown that greater color may be secured on apples in this district by summer pruning.

Pear-growing is rapidly gaining prominence in certain parts of the Palouse district. All sweet cherries do exceptionally well. The Bing is the leader, although the Royal Ann and Lambert are excellent. The sour cherries also find here soil and climate congenial to their growth. The Italian prune does not attain the size which it reaches in some of the the irrigated sections of the state, but the quality is excellent. Peaches are nearly always killed by frost and practically none is raised in the district; the same is true of grapes.

The strawberry is one of the most popular fruits grown. It thrives well in practically all parts of the district. The Clarks Seedling is a favorite on account of its superior shipping qualities, its flavor and its yield. Very few loganberries are raised although they apparently do very well. All other small-fruits grow well when cared for in a proper manner.

The Lewiston district includes the territory around the town of Lewiston in the Lewiston Valley. It extends up the Clearwater Valley to Stites; up the Potlatch Creek Valley to Kendrick; and south from Lewiston along the Snake River. The average elevation is low. It varies from 700 feet to about 2,000 feet at the upper end of the Potlatch Creek Valley. The annual precipitation ranges from 12 to 20 inches. Irrigation is practised in the Lewiston orchards as well as in parts of the Clearwater and Snake River valleys. Practically all kinds of fruits of excellent quality are raised here. In a few favored localities, European grapes, such as Flame Tokay, Muscat, and the like are grown successfully. A large percentage of the fruit in this district is grown on a bench about 3 miles southeast of Lewiston at an approximate elevation of 1,500 feet, known as the "Lewiston orchards." In these tracts there are about 6,000 acres. A few varieties of fruit are grown in this locality that do not do well in other parts of the state, among them being the Spitzenberg and Yellow Newton varieties of apples.

The Payette district includes the territory along the Payette River from its mouth to the Horseshoe Bend and Brown Lee country; along the Snake River from Weiser to Payette; and along the Weiser River from Weiser to the Council Valley. A large percentage of the fruit is planted around the towns of Payette, Fruitland, New Plymouth, Emmett, Woods Spur, Jonathan and Weiser. This is the largest fruit district of Idaho, calculated on the basis of the acreage planted to fruit. The soils are volcanic ash and vary in texture from light sandy loams on the uplands to heavy dark loams in the valleys. The annual precipitation ranges from 10 to 15 inches. Irrigation is necessary.

The Council Valley section is located along the upper Weiser and Council rivers. Its elevation varies from

3,000 to 4,000 feet. The protection is very good and fruit of fine quality is grown. Approximately 3,000 acres are in fruit at the present time.

Almost all kinds of fruit of excellent quality are grown in the Payette district. However, at the present time, apples and prunes are the leaders in importance from a commercial standpoint. Blackcap raspberries are also of some importance commercially. Almost all kinds of apples grow well. The Arkansas Black is one of the best money-makers, with the Rome Beauty a close second. The acreage in Jonathans is large.

Pears are not grown extensively at the present time in the Payette Valley. Very fine peaches are grown, also all kinds of cherries, Italian prunes, plums and practically all of the small-fruits and American grapes.

The "Emmett bench," being farther up the Payette River valley, presents conditions slightly different. The protection is better and there is a longer growing season. In this section, all American varieties of grapes mature well and are of excellent quality. In favored situations, the European varieties, especially the Malaga, Sweetwater, Cornichon, Muscat and Thompson Seedless, are grown. The Tokay is also grown, although it does not always mature properly.

The Boise Valley district includes the entire Boise Valley with Boise at one end and Parma at the other. It is about 35 miles long and varies in width from 2 to 10 miles. While fruit is raised in the entire valley, most of the commercial orchards are found in the country around the towns of Boise, Eagle and Star, Parma, Collister and Middleton on the north side of the River, and Meridian, Nampa, Caldwell and Roswell on the south side. There are approximately 25,000 acres and it is the second largest fruit district in Idaho. While many varieties of apples do excellently in this district, the Rome, according to many of the growers, is the most profitable. However, the growers are almost unanimous in agreeing that the Italian prune is the leading money-maker in the Boise Valley at the present time. The sloping ground nearer the mountain ranges is best adapted to the growing of peaches, sweet cherries and grapes commercially. In the lower elevations, there is great danger of frost. Sour cherries succeed well in the level, open country. Berries of all kinds succeed well and there is seldom a failure, although strawberries are sometimes affected by a late spring frost. The soils of the Boise Valley are very rich. The elevation varies from 2,000 to 3,000 feet. The annual precipitation is from 10 to 15 inches. Irrigation is depended upon to mature crops grown in the valley.

The Snake River Cañon district consists of: (*a*) The Homedale section, which includes Indian Cove, Central Cove, Sunnyside, Fargo and Peaceful valleys. All of these are coves along the Snake River. This section is well adapted to fruit as the climate is excellent for fruit-growing purposes. However, trees should not be planted on the adobe land on the floor of the river valley. There are about 2,000 acres in this section, which are distributed along the Snake River for 30 miles. (*b*) The Upper Snake River Cañon section which consists of Grand View, Medbury Valley, Glenns Ferry, King Hill, Swiss Valley, Hagerman Valley, Crystal Springs, Niagara Springs and Blue Lakes. This is approximately 100 miles long and is a narrow cañon varying in width from 1 to 4 miles. The fruit is planted in spots.

The entire district is located directly along the Snake River. The hills or cañon walls on each side of the river afford an excellent protection, although there is a wide variation. At Blue Lakes, the cañon walls of the river are very steep and about 800 feet high, while in the Homedale section, the valley is much wider and the hills not nearly so abrupt nor high. This entire area has a mild climate and long growing season, well adapted to the growing of fruits, and there are localities where even tender fruits, such as European grapes, are grown successfully. Apples thrive well and are grown commercially. Peaches, sweet cherries, grapes, and the like, have the advantage of a good local market, due largely to the fact that they ripen earlier than those grown outside of the cañon district. Sour cherries are excellent and sweet varieties succeed well. Prunes, plums, strawberries and all of the small-fruits grow well and produce abundantly.

The Twin Falls district includes: (*a*) The territory known as the North Side Twin Falls section and the surrounding country where the conditions are similar, especially the vicinity around the towns of Ticeska, Bliss, Jerome, Gooding, Wendell, Shoshone and Richfield. In this entire section, there are approximately 6,000 acres in fruit. (*b*) The South Side Twin Falls section, especially the area surrounding the towns of Hansen, Kimberly, Twin Falls, Filer, Buhl, Minidoka, and Burley. Minidoka and Burley are located on the Minidoka project and at the present time very little fruit is grown in this vicinity. In this section there are about 19,000 acres in fruit. (*c*) The Salmon Tract is a flat, irrigated country located to the east of Salmon River and watered by the Salmon River and Deep Creek. There are approximately 3,000 acres in fruit.

The average elevation of this district is rather high, varying from 3,500 to 4,500 feet. The soil is a clay loam and is excellent for the production of fruit. Throughout the entire district, irrigation must be practised in order to produce crops. Peaches and American grapes are grown to a limited extent, although these are much later than those grown in the cañon district nearby. Few sweet cherries are grown. Apples are the leading commercial fruit, although sour cherries, prunes, plums and all the small-fruits will grow to perfection. Occasionally a late frost affects the berries. This district is still very young from a horticultural standpoint as most of the land was first irrigated about ten years ago.

The Blackfoot and Idaho Falls district consists of a strip of land running from Blackfoot through Idaho Falls and on to St. Anthony, being approximately 80 miles long and 30 miles wide. The average elevation is about 4,700 feet. There is a gradual rise in elevation from Blackfoot to St. Anthony of about 13 feet to the mile. In general, the soil is excellent The area planted to fruit in this district is small compared with some of the other fruit districts of Idaho. There are some favored localities where commercial plantings have been made. Sour cherries, dewberries, blackberries and blackcap raspberries are grown on a small scale. Prunes and plums succeed well while strawberries, red raspberries, gooseberries and currants grow to perfection.

Public-service agencies for horticulture.

The University of Idaho was established in 1889, by an act of the Territorial Legislature, at Moscow. The College of Agriculture was established in 1891, by order of the Board of Regents, as one of the colleges of the University. The horticultural staff consists of four members.

The Experiment Station is a regularly constituted department of the University, and was also established in 1891. The gardens and orchards, consisting of 45 acres, give ample room for all research work, which is being carried on at the present time. Since the establishment of the Experiment Station, twenty-seven bulletins and circulars have been published, having a direct bearing upon horticultural subjects.

The Extension Department of the University was established in 1912, with headquarters at Boise.

The Horticultural laws of the state of Idaho provide for a State Horticultural Inspector, whose jurisdiction shall extend throughout the state. To render more efficient service, the state has been divided into fourteen districts, a deputy horticultural inspector being placed in charge of each district.

Statistics (*Thirteenth Census*).

The approximate land area of Idaho is 53,346,560 acres, which includes 32,640 acres in Yellowstone National Park. Of the total land area, 5,283,604 acres or 9.9 per cent is in farms, of which 52.6 per cent or 2,778,740 acres are improved; 584,556 acres are in woodland; and 1,920,308 acres are classified as other unimproved land in farms. There are in the state 30,807 farms, the average acreage of which is 171.5 acres. [The total area is 83,888 square miles.]

The leading agricultural crops are cereals, hay and forage, sugar crops, and forest products of the farm. The cereals in 1909 occupied 847,138 acres as compared with 369,788 acres in 1899. This showed an increase in acreage of 129.1 per cent for the period. The value of the cereals in 1909 was $16,026,676 or 46.4 per cent of the total value of all crops. Hay and forage increased in acreage 42.7 per cent for the same period, the acreage being 513,656 in 1899 and 732,886 in 1909. The value of the hay and forage for 1909 was $12,099,963, or 35.2 per cent of the total value of all crops. The percentage of improved land occupied by the cereals and hay and forage was 30.5 and 26.4, respectively, in 1909. Sugar crops, in 1909, occupied 15,630 acres as compared with 21 acres in 1899 and the value of the sugar products in 1909 was $815,068. The value of the forest products of the farms in 1909 was $1,280,512, as compared with $315,821 in 1899.

Horticultural crops grown are fruits and nuts, vegetables including potatoes, small-fruits, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $882,526, as compared with $371,273 in 1899. Small-fruits increased in acreage from 957 in 1899 to 1,673 in 1909, when the value of their products was $201,525. Vegetables lead in value of the horticultural crops grown in Idaho. In 1909 the total acreage of potatoes and all other vegetables was 38,371 and their value $2,591,199. Flowers and plants and nursery products increased in acreage from 120 in 1899 to 548 in 1909, when their value was $186,548.

The total quantity of orchard-fruits produced in 1909 was 924,223 bushels, valued at $863,516. Apples contributed more than two-thirds of this quantity; plums and prunes most of the remainder. In 1910, there were in Idaho 1,005,668 apple trees of bearing age and 1,539,896 apple trees not of bearing age. The production in 1909 was 659,959 bushels, valued at $610,504. Plum and prune trees of bearing age in 1910 numbered 302,855; those not of bearing age, 98,017. The production in 1909 was 179,027 bushels, valued at $132,804. Peaches and nectarines are of interest for while the number of trees of bearing age numbered only 73,080 in 1910, those not of bearing age numbered 212,995. The production in 1909 was 18,734 bushels, valued at $28,149. In 1909 the production of pears was 42,649 bushels, valued at $48,045; that of cherries 22,609 bushels, valued at $41,766; and that of apricots 1,108 bushels, valued at $2,034. The production of quinces and mulberries was of little importance.

The grape-vines of bearing age in 1910 numbered 68,269; those not of bearing age, 124,806. The production in 1909 was 604,227 pounds, valued at $18,814.

Nuts are of little or no importance in Idaho. The nut trees of all varieties in 1910 of bearing age numbered only 1,379 and those not of bearing age, 3,495. The production in 1909 was 3,328 pounds, valued at $196.

Strawberries are by far the most important of the small-fruits raised in Idaho, with raspberries and loganberries ranking next. The acreage of strawberries increased from 239 in 1899 to 698 in 1909, when the production was 953,723 quarts, valued at $92,904; the acreage of raspberries and loganberries was 496 in 1909 and the production was 575,209 quarts, valued at $59,854. Other small-fruits produced were: 249,984 quarts of blackberries and dewberries, valued at $24,688; 161,230 quarts of currants, valued at $13,760, and 130,987 quarts of gooseberries, valued at $10,317.

Of the vegetables, the potato was by far the most important. The acreage increased from 9,313 in 1899 to 28,341 in 1909, an increase of 204.3 per cent. The value of the 4,710,262 bushels produced in 1909 was $1,583,447. The most important of the other vegetables grown in 1909 were: 289 acres of cabbage, valued at $43,517; 213 acres of cantaloupes and muskmelons, valued at $15,407; 165 acres of watermelons, valued at $15,016; 85 acres of onions, valued at $17,065; and 42 acres of tomatoes, valued $8,840. In 1912, beans were valued at $210,000 and peas at $725,000. There were also grown in smaller quantities, carrots, celery, sweet corn, cucumbers, and turnips.

The acreage devoted to flowers and plants increased from 5 in 1899 to 18 in 1909. The area covered by glass was 59,477 square feet, of which 58,727 were covered by greenhouses and 750 by sashes and frames. The value of the flowers and plants produced in 1909 was $43,314, as compared with $2,805 in 1899.

The growing of nursery products was of more importance than the growing of flowers and plants. The acreage occupied by nursery establishments increased from 115 in 1899 to 530 in 1909, an increase of 360.9 per cent. The value of the nursery products in 1909 was $143,234, as compared with $38,431, the value in 1899.

C. C. Vincent.

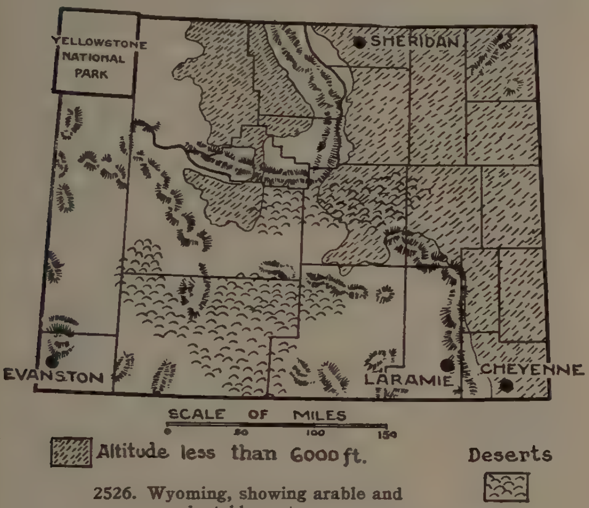
Wyoming.

The agricultural land in Wyoming (Fig. 2526) is at a higher average altitude than that in any other state. Broadly speaking, the range is from about 3,500 feet to twice that height. In a few protected valleys a limited agriculture is practised at even greater elevations, but most of the recognized districts lie below 6,000 feet. Taking the state as a whole, more than one-half the total area is above 6,000 feet. This includes the high mountain ranges which, as a rule, are forest-covered and included in the National Reservations. The conservation policy has nowhere been better exemplified than in Wyoming, where its beneficent results are seen not only in the husbanding of the timber resources, but also and more particularly in the equalized water-flow in the streams, and the larger, safer and more equitable use of the forests as grazing-lands. Perennial streams flow in every direction from the mountains and furnish enough water for the irrigation of very extensive tracts. In the course of time, when provision shall have been made for the impounding of all of the flood-waters, the areas thus reclaimed will be much greater than at present. It has been estimated that there is a sufficient water-supply to reclaim about 12,000,000 acres, only about one-fourth of which is now under canals.

Wyoming extends some 355 miles from east to west, and 276 from north to south, embracing something more than 97,000 square miles. It lies in the very heart of the Rocky Mountains, three great river systems, the Missouri, the Columbia, and the Colorado arising within its boundaries. As would be expected, there is great diversity of climate, soil and vegetation (indigenous and introduced). There are protected valleys, bench-lands, and fertile foothills; semi-arid plains, bleak plateaus, and saline deserts; forested slopes and snow-capped mountains. These are further diversified by marshlands in the valleys and occasional alkali ponds on the plains, and splendid fresh-water lakes in the mountains, thus preventing even a semblance of monotony in the geographical configuration. A physical environment so complicated readily accounts for the fact that Wyoming's native flora is far richer in the number of species than any of the other states, except possibly two or three of the other and larger mountainous ones, notably California and Colorado. The mean annual temperature varies from less than 40°F. to about 50°.

The rainfall is as little as 4 to 6 inches per annum in the Red Desert and reaches a maximum of 30 inches or more on the higher mountains. The average for the irrigated agricultural districts is probably less than 12 inches, while in certain localities where "dry-farm" methods are proving successful it may be as much as a third more. In the eastern part of the state, particularly in Crook, Weston, Niobrara, Goshen, and Laramie counties, many new communities have been established in the last decade where general farming is practised, the natural rainfall being sufficient in average years to grow profitable crops if the water be wisely conserved by the new approved methods of tillage.

The last decade has seen also the breaking up of many of the great stock ranches and ranges into smaller holdings. The marked increase in the state's population is due primarily to the settlement of some of the agricultural lands by farmers from the older commonwealths. Wyoming has therefore entered upon a new era,—a time when it will be seen that a diversified agriculture is the basis of an enduring prosperity. The natural conditions make the live-stock business of paramount importance. The soil is cultivated principally, in most parts of the state, to increase the amount of stock-food, and little intensive farming has been inaugurated. Some of the ranches that extend for miles along the streams have not yet known the use of a plow except in the construction of the ditches to irrigate the native meadows. This condition of things is, however, rapidly passing. The large holdings are being broken up into irrigated farms, thus supporting scores of families instead of a few non-resident owners of the incorporated live-stock companies. Progress in the direction of home-building has also been promoted by the great government projects in conservation and irrigation, as for example the Pathfinder and the Shoshone dams, the canals from which are reclaiming hundreds of thousands of acres. The coming in of the sugar-beet industry, with its factories, is further adding to the population.



2526. Wyoming, showing arable and adaptable parts.

The state as a whole will not reach great commercial importance because of its horticultural products, but certain rather extensive districts, primarily parts of Big Horn, Fremont, Natrona, Goshen, Sheridan, and Washakie counties, have lands that will be worth more as apple and plum lands than for any other purpose. Some of the hardy fruits have been grown in every county in the state and in most of them there are many locations in which astonishingly satisfactory results have been attained.

Commercial orchards are being established in a few localities, some of which are now coming into bearing. They vary in size from 10 acres to even 100 acres or more. The very remarkable activity, however, along horticultural lines has expended itself, in large part, upon the home orchard. During the last few years, the growing of fruit for the family table has been attempted for the first time in Wyoming, upon thousands of homesteads. New settlers from the states to the eastward come with definite notions of what they will attempt and they are meeting with a substantial degree of success both upon the irrigated and the "dry farms."

The agricultural land along the water-courses naturally were the first areas to be brought under cultivation, since the canals necessary to bring the water to the soils could be easily and cheaply constructed. The bench areas, or uplands, however, have better drainage both for water and air, and are more likely to be free from injurious late and early frosts. These are now being brought under cultivation and are well adapted for fruit-growing, though it should be said they are no better than certain of the bottom lands and foothills locations. Warm, sandy loams in protected places, whether on the stream bank or in the valleys among the foothills, may be depended upon. On the open plains and table-lands, in most parts of the state, it is necessary to provide windbreaks to protect both tree and fruit against stiff storms and desiccating winds.

The great diversity of soil and climate and the differing degree of protection, gives a gradually diminishing list of fruits that are hardy and adapted. Beginning with the most favored localities, tender vegetables, like tomatoes, melons, cantaloupes and sweet potatoes, are grown successfully on a commercial scale. Under these conditions all the hardy fruits that will mature in a growing season of 150 to 180 days are standard. As the lands lie at successively higher elevations and with less favorable exposures or with less natural or artificial protection, the reliable varieties shade down to a few of the so-called "iron-clad" ones. At 6,000 to 8,000 feet, light frosts occasionally occur, even in July and August. It is, however, a matter of common observation that with increasing altitude the effect of frost is less and less marked, so that tender vegetation which goes down under 1° or 2° of frost at sea-level, at 8,000 or 9,000 feet will stand untouched when night temperatures are several degrees below the freezing-point. Potatoes, in the mountain valleys, will bend under the dense hoar-frost night after night without injury. Another physiological phenomenon is borne out by common observation, viz., that plants in the high altitudes "learn to hurry." The identical species that in the lower altitudes take the whole growing season will reach maturity in the successively fewer growing days of the season at higher levels.

During the past few years, the State Board of Horticulture, the State Horticultural Society, and the Superintendent of the Horticultural Experimental Farm have coöperated in compiling a list of the fruits that may be relied upon. This tentative list stands as below. It is to be remembered that Wyoming is, horticulturally speaking, very young and therefore further observation and experiment will no doubt add to and subtract from this.

For altitudes above 6,000 feet.—Apples—Transparent, Duchess, Tetofsky, Wealthy. Crabs—Siberian, Transcendent, Florence. Cherries—Compass cherries only. Plums—Sapa, Opata, DeSoto. Currants—Red Dutch, Fay's Prolific, Champion. Gooseberries—Houghton, Industry. Strawberries—Dunlap, Crescent.

For altitudes above 4,500 and under 6,000 feet.—Apples, fall—Transparent, Duchess, Tetofsky; late fall and winter—Wealthy, Longfield, Patten. Crabs—Transcendent, Whitney, Florence. Pears—Douglas, Idaho, Flemish. Cherries—Compass, Richmond, Plums—Cheney, Wolf, Hanska, Opata. Raspberries—Sunbeam, King, Turner. Currants—Victoria, Red Dutch, White Grape. Gooseberries—Houghton, Industry, Carrie. Strawberries—Dunlap, Bederwood, Warfield, Jessie. Grapes—Beta.

For altitudes below 4,500 feet.—Apples, summer and fall—Transparent, Duchess, Tetofsky, Charlamoff; late fall and winter—Wealthy, Wolf River, Northwestern Greening, Windsor, Fameuse, McIntosh, Banana, Jonathan. Crabs—Transcendent, Whitney, Bailey. Pears—Douglas, Idaho, Flemish. Cherries—Morello, Richmond, Suda, Etopa, Compass. Plums—Wolf, Cheney, Burbank, DeSoto, Sapa, Opata, Hanska. Raspberries—King, Turner, Herbert, Ranere. Currants—Victoria, Red Dutch, White Grape, Champion. Gooseberries—Houghton, Industry, Carrie. Strawberries—Dunlap, Bederwood, Warfield, Gandy. Grapes—Beta, Concord (with protection). Dewberries—Lucretia (with protection).

The state maintains an experimental fruit farm at Lander. The altitude there is about 5,500 feet,—about midway between the lowest and the highest points at which fruit-growing is attempted.

The number of plantings at that farm is 2,420 trees, distributed as follows: Apples, 160 varieties, of which forty-eight have fruited; crabs, twenty varieties, all of which have fruited; pears, fourteen varieties, five of which have fruited; plums, twenty-four varieties, sixteen of which have fruited; cherries, fifteen varieties, five of which have fruited; prunes, two varieties, one of which has fruited; apricots, two varieties, one of which has fruited.

Based upon the results thus far attained, the following list of apples is a suggestion from which planters may select, the arrangement being in the order of hardiness or adaptability to Wyoming conditions: Summer varieties—Transparent, Charlamoff, Linfield, Duchess, Whitney No. 20, Enormous, Utter, Astrachan, Okabena, Hutchins, Hibernal, Patten Greening and Grundy; winter varieties—Wealthy, Peter, Gideon, Fameuse, McIntosh, Northwestern Greening, Pewaukee, Scott, Windsor, York, McMahon, Wolf, Gano.

Trucking is developing satisfactorily in the vicinity of several of the larger towns and cities. Everything, however, is for the home market exclusively, no shipments being made out of the state. Most of the vegetables grown are delivered fresh and direct to the consumer from the producer's wagon. The principal items are lettuce, radishes, peas, beans, beets, carrots, parsnips, turnips, cabbage, cauliflower and, in fact, all of the usual hardy vegetables.

Public-service agencies for horticulture.

The schools for higher education are all located at Laramie. These include the State University, with its several schools and departments, the State Normal School, the Agricultural College, the University Extension Department, and the State Experiment Station. The University was opened in 1887 and the Agricultural College was an integral part of it from the beginning, but the work in agriculture was scarcely organized till 1891, when the Experiment Station was established. Since that time, courses in horticulture have been offered in connection with the work in other departments. At present, the Experimental Fruit Farm at Lander is coöperating closely with College and Station. Only a few horticultural bulletins have been issued, and these are now out of print.

The chief agency for promoting horticultural work in the state is the State Board of Horticulture, organized in 1905. The work of the Board of Horticulture may be divided into two categories: (1) the enforcement of quarantine regulations and the inspection of nursery stock and orchards; (2) the promotion of horticultural development along all lines by the dissemination of information that will help to safeguard the industry, and of literature calculated to encourage the growers. Since the primary object has been to encourage production for home consumption along safe lines, the problems connected with packing and marketing are yet to be considered. The publications of the Board are appearing in two series, the biennial reports, of which five have been issued, and special bulletins.

A State Horticultural Society was organized in 1907. The Society maintains a horticultural department in the "Wyoming Farm Bulletin," a monthly journal issued by the Experiment Station.

Statistics (Thirteenth Census).

The approximate land area of Wyoming in 1910 was 62,460,160 acres. The land in farms was 13.7 per cent of the land area, or 8,543,010 acres. Of this land in farms, the improved land numbered 1,256,160 acres; the woodland, 252,152 acres; and other unimproved land in farms, 7,034,698 acres. The total number of farms in 1910 was 10,987, and the average number of acres to the farm was 777.6. [The total area of the state is 97,914 square miles.]

The leading agricultural crops of Wyoming are hay and forage, and cereals. Hay and forage increased in acreage from 380,769, in 1899, to 585,386 in 1909, when the production was valued at $6,077,354, or 60.6 per cent of the total value of all crops. Cereals increased in acreage from 50,528, in 1899, to 186,947 in 1909, when the production was valued at $2,744,502, or 27.4 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was $104,259, and in 1899, $14,700.

Horticultural crops grown in Wyoming are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $39,806, as compared with $1,470 in 1899. Small-fruits increased in acreage from 37, in 1899, to 106 in 1909, when the production was 96,883 quarts, valued at $13,984. The total acreage of potatoes and other vegetables in 1909 was 11,266, and their value $856,639. Excluding potatoes, the other vegetables increased in acreage from 1,431, in 1899, to 2,933 in 1909, when the production was valued at $332,120. Flowers and plants and nursery products decreased in acreage from 7, in 1899, to 6 in 1909, when the products were valued at $13,960.

The total quantity of orchard-fruits produced in 1909 was 18,586 bushels, valued at $39,774. Apples contributed about 96 per cent of the quantity, the production of apples in 1909 being 17,836 bushels, valued at $37,580. Apple trees of bearing age in 1910 numbered 27,773; those not of bearing age, 84,024. Plum and prune trees of bearing age in 1910 numbered 4,564; those not of bearing age, 7,475. The production of plums and prunes in 1909 was 659 bushels, valued at $1,842. Cherry trees of bearing age in 1910 numbered 919; those not of bearing age, 4,025. The production of cherries in 1909 was 68 bushels, valued at $251. The value of peaches and nectarines, pears, and apricots produced in 1909 was $30, $65, and $6, respectively.

Grapes are of practically no importance, the production in 1909 being only 159 pounds, valued at $32. The vines of bearing age in 1910 numbered 74; those not of bearing age, 1,147. The production of nuts is a negligible quantity.

The most important of the small-fruits grown in Wyoming in 1909 were currants, the acreage increasing from 8, in 1899, to 41 in 1909, when the production was 38,833 quarts, valued at $4,378. Strawberries increased in acreage from 19, in 1899, to 24 in 1909, when the production was 20,895 quarts, valued at $3,820. The production of blackberries and dewberries was 149 quarts, valued at $29; that of raspberries and loganberries 15,213 quarts, valued at $2,910; and that of gooseberries 21,513 quarts, valued at $2,819.

Potatoes, the most important of the vegetables, increased in acreage from 2,809, in 1899, to 8,333 in 1909, when the production was 932,162 bushels, valued at $524,489. The more important of the other vegetables produced in 1909 were: 32 acres of cabbage, valued at $6,289; 16 acres of onions, valued at $3,260; 33 acres of turnips, valued at $2,839; 44 acres of sweet corn, valued at $1,815; 5 acres of tomatoes, valued at $1,324; 9 acres of watermelons, valued at $1,150; and 5 acres of cucumbers, valued at $700. Small amounts of green beans, beets, carrots, celery, parsnips and pumpkins were also grown.

The land devoted to the use of flowers and plants increased from 5 acres, in 1899, to 6 acres in 1909. The area under glass in 1909 was 33,034 square feet, of which 31,584 were covered by greenhouses and 1,450 by sashes and frames. The value of the flowers and plants produced in 1909 was $12,280, as compared with $2,480 in 1899.

The value of nursery products in Wyoming for 1909 was $1,680, as compared with $215 in 1899.

Aven Nelson.

Colorado.

The state of Colorado (Fig. 2527) includes the territory lying between the parallels 37° and 41° north latitude, and between the meridians 102° and 190° west longitude. Its surface is diversified by mountains, high tablelands, plains and valleys, with a range above ocean-level from 3,400 feet on the eastern border to over 14,000 feet in many of the higher peaks. It is traversed in a generally north and south direction by the great Rocky Mountain range, and is thus divided into two well-marked, though unequal, divisions. The main continental divide is supplemented by several well-defined ranges and by numerous mountain spurs, between which at altitudes ranging from 5,000 to 10,000 feet lie four large and several small parks and valleys, which were originally utilized as hay-ranches and for stock-ranges. At present, many of these mountain valleys are the most important farm lands of the state.

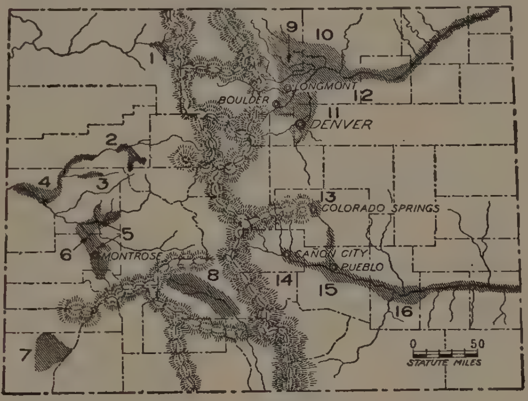
The tillable lands of the state are scattered more or less over the mountainous areas, as well as in the valleys of the Great Plains region. As the rainfall over the tillable area of Colorado is, for the most part, not above 13 to 15 inches, the larger part of the important agricultural production is by irrigation. Irrigation being a necessity, the lands useful for horticultural purposes are those which are reasonably level, either in the bottom-lands or on the mesas bordering the valleys, and which were at one time the bottom-lands along the streams. The first ditches were constructed cheaply and for the irrigation of bottom-lands only. Later, the idea of utilizing the higher mesas gave rise to great canal systems and made productive vast tracts of fertile soil both in the plains district and in the great basins of the mountain districts.

The main horticultural developments of Colorado are shown in the outline map, Fig. 2527, as follows: (1) strawberries; (2) potatoes; (3) dewberries; (4) orchard-fruits; (5) orchard-fruits and potatoes; (6) orchard-fruits, potatoes, onions; (7) apples, peaches; (8) potatoes; (9) apples, cherries, plums; (10) vegetables; (11) orchard-fruits; (12) raspberries; (13) greenhouse interests; (14, 15) fruit and vegetables; (16) apples, cherries, cantaloupes.

Owing to differences in latitude, altitude, and climatic conditions, the irrigable regions of the state are naturally separable into three divisions. These divisions are the Northern, which embraces the drainage basin of the South Platte and its tributaries, including Clear Creek, Boulder Creek, St. Vrain, Big and Little Thompson, and the Cache la Poudre. The Southern, or Southeastern, embraces the valleys of the Arkansas and its tributaries. The Western and Southwestern, which are more or less the same, embrace the valleys of the Grande and its tributaries, the Uncompahgre and Gunnison in Mesa Delta and Montrose counties, and a great tract of land extending from Montrose around the spur of the San Juan Mountains, including the valleys of the San Miguel, Dolores, Mancos, La Plata, Animas, Florida, Pine, Rio Piedra, and the San Juan. These rivers drain the territory included in western Montrose, San Miguel, Dolores, Montezuma, La Plata, and Archuleta counties.

Other horticultural regions that are still largely undeveloped are the valleys of the Yampa or Bear River in northwestern Colorado and the White River in Rio Blanca County.

The apple is the leading fruit of the northern Colorado district. All the standard varieties are grown, though probably there are more Ben Davis trees than any other one variety. The cherry is the fruit of next importance and gives promise of becoming the leader, as the sour cherry is adapted to the conditions in northern Colorado and is more successfully grown without irrigation than any other fruit. The estimated acreage of fruit in this district is 15,000 acres. Plums are more or less successfully grown in northern Colorado. Of these, the so-called native plums, or those varieties derived from *Prunus americana*, are most hardy and successful; many varieties of *Prunus domestica* are also grown.



2527. Colorado, with the parts developed in horticultural products.

In the Southern district the counties most prominent in fruit-culture are Fremont, which is at the base of the mountains in the Arkansas Valley, Pueblo, and Otero. Fremont County is one of the oldest and most important fruit districts of the state. What are supposed to be the oldest orchards of the state are located near Florence. In this district the apple is the most important fruit, followed by the cherry and plum, as in northern Colorado, and some peaches are grown in Otero County by protecting the trees during the winter. This protection is given by laying down the trees and covering with soil. The total area in fruit in the Southern district is approximately 25,000 acres.

In area devoted exclusively to fruit-growing and in importance of the product, the west slope easily leads other parts of the state. The largest solid areas devoted to fruit-growing are in Mesa, Delta, and Montrose counties in the valleys of the Grand, the Gunnison and Uncompahgre rivers. In these districts there is a great range of altitude, as fruit is grown as low as 4,500 feet at Grand Junction and at as high an altitude as 7,000 feet at Paonia and Cedaredge. In the narrow cañon at Palisade is one of the most remarkable peach districts of the country. Here in a cañon with walls on the north 2,000 feet high, peaches are grown at their best. The areas of fruit-production in these districts are rapidly increasing. The Gunnison Tunnel, an irrigation project in the Uncompahgre Valley, furnishes water for 65,000 acres of land. Other ditches and projected canals in the Grand Valley are still more extensive, so that all told, the irrigated area of these three river basins approximates 300,000 acres.

The leading fruit of the west slope, as of other districts, is the apple. All varieties are grown, although the Jonathan, Rome Beauty, Winesap, Gano or Black Ben Davis, are coming to be the leading varieties. Pears are grown extensively in this district, except where the blight has destroyed the trees or made pear-growing unprofitable. Both the sweet and sour cherries are grown successfully. Of these, Montmorency and English Morello are the leaders among the sour cherries and Napoleon and Black Republican, of the sweet cherries. Peach-growing is largely limited to the Palisade and the so-called North Fork districts in the neighborhood of Paonia. The Elberta is at present the leading variety. Plums, both the American and European species, are grown extensively.

The fruit districts of the southwestern part of the state have not developed so rapidly as those of the western slope, largely owing to a lack of railroad facilities. Montezuma County has for several years been renowned for its excellence of fruit, and large plantings are being made there. The area adapted to fruit-growing in this Southwest district, which is from 100,000 to 200,000 acres, is as yet largely undeveloped and will require immense irrigation projects to bring it up to its possibilities of production. The area of the West and Southwest District approximates 65,000 acres planted to fruit.

Owing to the remarkable diversity in altitude, precipitation, soils, temperatures and exposures incident to its mountainous surface, Colorado has developed many peculiarities in horticultural crops. One of the most marked of these is the strawberry-growing industry of the Steam Boat Springs district of the northwestern part of the state. The climate is normally cool and the winter snowfall is heavy, lying on the ground from early fall till late spring. This gives perfect winter-protection to the plants. Their growth during the short, cool growing-season is remarkable. The fruit, which is abundant, large and of good quality, begins to ripen July 1 to 10 and continues well into August. At present there are only a few hundred acres of strawberries in the district, but the planting is rapidly increasing.

In the Plateau Valley, a few miles above Grand Junction, under climatic conditions somewhat similar to those of the Steam Boat Springs district, there has developed a rather unique industry in the way of dewberry-growing. There in the deep, rich, cool soils the dewberry attains a remarkable degree of excellence and productivity. Distance from railroad and the perishable nature of the fruit have prevented this crop from assuming extensive proportions, although the work has been profitable to a few individuals.

The red raspberry has been a profitable crop in various fruit districts of Colorado, particularly in the vicinity of Loveland. The strong, fertile soils, congenial climate, and moisture supplied by irrigation, combine to make a luxuriant growth of vines and heavy yields of fine fruit. In order to avoid the drying and killing effects of the arid winters, the practice is followed of laying down the canes and covering them with soil during the dormant season.

The potato is in point of value, with the possible exception of the apple, the most important of the horticultural crops of Colorado. There are many peculiarities in its adaptability to the conditions of soil and climate and the distribution of its production over the state. The climate and soil of the higher mountain valleys are exceptionally congenial, possibly because they are similar to its habitat in the high altitudes of the Andes Mountains of South America. One species, *Solanum Jamesii*, is native to the mountain plateaus of Archuletta and La Plata counties in southern Colorado. Only a small part of the irrigated land of Colorado, however, is adapted to the growing of potatoes and but relatively small sections outside the high mountain valleys can produce potatoes at all successfully. For some reason, as yet not understood, the potato cannot be depended upon to make tubers on a large part of the best lands of the lower altitude districts. The more important potato-growing areas, in point of total production, are: the Greeley district, with a normal acreage of 35,000 to 40,000 acres, in the plains territory of northern Colorado; the Carbondale district at the junction of the Roaring Fork and the Crystal rivers in Garfield County; the Uncompahgre and North Fork valleys in Montrose and Delta counties; and the San Luis Valley, a mountain valley above 7,000 feet in altitude, comprising more than 3,000,000 acres in the southern part of the state. Other small valleys in the mountain areas are equally important in respect to yields and quality of product. No district in the United States gives greater average yields than are obtained by some of the better growers in these mountain valleys. From 300 to 400 bushels an acre on large fields are not uncommon average yields, and this without the use of any fertilizer. A large part of the available potato lands of these high mountain valleys are as yet undeveloped and the acreage planted to this crop is rapidly increasing.

The cantaloupes grown at Rocky Ford and other points along the Arkansas Valley in Colorado have brought that district to the attention of the whole country. The natural adaptability of the soils and climate is such that the cantaloupe has become the leading "hoed" crop in general rotation with grain and alfalfa, over a large area of land. Thousands of cars of cantaloupes are shipped each year from the Rocky Ford territory and the market extends over all parts of the United States. The cantaloupe is also grown, for distant markets, in the Grand Junction district on the West Slope and, for local markets, in the Greeley district.

Cabbage-growing, on the East Slope, for distant markets is an industry of increasing importance. The northern Colorado irrigated district, with Greeley as a center, is now producing heavy yields of cabbage that are shipped to markets in the cotton- and grain-belt states. Wakefield and Winnigstadt are grown for early shipments, while Scott's Cross, Flat Dutch and Ballhead are the most common late varieties. The high-altitude mountain districts are also well adapted to the growing of heavy yields of good-quality cabbage, but the transportation facilities are such that no considerable industry in cabbage-growing has been developed.

The onion is grown, not only for home use and local markets, but its production as a crop for shipping into distant markets has in several districts become of considerable commercial importance. The districts where onion-growing has become established as a permanent industry are Greeley, Pueblo and Cañon City on the East Slope, with Olathe as a center in the Uncompahgre Valley in the western part of the state.

One of the vegetable crops to which the irrigated lands of Colorado are admirably adapted is celery. This vegetable is being grown for local consumption in all parts of the state. The growing of celery for distant markets is steadily on the increase, and is being found generally profitable, in the region above Denver, Pueblo and near other towns where stable manure can be procured for fertilizing the land.

Peas grow well in all the higher parts of the state. In the San Luis Valley, the Canada field pea is grown extensively as a field crop for feeding sheep and hogs. The garden pea is grown for the canning industry in the vicinity of Longmont, Loveland, Greeley and Ft. Lupton, at which places canneries are located. Other canning crops are also grown in these same districts, as beans, tomatoes and the like, but the pea is by far the most important.

Another horticultural crop that gives promise of future importance in Colorado is cauliflower. This vegetable, like the cabbage, thrives better as the altitude becomes higher, and is grown to perfection at 7,000 to 9,000 feet. Growers in the high altitudes frequently grow individual "flowers" weighing from six to ten pounds, perfect in every way, and many growers claim that a yield of 20,000 pounds an acre is not difficult to obtain.

The florist and forcing industries of the state are limited for the most part to the growing of flowers and vegetables for local trade only. Each city or small town has one or more greenhouse plants and the larger cities of Denver, Pueblo and Colorado Springs have extensive forcing and greenhouse establishments.

The larger part of the flowers and shrubs common to the northern sections of the United States must be included in the list of outdoor plants for Colorado. Their use, however, is limited largely to the home and town or city parks. Most biennials and herbaceous perennials that are grown in the North grow well in Colorado at the altitude of Denver and in many cases at much higher altitudes, though some shrubs need more or less winter protection to prevent killing back to the ground. Many ornamental shrubs and trees that are native to the mountains of Colorado are used as ornamentals both in Colorado and elsewhere. The arid lands of the plains and mountains abound with many beautiful trees, shrubs and plants which would be of value for transplanting as ornamentals but for their tendency toward slow growth, which has made it possible for them to exist under the arid conditions of that climate.

Most vegetables, fruits and flowers that are adapted to a cool climate are at their best in the larger part of the irrigated sections of Colorado. Eighty-five per cent of all the days of the year are cloudless and in the cool dry air, fungi are not generally troublesome as compared with the more humid parts of the United States. Plants that require a warm climate or a long season, as the tomato, cucumber and sweet potato, are grown successfully in the warmer parts of the state, but for the most part such crops have not made the marked showing that has been made by the fruits and vegetables adapted to a cooler climate.

Few individuals stand out prominently as having been especially instrumental in the development of Colorado horticulture. Jesse Frazier, of Florence, was one of the first men of the state to plant apples extensively. In 1864 he brought trees from Missouri and his orchard still bears evidence to the care and skill with which it has been handled. Capt. B. F. Rockafellow, of Cañon City, whose orchard of apples and cherries, planted about forty years ago, is still producing profitable crops, was also instrumental in the development of fruit-growing in that district. J. S. McClelland, of Fort Collins, was one of the earliest and most successful nurserymen and orchardists of the state. His trials of varieties and methods of culture did much to make fruit-growing a success in that region. W. S. Coburn, of Paonia, who was for several years president of the State Horticultural Society, was one of the first of the West Slope growers to plant heavily, as was also Mr. Steele who planted one of the first orchards in the Grand Junction district.

Public-service agencies for horticulture.

The development of all the different horticultural activities in a climate totally different from that of the older parts of the country, necessitated the solution of many new problems. From time to time public-service agencies have been created to take care of these problems. In 1879 an act of the State Legislature created a Board of Agriculture whose duties were largely to organize and control a State College of Agriculture. The same year, the College was established at Fort Collins in northern Colorado, according to the Land-Grant Act of Congress of 1862. The College, together with the State Agricultural Experiment Station which was organized in 1887 and established at the same place, has done much for the horticultural interests of the state. The numbers of the horticultural staff of the College and Station has varied with the support given the institution by the state. At present it comprises four men, all located at Fort Collins. Up to the present time fifty-six bulletins have been issued by the Experiment Station that relate to or have a direct bearing on the horticultural problems of Colorado.

Instruction in horticulture is given among the farmers of the state through the agency of farmers' institutes, and one-week short courses in horticulture are held in the various horticultural centers of the state. Horticulture is also taught in many of the graded and high-schools of Colorado.

A State Horticultural Society was organized in 1880 which is still active. In 1903 a bill was passed by the Colorado Legislature establishing a Board of Horticulture, the object of which was similar to that of a State Horticultural Society. The 1913 Legislature abolished this Board and created in its stead the office of State Horticulturist. By the provisions of this act, the Horticulturist of the State College is State Horticulturist and his duties are to assist the horticulturists of the state by giving them advice or investigating such problems as may arise.

An act of the Legislature of 1909 made the Entomologist of the State Agricultural College, ex-officio, State Entomologist. The duties of this office are to inspect all nursery stock grown or shipped into the state and to destroy or reject all found infested with injurious insects or fungous diseases.

Statistics (Thirteenth Census).

The approximate land area of Colorado is 66,341,120 acres. Of this area, there are 13,532,113 acres in farms, or 20.4 per cent of the land area; 31.8 per cent of the farm land, or 4,302,101 acres, are improved; 891,698 acres are in woodland, and the unimproved land in farms totals 8,338,314 acres. The number of all the farms in 1910 was 46,170. The average acreage to the farm was 293.1. [The total area is 103,948 square miles.]

The leading agricultural crops are cereals, hay and forage, sugar crops, and broom-corn. The acreage of cereals in 1909 was 1,057,905, as compared with 525,299 in 1899, showing an increase of 101.4 per cent. The value of the cereals in 1909 was $14,787,519. Hay and forage in 1909 occupied 1,285,064 acres, as compared with 952,214 acres in 1899, an increase of 35 per cent. The value of hay and forage produced in 1909 was $17,282,276. Sugar crops are significant in that the acreage has shown an increase of 9,615.7 per cent in the period from 1899 to 1909. The acreage in 1909 was 111,251; in 1899, 1,145. The value of the sugar crops in 1909 was $6,104,672; in 1899, $27,818, showing an increase in value of 21,844.8 per cent. The acreage of broom-corn in 1909 was 5,631; in 1899, 1,241, showing an increase of 353.7 per cent. The value of forest products from the farms in 1909 was $305,719; in 1899, $113,055.

The leading horticultural crops of the state are fruits and nuts, vegetables, including potatoes, sweet potatoes and yams, flowers and plants and nursery products, and small-fruits. The value of all fruits and nuts in 1909 was $4,680,142, or 9.2 per cent of the total value of all crops grown; vegetables in 1909, including potatoes, sweet potatoes and yams, were valued at $6,058,939, or 11.9 per cent of the total value of all crops. Flowers and plants and nursery products in 1909 were valued at $540,775 as compared with $264,415, their valuation in 1899. The acreage of small-fruits in 1909 was 2,829, an increase of 20.5 per cent since 1899, and their value $398,836.

Apples are the most important of the orchard-fruits, with peaches and nectarines ranking second. In 1910, the apple trees of bearing age numbered 1,688,425; those not of bearing age, 1,972,914. The production of apples in 1909 was 3,559,094 bushels, valued at $3,405,442. The peach and nectarine trees of bearing age in 1910 numbered 793,372; those not of bearing age, 606,001. The production in 1909 was 692,258 bushels, valued at $764,561. The other orchard fruits and their production and value of their products in 1909 follow: pears, 132,536 bushels, valued at $210,685; plums and prunes, 81,539 bushels, valued at $81,354; cherries, 88,937 bushels, valued at $173,895; apricots, 11,403 bushels, valued at $15,658.

The number of grape-vines of bearing age in 1910 was 254,292; those not of bearing age, 101,332. The production in 1909 was 1,037,614 pounds, an increase of 77 per cent over the production in 1899. The value of the grape products in 1909 was $28,026.

The quantity of nuts produced in 1909 was 7,796 pounds, valued at $324. The nuts included in this grouping are Persian or English walnuts, black walnuts, almonds, chestnuts, pecans, Japanese walnuts, hickory-nuts, filberts, hazelnuts, and others.

Of the small-fruits grown, raspberries and loganberries are the most important in value, with strawberries second. Considered from the standpoint of production this order is reversed. The acreage of strawberries in 1909 was 1,326, producing 1,674,923 quarts of berries, valued at $156,059. The acreage of raspberries and loganberries in 1909 was 801, producing 1,650,785 quarts of berries, valued at $156,668. Other small-fruits, their production and value were, in 1909: blackberries and dewberries, 227,598 quarts, valued at $27,833; currants, 493,726 quarts, valued at $39,935, and gooseberries, 247,956 quarts, valued at $18,341. The acreage in each case in 1909 was, 195, 226, and 122 acres respectively.

Of the vegetables, the potatoes, sweet potatoes and yams were the more important. The acreage of the potatoes, sweet potatoes and yams in 1909 was 85,860, an increase of 94.7 per cent since 1899. The production was 11,783,501 bushels, valued at $3,709,305. Other vegetables in 1909 occupied 32,422 acres, producing products valued at $2,349,634. The acreage and value of the more important vegetables in 1909 follow: 2,568 acres of cabbage, valued at $180,964; 3,970 acres of cantaloupes and muskmelons, valued at $334,291; 357 acres of celery, valued at $110,114; 577 acres of onions valued at $64,665; and 1,646 acres of tomatoes, valued at $138,339. Other vegetables grown are asparagus, green beans, sweet corn, cucumbers, lettuce, green peas, turnips and watermelons.

The acreage devoted to the growth of flowers and plants in 1909 was 154; in 1899, 137. The area under glass was, in 1909, 1,340,824 square feet, of which 1,244,425 were covered by greenhouses and 96,399 by sashes and frames. The total value of flowers and plants produced in 1909 was $468,685.

The acreage occupied by nursery establishments was 241 in 1909, as compared with 497 in 1899, showing a decrease of 51.5 per cent. The value of the nursery products, however, increased 9.3 per cent during that time, from $65,936 in 1899 to $72,090 in 1909.

E. R. Bennett.

New Mexico.

New Mexico (Fig. 2528), though rich in mineral resources and in its salubrious climate is, nevertheless, an agricultural commonwealth. Because of its location in the southwestern part of the United States, it is sometimes thought by persons not familiar with its topography and other physical conditions that it must have a tropical or at least a semi-tropical climate. This would probably be true if it were not for its great elevation. The high altitude gives New Mexico a temperate zone climate suitable for temperate zone fruits and other plants. New Mexico is mostly a country of mountains, valleys and prairies. Spurs of the Rocky Mountain system extend from north to south through the central and western parts of the state. The extreme eastern part, with an altitude varying from about 3,000 feet in the extreme southeast corner to about 5,000 feet in the northeast part, partakes more of the nature of a prairie country. This part has a larger average rainfall than the central and western agricultural valleys and during the last ten years it has developed extensively into a dry-farming section. The rainfall, however, is not enough to insure satisfactory results in the growing of fruits and vegetables, particularly on a commercial scale.

Some of the higher horticultural districts in which many fruits and vegetables succeed, range from 6,000 to 7,500 feet. This is the altitude of such places as Santa Fe, Mountain Park, Cimarron, Las Vegas and Taos; while the Roswell, Carlsbad, Las Cruces, Socorro, Albuquerque and Deming districts, in which horticulture has developed into a high state of cultivation, have altitudes varying from 3,100 at Carlsbad to 5,000 feet at Albuquerque. Perhaps the average height of New Mexico valleys and irrigable areas varies from 4,000 to 5,500 feet.

New Mexico is a large state, ranging fourth in size. On account of its being practically in the center of the arid section of the United States, however, it is impossible to utilize all of its large acreage for agricultural purposes. Only the places which can be irrigated, in the extreme eastern part of the state and any parts in between the mountains which get a fairly large amount of rain can be brought into cultivation. Out of its large acreage, it is now pretty well known that about 3,500,000 acres are irrigable and that 10,000,000 acres are claimed to be adaptable for dry-farming crops.

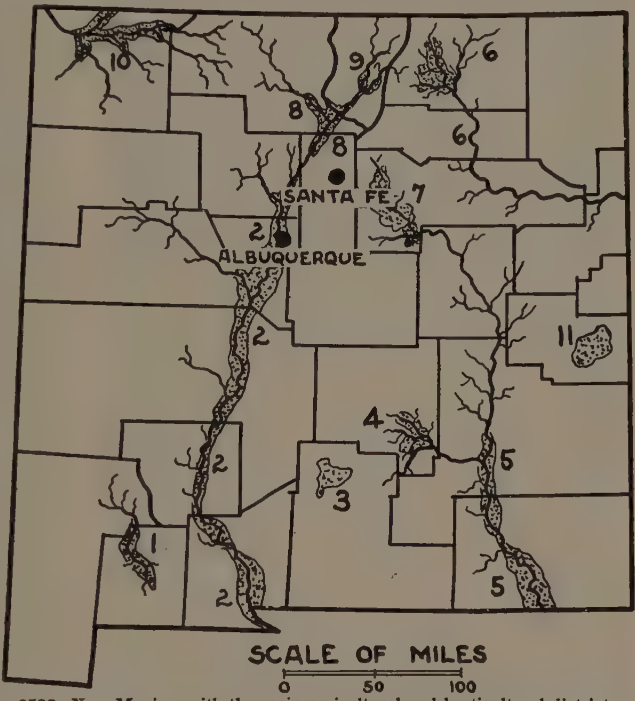
Since practically all of the truck and fruit crops have to be raised under irrigation, this discussion will be limited to those agricultural districts which are being developed by irrigation. Wherever water for irrigation may be had, either from rivers, reservoirs, springs, or wells, it is reasonably safe to expect good results from certain horticultural plants. Almost every county in the state has one or two districts in which horticultural operations may be conducted very successfully. The accompanying map gives the larger fruit-growing districts in the state, eleven in number. District No. 1 takes in part of Grant and Luna counties; district No. 2 takes in all of the Rio Grande Valley from Santa Fe down to the Texas line; district No. 3 is found mostly in Otero County around Alamogordo, extending somewhat into the mountains; district No. 4 includes all of the little mountain streams in Lincoln and Chaves counties; district No. 5 includes all of the Pecos Valley; district No. 6 takes in all of the mountain streams in northern New Mexico, mostly in northwestern and southern Colfax County; district No. 7 is found in Mora and San Miguel counties, in the southern and northwestern parts; district No. 8 includes parts of Santa Fe and Rio Arriba counties along the Rio Grande Valley and mountain streams; district No. 9 includes the old Taos Valley and the little mountain streams in Taos County; district No. 10 is located in the northwestern corner of New Mexico, mostly in San Juan County; district No. 11 is the Portales district in Roosevelt County, being developed by pumping.

At the present time the leading horticultural industries are fruit-growing and truck-gardening, fruit-growing being the leading and most important one. The horticultural districts in New Mexico, on the whole, are better suited for fruit-growing than for truck crops. The leading fruits are apples, peaches, pears, plums, and grapes. Some cherries and quinces are also grown. In the last ten years, much interest has developed in apple-growing. Many large apple orchards have been and are being planted in practically all of the horticultural districts. From all indications, it is safe to say that New Mexico will yet be an apple-producing state, though pears and peaches will also be grown on a large scale. The principal apple-growing sections at the present time may be found at Roswell, Dexter, Artesia, Hope, Mountain Park, Three Rivers, Cimarron, Taos, Española, Santa Fe, Albuquerque, Socorro, Las Cruces, Mesilla Park, Aztec, and Farmington.

New Mexico has many different kinds of climate and soil and for this reason it is impossible to make any definite statements as to the adaptability of varieties to all of the horticultural districts. As a matter of fact, it is found that certain varieties do better in certain parts of the state than in others. The most widely grown varieties in the state seem to be, at the present time, Red June, Early Harvest, Yellow Transparent, Maiden's Blush, Ben Davis, Mammoth Black Twig, Gano, Black Ben Davis, Winesap, Jonathan, Arkansas Black, Rome Beauty, and White Winter Pearmain. In the lower and warmer parts of the state, the Jonathan, King David, Ben Davis, Gano, Black Ben Davis, Winesap, Mammoth Black Twig, and Arkansas Black are among the leading varieties. In the cooler and higher altitudes these same varieties are popular, with the exception of the Mammoth Black Twig, King David and Arkansas Black. In place of these, Stayman Winesap, Delicious, Grimes' Golden and White Winter Pearmain are used. In the lower and warmer valleys, the Delicious apple varies very materially from the original Delicious type.

There are not so many pears being grown as there are apples, but in some of the horticultural valleys there is a marked interest being taken in growing this fruit. At the present time in district No. 2, particularly in the Mesilla Valley, many orchards are being planted to the Bartlett pear. So far this fruit has not been threatened by the dreaded pear-blight. The climatic and soil conditions seem to be particularly well suited to the pear in some of the lower and warmer districts. In 1914 the first two carloads of fancy Bartlett pears were shipped to New Orleans markets from young orchards in district No. 2. This industry promises to become a very important one. Aside from the Bartlett, the Doyenne d'Ete, Howell, Clapp Favorite, Flemish Beauty, D'Anjou, Winter Nelis, and Winter Bartlett comprise a good list of varieties of pears to plant in New Mexico. So far the Bartlett orchards have not shown any indications of trouble due to self-sterility of the variety. However, to be on the safe side, there should be at least two varieties used with the Bartlett, if for no other purpose than for cross-pollination. These varieties may be the D'Anjou, the Winter Bartlett, or Winter Nelis.

The peach probably holds second place among the orchard-fruits grown in the state at the present time. In the lower and warmer valleys this species grows very well and blooms very heavily. The greatest drawback to the peach is the injury to the blossoms or young fruit from the late spring frosts. This injury may be mitigated to some degree by the proper and judicious use of smudge pots. Peach-growing is conducted on a comparatively large scale in districts Nos. 2, 3, 5, and 10. The largest commercial peach orchards are to be found at Carlsbad, Tularosa, Las Cruces and Farmington. Most of the varieties that have been tried seem to do well, but the following is a list which has become somewhat popular and the varieties are given in the order of their ripening,—Alexander, Hynes' Surprise, Texas King, Mamie Ross, Carman, Elberta, Late Crawford, Crothers, and Salway. The Alexander and Hynes' Surprise are the latest-blooming varieties and are the earliest to ripen. Because they are very late in blooming they are, as a rule, the surer bearers. The Texas King, Mamie Ross and Crothers are medium late in blooming and, as a rule, are sure bearers. In this class, so far as blooming is concerned, may be listed the Late Crawford and Salway. The earliest blooming commercial variety is the Elberta, and this peach fails oftener to bear than any other variety. Experiments show that it is not safe to count on more than one full crop in five years. The new peach, the J. H. Hale, which is very promising in many respects, appears to be an early bloomer, blooming as early, if not earlier, than the Elberta.



2528. New Mexico, with the main agricultural and horticultural districts. (Irrigated districts.)

The apricot is one of the hardiest and most resistant fruit-trees to unfavorable conditions, but all of the varieties tried bloom entirely too early to escape the late spring frosts, and for this reason it is not considered a profitable fruit to grow.

Districts Nos. 1, 2, 3, 4, 5, 8, and 10 seem to be well suited for plum-growing. Almost any variety of plums seems to grow well in most of these districts. Varieties of the European group are best suited for New Mexico conditions, as they are extremely late bloomers. As a rule they bloom as late, and in some cases later, than the apples. Coe's Golden Drop, Jefferson, Imperial Gage, Green Gage, Pond's Seedling, Yellow Egg, Shippers' Pride, Robe de Sargent, German prune and French prune are among the leading varieties. The Japanese plums bloom entirely too early and for this reason they can hardly be expected to bear a satisfactory crop more than once in every five years. In this group of plums may be found some of the best eating and early ripening varieties. The Japanese plums are not considered profitable to grow. There are a number of satisfactory native plums. In this group may be found a wider range of blooming periods than in any other group. A few of the later blooming varieties are the Wild Goose, Omaha, Wayland, Golden Beauty and Victor.

Cherries are not grown on a large scale at the present time, though trees of the sour varieties may be found growing in almost all of the fruit-growing districts. The sweet cherries do not seem to do nearly so well as the sour varieties. The Ostheim, Early Richmond, Montmorency and English Morello are some of the more popular sour cherries. The cherry trees, as well as the plum trees, are comparatively short-lived and in the lower and warmer valleys they are more or less subject to sun-scald.

The area devoted to grapes is not very large, though favorable climatic and soil conditions may be found in different horticultural districts. In the cooler and higher altitudes, the conditions are favorable for the American varieties, though very few American grapes are, at the present time, being grown in New Mexico. These varieties may be grown very satisfactorily in districts Nos. 1, 4, 5, 6, 7, 8, 9, 10, and 11. More grapes have been grown in district No. 2 than in all of the other districts put together. Varieties of the vinifera grape seem to be very satisfactory. Large vineyards are to be found in this locality, mostly of the old Mission grape. During later years, Thompson's Seedless, Chasselas, Black Hamburg, Muscat of Alexandria, Purple Damascus, Black Cornichon, Tokay, and Black Ferrara have been added to these plantations. The European grape grows and bears very satisfactorily, but it is somewhat tender and is liable to be winter-killed occasionally.

Much has been said about growing the date palm and figs in New Mexico. The winter temperatures are much too low, even in the warmer and lower valleys of the state, for the date palm to grow. The plant makes a good growth in the summer but it cannot stand the winter temperatures. The fig is a little more hardy and will stand zero temperatures frequently in the lower and warmer valleys. While the fig tree cannot be grown on a commercial scale, a few specimens may be planted in home plantations in southern New Mexico. The best results from these trees can be secured when they are planted either on the south or east side of a house or wall. When planted on the north or west side of the house, they are more liable to be winter-killed.

The small-fruits can be grown very satisfactorily. At the present time there are no large plantations in the state. On the whole, the best small-fruits are to be found growing in the higher districts. Strawberries, gooseberries and currants do well in the lower and warmer valleys and at the present time there is considerable interest being taken in strawberry-culture.

While, up to the present time, most of the horticultural industries have been the growing of fruits and vegetables, nursery and floricultural work is now attracting considerable interest. In the last two or three years a few nurseries have been started, mostly in district No. 5. Not much attention has been given, so far, to nut-culture in this state, though a few small experimental orchards of pecans, as well as a number of almond and English (Persian) walnut trees, have been set out.

Many vegetables can be grown satisfactorily. Among the most promising ones are asparagus, cantaloupes, melons, tomatoes, onions, sweet potatoes, red peppers, cauliflower, cabbage, spinach, peas, and beans. Because of the great distance to large vegetable markets, it is necessary to grow those vegetables which are less perishable and can stand shipping a long distance. Spinach in districts Nos. 1, 2, 3, and 5, can be grown very satisfactorily, particularly in the southern parts of districts Nos. 2 and 5. From there it may be shipped to the northern and eastern markets during January, February and March. Spinach in these districts yields from two to four tons an acre.

Sweet potatoes are grown all over the state, wherever irrigation is possible. Such varieties as the Southern Queen and Red and White Bermuda grow very large and produce from 15,000 to 20,000 pounds an acre. The Yellow Nansemond and Yellow Jersey are the best commercial varieties, but they are not so large, yielding about 15,000 pounds an acre.

One of the most promising vegetables that will stand long shipments is the onion. Most of the varieties of onions will grow well; in the higher and cooler districts, varieties of the American type, such as the Brown Australian, Yellow Danvers, Red Weathersfield and White Globe are the most suitable. These varieties are more popular in the local markets than the larger growing kinds, but are not considered so profitable when they have to be shipped to eastern markets. On the other hand, the large-growing and mild varieties, such as the Giant Gibraltar, White Tripoli, and Denias are very suitable for the warmer and lower valleys, particularly in districts Nos. 1, 2, 3 and 5. The Denia onion is being grown in fairly large quantities in these districts.

Chile, or pepper, is a vegetable that has been grown for many years by the Mexican gardeners. It does exceedingly well, particularly in the lower and warmer valleys. The season in the higher altitudes is not long enough for it to ripen satisfactorily. Under favorable conditions it will produce a very large crop. The chile may be used in the green stage or in the red ripe form. It can also be canned in the green stage. The ripe chile may be used in the pod or powder form.

Tomatoes are grown rather extensively in districts Nos. 1, 2, 3 and 5. At Lakewood there is a tomato cannery, which is putting up some very good tomatoes. In the higher altitudes the season is not long enough for tomatoes to ripen satisfactorily.

Many other vegetables can be grown, and many of the more perishable ones are grown by the local truck-growers for local or nearby markets.

One of the first crops that the new farmer usually tries to grow, and the one that he first fails with, is the Irish potato. Unless he is at an altitude of about 7,000 to 8,000 feet, he is not likely to succeed very satisfactorily in the growing of Irish potatoes. For one reason or another, Irish potatoes do not produce satisfactory yields in the lower and warmer parts of the state. The best potato-growing districts in New Mexico are found in the higher and cooler parts. New Mexico grows a large amount of potatoes at these higher altitudes, but practically none is grown in the lower and warmer valleys.

The Catholic priests first set out plantations of Mission grapes up and down the Rio Grande Valley in the early periods. Later such early settlers as T. J. Bull, Thomas Casad, Rafael Ruelas, Rafael Bermudas and Roman Gonzalez were prominent figures in the development of horticulture in district No. 2, while the late Archbishop Lamy and Gaspar Ortiz, James J. Johnson and Major Sena were among the early settlers to take much interest in the horticulture of district No. 8; and W. L. Thomson, and A. Ancheta were the pioneers in horticulture in district No. 1. The first one to start fruit-growing in district No. 5 was the late J. J. Hagerman who became the largest apple-grower in the Pecos Valley.

Public-service agencies for horticulture.

The Land-Grant Agricultural College is located in the Mesilla Valley in south-central New Mexico near Las Cruces, at State College. It was established in 1889. There are four instructors in horticulture on the teaching staff.

The United States Experiment Station is located at the same place as the College. There are eighteen on the station staff.

There are no special schools in the state where teaching in horticulture is undertaken. Some elementary horticulture is taught in some of the high-schools of the state.

Through the Experiment Station and the Extension Department a large amount of extension work in horticulture is going on all over the state.

There has been very little interest taken in the state relative to the inspection of trees for insects and diseases, though there is a state law providing for this work.

There has not been much interest in the state in horticultural organizations. In 1900 a horticultural society was organized with its headquarters at Santa Fe. At the present time there are boards of horticulture in San Juan and Chaves counties.

Statistics (Thirteenth Census).

The approximate land area of New Mexico in 1910 was 78,401,920 acres. The land in farms was 11,270,021 acres, or 14.4 per cent of the land area. Of this land in farms, 1,467,191 acres were improved; 1,491,025 were woodland; and 8,311,805 acres, other unimproved land. The number of all the farms in the state in 1910 was 35,676 and the average acreage to the farm 315.9. [The total area is 122,634 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage occupied by hay and forage increased from 87,358 in 1899 to 368,409 in 1909, when the production was valued at $4,469,709, or 50.1 per cent of the total value of all crops. Cereals increased in acreage from 96,402 in 1899 to 218,037 in 1909, when the production was valued at $2,382,996, or 26.7 per cent of the total value of all crops. The value of the forest products of farms in 1909 was $253,822, as compared with $34,268 in 1899.

Horticultural crops produced in New Mexico are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of fruits and nuts produced in 1909 was $536,165, as compared with $231,211 in 1899. Small-fruits increased in acreage from 48 in 1899 to 66 in 1909, when the production was 76,532 quarts, valued at $9,335. The total acreage of potatoes and other vegetables increased from 5,203 in 1899 to 14,660 in 1909, when the production was valued at $820,497. Excluding potatoes, the acreage of vegetables increased from 4,034 in 1899 to 8,219 in 1909, when the production was valued at $567,154. The production of flowers and plants and nursery products in 1909 was valued at $40,303.

The total production of orchard-fruits in 1909 was 504,059 bushels, valued at $519,677. Apples were the most important of the orchard-fruits, the production in 1909 being 417,143 bushels, valued at $420,536. The number of apple trees of bearing age in 1910 was 542,528; those not of bearing age, 914,254. Peach and nectarine trees of bearing age in 1910 numbered 136,191; those not of bearing age, 184,466, and the production in 1909 was 32,533 bushels, valued at $37,195. Pear trees of bearing age in 1910 numbered 37,220; those not of bearing age, 100,201, and the production in 1909 was 29,435 bushels, valued at $29,688. Other of the orchard fruits produced in New Mexico were: 15,528 bushels of plums and prunes, valued at $17,054; 6,384 bushels of cherries, valued at $10,684; 2,379 bushels of apricots, valued at $3,446; and 657 bushels of quinces, valued at $1,074.

Grapes and nuts are of comparatively little importance in New Mexico. The production of grapes in 1909 was 425,415 pounds, valued at $16,101; and that of nuts, 1,498 pounds, valued at $195. However, the nut industry seems to be on the increase, since the total number of nut trees of bearing age in 1910 was 503, while those not of bearing age numbered as many as 5,199.

Strawberries are the most important of the small-fruits in New Mexico. The acreage increased from 9 in 1899 to 20 in 1909, when the production was 35,634 quarts, valued at $4,086. The production of the other small-fruits in 1909 was: 10,089 quarts of blackberries and dewberries, valued at $1,698; 10,222 quarts of raspberries and loganberries, valued at $1,581; 14,800 quarts of gooseberries, valued at $1,348; 5,523 quarts of currants, valued at $591; and cranberries to the value of $10.

The acreage of potatoes increased from 1,122 in 1899 to 6,230 in 1909, when the production was 295,255 bushels, valued at $234,636. Sweet potatoes and yams increased in acreage from 47 in 1899 to 211 in 1909, when the production was 13,831 bushels, valued at $18,707. Other vegetables of importance produced in New Mexico in 1909 were: 491 acres of cantaloupes and muskmelons, valued at $36,095; 260 acres of green peppers, valued at $17,228; 106 acres of cabbage, valued at $15,034; 287 acres of watermelons, valued at $13,978; 49 acres of celery, valued at $13,500; 97 acres of onions, valued at $8,640; and 24 acres of asparagus, valued at $7,660. Other vegetables produced were green beans, sweet corn, squash, tomatoes, and turnips.

The acreage devoted to the production of flowers and plants increased from 5 in 1899 to 8 in 1909, when the production was valued at $31,121. The total area under glass in 1909 was 87,054 square feet, of which 59,752 square feet were covered by greenhouses, and 27,302 by sashes and frames. The acreage devoted to nursery products decreased from 32 in 1899 to 24 in 1909, when the value of the nursery products was $9,182, as compared with $5,753 in 1899. FABIAN GARCIA.

Arizona.

Arizona (Fig. 2529) is divided nearly equally into two climatic parts by a diagonal line running from northwest to southeast through the state. The region north and east of this line consists largely of plateaus, 5,000 to 8,000 feet above sea-level, diversified by isolated mountains and cut by eroded cañons, including the Grand Cañon. The southwestern half of the state is of comparatively low elevation and is crossed from northwest to southeast by a succession of low mountain chains and wide valleys.

Nearly the whole drainage of Arizona passes by way of the Colorado River to the Gulf of California. The little Colorado drains the northeastern plateau into the Grand Cañon, while the Gila River collects the drainage of the central and southern parts of the state and joins the Colorado just above Yuma.

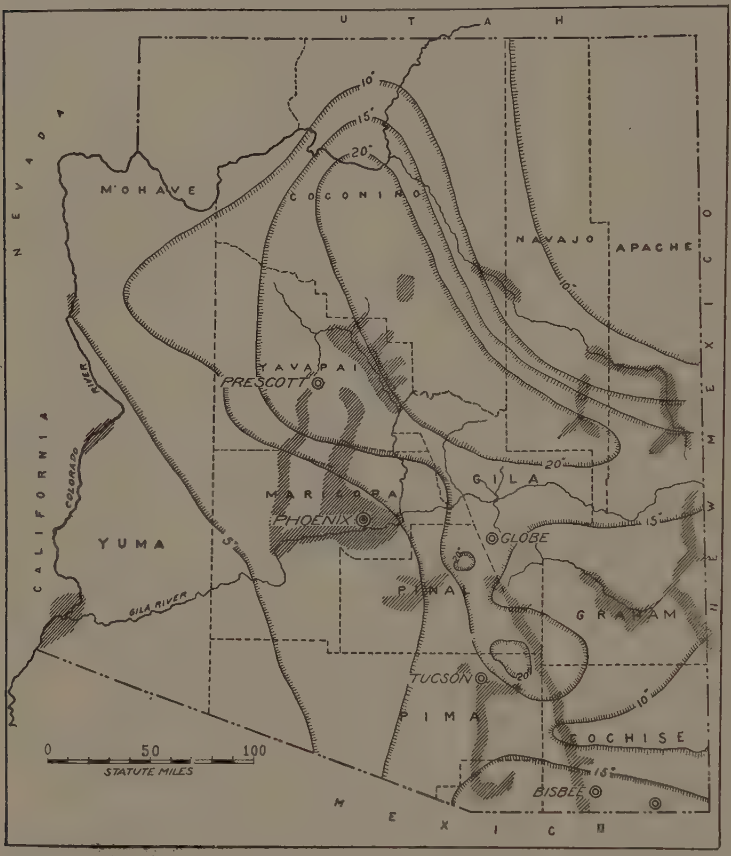
In general, the climate of Arizona combines low rainfall with a very high percentage of possible sunshine, a long hot season, frosty minimum temperatures in winter, and low humidity. With respect to temperature and seasons, the state may be divided into two distinct regions: The northeastern elevated half is comparatively cool, with frostbound winters and temperate summers; the southwestern, and lower, half is arid, subtropical, with long hot summers, but with moderate frosts in winter.

With the help of irrigating waters, temperate-region crops are grown in the northeastern section, while a combination of temperate-region crops in winter and of subtropical crops in summer are grown in the southwestern section.

The daily range of temperature is great, averaging about 30° F., and occasionally reaching as much as 50° F. Relative humidities of less than 10 per cent occur in June; 80 per cent of possible sunshine occurs during the year; average wind-movement ranges from 2 to 3 miles an hour at lower altitudes to 6 to 7 miles at higher altitudes; and the maximum average annual evaporation of 86.51 inches has been observed at Tucson.

The average yearly precipitation in Arizona ranges from 3 to 5 inches along the Colorado River in the west, to as much as 35 inches in the form of rain and snow in the high mountain ranges of the state. The comparatively abundant precipitation of the highlands of Arizona gives rise to numerous never-failing streams, which converge to form the Little Colorado, Salt and Gila rivers. These streams finally empty into the Colorado River of the West, which derives its main flow from the distant watersheds of Colorado, Utah and Wyoming. The Salt, Gila, and other smaller streams, as they flow westward through the arid plains bordering upon the Colorado River, gradually evaporate, or are absorbed, and finally become intermittent in character, floods reaching their mouths only at infrequent intervals.

Numerous storage sites exist which are gradually becoming utilized for the storage of flood-waters, and the ground-waters of the region are being rapidly developed by means of pumping-plants and artesian wells.



2529. Arizona, showing the areas of horticultural development.

In a region where the rainfall is so inadequate for the irrigation of the entire area, horticultural pursuits can only be developed under the constant streams of higher Arizona, and the never-failing Colorado; where flood-waters can be stored, or where ground-waters are available. Only in higher or more favored areas is it possible to cultivate orchards or gardens, depending upon rainfall only. The horticultural districts of the state, therefore, are located almost entirely according to available irrigating water-supply. These districts, so far as they are at all developed, are indicated upon the accompanying map.

Irrigation was first practised at favorable points throughout Arizona by prehistoric peoples, the ruins of whose dwellings and ditches yet exist. Among the crops cultivated by the Indians, are quick-growing varieties of Indian corn, native beans, squashes, pumpkins, martynias, and, in former times, probably, cotton and tobacco. Following the Indians came the Spaniards, from Mexico, who established themselves in the Santa Cruz Valley early in the eighteenth century. The Jesuits at their missions introduced Old World crops, including barley, wheat, apricots, cotton, dates, figs, grapes, melons, olives, onions, citrous fruits, peaches, pears, pomegranate, quinces and vegetable crops.

With the advent of Americans, dating from the Gadsden Purchase in 1854, agricultural and horticultural developments have been rapid, especially in irrigated parts of the state. Improved varieties of the crop-plants introduced by the Jesuits have been developed in large number, and in addition some crops new or previously little known have been imported, among them, alfalfa, apples, sugar-beets, the sorghums, cowpeas, eucalypts, millets, oats, plums, sweet and Irish potatoes, strawberries, tomatoes, and other fruits and vegetables.

Horticulturally, the state is divided into the northeastern elevated portion, best suited to deciduous fruits, summer vegetables and those ornamentals common in temperate climates; and the southwestern half of the state, of low altitude and higher temperatures, in which may be grown those subtropical plants which resist mild frosts and in which winter-growing vegetables and heat-resistant ornamentals thrive.

In the northeast, the leading horticultural products are apples, peaches, pears, plums and grapes. Strawberries, blackberries and a wide range of vegetable crops may also be grown, chiefly under irrigation. The most important of all horticultural crops at the present time is apples, which thrive vigorously at altitudes of 3,000 feet and above. The principal apple-growing districts are irrigated from the Gila River in Graham County and from the Verde and its tributaries in Yavapai County. Occasional orchards are scattered at higher altitudes throughout the state.

In the southwest, a great variety of subtropical and temperate-region crops are possible. Among the more distinctly subtropical plants, resistant to both heat and mild frost, are apricots, dates, eucalypts, figs, olives, oranges, pomelos, lemons, pomegranates and quinces; while many plants common to more temperate regions may be adapted to these lower altitudes, such as grapes, peaches, pears, plums, strawberries, and many vegetables which may be grown during the cooler fall, winter and spring seasons. Among the most important horticultural features of the southwestern half of Arizona, are the olive, the date palm, figs, grapes, and specialties, such as sugar-beets, cantaloupes and winter-grown vegetables. An attractive array of flowers, grown chiefly in the winter season and having commercial possibilities, includes roses, sweet peas, dahlias, and many flowering bulbs.

Various horticultural specialties are possible in Arizona at all seasons of the year. At higher altitudes apples are the most important horticultural crop. Among the most satisfactory varieties grown are Ben Davis, Arkansas Black, Gano, White Winter Pearmain, Jonathan, Limber Twig, and others. Excellent markets for the entire crop are to be found in the populous mining towns of the state; and consequently, practically no outside shipments are made. Peaches and pears are grown to the best advantage in irrigated valleys at higher altitudes, although they will also endure fairly well climatic conditions as low as Yuma. The Elberta peach is probably the best all-round variety for Arizona, although Late Crawford, Salway, Sylphide Cling, and others, do well. Among pears, the Kieffer produces fruit of comparatively fair quality for this variety; while Le Conte, Bartlett, Winter Nelis, and others, may be grown. A great advantage of the Kieffer is its resistance to blight, which badly affects other varieties in the region. Peaches and pears are also locally consumed, not yet being produced in sufficient quantity for outside shipments. Grapes produce abundantly in all sections, American varieties being grown at higher altitudes, while European varieties do best in the lower and warmer irrigated valleys. Raisins may also be manufactured from suitable varieties of grapes in those parts of Arizona sufficiently free from summer rains to permit of outdoor drying. Oranges, including Washington Navel, Valencia, Ruby, St. Michaels, Jaffa, and Mediterranean Sweet, can be grown at higher levels, in irrigated valleys up to 1,200 feet altitude in southern Arizona. Pomelos, including Marsh Seedless, Triumph, Duncan, and Aurantian, produce fruit of superior appearance and good quality. Lemons are profitably grown in the least frosty parts of the citrous districts.

Citrous fruits ripen in Arizona well in advance of the California crop, and as yet, fortunately, the orchards are entirely free from the pernicious scale insects which infest the orchards of California and Florida. These advantages, together with abundant and dependable water-supplies developed by the United States Reclamation Service and other projects in southern Arizona, give the citrous fruit-grower of the region special advantages in supplying eastern markets. Development of the citrous industry is therefore taking place rapidly, and probably will soon be the most important horticultural industry in Arizona.

The olive, which comes from semi-arid parts of the Old World, is at home in the lower irrigated valleys of Arizona. The trees grow vigorously with moderate water-supplies and are entirely free from the black scale which so disfigures the orchards of southern California. The quality of fruit produced is high, and the development of the oil and pickling industries is rapidly taking place at this time. The varieties best suited for pickles are Mission, Manzanillo, Sevillano; those best suited for oil are Mission, Correggiola, Nevadillo, Razza, Pendulina, and others. On account of its drought-resistance, the olive will undoubtedly be developed in parts of southern Arizona not having sufficient water for the more intensively cultivated crops.

The date palm is a very interesting and promising crop for altitudes up to 2,500 feet. In parts of northwest Mexico, resembling southern Arizona in climate, date palms up to 200 years of age, producing heavy crops, indicate a successful outcome for the many trees that are now being planted in southern Arizona. The selection of varieties of dates is exceedingly important because of the great difference in quality, productiveness and time of ripening of the different varieties. Although conditions in southern Arizona generally resemble those in date-growing regions of the Old World, they are sufficiently different in detail to reopen the whole question of the particular sorts best suited to Arizona conditions. At Tempe, 124 varieties of Old World dates have been under trial for fifteen years to determine the types best suited to Arizona conditions. Among the varieties at present approved for Arizona are Hayany, Khadvawi, Kustawi, Maktum, Moltagi, Nazl el Bacha, and possibly Deglet Noor,—the ideal being an early semi-dry cane-sugar date of high quality, ripening on the bunch, as far as possible, at one time.

The palm has many enemies, including rats and gophers, which may be controlled by poison and explosives; and date palm scales from the Old World, which multiply enormously under southwestern conditions. These, however, can be controlled by the blast-torch treatment, and by carbolic sprays. The fruit is damaged by untimely rains, by fruit-eating beetles, and by a spot-fungous disease which thrives in damp weather. To some extent these difficulties may all be overcome by artificial ripening processes, by means of which the mature but not yet soft fruits may be removed in bunches from the trees and artificially ripened by chemical or thermal treatments which hasten the maturing process, in rooms protected from insect pests or weather. Pasteurization of the finished product also kills the maggots and insect eggs which would otherwise in a short time ruin the product.

Many varieties of Adriatic figs are grown at altitudes up to 3,000 feet. Climatic conditions, especially along the Colorado River, are also favorable to the culture and handling of Smyrna figs, which, however, have not yet been developed because of the time required to establish Capri figs suitable for the maintenance of the Blastophaga wasp. Smyrna figs, however, should in time become an important horticultural asset of the region.

Heavy yields of cantaloupes of high quality are of frequent occurrence. Six cantaloupe-growers' associations have been organized in Arizona at different times, and the annual shipments are probably not far from 400,000 crates of melons.

Sugar-beets have been grown as a winter and spring crop, being planted in southern Arizona from December to February and harvested mostly during June and July.

Winter onions produce abundantly, crops of 20,000 pounds an acre of White Bermudas being recorded.

Strawberries produce from February to November in southern Arizona, the Arizona Everbearing being a productive variety originating in the region.

Beginnings are being made in various horticultural industries, such as the manufacture of olive oil and pickles, tomato canning, and the like.

On account of the newness of the region, the nursery business is only in its beginning, the larger part of nursery stock and seeds being imported from other states. Citrous stock for home trade, however, will soon be produced exclusively in Arizona, largely on account of the quarantine regulations established under the Crop Pest Law. The two largest nurseries in the state are located near Phoenix and Safford, respectively, and serve the Salt and Gila River valleys, in which they are located. The opportunity for developing varieties especially adapted to the region is exceptional, experience having shown in other new districts, especially in California, that the best varieties for a region are finally found to be those which originate there.

Public-service agencies for horticulture.

The Land-Grant school of Arizona is situated at Tucson. It was legally established in 1885, but operations did not begin until 1891. There are but two members of the horticultural staff.

The Experiment Station is also located at Tucson, although the cultural work is distributed through the state as follows: gardens and greenhouses at Tucson; experimental farm near Phoenix; date orchards and intensive gardens at Tempe and Yuma; dry farms at Cochise, Prescott and Snowflake. The staff consists of nineteen scientific workers. The number of horticultural bulletins and timely hints for farmers is approximately thirty-three.

The inspection of nurseries and orchards is in charge of the Horticultural Commission, a board of three members.

High-school courses to include the teaching of horticulture and agriculture have been endowed by the first state legislature of Arizona. All high-schools providing facilities for agricultural instruction are entitled to receive to the amount of $2,500 a year. Under the stimulus of this endowment, nine high-schools have installed these courses of instruction.

Associations exist for the marketing of oranges in Salt River Valley, of apples in the Verde and Gila valleys, and of miscellaneous produce in the Yuma and Gila River valleys. For the advantageous marketing of crops, association is necessary in a region somewhat distant from markets, and the movement toward association in connection with all horticultural industries in Arizona is strong.

Statistics (*Thirteenth Census*).

The land area of Arizona is 72,838,400 acres, of which 1.7 per cent, or 1,246,613 acres, is in farms. Of this land in farms, 28.1 per cent, or 350,173 acres, are improved; 100,061 are woodland; and 796,379 unimproved. [The total area is 113,956 square miles.]

The leading agricultural crops are hay and forage and cereals. The hay and forage occupied 102,490 acres in 1909 compared to 92,674 acres in 1899, an increase of 10.6 per cent. The value of hay and forage in 1909 was $2,553,228. The acreage in cereals in 1909 was 75,269; in 1899, 53,958, showing an increase of 39.5 per cent in acreage. The value of cereals in 1909 was $1,570,853. The value of the forest products in 1909 was $45,312; in 1899, $48,877. The value of sugar crops in 1909 was $251,602. The acreage in sugar crops increased 2,656.8 per cent in the past decade, from 183 acres in 1899 to 5,045 acres in 1909.

The leading horticultural crops and their value in 1909 were as follows: potatoes $126,695; other vegetables $379,293; fruits and nuts, $334,598; flowers and plants and nursery products, $15,712; small-fruits, $12,987.

The production of all orchard fruits increased 35.8 per cent in quantity from 1899 to 1909. The value increased from $96,764 in 1899 to $241,110 in 1909. Apples and peaches and nectarines lead in quantity of production and value. The number of bearing apple trees in 1909 was 62,027; of trees not of bearing age 53,884. The production in 1909 was 72,814 bushels valued at $109,395. The number of trees of bearing age in the case of peaches and nectarines was, in 1910, 51,415; those not of bearing age 32,562. The production was 50,102 bushels valued at $80,325. The production and value of the other orchard fruits in 1909 were as follows: pears, 13,289 bushels, valued at $21,331; plums and prunes, 8,420 bushels, valued at $16,261; apricots, 6,849 bushels, valued at $10,053; quinces, 1,815 bushels, valued at $2,805; cherries, 476 bushels, valued at $840.

There were 131,579 vines of grapes of bearing age in 1910 and 84,510 not of bearing age. The production in 1909 was 837,842 pounds and its value $25,371.

The principal nuts grown in Arizona are the almonds and pecans. In 1910, the almond trees of bearing age numbered 6,639; those not of bearing age, 845. The production of almonds in 1909 was 33,759 pounds, and their value $4,193. There were, in 1910, 64 pecan trees of bearing age and 212 trees not of bearing age. The production in 1909 was 1,075 pounds, and value $131.

The number of tropical fruit-trees of bearing age in 1910 were 51,036. They included, 818 pomelos (grapefruit); 1,216 date trees; 776 pomegranates; 9,353 olives; 33,373 oranges; 3,848 figs; and 1,652 lemons. The production and value in 1909 were as follows: pomelos, 820 boxes, valued at $1,508; dates, 6,500 pounds, valued at $96; pomegranates, 23,360 pounds, valued at $477; 264,895 pounds of olives, valued at $3,073; 32,247 boxes of oranges, valued at $52,341; 127,081 pounds of figs, valued at $4,103; and 1,010 boxes of lemons, valued at $2,034.

The total production of all small-fruits in Arizona in 1909 was 112,190 quarts, and in 1899, 129,000 quarts, and their value was $12,987 in 1909, as compared with $12,265 in 1899. The most important of the small-fruits grown in 1909 were strawberries, there being 58 acres devoted to the crop, producing 95,247 quarts, valued at $10,775. The production of blackberries was 13,808 quarts, amounting in value to $1,761. The other small-fruits were raspberries, loganberries, currants and gooseberries.

The leading vegetables were potatoes, sweet potatoes and yams, onions, tomatoes and watermelons. In 1909, from 1,151 acres of potatoes, there were produced 97,141 bushels, valued at $98,597. The acreage of sweet potatoes and yams in 1909 was 200, the production of which was 21,206 bushels, valued at $28,098. The production of onions in 1909 was valued at $11,480, and that of tomatoes $9,239. The value of watermelons from 735 acres, in 1909, was $52,502.

The area of land under glass, in 1909, used for the production of flowers and plants, was 29,810 square feet. Of these, 26,730 were covered by greenhouses and 3,080 by sashes and frames. The value of the products from flowers and plants was $11,177.

As regards nursery products, the value, in 1909, was $4,535, as compared with $2,914 in 1899. From 1899 the area devoted to the production of nursery products increased from 14 acres to 18 acres in 1909.

R. H. Forbes.

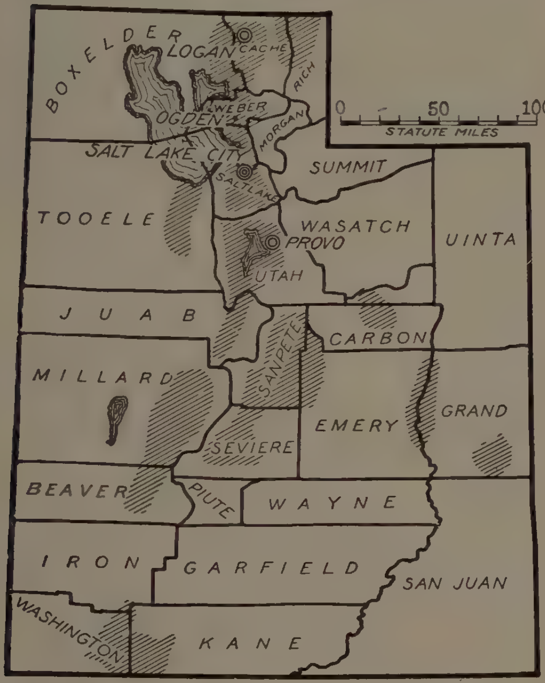
Utah.

The whole state of Utah (Fig. 2530) is cut up with mountain ranges running in a north and south direction. Between these mountain ranges lies the agricultural land of the state. These valleys vary in size from only 1 or 2 miles across, such as Pine Valley, to 30 or 40 miles in length by 8 to 15 miles in width, such as Cache Valley. The deep rich soil in these valleys makes a very intensive type of agriculture possible. The main fruit sections are at an altitude of 4,000 to 4,800 feet above sea-level. This includes the sections around Brigham, Ogden, Salt Lake, Green River, and Provo. At a higher altitude, frost-injury is likely to be experienced except in specially favored spots of limited area. Such small areas are usually at the mouths of cañons. The most desirable orchard sites are situated on the bench-lands and near cañons, thus insuring good air-drainage to ward off the occurrence of late spring frosts. Several extensive observations have been made which show that the average minimum temperature in the valley bottoms is from 8° to 10° F. lower than the bench-lands. The winter temperatures are congenial to apple-, pear,- peach-, plum- and sour cherry-production even in the northern part of the state, whereas apricots, sweet cherries and Persian walnuts thrive along the bench-land from Brigham southward. Almonds are being produced in the favored sections in the vicinity of Salt Lake City.

The average rainfall throughout the orchard sections of the state varies from 8 to 17 inches. With most of the rainfall coming during the dormant season, irrigation is necessary for practically all kinds of fruit-production in the state. The larger part of the orchards receive water from some of the irrigation canal systems. However, many acres of fruit have been developed about Brigham by pumping from wells. These wells vary in depth from 30 to 80 feet. Most of the pumps are operated by electricity which is obtainable at a very cheap rate.

Sagebrush (*Artemisia tridentata*) is the natural vegetation of the best orchard soils. Such soils are generally deep, rich and free from alkali. Greasewood (*Sarcobatus Baileyii*) and rabbit-brush (Bigelovia sp.) are found on soils containing more or less alkali, and perhaps otherwise unfit for fruit land.

The Mormons were the first to grow fruit in the intermountain region. With their first immigration to Utah in 1847, they brought seeds of grains, vegetables, fruit, shrubbery, trees, and vines. In a state thus settled by an agricultural people, fruit-growing became established early in its history, and held a place of importance in the agricultural development of the state. Practically every farm in the early days had its family orchard, consisting of many varieties of apples, peaches, plums, pears and cherries. Many of these trees were grown from seed. The following fruits which are gradually taking an important place in their respective classes originated in the state of Utah: the Poorman gooseberry, the Early Elberta peach, and the Knudson cherry. The planting of mixed orchards for local market purposes was well established as early as 1875. Bancroft, the historian, states that at this time there were from 500 to 600 acres of grapes in southern Utah, and the value of Utah's fruit products of all kinds was estimated at $157,000. The planting of commercial orchards for the general markets began about 1895 to 1900. This industry increased manyfold from 1900 to 1910.



2530. Utah, with important horticultural areas.

With the variations in altitude, soil, and exposure which exist within the state of Utah, it is possible to grow a great variety of fruits. Only the hardier apples, pears and small-fruits are grown successfully in the regions of high altitude, such as Summit and Rich counties, in the northern part of the state, where the altitude is 5,500 to 7,000 feet above sea-level. However, pomegranates, figs, and European grapes are grown to perfection in Washington County in the southwestern corner of the state at an altitude of 2,880 feet.

The chief fruit-growing sections are along the uplands at the foot of the west slope of the Wasatch Mountains from Brigham and vicinity to Provo and throughout the Bear River Valley. Cache County, at the north of the state, has a most favorable climate and soil for apple-production. Peaches and sour cherries are also a success here wherever suitable soil is obtainable. All except the most hardy sweet cherries, such as the Tartarian, are likely to suffer from late spring frosts in Cache County. Small fruit-growing areas have been developed recently in the vicinity of Price, Carbon County, and Green River, Emery County. Washington County is one of the oldest and it is naturally the most favored fruit section in the state. With a semi-tropical climate, this region excels in the production of the stone-fruits, European grapes, figs, pomegranates, almonds and Persian walnuts. Seclusion from railroad transportation has kept this country from developing a world-famous fruit-growing region.

Apples are the chief fruit crop of the state and make up more than half of the total acreage in orchards. With the exception of a few orchards planted for local markets, all commercial orchards are composed of late fall and winter varieties; chief among these are the Jonathan, Winesap, Rome, Ben Davis, Gano, Arkansas, Banana, and Rhode Island.

The peach orchards of Utah have been developed almost entirely to supply the fresh-fruit markets; therefore, the Elberta orchards compose nearly 90 per cent of the total acreage in peaches. Other varieties occasionally found are the Early Elberta, Early Crawford, Late Crawford, Lemon Cling, Tuscan, Champion, Alexander, and Hale's Early.

Cherries are the next most important fruit crop of the state, being produced chiefly around Brigham, Ogden, Salt Lake City and Provo. Most of this crop is sold in the fresh state among the markets of the intermountain region. A very firm high type of cherry is produced. Chief among the varieties are Napoleon, Tartarian, Hortense, Bing, Lambert, Windsor, Morello, Knudson, Double Natte, and Late Duke.

Small-fruits are produced for local markets and markets of the surrounding intermountain states. Strawberries, raspberries, dewberries, currants and gooseberries are readily produced practically throughout the state.

Pears, plums and apricots have been somewhat neglected in developing the fruit industry of the state, and although the nearby markets are partly supplied with Utah fruit of the above sorts, these fruits form a small part of the export trade of the state.

The grape, however, is the most neglected of all fruits in the state. The common American varieties can be successfully produced throughout the northern and central parts, and some of the most hardy European sorts, as the Thompson, can be produced from Box Elder County south to Washington County. Grapes are among the chief fruits in the latter county, where the following vinifera varieties are produced in abundance: Flame Tokay, Cornichon, Thompson's, Black Ferarra, and Muscat of Alexandria.

Utah apples, peaches, pears and cherries are packed almost entirely in boxes. The chief markets for this fruit are in the intermountain and plains states, where stock-raising and grain-production are the chief industries. The southern cotton states are also good markets for Utah fruit. Storage facilities have not been well developed as yet and oftentimes fruit is sold at a moderately low price by being rushed to an overstocked market.

Diversified fruit-growing is often encountered in Utah. Many orchardists grow several kinds of small-fruits as well as stone-fruits. Apples are often grown as one of the principal crops on a general farm. For example, the farmer may have 10 acres of apples, and 20 acres or more of such crops as sugar-beets, alfalfa, or vegetable crops for cannery purposes. With this system of farm management, the cost of production of the fruit crops is somewhat lower than on the more specialized fruit-farms, where the owner's time is not fully occupied throughout the year. Much of the general farm equipment can be used in the orchard, while the presence of live-stock on most of the fruit-farms goes a long way toward solving the question of maintaining soil fertility. Clean cultivation is practised in most of the bearing orchards, although some attention has been directed recently to the sod-mulch system of orchard management. The latter system seems to have considerable promise in the sections where irrigation water is not the limiting factor. While the young orchards are being grown to a bearing age they are usually intercropped with some vegetable or small-fruit crop, as sugar-beets, tomatoes, strawberries, and the like. Cover-crops are the exception rather than the rule, and the application of chemical fertilizers is practically unheard of within the state. Thus far the application of moderate amounts of stable-manure seems to have maintained the plant-food and humus.

Irrigation water is usually applied by the furrow system. The basin system is occasionally used, however, in the case of orchards growing a sod or a cover-crop. The number of irrigations necessary to produce a crop of fruit will vary considerably with the soil conditions and the kind of fruit. Apples on the clay-loam soils are usually watered three or four times during the season of July to September inclusive. Sufficient water is applied to wet the soil down to a depth of 6 or 8 feet.

Peach orchards and the other stone-fruits on gravel-loam soils with only a medium water-holding capacity, are more frequently irrigated than apple orchards, and less water is applied at an irrigation. For the best production of peaches, it is especially desirable to have plenty of water available during the season following the hardening of the pit till harvest time. No amount of water during the early growing season will make up for lack of water during the month preceding the harvest. Early irrigation stimulates vegetative growth and thus causes an even greater demand for moisture later in the season than would otherwise be the case.

The fruit industry of Utah has undergone little or no boom when compared with some other sections. The steady, conservative growth of this industry seems reasonably certain, and future generations may see the horticultural crops of more relative importance than they are at present.

Utah is characterized, as a whole, by farmers owning their own farms, and the fruit industry is no exception to this rule. Land values have remained at conservative levels. The fruit-grower not only owns the orchard in which he works but usually has no desire to sell it.

Truck-gardening has only been locally developed around Brigham, Odgen and Salt Lake City. However, the canning factories have developed profitable and intensive production of tomatoes and peas in various sections throughout the state.

The cut-flower establishments around Salt Lake City and Ogden supply the local markets and export a quantity of flowers to the northwestern states.

Utah is especially free from insects and plant diseases harmful to fruit crops. The arid climate makes an uncongenial home for most of the fungous diseases and only the easily controlled fruit insects are prevalent within the borders of the state.

Very stringent horticultural laws promote the production of clean high-class fruit, as it is a misdemeanor in the state of Utah to sell, ship or offer for sale any fruit infested with insect or plant-disease blemishes.

Utah fruit enjoys a very favorable reputation among local and general markets. Utah Jonathan apples, Napoleon cherries, and Elberta peaches bring the top prices for these varieties, and compare favorably with similar fruit from other fruit-growing sections, wherever comparisons are made. Rich soils, the intense sunshine of an arid climate, and an abundance of irrigation water combine to produce fruit of the very highest quality and color.

Public-service agencies for horticulture.

The Utah Agriculture College is located in the northern part of the state at Logan in Cache County. This institution was established in 1888. The horticultural staff consists of three teaching members.

The Agriculture Experiment Station, organized as a division of the College, has played an important part in helping the fruit-growers to solve their problems. The experimental staff has usually included at least one additional worker to the teaching staff mentioned above.

The following institutions in Utah teach one or more courses in fruit-growing to a large number of students of high-school and college grade: Utah Agriculture College Branch Normal School at Cedar City, Brigham Young University at Provo, Brigham Young College at Logan, Snow Academy at Ephraim, Murdock Academy at Beaver, and St. George Academy at St. George. With the exception of the first-mentioned, which is a state institution, the above schools were established and are now maintained by the Mormon Church. In addition to the above, every high-school in the state teaches at least one course in horticulture except schools located at Salt Lake City and Eureka.

The Utah Horticultural Society was formed in 1905 and has grown steadily in influence and value to the state since its foundation. A State Horticultural Commission was created in 1899, consisting of the Entomologist and Horticulturist of the Utah Agricultural College and three practical horticultural resident citizens of the state, one to be the Horticultural Inspector appointed by the Governor, and the other two to be appointed from the members of the State Horticultural Society.

Statistics (Thirteenth Census).

The approximate land area of Utah in 1910 was 52,597,760 acres. The land in farms was 6.5 per cent of the land area, or 3,397,699 acres. Of this land in farms, the improved land numbered 1,368,211 acres; the woodland, 145,510 acres; and other unimproved land in farms, 1,883,978 acres. The total number of all the farms in Utah in 1910 was 21,676, and the average acreage to the farm, 156.7. [The total area is 84,970 square miles.]

The leading agricultural crops grown in Utah are hay and forage, cereals, and sugar crops. The acreage devoted to the production of hay and forage increased from 388,043 in 1899 to 405,394 in 1909, when the production was valued at $7,429,901, which was 40.2 per cent of the total value of all crops. Cereals increased in acreage from 255,699 in 1899 to 298,613 in 1909, when the production was valued at $6,092,281, or 33 per cent of the total value of all crops. Sugar crops increased in acreage from 7,917 in 1899 to 27,812 in 1909, an increase of 251.3 per cent, when the production was valued at $1,871,478, or 10.1 per cent of the total value of all crops. Forest products of the farms were valued at 6,730 in 1909, as compared with $13,325 in 1899.

Horticultural crops grown in Utah are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $671,165, as compared with $291,902 in 1899. Small-fruits increased in acreage from 1,052 in 1899 to 1,416 in 1909, when the production was 3,118,395 quarts, valued at $217,327. The total acreage of potatoes and other vegetables in 1909 was 21,216 and their value $1,591,847. Excluding potatoes, other vegetables increased from 6,023 in 1899 to 7,006 in 1909, when the production was valued at $717,776. Flowers and plants and nursery products increased in acreage from 250 in 1899 to 597 in 1909, when the production was valued at $269,571.

The total production of orchard-fruits in 1909 was 633,739 bushels, valued at $640,904. Apples contributed more than one-half of this quantity, and peaches and nectarines ranked next in importance. The apple trees of bearing age in 1910 numbered 517,039; those not of bearing age, 789,260. The production in 1909 was 350,023 bushels, valued at $319,691. Peach and nectarine trees of bearing age in 1910 numbered 544,314; those not of bearing age, 651,233. The production in 1909 was 143,237 bushels, valued at $156,451. The production of the other orchard fruits in 1909 was: 68,249 bushels of plums and prunes, valued at $54,040; 21,402 bushels of cherries, valued at $54,170; 38,654 bushels of pears, valued at $44,365; 12,047 bushels of apricots, valued at $12,037; and 118 bushels of quinces, valued at $135.

The production of grapes in 1909 was 1,576,363 pounds, valued at $28,126. Grape-vines of bearing age in 1910 numbered 204,445 and those not of bearing age, 94,043.

The production of nuts in 1909 was 16,649 pounds, valued at $1,547. The nuts contributing to this quantity were 10,664 pounds of almonds, valued at $1,014, and 5,985 pounds of Persian or English walnuts, valued at $533. The production of tropical fruits was valued at $588, of which figs produced $576.

Strawberries are by far the most important of the small-fruits grown in Utah, with raspberries and loganberries ranking next. The acreage of strawberries increased from 345 in 1899 to 719 in 1909, when the production was 1,832,796 quarts, valued at $125,854. Raspberries and loganberries increased in acreage from 284 in 1899 to 374 in 1909, when the production was 758,317 quarts, valued at $54,826. Blackberries and dewberries increased in acreage from 72 in 1899 to 95 in 1909, when the production was 184,140 quarts, valued at $13,447. Currants decreased in acreage from 194 in 1899 to 128 in 1909, when the production was 195,901 quarts, valued at $13,435. Gooseberries decreased in acreage from 110 in 1899 to 100 in 1909, when the production was 147,241 quarts, valued at $9,765.

Potatoes, the most important of the vegetables, increased in acreage from 10,433 in 1899 to 14,210 in 1909, when the production was 2,409,093 bushels, valued at $873,961. Of the other vegetables grown, the more important were: 1,571 acres of tomatoes, valued at $154,455; 210 acres of cabbage, valued at $24,922; 323 acres of green peas, valued at $18,810; 192 acres of cantaloupes and muskmelons, valued at $16,917; 72 acres of onions, valued at $13,394; 137 acres of watermelons, valued at $12,232; 43 acres of celery, valued at $10,835; 99 acres of asparagus, valued at $10,645; and 120 acres of sweet corn, valued at $8,842. Vegetables of less importance were green beans, beets, carrots, cauliflower, pop-corn, cucumbers, squash and turnips.

The acreage devoted to the production of flowers and plants increased from 14 in 1899 to 20 in 1909. The total area under glass in 1909 was 261,292 square feet, of which 249,280 were covered by greenhouses, and 12,012 by sashes and frames. The flowers and plants produced in 1909 were valued at $81,116, as compared with $34,173 in 1899.

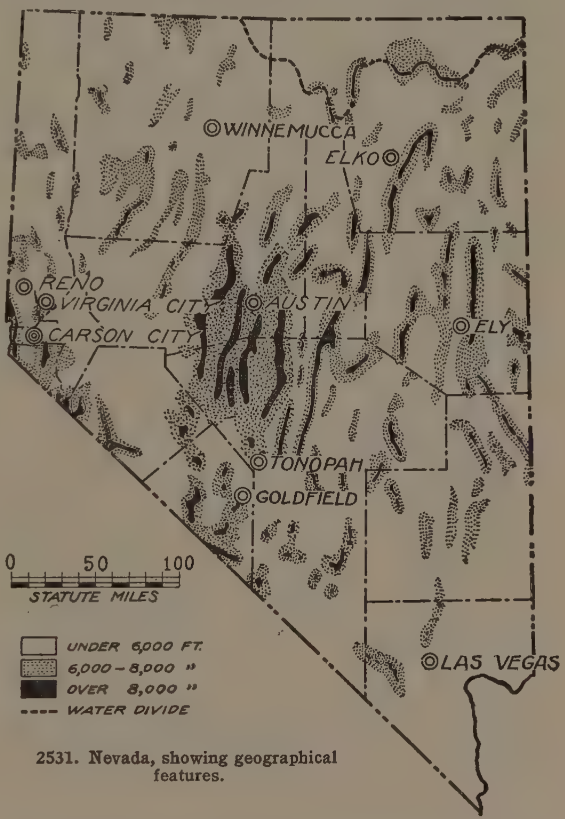
The acreage occupied by nursery products increased from 236 in 1899 to 577 in 1909, when the products were valued at $188,455, as compared with $120,648, in 1899.

L. D. Batchelor.

Nevada.

Nevada (Fig. 2531) comprises the western half of the Great Basin or plateau situated between the Rocky and Sierra Nevada mountain ranges. The general elevation of this plateau varies from 4,000 to 6,000 feet. Within the limits of Nevada there are numerous parallel mountain ranges sheltering approximately 200 valleys.

The climate is comparatively mild and semi-arid. The annual precipitation at the base of the main ranges varies from 10 to 26 inches in the west to 15 inches in the east and is as little as 3 inches in the interior valleys. In southern Nevada, the annual precipitation is 5 to 7 inches. On the mountain ranges the maximum winter precipitation in the form of snow reaches the water equivalent of 30 inches. Since two-thirds of the total annual precipitation occurs in the non-growing season, snow is the main dependence of the state for moisture on both range and farm, and is conserved by the mountains. Of these, the Sierra Nevada, Toyabe, Ruby, and Independence Ranges, three of which attain a maximum elevation of 11,400 to 14,500 feet, are the watersheds of the larger streams from which water for irrigation is derived. These streams, the Walker, Carson, Truckee, Reese, and Humboldt, traverse broad valleys and empty within the state. The Snake and the Colorado, on the northern and southern borders, are of little economic importance. The Muddy and its tributary, the Virgin, which flow into the Colorado, supply a limited area in southern Nevada.



2531. Nevada, showing geographical features.

The mean annual relative humidity is only 50 per cent. The rate of evaporation from water surfaces relative to other parts of the United States is high. Although strong winds occur frequently, destructive or blasting winds are rare. The mean annual velocity of the wind at Reno is 7 miles an hour.

According to temperature, which determines the length of the growing season and the type of products, Nevada is divided into three main divisions: northern and western Nevada, central Nevada, and southern or subtropical Nevada. The mean minimum temperature in northern Nevada ranges from 33.1° F. in the west (elevation 4,500 feet) to 30.2° F. in the east (elevation 6,000 feet); and the mean maximum temperature from 67.4° F. to 60.8° F. In central Nevada (elevation above 6,000 feet), the mean minimum temperature is 31.5° F. and the mean maximum 60.6° F., a condition too precarious for other than home horticulture. In southern Nevada (elevation below 3,000 feet), the mean minimum temperature is 48.9° F. and the mean maximum 81.9°.

An average of fifteen to twenty-five clear days and 74 to 89 per cent of sunshine occurs each month during the growing season. But intense radiation during the night diminishes somewhat the effect of the warm days. In northern Nevada, the growing season fluctuates from 77 to 168 days; in central Nevada from 52 to 139; and in southern Nevada from 130 to 240, the normal in each case lying midway between the two extremes. However, in the latter section the intense heat of the summer retards rather than accelerates growth.

The two great industries of the state are mining and agriculture, with a gross income for the former of approximately $35,000,000 and the latter of $15,000,000.

Irrigation is practised on approximately 90 per cent of the farms in Nevada, and little development of any source of water-supply other than streams has yet been made. Reservoirs still furnish only 5 per cent of the water used. The era of wells is just beginning. Dry-farming, which is necessarily limited to those parts of the state possessing a precipitation in excess of 12 to 15 inches, now embraces at least 4,000 acres.

Because of the preponderence of range land, forage crops have been greatly in excess of intensive crops and fruit, but seem now to have attained their highest acreage until the range is made capable of supporting a greater amount of live-stock, or until dairying and intensive stock-raising are established. The present (1915) value and relative importance of each is as follows:

Forage crops	$5,488,250
Cereals	1,838,400
Intensive crops	1,125,000
Fruit	200,000

On the basis of the forage crops, the intensive and fruit crops represent a value of 20 and 3.6 per cent respectively.

Except in the matter of frost, Nevada is ideally adapted for the growing of fruit; the clear skies and cool climate aid materially in producing fruit of fine external appearance and unusually delicate flavor. In northern Nevada, apples, plums, pears, and the hardier cherries are readily grown, while southern Nevada is congenial to the growing of peaches, pears, apricots, pomegranates, figs, olives, quinces, grapes, and almonds. The growing of citrous fruits is effectually prevented by the temperature of 20° F. that regularly occurs in the winter and by an occasional drop in temperature to 10° or even 9° F.

Seventy per cent of the orchard-fruits and grapes grown in Nevada are produced in three counties: Washoe, in 1910, producing 49.5 per cent; Nye, 12; Elko, 8.5. Lyon and Churchill counties are coming into prominence as potential producers of fruit. All of the standard varieties of apples are found in Nevada.

The frequency and duration of frost varies with elevation. According to a temperature survey of Washoe and Churchill counties, the temperature has been found to vary 8° in a rise of 13.5 feet and only 9.5° in 250 feet, the average variation being probably not more than half of these amounts. It has been found that an increase in elevation of 250 feet is accompanied by a decrease in the number of occurrences of frost of fourteen to five in a season and a decrease in the duration of freezing temperatures from at least forty to sixteen hours.

In the bottom lands of northern and western Nevada, the fruit crop fluctuates approximately as follows: full crop one year in five; total failure one year in five; and three half crops. In the foothills, only one total failure has been recorded in twenty-five seasons. At one point, 1,000 feet above the valley, apricot and almond trees, unknown to produce fruit elsewhere in northern and western Nevada, grow secure from frost. On the average, two heatings a season should save the Nevada crop, except in the coldest spots or in abnormal years.

The bench lands along the Sierra Nevada and the Ruby mountains compare closely in temperature with Provo, Utah, but are inferior to Grand Junction, Colorado. Furthermore, dry orcharding in these lands, as based on a five years' test, with an average annual precipitation of 13.61 inches, has proved successful, Ben Davis apples from the Elko County Dry Farm having received first prize at the State Fair in 1914.

The type of apple best adapted economically to Nevada is a late and long bloomer. Such is the so-called Nevada Sheepnose which has never been known to fail utterly. It is, moreover, a late keeper.

Most of the orchards and orchard land in Nevada are adjacent to railroads, but owing to the uncertainty regarding the crop, little effort is made to keep the orchards free from insect pests or to grade the fruit for marketing. Consequently, even the local markets are controlled largely by the California product. The orchards are usually small. Orchards of 20 to 50 acres are known, but these are very rare. The largest orchard is said to have 160 acres. Pears, plums, and cherries are grown only for family use.

In southern Nevada, apricots find a congenial environment because of the rainless weather at the time of ripening. Shipments of early fruit as well as the evaporated product find a ready market. For the same reason, and also because of a steadily increasing demand, almonds should be an ideal crop. Furthermore, the almond requires less moisture than most deciduous fruits.

The seedless grape industry is limited largely to acre tracts on each farm. One 50-acre vineyard is known. The grapes are shipped as raisins, but no attempt has been made to market them in carlots.

Of lesser fruits, the Mission and White Adriatic figs have been produced for years without a failure, and other varieties show especial promise. The Mission olives also "have withstood all extremes of temperature, and the few trees growing indicate possibilities of a new industry." Pears and quinces thrive in this climate, although the latter are not grown extensively. Peaches, especially the Elbertas, being short-lived, are grown only for home use.

In northern and western Nevada, raspberries, being late bloomers, are an unfailing crop. Currants and gooseberries are usually successful. Strawberries do well on the hill slopes. In southern Nevada, blackberries and dewberries are the most adaptable of the small-fruits; currants, gooseberries, raspberries, and strawberries are grown only with great care.

Owing to the scattered population and the control of the wholesale fruit industry by California companies, it will be difficult to increase the horticultural acreage unless concerted action is taken to develop the home as well as the foreign market. However, the impending increase in the dairy industry with resultant increase in population should stimulate the fruit industry; and since fruit requires, after the root system is developed, from 25 to 50 per cent less water than farm crops, it seems probable that fruit-culture on the higher slopes may become an independent industry, particularly so if combined with other intensive agriculture such as the raising of bees and poultry.

Of intensive crops, potatoes seem to be the coming premier crop in Nevada. Of the 840,000 acres of land now under actual cultivation, at least 150,000 acres are said to be adapted to potato-culture. The Inter-mountain States, because of their porous soils, moderate summer temperature, and control of moisture through irrigation, are well adapted to the raising of excellent potatoes, and Nevada especially so because of its proximity to the markets of California and the low shipping rates via the Panama Canal to New York. Under fair cultivation, five tons or 170 bushels of potatoes to the acre can be grown in Nevada, and under skilful cultivation the output can be increased to twelve tons. The average price is $20 a ton, the price fluctuating between $12 and $25. Early varieties adapted to the state are Early Ohio, Rose Seedling, and Early Rose; the late varieties, White Pearl, Rural New Yorker No. 2, Perfect Peachblow, Great Divide, Burbank, and Peerless. The greater part of the potatoes grown in Nevada come from three counties, Lyon, Washoe, and Elko, the ratio in 1910 being 25.9, 25.7, and 8.5 per cent respectively. In southern Nevada, only early marketing is profitable, for potatoes do not keep well in that climate.

It is probable that the area of potato land can be further increased by the use of dry-farming on the higher slopes of the mountain valleys, where the conditions of rainfall and frost are much more favorable than in the center of the valleys below. The rainfall should be at least 12 inches and preferably 15 to 18 inches, and the slope free from frost after the first of May. The only serious pest is the eelworm, a nematode gallworm, which causes some trouble. This parasite can be partially controlled by planting clean seed and rotating cereal crops with potatoes. Fall plowing and exposure of the soil to the hot sun has been suggested as a feasible method in Nevada where the winter cold is not sufficiently prolonged to destroy the eggs and larvæ.

The culture of onions is highly profitable if they are planted on the best soil, for the dryness and low temperature "make it comparatively easy to keep well-matured bulbs in inexpensive storage-houses until the market becomes favorable, which usually occurs after January 1, when the bulk of the California crop has been marketed." The best fields yield twenty tons an acre, and the normal price is $20 a ton.

The soil of western Nevada is well adapted to the growing of sugar-beets, which attain a general average of 18 per cent sugar. A beet-sugar factory at Fallon (Churchill County) on the Truckee-Carson Project has a capacity of 65,000 tons per annum, but tariff conditions and the difficulty of establishing a local market for beet-sugar have so far seriously retarded the industry.

Since watermelons and cantaloupes are perishable, their commercial cultivation is dependent upon the quality of the product placed on the market. In northern Nevada, they mature late and consequently must come into direct competition with the produce of northern California. In southern Nevada, the cantaloupe is well adapted to the climate and is matured by the middle of July, after the season in Imperial Valley is over and before the season in Utah and Colorado has begun. Consequently, there is a potential market on either side. At present cantaloupes constitute the chief crop of Moapa Valley (Clark County) and vicinity. In 1913, $80,000 or $160 an acre was realized from their sale after transportation charges and commissions were paid. In 1914 the crop was 75 per cent larger, but owing to unfortunate markets the profits were less. The most serious drawback is the melon aphis which is difficult to control. The varieties of watermelons are Kleckley Sweets, Halbert Honey, and Florida Favorite, and of cantaloupes Emerald Gem, New Fordhook, and Rocky Ford.

Celery is still an experimental crop, and in northern and western Nevada, skill is necessary to carry it through the warm summer. The celery is of excellent texture and good flavor, and the crop, although limited, is so valuable that it is shipped even into California, where it sells at a higher price than the local product. Since much labor and care are required in securing a good product, there seems little prospect of over-production.

Asparagus thrives in both northern and southern Nevada and will grow in soils too alkaline for most other crops. Furthermore, little summer irrigation is required. In southern Nevada, it is a poor second to cantaloupes as a commercial crop. It is marketed for six weeks in March and April in Chicago and other eastern cities. A canning factory is essential to care for the output after distant shipments are unprofitable.

The market and home gardens produce practically all of the vegetables grown in temperate climates, particularly beans, beets, cabbage, cauliflower, carrots, corn, cucumbers, garlic, kohlrabi, lettuce, onions, peas, pumpkins, radishes, squashes, sweet potatoes, rutabagas, tomatoes, and turnips. In southern Nevada, tomatoes ripen from late May until late November or December, the crop, however, being very light during the heat of summer. Commercial gardening in western Nevada is mainly in the hands of Italians, and the prices are reasonable. Except in southern Nevada, the market is local and is forced to compete to a certain extent with California. The winter-grown vegetables of southern Nevada find a parcel-post market in Salt Lake City. Lettuce has been shipped in carload lots, but the marketing of it has not always been successful.

Practically all the flowers and shrubs that are grown in the northern part of the United States, as well as the hardy perennials of California, grow well in northern Nevada. Peonies and bulbous plants bloom with only occasional injury from frost, and, owing to the lateness of the Nevada season, would find a ready market in California, if grown commercially. Owing to the dryness of the atmosphere, English holly does not thrive in this climate.

In southern Nevada, such semi-tropical plants as the oleander, the ornamental date palm, and weeping fan palm have been grown successfully. The bamboo and the pampas grass, which find a congenial environment in northern Nevada also, here grow to stately proportions, while the chrysanthemum supplies almost perfect blooms in the garden until after Thanksgiving.

Commercial greenhouse floriculture should be eminently successful, for the percentage of sunshine in the winter in Nevada is far in excess of that in California, and flowers can be grown in one-half the time.

Public-service agencies for horticulture.

The Agricultural College is situated at Reno and was established in 1888. It is an integral part of the University of Nevada. There is one member on the horticultural staff.

The Experiment Station is also at Reno and is a department of the University. The University and the Experiment Station possess two orchards, one exposed to frequent frosts, the other reasonably free from them. Two horticultural bulletins have been published, one on ornamental trees and shrubs, the other on the avoidance and prevention of frost.

A limited amount of extension work in horticulture is given. The Public Service Department of the University maintains an inspection service for plant insects and diseases, but not for fruit-grading.

Statistics (*Thirteenth Census*).

The approximate land area of Nevada in 1910 was 70,285,440 acres. The land in farms numbered 2,714,757 acres, or 3.9 per cent of the land area. The amount of improved land in farms was 752,117 acres; the amount of woodland in farms, 48,209 acres; and there were 1,914,431 acres of other unimproved land in farms. The number of all farms was 2,689 and the average acreage to the farm 1,009.6. [The total area of the state is 110,690 square miles.]

The leading agricultural crops of the state are hay and forage, and cereals. In 1909 the acreage devoted to hay and forage was 350,538, an increase of 20 per cent in acreage since 1899. The value of the production in 1909 was $4,185,071, which was 70.7 per cent of the total value of all the crops. The acreage in cereals in 1909 was 34,958, as compared with 31,075 in 1899; the production in 1909 was valued at $923,763, or 15.6 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was $42,748, as compared with $23,853 in 1899.

Horticultural crops grown in Nevada are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $97,128, as compared with $16,752 in 1899, an increase in value of 479.8 per cent. Small-fruits decreased in acreage from 53 in 1899 to 37 in 1909, when the production was 50,287 quarts, valued at $5,683. The total acreage of potatoes and other vegetables in 1909 was 6,822, as compared with 3,164 in 1899; the production in 1909 was valued at $661,803. Vegetables, not including potatoes, increased in acreage from 924 in 1899 to 1,952 in 1909, when their products were valued at $264,122. In 1909, 1 acre was devoted to flowers and plants and nursery products, as compared with 5 acres in 1899, and the value of the production in 1909 was $2,113.

The production of all orchard-fruits in 1909 was 86,576 bushels, valued at $82,695. This production was nearly six times as great as in 1899, when 15,287 bushels were produced. Apples are by far the most important orchard fruit, producing nearly seven-eighths of the total production in 1909, when 74,449 bushels of apples were produced, valued at $66,097. The number of apple trees of bearing age in 1910 numbered 74,454; those not of bearing age, 16,868. The other orchard-fruits of any importance in 1909 were: 4,083 bushels of pears, valued at $5,119; 3,857 bushels of plums and prunes, valued at $4,654; 3,171 bushels of peaches and nectarines, valued at $4,500; and 524 bushels of apricots, valued at $1,418. In addition, cherries were produced to the value of $894, and quinces to the value of $13.

The production of grapes in 1909 amounted to 376,205 pounds, valued at $12,045, as compared with 287,600 pounds, the production in 1899. The number of vines of bearing age in 1910 numbered 26,607; those not of bearing age 7,941.

The production of nuts and tropical fruits in Nevada is relatively unimportant. In 1909, almonds were produced to the value of $606; Persian or English walnuts to the value of $20. Of the tropical fruits, in 1909, 45,550 pounds of pomegranates were produced, valued at $915; and 29,270 pounds of figs, valued at $818.

Of the small-fruits, the raspberries and loganberries are the most important, with gooseberries and strawberries next in importance. In 1909 the production of raspberries and loganberries was 17,841 quarts, valued at $1,901; that of gooseberries, 11,355 quarts, valued at $1,317; that of strawberries, 11,189 quarts, valued at $1,218; that of currants, 8,284 quarts, valued at $1,083; and 1,078 quarts of blackberries and dewberries, valued at $164.

The acreage devoted to the production of potatoes increased from 2,235 in 1899 to 4,864 in 1909, when the production was 766,826 bushels, valued at $396,652. Of the other vegetables grown in 1909 the more important were: 399 acres of cantaloupes and muskmelons, valued at $56,715; 124 acres of onions, valued at $32,523; 37 acres of lettuce, valued at $6,380; 43 acres of cabbage, valued at $5,467; 27 acres of asparagus, valued at $2,973; 34 acres of watermelons, valued at $2,923; and 10 acres of tomatoes, valued at $2,126. Vegetables of minor importance grown in 1909 were green beans, beets, carrots, cauliflower, celery, sweet corn, green peas, pumpkins, squash, and turnips.

There was 1 acre devoted to the production of flowers and plants in Nevada in 1909. The value of the flowers and plants produced from this 1 acre was $1,620. The total area under glass in 1909 was 4,600 square feet, all of which was covered by greenhouses. The land devoted to nursery products in 1909 was less than an acre, and their value $493.

J. E. Church, Jr.

PACIFIC STATES.

Washington.

The state of Washington (Fig. 2532) is naturally divided into two very different climatic areas. The slope on the west side of the Cascade Mountains is generally very rolling. The plains and mountain sections are usually covered with heavy timber. The elevation is from sea-level to 3,000 feet and mountain peaks extending to much greater elevations. The rainfall in the sections varies from 20 to 100 inches annually. The summers are generally warm and with very light rainfall. The winters are usually cloudy with a great deal of rain but with very little wind and cold weather.

The section of the state east of the Cascade Mountains is a broken elevated plain with mountains in the northern part of the state. The altitude varies from 500 to 3,600 feet, with mountains much higher. The rainfall varies from 5 inches in the lowest valleys to about 35 inches at elevations of 3,500 feet. There is practically no rainfall during the summer months and crop-production in the valley regions is developed almost entirely by irrigation. The temperature is equable and seldom reaches more than 16° below zero. The changes in temperature during the winter are usually gradual, and the extreme temperatures are seldom accompanied by wind.

The leading horticultural districts in the state are in the Yakima Valley, Wenatchee Valley, Spokane Valley, Okanogan Valley, and the lower Columbia Valley and the valleys of the Snake River. In the western part of the state the important horticultural districts are in Clark, Thurston, Pierce, King, and Whatcom counties.

Apple-growing is the leading horticultural industry in the state and in all probability will be for years to come. The fruit-growing sections producing apples in the largest quantities rank in the order named: Yakima Valley, Wenatchee Valley, Spokane Valley, Walla Walla district, Okanogan district, and the Clarkston district. The lower warm valleys grow the long-season apples, like Yellow Newtown and Esopus, to perfection, while the higher altitudes are best adapted to a shorter-season fruit, like the Wealthy and the Gravenstein. All apples color finely, and are very fair in appearance.

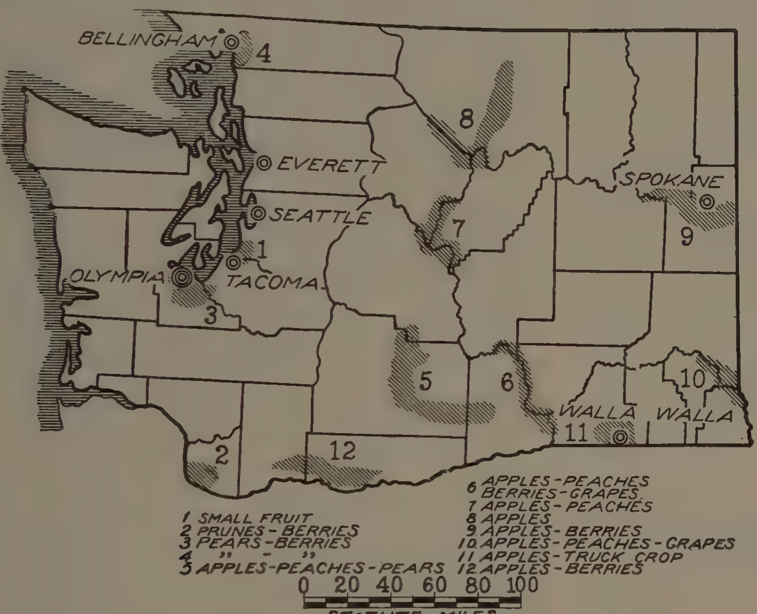
The greatest prune-growing area in the state is in Clark County. The Italian prune (Fellenberg plum) is planted in great numbers on both sides of the state. The French prune (Agen, Prune d'Agen, Petite, and the like), is planted in considerable numbers, but nothing like the Italian. Washington seems to be unable to compete with California in the production of this fruit. Nevertheless it is fairly profitable in Washington, yielding about the same number of pounds to the tree as the Italian, and selling in the eastern markets at a good price. But the Italian usually sells for more money, as the fruit is much larger. The Silver prune, or Coe plum (Coe Golden Drop), is a large, handsome prune when well prepared and always brings a good market price, selling for 2 or 3 cents a pound more than Italian or French. Not a great many are planted, and in some cases the prune-growers work their Silver prunes over to Italians. There are numerous varieties of prunes planted on the coast, but none in so great quantities as the Italian. Much of the fruit of this prune is shipped green, i. e., in a half-ripe condition. This finds its way to the most eastern markets, and some of it even to England. The fruit of the Italian stands shipment better than any other variety. Most large growers have evaporators in their orchards, and the most of the fruit is preserved in this way.

Pears are grown to great perfection in almost every part of the state, but there is no finer fruit than that which comes from the low warm valleys of the Snake, the Columbia, Walla Walla, and Yakima. The Bartlett is the great summer pear, followed closely by Flemish Beauty. For fall and winter, Anjou, Clairgeau, Easter and Winter Nelis are largely grown.

In peach-growing, the Yakima Valley ranks first, with Wenatchee Valley second, and Clarkston third.

In the growing of grapes, the lower Yakima Valley and the Columbia River Valley in the central part of the state are taking the lead, with the Clarkston district a close second.

Sweet cherries grow to great perfection in all parts of the state, but especially so in the Puget Sound region and in the warm valleys of the east side. The sour varieties also grow and yield abundantly. Sweet cherries attain their greatest perfection in the warm valleys at an altitude not much above 1,000 feet. Sour varieties do best on the high lands, at an altitude of about 2,000 feet. Cherries have been found to be profitable, yet few new plantations are being set. The reason for this is probably to be found in the labor market, it being almost impossible to get the necessary help to care for a large crop of cherries.



2532. Washington, with distribution of horticultural crops.

The greatest berry-growing section is in Thurston and King counties, Sumner and Puyallup being the centers. Bellingham, in Whatcom County, is the center of the berry and small-fruit district. Kennewick is the largest strawberry section east of the Cascade Mountains. Cranberry-growing is a new and rapidly developing industry in Pacific, Thurston, and Chehalis counties.

In the production of vegetables and truck crops the Walla Walla district ranks first, with Thurston and King counties second.

The vegetables that do well in cool weather are especially adaptable to wide planting in Washington and reach a very high measure of perfection. Lettuce, peas, onions, cabbage, cauliflower, kohlrabi, spinach, asparagus, and rhubarb do especially well. The warm-weather plants, such as tomatoes and sweet potatoes, are grown to the greatest perfection only in the lower altitudes. District above 1,500 to 1,600 feet are seldom able to mature tomatoes satisfactorily. The plant grows well and produces enormous crops of fruit in practically all sections of the state, but only the lower sections have sufficient length of growing season to make the crop profitable. Beans are grown in eastern Washington in great quantity. In the irrigated sections, this crop has not proved its capacity to adapt itself to the peculiar soil conditions existing. Celery can be grown in almost all sections of the state where the rainfall or water-supply is sufficient. There is a great deal of land in western Washington especially adaptable to this plant. Root crops, such as radishes, turnips, rutabagas, beets, carrots, and parsnips, do especially well. The plants of the crucifer family are very generally attacked by maggots and are difficult to grow to the highest degree of perfection unless planted extremely early or grown as an extremely late crop.

Seed-growing is a very important industry in Snohomish and Spokane counties. Large quantities of vegetable seed are grown in other districts also. The seeds grown in greatest quantity are garden and field peas, cabbage, cauliflower, beets, and turnips. Experimental work in bulb-growing is being conducted at Bellingham and promises to be the foundation for a large bulb industry.

Great progress is being made in Washington in the establishment of fruit-product plants. There are several canning factories being very successfully conducted. Several of these are on coöperative basis. They do a regular canning business in fruits and vegetables and find especially profitable the making of strawberry mash and the canning of cherries, pears, and tomatoes. There are several vinegar factories in the state that use only the cheap or culled grades of fruit. There is one commercial plant manufacturing the unfermented fruit juice, paying especial attention to grape juice.

The flowering plants ordinarily grown in gardens for commercial purposes do especially well in Washington. The rose probably does no better in any state in the Union than in Washington. Rose shows are very popular in the larger cities of the state. Sweet peas also reach a very high degree of perfection. Flower-culture, including the more common kinds for the home-garden, is receiving a great impetus, as it has been neglected greatly in the past. Commercial florists' work is developing rapidly. The most common plants handled are the carnations, roses, chrysanthemums, ferns, and foliage plants. The city trade is usually supplied by the local houses. A great deal of attention is being given now to the production of bedding and border plant materials. Greenhouse establishments are increasingly popular for the production of flowers, but very little is done along the line of forcing winter vegetables. Transportation rates from the southern part of California are such as to prevent profitable vegetable-forcing work. The lowland valley districts are capable of producing crops of lettuce as late as the latter part of November and also of placing the spring crops on the market from the out-of-door beds as early as March.

The nursery business has been well developed in this state, but has fallen off greatly in the last three years. At present the nurseries are developing good stocks of ornamental plants and trade is rapidly increasing.

The most common pests to the general horticultural crops are codling-moth, bud-moth, apple- and peach-tree borers, San José scale and the various forms of aphis. There are many other insects making trouble in small localities. Of the plant diseases, pear blight, apple-scab, apple powdery mildew, anthracnose, or black-spot canker, and brown-rot are the most common. There are a few physiological diseases that appear in the orchards. Most of these seem to be due to lack of adaptation of the plant to the peculiar soil conditions of the district. The most common spray materials in use are lime-sulfur, bordeaux mixture, nicotine sulfate and crude-oil emulsion.

The large orchard planting in Washington has been induced by the great profit made by the owners of the oldest orchards in the state. Between 1901 and 1911, many orchards yielded crops that netted their owners profits of several hundred dollars an acre. Heavy orchard planting followed. The extremely high price received for the apple before 1912 still left good profits after deducing high freight rates. The increased crop and reduced price has made the marketing problem a very difficult one. The organization of coöperative selling associations began about 1907, although some small organizations were in operation before that date. The coöperative canneries were among the first to start and the first to fail. The Puyallup-Sumner Fruit Association is one of the oldest and most successful organizations of its kind in the state. This organization owns and operates its own canning plant and handles approximately 95 per cent of the berry crop of that section. The organization is composed primarily of berry-growers. The Yakima Valley Fruit Growers' Association is a coöperative organization that sells fresh fruit only. This is the largest and one of the oldest local organizations in the state. There are now several similar organizations. The North Pacific Fruit Distributors is the largest coöperative organization in the state. It is composed of several affiliated local organizations. It is a selling agency only and does not attempt to do any of the work of the local organizations. Each local organization has its own brands and advertising methods and to a large extent its own set of rules for grading and packing. The f. o. b. sales at origin of the shipment are most desired by the grower, as the consignment shipments have very frequently failed to return a reasonable price to the grower.

Public-service agencies for horticulture.

The Land-Grant college of Washington is located at Pullman and was established in 1890. The institution is known as the State College of Washington. The Experiment Station is a department of the College and is located at the same place. At the present time there are seven men on the staff of the department, four doing college work only, and two connected only with the Experiment Station; the head of the department works in both College and Experiment Station. Since the establishment of the Experiment Station, fourteen bulletins have been published by the horticultural department. Several of these have been popular bulletins.

There are no special schools in this state teaching horticulture at the present time. Horticulture is taught in most of the high-schools in the state. Brief attention is given to it in the normal schools as a part of the agricultural course.

The extension work in horticulture is done by members of the Horticultural Department. Lectures, farmers' institutes, movable schools, and the conducting of correspondence courses in horticulture are the principal lines of activity.

The State Department of Agriculture has a subdivision of horticulture. The head of that division is known as Commissioner of Horticulture and all of the inspection work of the state is directly under his supervision. The state is divided into five inspection districts with district inspectors in charge.

The Washington State Horticultural Society is an organization of the fruit-growers of the entire state. Practically all of the members, however, reside east of the Cascade Mountains. The Western Washington Horticultural Society is an organization of the fruit-growers residing west of the Cascades. The special interest of this society is for the promotion of the fruit-growing industry in western Washington. Fruit-growing unions and commercial organizations exist in every fruit-growing section of the state.

Statistics (Thirteenth Census).

The approximate land area of Washington in 1910 was reported as 42,775,040 acres. The land in farms was 27.4 per cent of the land area, or 11,712,235 acres. Of this land in farms, the improved land numbers 6,373,311 acres; the woodland, 1,541,551 acres; and other unimproved land in farms, 3,797,373 acres. The number of all the farms in the state in 1910 was 56,192 and the average acreage to a farm 208.4. [The total area is 69,127 square miles.]

The leading agricultural crops of the state are cereals, and hay and forage. The acreage of cereals increased from 1,350,897 in 1899 to 2,591,582 in 1909, when the production was valued at $44,762,138, which was 56.7 per cent of the total value of all crops. Hay and forage increased in acreage from 497,139 in 1899 to 742,137 in 1909, when the production was valued at $17,147,648, or 21.7 per cent of the total value of all crops. The value of forest products of farms was $3,754,293 in 1909, as compared with $1,002,126 in 1899.

Horticultural crops produced in Washington are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $4,329,058, as compared with $1,027,539 in 1899. Small-fruits increased in acreage from 2,845 in 1899 to 5,508 in 1909, when the production was 13,490,930 quarts, valued at $941,415. The total acreage of potatoes and other vegetables in 1909 was 82,312 and their value $5,982,665. Excluding potatoes, the acreage of other vegetables increased from 13,848 in 1899 to 24,410 in 1909, when the production was valued at $2,988,510. Flowers and plants and nursery products increased in acreage from 189 in 1899 to 1,682 in 1909, when the production was valued at $1,044,907.

The total quantity of orchard-fruits produced in 1909 was 4,244,670 bushels, valued at $4,274,124. Apples contributed considerably more than half of this quantity and plums and prunes most of the remainder. The apple trees of bearing age in 1910 numbered 3,009,337; those not of bearing age, 4,862,702. The production of apples in 1909 was 2,672,100 bushels, valued at $2,925,761. Plum and prune trees of bearing age in 1910 numbered 823,082; those not of bearing age, 122,912, and the production in 1909 was 1,032,077 bushels, valued at $600,503. Pear trees of bearing age in 1910 numbered 290,676; those not of bearing age, 617,754, and the production in 1909 was 310,804 bushels, valued at $328,895. Cherry trees of bearing age in 1910 numbered 241,038; those not of bearing age, 229,067, and the production in 1909 was 131,392 bushels, valued at $278,547. Peach and nectarine trees of bearing age in 1910 numbered 536,875; those not of bearing age, 1,028,141, and the production in 1909 was 84,494 bushels, valued at $118,918. Other orchard-fruits produced in 1909 were: 10,789 bushels of apricots, valued at $17,280; and 3,008 bushels of quinces, valued at $4,198.

The production of grapes in 1909 was 1,704,005 pounds, as compared with 1,194,700 pounds, the production in 1899. The value of the grapes produced in 1909 was $51,412. The number of vines of bearing age in 1910 was 322,007; those not of bearing age, 371,733.

The production of nuts in 1909 was 65,441 pounds, valued at $3,522. The more important of the nuts produced were: 16,450 pounds of English or Persian walnuts, valued at $2,241; 43,438 pounds of black walnuts, valued at $687; and 770 pounds of almonds, valued at $86.

Strawberries are by far the most important of the small-fruits produced in Washington, with raspberries and loganberries second in importance. The acreage of strawberries increased from 1,268 in 1899 to 3,283 in 1909, when the production was 7,683,774 quarts, valued at $529,535. Raspberries and loganberries increased in acreage from 625 in 1899 to 1,210 in 1909, when the production was 3,118,720 quarts, valued at $223,001. Blackberries and dewberries increased in acreage from 338 in 1899 to 769 in 1909, when the production was 2,340,779 quarts, valued at $159,094. Other small-fruits produced were: 194,365 quarts of currants, valued at $16,518; 143,264 quarts of gooseberries, valued at $12,285; and 9,728 quarts of cranberries, valued at $953.

Potatoes, the most important of the vegetables, increased from 25,119 acres in 1899 to 57,897 acres in 1909, when the production was 7,667,171 bushels, valued at $2,993,737. Of the other vegetables grown the more important were: 934 acres of cabbage, valued at $106,865; 415 acres of onions, valued at $67,949; 364 acres of tomatoes, valued at $62,613; 103 acres of celery, valued at $39,686; 561 acres of sweet corn, valued at $34,891; 352 acres of peas, valued at $27,758; 194 acres of asparagus, valued at $24,129; 310 acres of cantaloupes and muskmelons, valued at $18,688; 214 acres of watermelons, valued at $15,525; and 87 acres of turnips, valued at $11,484. Vegetables of less importance were green beans, beets, carrots, cauliflower, cucumbers, lettuce, parsnips, radishes, rhubarb, rutabagas, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 34 in 1899 to 340 in 1909. The area under glass in 1909 was 1,539,972 square feet, of which 1,257,616 were covered by greenhouses and 282,356 by sashes and frames. The value of the flowers and plants produced in 1909 was $518,226, as compared with $50,450 in 1899.

Nursery products increased from 155 in 1899 to 1,342 in 1909, when the value of the nursery products grown was $526,681, as compared with $28,699 in 1899.

O. M. Morris.

Oregon.

Oregon (Fig. 2533) is a state of great extremes, the rainfall varying from as high as 130 inches down to a very few inches, in extreme seasons certain sections averaging as low as 2 or 3 inches, although 9 or 10 inches is generally the minimum. Along the coast, the annual rainfall averages about 70 inches, while in western Oregon between the Cascade and the Coast Range mountains, the rainfall varies from 25 to 45 inches. East of the Cascade Range, it varies from 20 inches down to about 9 inches.

There is also an extreme range of elevations. This difference varies from sea-level to the frost line. This line, with the exception of a few favored locations, is in the neighborhood of 3,000 feet, and this elevation is about the limit of successful fruit- and tender vegetable-production in this state.

The soils in the horticultural valleys tend to vary greatly and are very spotted; nearly all extremes are found. It is not uncommon to find twelve or fifteen distinct types of soil in one small valley. These soils will vary from the heaviest adobe, or so-called sticky soils, to the lightest volcanic ash or pumice-stone soils.

These changes in rainfall, elevation and soils, coupled with certain climatic factors, such as length of growing seasons, mean temperatures, extremes of heat and cold, give the state a very wide range of conditions. This means that a great many varieties of fruit can be grown successfully. While it is true, however, that each locality may be able to grow only a few varieties to the highest degree of perfection, yet there are very few varieties of deciduous fruit that are not found within the state.

Oregon can geographically be divided into two districts,—western and eastern Oregon; the Cascade Range is the dividing line. Western Oregon, in turn, can be divided into two great districts, each of which can be further subdivided. The first great district extends between the Cascade and Coast Range Mountains and includes the Willamette, Umpqua, Rogue River, and other smaller valleys. The second district contains the area found west of the Coast Range Mountains and includes the coast counties of Coos, Lincoln, Tillamook, and so on.

East of the mountains several divisions can be made. First, there are those regions along the Columbia River and certain other parts of eastern Oregon which have a low altitude. These areas include such well-known districts as The Dalles, Hermiston and Freewater-Milton, which is a part of the Walla Walla Valley. Second, there are those regions which contain valleys of fairly high altitude, in the neighborhood of 2,000 feet, such as the Grand Ronde and certain areas in the vicinity of Vale and Ontario and a few of the interior valleys such as the John Day. The third district includes those regions found on the high tablelands. On the whole, this district is rather too bleak for successful commercial orcharding. There are, however, certain select parts along the streams and along certain of the lakes, like Summer and Goose lakes, that are splendidly adapted for fruit- and vegetable-production.

Hidden among the Cascade Mountains are found certain valleys which do not come in any of the classes already enumerated. These include such well-known regions as the Hood River and Mosier valleys.

In Oregon, fruit-growing is largely confined to valleys nestled among the mountains. Some of these valleys are very large; the Willamette Valley, for example, has 5,000,000 acres of tillable land. On the other hand many of the valleys are comparatively small, often containing only a few thousand acres.

The apple is the leading horticultural crop in Oregon and is being grown commercially in every horticultural section of the state. Within the last ten years, the planting of apples has gone forward on a tremendous scale and in the near future the output of this fruit should be enormous.

The prune is the second crop of horticultural importance in the state. East of the Cascade Mountains, it is grown in limited quantities for shipping green, while west of the mountains it is grown largely for evaporation purposes. The Italian (Fellenberg) prune is the principal variety grown, although a considerable quantity of French or Petite prunes are produced, especially in southern Oregon. There is an increased interest being shown in the prune within the last two years and new plantings have been very extensive.

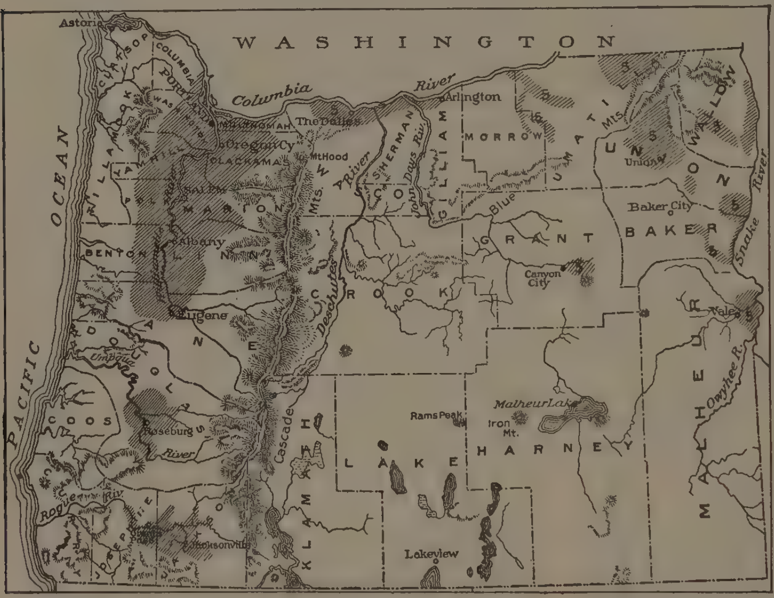
The pear is rapidly coming to the front commercially. In certain sections, very large areas have been planted and the tendency all over the state is to increase the acreage devoted to its culture. At the present time the pear-growing areas are confined to certain sections of western and southern Oregon.

Sweet cherries are grown very extensively in western Oregon. The Willamette Valley excels in cherry-production, the Lambert doing especially well in that section, although the Royal Anne and Bing are grown commercially. Along the Columbia River, in the vicinity of The Dalles, the Royal Anne (Napolean Bigarreau) does extremely well. In the higher altitudes of eastern Oregon, the Bing becomes the leading variety. Few sour cherries except those produced for home purposes are being grown at the present time. This fruit, however, does remarkably well in the state and there is some inclination toward commercial plantings.

Peaches are grown largely as fillers, there being but very few sections of the state as yet that have a distinct peach industry. The nearest approach to this condition is found at certain points along the Columbia, the Mission bottoms of the Willamette near Salem, and certain parts of the Rogue River Valley, especially at Merlin and Ashland.

In western Oregon, the principal developed horticultural regions are the Rogue River, the Umpqua, and the Willamette valleys. The Rogue River is rapidly becoming the pear center of the state. Large acreages of such varieties as Bartlett, Bosc, Winter Nelis, and Comice have been planted. In addition to the pear, extensive areas of apples, apricots and peaches are being grown. Grapes, especially of the vinifera type, such as the Tokay, Malaga and Muscat are receiving considerable attention.

The Umpqua Valley is rapidly developing into an apple district. Spitzenberg and Yellow Newtown are the leaders. Large areas of this valley, however, are devoted to the culture of French prunes, a few Italian prunes, and a scattered planting of almonds and English walnuts. The region is extremely early and some attention is being given to the production of early fruits and vegetables.



2533. Oregon, with the main horticultural parts.

The Willamette Valley, which is the largest horticultural valley in the state, is the center of the Italian prune, sweet cherry and the English walnut industry. In addition to these crops, large areas have been planted to both apples and pears. At the present time there is a revival of interest in the pear and a large acreage devoted to this fruit is being established. The loganberry output at the present time is largely centered in the Willamette Valley. The valley is so large and has so many varied conditions that its horticulture is becoming greatly diversified.

Along the coast, small-fruits grow to the highest degree of perfection and this is especially true of the brambles. The coast districts are also producing apples commercially, such varieties as the Gravenstein and King of Tompkins County growing particularly well. Coos Bay, from a horticultural point of view, is the leading section.

Along the Columbia River, in the heart of the Coast Range Mountains, is the Hood River Valley. This valley is unsurpassed in the grade of Spitzenberg and Yellow Newtown apples which it produces. There are other varieties which are being grown commercially and, of late, considerable attention has been given to pears, such varieties as the Anjou, Comice, and Bartlett all doing well. This section is also famous for its strawberry-production, the strawberry being the principal crop grown among the young trees. A few miles east of Hood River is a small section known as the Mosier Valley which has conditions similar to those found in Hood River.

The Dalles district which is along the Columbia River, 22 miles east of Hood River, is becoming famous for its stone-fruits, and vinifera grapes. Royal Anne cherries, apricots, peaches, plums and prunes, Tokay, Malaga and Muscat grapes grow to a wonderful degree of perfection. This section is also producing large quantities of vegetables, especially tomatoes for table use.

The Freewater-Milton district, which is a part of the Walla Walla Valley, is characterized by the diversity of crops which it produces. This region is very early and is attracting particular attention because of its ability to put early fruits and vegetables into our leading city markets. Nearly all the fruit from this district is shipped fresh.

The Grand Ronde Valley in eastern Oregon, in Union County, has one of the largest areas planted to apples to be found in the state. Such varieties as York Imperial, Rome Beauty, Gano and Jonathan are being planted very extensively. At Cove, in this same valley, prunes and cherries predominate. The Bing cherries from this district are famous because of their splendid shipping qualities.

There are many other valleys in the state which are producing fruit, but as yet only in small quantities. Some of these districts, such as the Pine Valley, Eagle Valley, John Day Valley, and a few regions in the vicinity of Ontario and certain select parts in proximity to Summer and Goose lakes, will undoubtedly develop their horticultural possibilities very extensively in the near future.

Oregon is developing a very large nursery business. In fact, one of the largest nurseries in the United States, namely the Oregon Nursery Company, is located at Orenco. This nursery has 1,000 acres planted to nursery stock at Orenco besides plantings in other parts of Oregon. There are also a number of smaller nurseries located throughout the state. Most of these, however, are in western Oregon in close proximity to Portland.

Among the unusual crops which are being grown in the state should be mentioned the English holly. A large number of persons are planting out this tree commercially. The tree thrives especially well in the rolling foothill country of western Oregon.

The cranberry is produced in this state very successfully and in all the coast counties limited areas of cranberry land can be obtained. Up to the present time, all bogs established have proved themselves very productive and have shown great promise for the future.

The loganberry is rapidly becoming one of the leading horticultural crops and the indications are that within the next ten years it may surpass in output all the other horticultural crops in the state. West of the Cascade Mountains there are large areas adapted to this fruit. It is very productive and, having so many uses, is meeting with a brisk demand. It is canned for sauces and pies, evaporated, made into jellies and jams, and produces a most excellent beverage similar to grape-juice.

Broccoli-growing is beginning to attract a great deal of attention. This crop is very easily grown and can be harvested during the winter, and in the very near future large shipments will be sent out of the state. A large area of land along the Columbia River and in the coast counties, and certain districts west of the Cascades, are adapted for this crop.

The onion is becoming one of the leading vegetable-gardening crops and is confined to certain sections of western Oregon which contain what is known as the Beaverdam soils. Many carloads of onions are shipped out of the state annually.

Some attention is being given to ginseng-growing, although as yet this industry is still in its infancy.

Since Oregon has few large cities, park systems of great importance have not been developed. However, the smaller towns and cities are growing very rapidly and many of them are establishing splendid foundations for future development. There are farms of vast acreage, but very few private estates have been developed as country homes.

The first fruit brought into the Northwest was introduced by the Hudson Bay Company in 1824. A group of young men who were about to sail from England for Vancouver were attending a banquet, and the young women present saved the seed from the apples eaten on the occasion, and gave them to the young men to plant in the new country. These seeds were eventually planted and the resultant grove of trees produced the first apples grown on the Pacific coast. In 1847, Henderson Lewelling and William Meek brought across the prairies from Iowa several thousand grafted sprouts, a few trees and a large quantity of seed. With this stock they established the first nursery in the state at Milwaukee. Ralph C. Geer, in the same year, also brought seed from the East and planted it. All these men were closely associated with the horticultural development of the state and, together with Seth Lewelling, were instrumental in its inception.

Seth Lewelling produced some of our finest varieties of fruit. Among these are the Bing and Black Republican cherries, which were produced in the sixties, and the Golden prune produced in 1876. J. H. Lambert in 1896 presented the Oregon State Horticultural Society with the Lambert cherry. This variety is probably the finest cherry grown in America, and is rapidly becoming our leading shipping sort. A. I. Shippley for years was identified with the grape industry, and was responsible for the introduction of many varieties which are now being grown commercially. Mr. Pettyman introduced the Oregon cherry, which is now being grown on a commercial scale in various parts of the state. Cyrus Hoskins brought out the Hoskins, Vesta and Lake cherries. They are very good, and superior to many now grown in America, but, owing to the introduction of the Bing and Lambert, have not been planted extensively. The Major Francis cherry, one of our best early varieties, was introduced by G. W. Walling, of Portland.

Other varieties of fruit of commercial importance which have been introduced by Oregon are the Winter Bartlett pear, Willamette and Pacific prune, Early Charlotte peach, Vanderpool Red apple, Clark Seedling, Gold Dollar, Magoon and Oregon strawberries.

Public-service agencies for horticulture.

Under the Land-Grant Act of 1862, Oregon was granted 90,000 acres of land. There was no state college in Oregon in 1868. The Legislature that year provided for the location of the land received and gave the interest on funds derived from the sale of the land to the Corvallis College, a private institution in Benton County, which was then under the control of the Methodist Episcopal Church. In 1885, the church voluntarily relinquished its claim on the College, and the State assumed entire control of the institution, which then became known as the Oregon Agricultural College. There are at present fourteen members of the horticultural staff.

The Experiment Station is also located at Corvallis. There are fifteen men giving part or all of their time to horticultural research work. Two of these men are located at Talent, in southern Oregon, where 20 acres of land are being devoted to pear-production problems. In Hermiston, eastern Oregon, three men are studying fruit-production problems under irrigated conditions, 40 acres of land being used for these problems. One man is located at Hood River, Oregon, investigating special apple problems. Forty-three bulletins on horticultural subjects have been issued in addition to circulars.

The College is also paying considerable attention to extension work, one man devoting his entire time to extension work in pomology.

There are no other institutions in the state giving instruction in horticulture. There is one correspondence school known as The Pacific Horticultural Correspondence School located at Orenco. Considerable attention is being given in the state to work in school-gardens and children's club work in horticulture. Other than this, however, there is very little horticultural teaching done, with the exception that in a few high-schools courses have been introduced.

The Oregon State Horticultural Society is the leading society of its kind in the state. There is a special State Board of Horticulture consisting of five commissioners, the state being divided into five horticultural districts and one commissioner having charge of a district. In most of the counties will be found County Fruit Inspectors under the jurisdiction of a commissioner. The duties of the Board of Horticulture consist largely of police duties, enforcing horticultural laws on spraying, quarantine, and so on.

Statistics (Thirteenth Census).

The approximate land area of Oregon in 1910 was 61,188,480 acres. The land in farms was 11,685,110 acres, or 19.1 per cent of the land area. Of this land in farms, 4,274,803 acres were improved land; 2,237,826 acres were woodland, and 5,172,481 acres other unimproved land in farms. The number of all the farms in 1910 was 45,502, and the average acreage of each 256.8. [The total area is 96,699 square miles].

The leading agricultural crops of Oregon are cereals, hay and forage and hops. The acreage of cereals increased from 1,222,648 in 1899 to 1,242,300 in 1909, when the production was valued at $17,860,136, which was 36.4 per cent of the total value of all crops. Hay and forage increased in acreage from 731,823 in 1899 to 939,979 in 1909, when the production was valued at $15,225,957, which was 31 per cent of the total value of all crops. Hops increased in acreage from 15,433 in 1899 to 21,770 in 1909, when the production was valued at $2,838,860. The value of forest products of the farms in 1909 was $2,889,991, as compared with $1,300,724 in 1899.

Horticultural crops produced in Oregon are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was $3,452,205, as compared with $1,071,129, in 1899. Small-fruits increased in acreage from 3,470 in 1899 to 5,122 in 1909, when the production was 9,348,490 quarts, valued at $641,194. The total acreage of potatoes and other vegetables increased from 46,407 in 1899 to 67,399 in 1909, when the value of the production was $4,548,523. Excluding potatoes, the acreage of other vegetables increased from 16,345 in 1899 to 23,129 in 1909, when the value of the production was $2,448,917. Flowers and plants and nursery products increased in acreage from 1,072 in 1899 to 2,298 in 1909, when the production was valued at $1,051,853.

The total production of orchard-fruits in 1909 was 4,423,244 bushels, an increase of 190.6 per cent over the production in 1899. Apples were the most important of the orchard-fruits, with plums and prunes second in importance. The number of apple trees of bearing age in 1910 was 2,029,913; those not of bearing age, 2,240,636, and the production in 1909 was 1,930,926 bushels, valued at $1,656,944. The plums and prune trees of bearing age in 1910 numbered 1,764,896; those not of bearing age, 427,609, and the production in 1909 was 1,747,587 bushels, valued at $838,783. Pear trees of bearing age in 1910 numbered 273,542; those not of bearing age, 795,669; and the production in 1909 was 374,622 bushels, valued at $366,977. Cherry trees of bearing age in 1910, numbered 223,456; those not of bearing age, 313,770; and the production in 1909 was 181,089 bushels, valued at $269,934. Peach and nectarine trees of bearing age in 1910 numbered 273,162; those not of bearing age, 508,179; and the production in 1909 was 179,030 bushels, valued at $194,314. Other orchard fruits produced were 4,616 bushels of apricots, valued at $7,727, and 5,354 bushels of quinces, valued at $5,140.

The production of grapes in 1909 was 3,206,874 pounds, valued at $98,776. The vines of bearing age in 1910 numbered 381,302; those not of bearing age 468,598.

The production of nuts in 1909 was 177,632 pounds, valued at $13,208. English or Persian walnuts are the most important nut, the production in 1909 being 79,060 pounds, valued at $8,288. The English walnut trees of bearing age in 1910 numbered 9,526; those not of bearing age, 177,004. Other nuts produced in 1909 were: 17,515 quarts of almonds, valued at $2,468; 69,097 pounds of black walnuts, valued at $1,333; and 5,731 pounds of chestnuts, valued at $599.

Of the small-fruits, strawberries are the most important in Oregon, with raspberries and loganberries ranking next. The acreage devoted to strawberries increased from 1,792 in 1899 to 2,941 in 1909, when the production was 5,322,040 quarts, valued at $395,349. Raspberries and loganberries increased in acreage from 479 in 1899 to 1,460 in 1909, when the production was 2,644,948 quarts, valued at $150,729. Blackberries and dewberries decreased in acreage from 717 in 1899 to 431 in 1909, when the production was 915,744 quarts, valued at $61,066. Other small-fruits produced were: 307,395 quarts of gooseberries, valued at $20,893; 117,354 quarts of currants, valued at $9,452; and 40,864 quarts of cranberries, valued at $3,527.

The acreage of potatoes increased from 30,035 in 1899 to 44,265 in 1909, when the production was 4,822,962 bushels, valued at $2,098,648. Of the other vegetables produced the more important were: 721 acres of onions, valued at $168,261; 591 acres of cabbage, valued at $65,296; 203 acres of tomatoes, valued at $39,060; 568 acres of watermelons, valued at $32,842; 198 acres of cucumbers, valued at $22,825; 457 acres of sweet corn, valued at $21,371; 113 acres of cantaloupes and muskmelons, valued at $14,337; 24 acres of celery, valued at $14.290; and 50 acres of horse-radish, valued at $13,570. Vegetables of less importance grown in Oregon in 1909, were asparagus, green beans, beets, carrots, cauliflower, pop-corn, lettuce, parsnips, rhubarb and squash. The whole range of temperate vegetables can be grown in the state.

The acreage devoted to the production of flowers and plants increased from 58 in 1899 to 130 in 1909. The total area under glass in 1909 was 716,543 square feet, of which 672,207 were covered by greenhouses, and 44,336 by sashes and frames. The value of the flowers and plants produced in 1909 was $268,833.

The acreage of nursery products increased from 1,014 in 1899 to 2,168 in 1909, when the value of the nursery products was $783,020, as compared with $151,498 in 1899.

C. I. Lewis.

California.

The horticultural resources of the state of California (Fig. 2534) can best be understood by a careful and thorough study of its geographical features, preferably by a contour map. Its more striking features consist of a rugged coast-line of a thousand miles on the ocean; a rugged, much-broken group of interlocked mountain chains, forming, as a whole, the great Coast Range, with its fertile valleys, plains, uplands, forests and pastures; a vast interior valley-plain, one of the richest in the world (the Sacramento and the San Joaquin valleys); the high Sierra Nevada Mountains along the northeast and east sloping down to the deserts, the Death Valley, and Salton Sink. This great region has marked unity and individuality, a multitude of local climates, much variety of soil and rainfall, and physical conditions which strongly differentiate it from the remainder of the United States. Its length north and south is 780 miles, and its width is from 150 to 350 miles. It is the second largest state in the Union, and the value of its staple horticultural products places it notably in the lead in these industries. New York, Ohio, Maine, New Jersey, Vermont, Massachusetts, New Hampshire, Connecticut, Delaware, and Rhode Island, united, have a less area than California.

The range of products grown in California is greater than that of all the remainder of the United States: the humid sea-level islands of Florida are adapted to some plants, such as cassava, which thrive but poorly in California, but on the sheltered uplands of California many species which entirely fail in Florida are perfectly at home.

In many places in California, a botanical garden might easily be established where a greater number of species of plants and trees would thrive than have yet been brought together anywhere else in outdoor culture. The United States Bureau of Plant Industry has now (1915) test-gardens in various places as far north as Chico, where many species of exotics are thriving. In ordinary cultivation in California one finds, and often on an enormous scale, the vines, walnuts and prunes of France; the olives, oranges, lemons, chestnuts, figs and pomegranates of Italy and Spain; the acacias, eucalypts, casuarinas and salt-bushes of Australia; the melons of Turkestan; the rice of China; the cotton and tobacco of the South; the hemp, flax, rye, Russian mulberries, and other products of the more extreme North, the cereals of the great West, the bulbs of Holland, the costly seed-crops of European gardens, and, in brief, examples of all the useful horticultural productions of the temperate zones, together with the greater part of the species of the semi-tropical and even some plants from the tropical regions. More than a hundred species of palms grow at Santa Barbara; many species of bamboo thrive at Bakersfield, and as far north as the base of Shasta. Eucalypts, acacias, camphor and cinnamon grow over the greater part of the state.

While the American pioneers of Kentucky were fighting the Indians and struggling to obtain the right to navigate the Mississippi, the Spanish pioneers of California were raising seedling peach, pear, lemon, orange and date-palm trees, were growing figs, grapes, and olives from cuttings brought from Mexico, and were making marvelous beginnings of horticulture about the early missions. After the American conquest, and the gold discovery of 1848, horticulture gained a foothold in the mountain lands below the Sierra peaks. Every village and town had its gardens and its beginnings of orchards. Soon the thoughts of men turned to the broad, fertile, untilled valleys, and in a few years the wheat farmer became the typical Californian.

LXXIV. North American horticulture.—Foothills orchards in California.

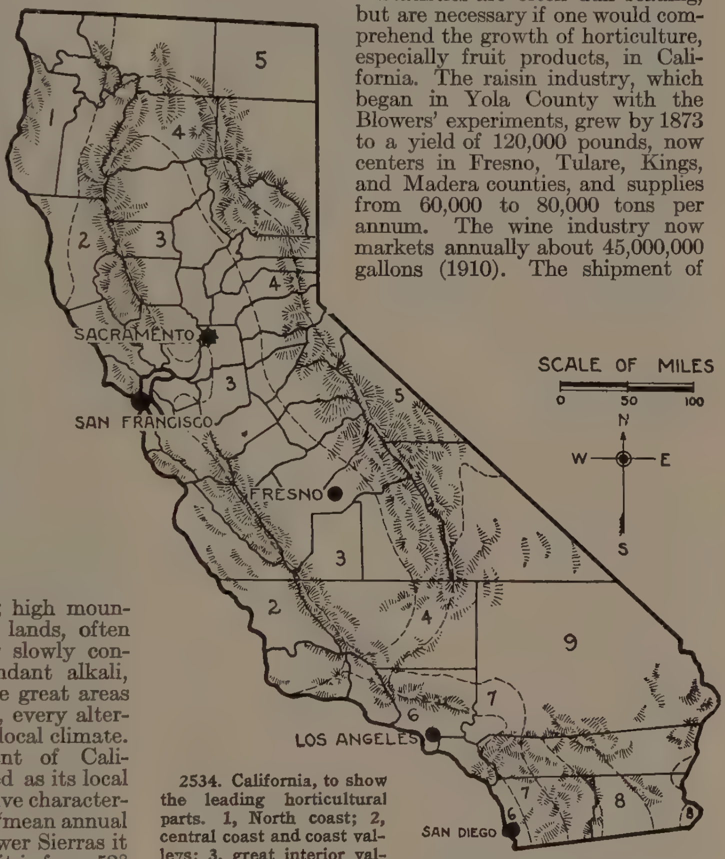
Lastly, the state entered upon a magnificant and still-continuing period of horticultural developments, which well deserves to be written down in history as one of the most important facts of modern material rogress.

Horticulture in California naturally divides itself into several distinct historical periods, such as: (1) The pre-American era, which ended with the gold discovery; (2) the pre-railroad period, when only California and to a small extent the Hawaiian Islands, the Orient and South America, were supplied with local products; (3) the period of expansion due to the opening of eastern and European markets by the railroad; (4) the modern period, since 1904, when the National Forest System, the conservation of water-supply, the rapid development of hydro-electric power all over the mountain regions of California, the extension of markets, rapid increase in population, and broader horticultural education, have united to establish every industry connected with plant life upon a more solid foundation.

Because of these recent developments in California, forests, pastures, farms, gardens, so suggestively occupy the land that, although there is room for many more, it is difficult to call anything horticulturally worthless except the great heights that shelter and water the valleys below. Even the deserts have underlying streams, and blossom with trees and vines as men sink artesian wells there; and on the unirrigated deserts the spineless cacti begin to create a new industry. The miracles of Italy, ancient Palestine, modern India, are being repeated over large districts of California.

The great valleys and nearly level lands of California, subject to frosts, comprise about 40,000,000 acres of land; the foothill fruit-belts, of Coast Range and Sierra, hardly as yet one-fifth occupied, comprise fully 25,000,000 acres; in timber and fine grazing land, capable of perpetual renewals, are 15,000,000 acres; high mountains cover some 10,000,000 acres; arid lands, often yielding enormously under irrigation, or slowly conquered by neutralizing their superabundant alkali, occupy about 8,000,000 acres. Over these great areas every wind current, every mountain spur, every alteration in slope or altitude, helps to make a local climate. The complicated geological development of California has produced soils almost as varied as its local climates. The state has been divided into five characteristic climate-zones: in the high Sierras the "mean annual temperature" is from 30° to 44°; in the lower Sierras it is from 44° to 52°; near the Pacific Ocean it is from 52° 67°; in the central valleys of Sacramento and San Joaquin it is from 60° to 68°, and in the southern counties from 68° to 72°. But every part of California shows very sharp horticultural contrasts upon farms not a mile apart. Local climate is the true keynote of California life. Placer County, for example, extends from the center of the Sacramento Valley east to the summit of the Sierras. It has upland Canadian valleys, pines and snow-blockades at one end; groves of oranges and lemons in the Sierra foothills, and rich alfalfa and rice fields along the "bottoms" of the Sacramento Valley rivers. Too much emphasis cannot be placed upon this local variation. For California no reliable horticultural map can yet be made. Citrous fruits, for example, are found to thrive wonderfully along the foothills of the Sacramento and the San Joaquin valleys, and far up in many a mountain valley. The most careful experimenting with each location, and indeed with all parts of each separate farm, are the keynotes of success in California. "Mean annual temperature" is a comparatively small factor in the California climate; winds, fogs, rainfall, frosts, and the daily variations of temperature are the all-important items.

It is now evident (1915) that the growth of citrous fruits, European grapes, olives, walnuts, chestnuts, and the finer deciduous fruits, will be leading industries over three-fourths of California; that large portions of the valleys of the Coast Range and some of the Sierra foothills will increasingly produce winter vegetables, small-fruits, the finer seeds, bulbs, cut-flowers, and the like; that the hotter, more arid districts will grow date palms, spineless cacti, the earliest melons, and many tropical fruits. In these respects Imperial Valley has been a revelation of immense possibilities.



2534. California, to show the leading horticultural parts. 1, North coast; 2, central coast and coast valleys; 3, great interior valleys and lower foothills; 4, higher foothills and mountains; 5, arid plateaus and mountains; 6, southern coast; 7, southern foothills; 8, irrigated desert areas; 9, southern desert.

Statistics are often dull reading, but are necessary if one would comprehend the growth of horticulture, especially fruit products, in California. The raisin industry, which began in Yola County with the Blowers' experiments, grew by 1873 to a yield of 120,000 pounds, now centers in Fresno, Tulare, Kings, and Madera counties, and supplies from 60,000 to 80,000 tons per annum. The wine industry now markets annually about 45,000,000 gallons (1910). The shipment of fresh deciduous fruits in 1911 above the supply of local demand, approximated 13,000 carloads; the shipments of cured fruits in 1911 were nearly 190,000 tons; the citrous fruit crop of that year was 14,000,000 boxes. The annual pack of canned fruits and vegetables is not less than 5,000,000 cases. Shipments of 1910 were 73,745 tons of canned fruits and vegetables and 78,829 tons of green vegetables, besides local consumption.

The growth of these interests can also be illustrated by the census reports on trees and vines. The first assessor's tabulations in 1850 showed a few dozen grape-vines, orange trees, and the like, about the old missions. In 1893, these reports showed that nearly half a million acres were in vineyards and orchards; seventeen years later (1910) the State Board of Equalization report of vines was as follows:

Class of fruit	Acreage bearing	Acreage non-bearing
Grape, table	35,859	17,970
Grape, raisin	108,882	19,385
Grape, wine	125,109	35,518
Total acreage of vines	269,850	72,873
Total of all vines	342,723 acres	

In 1914, the state had nearly 1,200,000 acres in orchards.

The five leading counties in their acreage of table grapes are San Joaquin, Fresno, Sacramento, Tulare and Placer. In raisin grapes, Fresno greatly leads, with Kings second, and Sutter third. Fresno, Napa and San Joaquin lead in wine grapes; Santa Cruz, Sonoma and Mendocino have the greatest number of apple trees; Santa Clara, Kings, Alameda and Ventura of apricots; Fresno, Kings, Placer and Santa Clara, of peaches; Fresno and Los Angeles of figs; Fresno and Placer of nectarines; Los Angeles, Riverside and Tehama of olives; Santa Clara, Sonoma and Placer, of plums and prunes; San Bernardina, Los Angeles, Riverside and Tulare of citrous fruits.

In recent years, the nursery business has been greatly extended, particularly in southern California, where the demand for rare plants and trees is constantly increasing.

Active clubs and associations of florists, gardeners, nurserymen, and amateurs interested in horticulture exist in various parts of California. In Ventura, Santa Barbara, the Lompoc Valley, Pasadena, Whittier, Santa Ana, Pomona, Riverside, and over a large area around Los Angeles, also in Santa Clara, Alameda, Marin, Sonoma, and other counties, many of the lesser horticultural industries are gaining strength year by year, as population increases.

The growth of parks, fine estates, and horticultural collections of note, while not as yet developing into a really great botanic garden, such as California should have, has still been noteworthy. The Golden Gate Park of San Francisco, the parks and public squares of Oakland, San Jose, Sacramento, Fresno, Los Angeles, Riverside, Pasadena, Redlands, San Diego, and many other cities, are becoming of much interest and importance. The beauty and, indeed, the splendor, of thousands of superb private estates around San Francisco, north, south, and on the east side of the Bay, in Santa Cruz and Monterey, and in southern California, have achieved a world-wide fame. Of especial importance are the Bidwell collections at Chico, the Gillespie arboretum at Montecito, Smiley Heights at Redlands, the Del Monte gardens near Monterey, the Stanford plantings at Palo Alto, the Tevis bamboos near Bakersfield, the collections of Dr. Pierce at Santa Ana, the government plant-gardens at Altadena, Chico, and other points, and the University of California stations at Berkeley and Santa Monica.

One of the most impressive facts connected with California horticulture is the extent to which state and national study of the problems involved has resulted in better methods and more complete organization. The citrous industry in particular has greatly profited from the investigations made by experts upon cultural methods, packing details, and so on. The University of California, the Experiment Station and institute work, have everywhere taught scientific methods and organization, until now (1912) the effectiveness of the fruit exchanges, and the general interest in the movement toward complete standardization of methods and products is everywhere increasing. One of the greatest factors in this progress is the State Horticultural Commission, formerly the State Board of Horticulture.

California has had many horticultural publications, large and small; some of them continue, and others enter the field every year. The Pacific Rural Press, although not horticultural in name, has presented the horticultural adaptabilities from its foundation in 1870, under the editorship of Professor Wickson. The official literature, state and national, and the mass of reports upon its horticultural industries which envoys from other countries have issued, is very large indeed.

The most striking single fact, however, in regard to California horticulture appears to be that since 1900 it has shown a marked tendency toward systematic organization and the most painstaking scientific study of its problems, to the end that as new horticultural centers develop, and older ones increase, each community will specialize according to its local resources. At the present time (1912) a committee of nurserymen are collecting and tabulating all available facts in regard to the percentage of trees which reach profitable bearing under different conditions, and in different localities. A similar spirit of investigation extends to all the minor horticultural industries, so numerous and so rapidly increasing in importance with a growing population. The planting of eucalpyts on a large and widely-advertised scale, has lessened, but still goes on. Acacias are being planted, to some extent, for tanbark, and bamboos for furniture.

The horticultural development of California has come in large measure from the tireless efforts of many and hard-working pioneers in every department. Nurserymen and gardeners like Fox, West, Rock, Lewelling, Sievers, spent their profits in experiments and introductions. Men and women like E. L. Beard, General John Bidwell and his wife, J. DeBarth Shorb, of San Gabriel, Mrs. Jeanne C. Carr, Mrs. Theodosia B. Shepherd, of Ventura, Mrs. M. E. Sherman, and many others, did noble pioneer work.

Public-service agencies for horticulture. (W. T. Clarke.)

The Land-Grant College is situated at Berkeley, and was established in 1868. The horticultural staff consists of thirty members. Aside from the usual equipment, the department has about 100 acres in the central and northern part of the state devoted to orchard purposes, and 200 acres devoted to the same purpose at the Riverside Citricultural Station.

The Experiment Station is also located at Berkeley, although the larger part of the work is done at the farm at Davis, the Kearney farm near Fresno and at the Riverside Station. A small amount of work is also done at the Imperial Valley Station, near Meloland. About 160 horticultural bulletins and 62 circulars have been issued.

Extension work in horticulture is given in connection with farmers' institutes, movable or extension schools and agricultural rural improvement clubs. An extensive correspondence is also carried on by the department.

Horticulture is taught in many of the public schools.

Statistics (*Thirteenth Census*).

The approximate land area of California comprises 99,617,280 acres, of which 27,931,444, or 28 per cent, are in farms. Of these 27,931,444 acres in farms, 11,389,894, or 40.8 per cent, are unimproved; 4,541,767 acres are in woodland; and 11,999,783 acres are unimproved. The total number of farms in the state is 88,197. The average acres to the farm are 316.7. [The total area of the state is 158,297 square miles.]

The leading agricultural crops are cereals, hay and forage, hops, sugar crops, and forest products. The cereals occupied 17.3 per cent of the improved land, or 1,970,492 acres, in 1909, a decrease in acreage of 50.8 per cent since 1899, when they occupied 4,004,254 acres. The value of the cereal products in 1909 was $28,039,826. Hay and forage occupied 22.2 per cent of the improved land area in 1909, or 2,533,347 acres, an increase in acreage of 13.1 per cent since 1899, when they occupied 2,239,601 acres. The value of hay and forage in 1909 was $42,187,215. The acreage of hops increased from

6,890 in 1899 to 8,391 in 1909, an increase of 21.8 per cent. The value of hop products in 1909 was $1,731,110. Sugar crops increased in acreage 92.4 per cent,—from an acreage of 41,382 in 1899 to 79,604 in 1909. The value of the sugar crops in 1909 was $4,335,358. The value of the forest products increased from $1,724,378 in 1899 to $2,949,732 in 1909.

The leading horticultural crops are fruits and nuts, the products of which were valued at $49,917,655 in 1909; vegetables (including potatoes), the total acreage of which, in 1909, was 151,962, and their value $12,121,958; flowers, plants and nursery products, the acreage of which was 5,816 in 1909, an increase of 62.2 per cent since 1899, and their value $3,601,301; and small-fruits comprising an acreage of 9,687 in 1909, an increase of 54.2 per cent since 1899. The value of the small-fruits in 1909 was $1,789,214.

The total quantity of orchard-fruits producted in California in 1909 was 31,501,507 bushels, valued at $18,358,897. Plums and prunes, peaches and nectarines, apples and apricots are the most important of the orchard-fruits. In 1909, there were produced 9,317,979 bushels of plums and prunes, valued at $5,473,539; 9,267,118 bushels of peaches and nectarines, valued at $4,573,775; 6,335,073 bushels of apples, valued at $2,901,662; and 4,066,823 bushels of apricots, valued at $2,768,921. Of the orchard-fruits of less importance, there were produced in 1909, 1,928,097 bushels of pears, valued at $1,660,963; 501,013 bushels of cherries, valued at $951,624; and 32,638 bushels of quinces, valued at $26,266, together with 52,766 bushels of mulberries, valued at $2,147.

The production of grapes in 1909 amounted to 1,979,686,525 pounds, valued at $10,846,812. The number of vines of bearing age in 1910 was 144,097,670; those not of bearing age, 39,526,319.

The production of nuts in 1909 was 28,378,115 pounds, valued at $2,959,845. Most of the nuts were Persian or English walnuts and almonds, there being produced in 1909, 21,432,266 pounds of the former, valued at $2,247,193 and 6,692,513 pounds of the latter, valued at $700,304. The production of other nuts and their value are as follows: 159,374 pounds of black walnuts, valued at $2,562; 44,955 pounds of pecans, valued at $4,632; 37,153 pounds of chestnuts, valued at $3,474; and 4,550 pounds of Franquette, valued at $910.

The value of the tropical fruits in 1909 was $16,752,101, an increase from $7,219,000 in 1899. The value of oranges represents three-fourths of this total, and the value of lemons is next in importance. In 1909, the production of oranges was 14,436,180 boxes, valued at $12,951,505; that of lemons 2,756,221 boxes, valued at $2,976,571; that of olives, 16,132,412 pounds, valued at $401,277; that of figs, 22,990,353 pounds, valued at $260,153; and that of pomelos (grapefruit), 122,515 boxes, valued at $143,180. Other tropical fruits grown in California are loquats, tangerines, guavas, Japanese persimmons, pomegranates, mandarins and dates.

Strawberries are by far the most important of the small-fruits raised in California, with raspberries and loganberries, and blackberries and dewberries ranking second and third, respectively. The total production in 1909 was 26,824,120 quarts, as compared with 14,852,000 quarts in 1899. The acreage of strawberries increased from 2,418 in 1899 to 4,585 in 1909; the production in 1909 was 15,694,326 quarts, valued at $1,149,475. The acreage of raspberries and loganberries increased from 987 in 1899 to 1,992 in 1909; the production in 1909 was 5,222,117 quarts, valued at $304,169. The acreage of blackberries and dewberries increased from 1,960 in 1899 to 2,576 in 1909; the production in 1909 was 4,898,524 quarts, valued at $282,383. The production of the other small-fruits, and their value, in 1909, was as follows: currants, 852,378 quarts, valued at $43,508; gooseberries, 145,119 quarts, valued at $9,086, and cranberries, 10,656 quarts, valued at $443.

Of the vegetables grown in California, potatoes, sweet potatoes and yams are the most important. The acreage of potatoes in 1909 was 67,688, an increase of 60.8 per cent from that in 1899, when it was 42,098. The production of potatoes, in 1909, was 9,824,005, valued at $4,879,449. During the same period, the acreage of sweet potatoes and yams increased 218 per cent; an increase from 1,607 acres in 1899 to 5,111 acres, in 1909. The production in 1909 was 572,814 bushels, valued at $355,624. The leading vegetables, other than potatoes, sweet potatoes and yams, their acreage, and value in 1909 follow: asparagus, 9,399 acres, valued at $448,694; green beans, 7,646 acres, valued at $309,439; cabbage, 3,647 acres, valued at $306,858; cantaloupes, 5,784 acres, valued at $406,944; celery, 2,881 acres, valued at $381,759; onions, 4,391 acres, valued at $472,808; tomatoes, 5,932 acres, valued at $504,704; and watermelons, 6,065 acres, valued at $255,977. Among the other vegetables grown were beets, carrots, cauliflower, sweet corn, cucumbers, lettuce, green peas, green peppers, rhubarb, turnips, and squash.

The total acreage of flowers and plants in 1909 was 1,013, as compared with 672 in 1899. The number of square feet under glass in 1909 was 5,037,132, of which 4,422,423 were covered by greenhouses and 614,709 by sashes and frames. The value of the products from flowers and plants in 1909 was $1,388,513.

The acreage of nursery products increased 64.8 per cent from 1899 to 1909, the number of acres being 4,803 in 1909, as compared with 2,914 in 1899. The value of the nursery products in 1909 was $2,212,788, as compared with $558,329 in 1899.

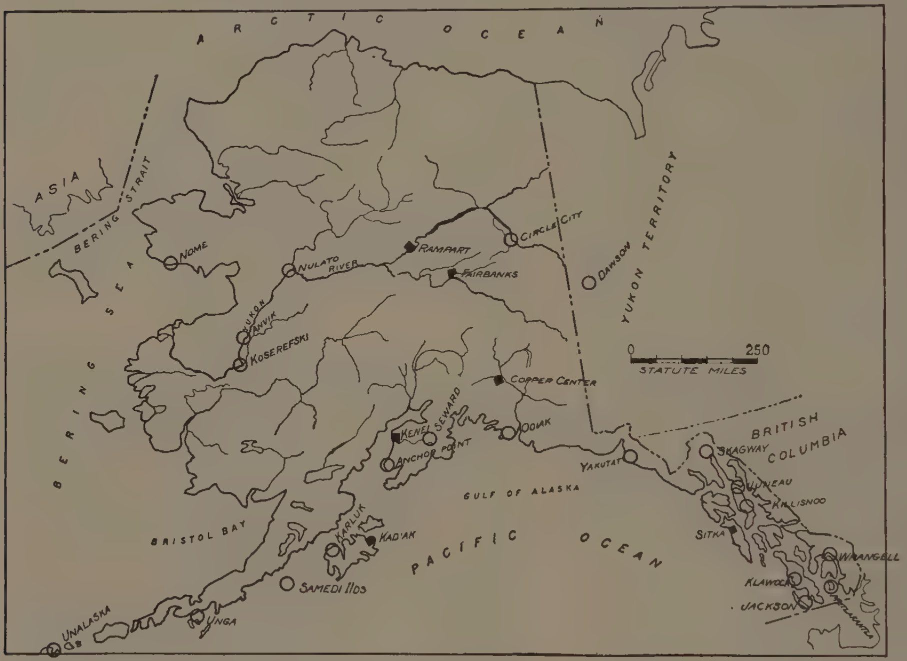
Charles H. Shinn.

ALASKA.

When considered from a horticultural or agricultural point of view, Alaska (Fig. 2535) may be very conveniently divided into two divisions, the southern coast region and the interior. These two regions differ very materially in their climate, and may be ultimately found as unlike in their possibilities. The climate of the coast region, which extends from Dixon's Entrance on the southeast to Unalaska on the southwest, is characterized by a heavy rainfall, a great preponderance of cloudy weather, and a rather low summer temperature, with little or no diurnal variation in the readings of the thermometer. The winter temperature is not excessively cold, zero weather being seldom experienced, while in the summer it is seldom high. The average rainfall, as shown by data from the Government Weather Service, varies between 55.9 inches at Killisnoo to 112 inches at Sitka, 113.6 inches at Unalaska, and 144.5 inches at Fortman Fish Hatchery, about one-third of the precipitation falling during the growing period, from May to September. The data concerning the interior portion of the country are mainly from along the Yukon River, that being the great thoroughfare of the region, and also from the valleys of the Tanana and Copper rivers. Here the rainfall is slight, varying between 9.31 inches at Copper Center, 10.8 inches at Rampart, and 13.6 inches at Fairbanks, and during summer clear skies are the rule. The intense cold of winter is followed by comparatively warm temperature in the summer, with a growing period of about four months, although occasional frosts have been reported from the upper part of the valley during the summer months. Maximum temperatures of above 90° F. have been reported from a number of interior stations. The regions about Cook Inlet and the lower part of the valley of the Susitna River have an intermediate climate, more rainfall than the interior valleys, and colder winters than those of the coast region.

The soils of the two regions, which in many places are thin and from various causes quite acid in reaction, are very similar, being largely of vegetable origin overlying rock or glacial deposits. In the coast region, arable areas are confined to rather narrow valleys and the slopes along the sea. In the interior are reported more extensive areas of comparatively level land. Of the coast region, the most extensive area of land adapted to cultivation is that on the Kenai Peninsula, and, extending across Cook Inlet, is continued up the Susitna River. This region, on account of its position relative to ocean currents, partakes more of the climatic characteristics of the interior, although still somewhat modified.

The accompanying map shows regions where some attempts have been made in gardening, from which definite reports have been secured. From the data at hand it seems probable that the local supplies of hardy vegetables might be produced nearer at hand than the Puget Sound. This is undoubtedly true of many parts of the country, where the production need be limited only by the demand for such supplies and the ability to secure arable lands at a cost that will permit the producer to compete with the Sound country. For some time certain economic features will enter into the subject of extensive horticulture. Among these are the high price of labor, the standard being at present determined by the wages paid for gold-mining, the question of transportation, and the rather limited markets.



2535. Alaska.

As it exists at the present time, horticulture in Alaska is of a very primitive type. A few gardens here and there, with perhaps a row of berries along the side and an occasional fruit-tree, represent nearly all that is done along this line. Near all the more important towns are market-gardens of considerable importance, but elsewhere only small areas are cultivated.

It has been said that during the Russian occupancy of the country, many attempts were made to cultivate gardens and fields, but the data are often so meager and contradictory as to throw doubt upon the sincerity of the endeavor. In the accompanying account, it is desired to place on record some of the horticultural achievements as gathered from reports from gardeners in many places, the personal observations of the writer during two seasons in the country, and the results of experiments conducted at experiment stations which have been maintained by the United States Department of Agriculture for ten or more years at Sitka, Fairbanks, Rampart, Copper Center, Kenai, and Kodiak. At all these places trials have been conducted of all the more important vegetables, and at Sitka of a considerable number of fruits and berries, as well as various ornamentals.

The great abundance, both in kind and quantity, of native fruits, especially berries, has doubtless contributed to the delay in the attempted introduction and cultivation of other sorts. Some early effort was made in this line, as is shown by the presence at Sitka of a number of old apple trees, remnants of the Russian days, which bear a very inferior fruit. A few young bearing trees of unknown variety are grown at the same place. At Wrangell, there were in 1898 apple trees of what were thought to be the Red June variety in bearing, and young thriving trees are known at Juneau and Metlakahtla. The mountain-ash (*Sorbus sambucifolia*) is grown as an ornamental tree. Attempts have been made at a number of places to cultivate some of the indigenous fruits, and the dewberry or "knesheneka" (*Rubus stellatus*), wild currants (*Ribes rubrum* and *R. bracteosum*), and the strawberry (*Fragaria chiloensis*) have all been domesticated, and their fruit is fully equal, if not superior, to the wild product.

At the Sitka Station, a number of apple trees, representing thirty or more varieties of crab, Russian, and other early apples, plum trees, and cherry trees have been under observation in the nurseries for several years. In 1911, five varieties bore mature fruit. These varieties were Yellow Transparent, Raspberry, Sylvan Sweet, Whitney, and Hyslop. In 1915 the first three varieties and Tetofsky ripened fruit. Among several varieties of cherries tested, Early Richmond has done the best and it has borne a light crop for several years. Of the plums planted, all have bloomed profusely, but none has as yet borne any fruit. The small bush-fruits thrive well over southeastern Alaska and the currant and raspberry have been successfully grown in the interior. Currants, both red and black, are indigenous to Alaska, and many of the improved varieties have been successfully introduced and distributed by the stations. Gooseberries also do well along the coast region, and they do not seem as subject to mildew as when grown elsewhere. Whitesmith, Columbus, Industry, Triumph, and Champion are varieties of gooseberry that have been successfully grown at the Sitka Station. Among the cultivated raspberries, Cuthbert does the best of any thus far tested. The fruit produced is large and well flavored, and the bushes are quite hardy. It has a long fruiting period, being in bearing at Sitka from August to October. Experiments with blackberries, dewberries, loganberries, and grapes have thus far resulted in failure. The wild salmon berry is widely distributed throughout Alaska, especially in the southeastern part. Crosses have been made between this and the cultivated raspberry, but the fruits thus far produced have been of very ordinary character. Strawberries are grown to some extent and at the Sitka Station hybrids have been made between a cultivated fruit of unknown origin and the native coast species of Fragaria, with the result that about thirty varieties exceeding the parent plants in all desirable qualities have been produced and are being propagated. The plants have proved absolutely hardy and the fruit is of large size and good quality.

More attempts have been made to grow vegetables than fruits, and some definite data have been obtained, showing what varieties are known to be adapted to Alaskan conditions. Most of the earlier data have been secured from Sitka and Wrangell, in the southeastern part of the country, and from the Holy Cross Mission, near Koserefski, on the lower Yukon. A report from the latter place states that potatoes of fine quality, weighing one and one-fourth pounds, and turnips weighing five and one-half pounds, were grown during the summer of 1898. In addition, notes were given of some of the varieties of vegetables adapted to the region, as follows: cabbage—Early Jersey Wakefield, Flat Dutch, and Drumhead; cauliflower—Early Snowball, Early Dwarf Erfurt; turnips—Early Flat Dutch, Yellow Globe, and Extra Early Milan; rutabagas—Improved American; radish—French Breakfast and Chartier; onions—Extra Early Red and Yellow Danvers; lettuce—Golden Heart; peas—American Wonder and Early Alaska; beets—Eclipse and Edmand's Blood Turnip; carrot—Oxheart; parsley—Extra Early Double Curled; celery—White Plume, Giant Pascal; rhubarb—Victoria.

The same varieties, with numerous additions, have succeeded in the coast region as well as at interior points. Snap beans, Challenge Black Wax, and Golden Wax have done fairly well at Sitka, where experiments were begun by the United States Department of Agriculture in 1898, and the English Windsor is quite in its element. At this place the Philadelphia Butter and San Francisco Market lettuce made fine heads of a most superior quality. Parsnips and carrots grow well, and salsify and spinach were successfully grown at Sitka, in 1898, for perhaps the first time. Peas were found to grow and yield well, and, in addition to the varieties above given, some of the dwarfs and the Norwegian sugar peas continued to produce their crop until cut off by the frost. The blood beets, Extra Blood Turnip and Extra Early Egyptian, grew well at Sitka, but in many places beets are a failure on account of their tendency to run to seed. This undesirable trait on the part of biennial plants is shared by other vegetables, principally turnips, although cabbage and cauliflower have been reported as doing likewise. It is believed by some growers that the flat type of turnip is more subject to run to seed than the globe type. Celery of exceedingly fine quality is grown at a number of places, although at Kodiak specimens have been seen in which the central axis was greatly elongated. The leafstalks were also lengthened in about the same proportion, and this trait was not considered undesirable.

Potatoes are more extensively grown in Alaska than any other crop, and the quality varies with the variety, locality, season, and culture. Usually little choice is exercised in the matter of varieties, but Eureka, Freeman, Early Ohio, Gold Coin, and Irish Cobbler appear well adapted to the conditions existing in this region. The two last are the best yielding varieties, and very favorable reports have been received from them wherever tried. Season and method of planting undoubtedly exert a strong influence on the crop. If the soil, which usually contains a high proportion of organic matter and moisture, is well drained or thrown up into beds, as is the custom in many places, good potatoes can be grown in the average season. Field trials of potatoes at the Rampart Station in 1911 gave yields at the rate of over 300 bushels an acre for Irish Cobbler, Gold Coin, and Eureka. Sprouting the tubers in flats in the light for two or three weeks before planting has been found advantageous in securing better quality and maturity of potatoes. In some parts of the country, especially from Cook Inlet westward, the natives until recently cultivated a small round potato, called the Russian, that seemed to be well suited to the country. It is said to have been brought from Siberia fifty or more years ago. Close planting of potatoes, as well as almost every other vegetable, is too often the rule, and to this fact alone may be attributed many failures. The object seems to be to grow a large crop by planting an abundance of seed. The result is a large growth of tops that completely shade the ground, thinning being seldom or never practised. Along the coast, where cloudy weather is the rule, it is safe to say that the sun's rays never strike the ground after the growing season has become well advanced. Under such conditions it is not an uncommon sight to see a crop of small potatoes borne in the axils of the leaves above ground, no tubers being formed below the surface.

Enough is now known of Alaska to warrant the claim that radish, mustard, turnips, kale, and lettuce can be grown anywhere up to the Arctic Circle, and, in favorable localities, even farther north than that. Carrots, parsnips, parsley, peas, cress, cabbage, cauliflower, brussels sprouts, onions, spinach, beets, rhubarb, potatoes, and mint, sage, thyme, and caraway among the herbs, can be grown along the coast and in the interior almost to the Arctic Circle if gardens are selected with reference to soil and exposure to the sun. Asparagus, beans, celery, cucumbers, squash, and salsify can be grown if planted in warm spots and given proper care and attention. In favored localities, especially about Hot Springs near Fairbanks, sweet corn, melons, tomatoes, eggplants, and other tender plants are successfully grown and on account of their rarity command high prices.

In general, considerable judgment is shown in the choice of garden sites. A southwestern slope is always preferred, and, if well drained, the garden is usually a thrifty one. In many places, the earth is thrown up into beds 4 or 5 feet wide and the crop planted crosswise the beds. Where it can be easily obtained, sand is added to warm and to lighten the soil. Kelp is extensively employed as a fertilizer in some places near the coast, but its value when added to a soil already largely composed of vegetable debris is questionable. Market-gardens have been successfully maintained for years at Skagway, Dawson, Circle City, Fairbanks, and other of the great mining centers of the Yukon, and the dirt roof of the miner's cabin is frequently utilized for early gardens, the heat from within supplying the necessary warmth required for growing early radishes, onions, lettuce, turnips, and the like.

The abundance of native fruits, especially of berries, has already been mentioned, and an enumeration of some of them would seem not out of place. Of widest distribution are the salmon berries (*Rubus spectabilis*), two so-called cranberries (*Viburnum pauciflorum* and *Vaccinium Vitis-Idæa*), currants (*Ribes rubrum*, *R. bracteosum*, and *R. laxiflorum*), crowberries (*Empetrum nigrum*), huckleberries (*Vaccinium uliginosum* and its var. *mucronatum*), blueberries (*V. ovalifolium*), red huckleberries (*V. parviflorum*), the molka or baked-apple berry (*Rubus Chamæmorus*) improperly called salmon berry in the interior, and raspberries (*Rubus strigosus*). Of less general distribution, yet very abundant in places, may be mentioned strawberries (*Fragaria chiloensis*), dewberries (*Rubus stellatus*), thimble berries (*R. parviflorus*), salal (*Gaultheria Shallon*), bog cranberries (*Vaccinium Oxycoccus*), bearberries (*Arctostaphylos alpina*), and so on.

Floriculture is not wholly neglected in Alaska, although but few data are available. Many of the hardier plants of the old-fashioned flower-garden are to be seen. Pansies of great size and brilliant color are common, and they remain in flower all summer. In some parts of the country sweet peas do well, and poppies, nasturtiums, mignonette, sweet alyssum, chrysanthemums, stock, candytuft, verbenas, and marigolds are not uncommon where any attempt is made to grow flowers. Window gardens and boxes add many sorts to the list already given.

Among ornamental perennials that have succeeded well with slight protection, or at Sitka with none, are phlox, milfoil, poppies, buttercups, columbines, iris, spirea, *Rosa rugosa*, Tartarian honeysuckle, and the like.

Experiments conducted under the direction of the Office of Experiment Stations, United States Department of Agriculture, at its stations and in coöperation with gardeners throughout the Territory for more than twelve years, have shown that much can be accomplished in various lines of horticulture if rational methods of culture and a proper selection of varieties and seed are followed. The possibility of locally producing seed of peas, turnips, rutabagas, mustard, and potato seed tubers has been fully demonstrated, and wherever such seed is planted better crops are almost invariably secured.

But little trouble has been met with from fungous diseases and insect pests, except for some mildews of apple, gooseberry, and currant, and from a root maggot that attacks many cruciferous plants. Spraying for the mildews, and rotation, and varietal selection have proved valuable aids in combating the root maggot. A variety of turnips, Petrowski, has proved quite resistant to their attack wherever it has been tried.

For further information, consult Yearbook of Department of Agriculture for 1897; Office Experiment Stations, United States Department of Agriculture, Bulletins Nos. 48 and 56; Alaska Experiment Stations, Bulletin No. 3, and Reports 1898 to 1914.

Walter H. Evans.

NOTHOCHLÆNA: *Notholæna.*

NOTHOFÀGUS (Greek words, meaning *not a true beech*). *Fagàceæ.* A genus of about 12 species, native of S. Amer., Austral. and New Zeal., closely allied to Fagus, but chiefly distinguished by the fls., both staminate and pistillate ones being borne in 3's or solitary. The lvs. are generally small, often evergreen and either plicate in bud, like those of Fagus, or not. The wood of some species, especially that of *N. Dombeyi* and *N. procera*, in Chile, and of *N. Cunninghamii*, in Austral. is much valued. They are not hardy in the N., and but little known in cult. The two following species have been recently intro. by the Dept. of Agric. **N. oblìqua,** Blume (*Fàgus oblìqua*, Mirb.). Deciduous tree, attaining 100 ft.: young branchlets glabrous: lvs. ovate-oblong, acutish or obtuse, oblique at the base, serrate, lobulate below the middle, glabrous or nearly so, with 8–11 pairs of veins, 1–2½ in. long: involucre 4-valved: nuts 3, 2 triangular and 3-winged, 1 flattened and 2-winged. Chile. **N. procèra,** Oerst. (*Fàgus procèra*, Poepp. & Endl.). Similar to the preceding: lvs. oblong, rounded at both ends, doubly crenate-serrate, pubescent beneath, up to 4 in. long. Chile.—The following 6 species have been intro. into European gardens and have proved fairly hardy in S. England and Ireland. *N. antárctica*, Oerst. (B.M. 8314, var. *uliginosa*. J.H. S. 37:53), *N. betuloìdes*, Oerst. (G.C. 1872: 467; II. 25:105; III. 33:11), *N. Cúnninghamii*, Oerst. (B.M. 8584), *N. cliffortioìdes*, Oerst., *N. fúsca*, Oerst., and *N. Mooèrei*, Krasser. They are all trees or sometimes shrubby, with small, ovate or elliptic crenate-dentate lvs., ½–1 in. long. The first one is deciduous, the others evergreen. They are perhaps oftener enumerated under Fagus, but besides the difference in the fls. they are different in habit, especially on account of their very small lvs., large only in *N. procera*. Prop. is by seeds or by layers.

Alfred Rehder.

NOTHOLÆNA (Latin, *spurious, cloak;* from the rudimentary indusium). *Polypodiàceæ.* Often written *Nothochlæna*, but the above is Robert Brown's original orthography. A group of mostly warm temperate rock-loving ferns, differing from Cheilanthes mainly in having no marginal indusium. Some of the species are coated with a golden or silvery wax-like powder. The following have been advertised only once by a dealer in native plants. Culture as in Cheilanthes, pages 734 and 1217.

A. *Foliage densely scaly beneath.*

B. *Lvs. once-pinnate.*

sinuàta, Kaulf. Lf.-blades 1–2 ft. long, 1–3 in. wide, growing on short stalks from thick, scaly rootstocks; pinnæ thick, entire or deeply pinnatifid; lower surface with rusty scales. S. W. U. S. to Chile.

ferrugínea, Hook. Lf.-blades 6–12 in. long, ½–1 in. wide, growing on wiry black stalks from thick, dark, scaly rootstalks; pinnæ deeply pinnatifid, with blunt lobes; texture thinner; lower surface densely matted with wool. S. W. U. S. to W. Indies and Chile.

BB. *Lvs. 3- to 4-pinnate.*

Néwberryi, D. C. Eaton. Cotton Fern. Lf.-blades 3–5 in. long, on stalks of the same length; ultimate segms. ⅓–½ line wide, covered on both sides with slender, entangled hairs, which are more dense on the under surface. Calif.

Párryi, D. C. Eaton. Lace Fern. Lf.-blades 2–4 in. long, tripinnate, with crowded roundish obovate segms. 1 line wide, which are densely covered above with entangled white hairs, beneath with a heavier pale brown wool. Utah to Calif.

AA. *Foliage with white or yellow powder beneath.*

cretàcea, Liebm. Rootstock short, with rigid scales: lf.-blades 1–2 in. each way, pentagonal on brownish stalks 2–7 in. long; ultimate segms. oblong or triangular-oblong, crowded. S. Calif. and Ariz.—Less handsome than the similar but larger and less divided *N. Hookeri* of Texas to Ariz.

cándida, Hook. Rootstock creeping: lf-blades 3–6 in. long, ovate or deltoid-ovate, pinnate; lowest pinnæ with inferior pinnules elongated and again pinnatifid; upper surface green. Texas and New Mex.

AAA. *Foliage naked below.*

ténera, Gillies (*Pellæa ténera*, Prantl). Lf.-blades 3–4 in. long, ovate-pyramidal, 2–3-pinnate; pinnæ distant, with ovate or subcordate, smooth, naked segms. S. Utah and Calif. to Bolivia.—Very rare.

L. M. Underwood. R. C. Benedict.†

NOTHÓLCUS (Greek, *nothos*, false, and *Holcus*, the name formerly applied to this group). *Gramíneæ.* Perennials with woolly or downy flat blades and narrow panicles: spikelets 2-fld., the lower floret perfect and awnless, the upper staminate and awned.—Species about 8, Eu. and N. Afr.

lanàtus, Nash (*Hólcus lanàtus*, Linn.). Velvet-Grass. Two to 3 ft. high: blades velvety: panicle greenish or purple-tinged. Dept. Agric., Div. Agrost., 20:89. Eu.—A forage grass of poor quality but of some value on sterile soil. A variegated form is cult. abroad for ornament.

A. S. Hitchcock.

NOTHOPANAX: Discussed under *Polyscias.*

NOTHOSCÓRDUM (Greek, *false garlic*). *Liliàceæ.* Herbs having an onion-like bulb and closely related to Allium.

Bulb tunicated, without the onion odor and taste: scape 6–12 in. high: lvs. several, linear, basal, 6–12 in. long: fls. yellow or white, in an umbel; style obscurely jointed; ovary 3-loculed; ovules several in each locule: caps. oblong-ovate, somewhat lobed, obtuse.—About 10–20 species mostly found in Trop. S. Amer., 1 in China and at least 1 in N. Amer. The species in this genus are variously placed under Allium and Ornithogalum by some authors.

bivâlve, Brit. (*N. striàtum,* Kunth. *Ornithógalum biválve,* Linn.). Yellow False Garlic. Streak-leaved Garlic. Bulb globular, 1 in. through, sometimes bearing bulblets at base: scape 1 ft. or less high: lvs. 7–8 in. high, 1/12–⅙in. broad, flat, blunt, shorter than scape or equaling it: fls. yellowish, 6–12 in an umbel on slender pedicels, the segms. narrowly oblong, 4–6 lines long; ovules 4–7 in each cell. Early spring. Va. to Ohio, Tenn., Neb., Fla., Texas, and Mex.—Hardy. Procurable from dealers in native plants.

fràgrans, Kunth (*Állium fràgrans,* Vent.). Bulb larger, round, yellowish white: lvs. linear, obtuse, 8–12 in. long: scape rotund, attaining height of 20 in.: spathe 2-parted, shorter than pedicels: fls. fragrant, 8–20 in an umbel, white slightly blushed, lined dark; stamens and anthers purplish. Subtrop. Amer.—Not very hardy; better treated as a tender bulb and dug up in fall, planting in spring. A. C. Hottes.†

NOTÒNIA (named for an English botanist, Noton). *Compósitæ.* About a dozen fleshy herbs or undershrubs, of Trop. Afr. and Asia, by many botanists included in Senecio. Heads discoid (without rays); style-branches with ovate or lanceolate papillose extremities: otherwise as Senecio: lvs. rudimentary or succulent, and the yellow or red heads rather large, solitary or cymose. They are to be treated like kleinias and various succulent tropical senecios; grown mostly as oddities and little known to gardeners.

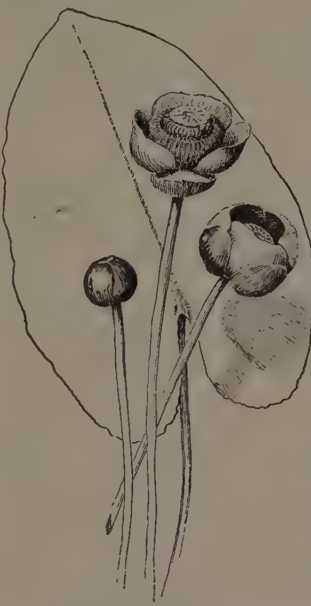
N. amaniénsis, Engler. Lvs. spatulate, fleshy, about 6 in. long and ½in. wide: scape rising to 4 ft., with 3 or more heads of yellow fls. on long reddish peduncles. E. Trop. Afr. *N. Grántii,* Oliver & Hiern. (*Senècio lóngipes,* Baker. *Kleìnia Grántii,* Hook. f. *N. sempérvirens,* Asch.). Short fleshy glaucescent plant: st. 4–8 in. high from a tuberous root, decumbent, bearing the peduncle at the summit: peduncle scape-like, with a few linear scale-like lvs. and bearing about 2 or 3 stalked orange-scarlet heads. B.M. 7691. G.C. III. 45:227. If this plant is the same as the *Cacalia sempervirens,* Forsk., it must then bear the name *N. sempervirens,* Asch. L. H. B.

NOTOSPÁRTIUM (name from *Spartium* or broom). *Leguminòsæ.* Two shrubs, leafless at maturity, with compressed pendulous branches, of New Zeal., one of them more or less planted in Great Britain. Fls. papilionaceous, rather small, in lateral racemes; calyx 5-toothed, campanulate; standard obovate or obcordate, clawed and somewhat reflexed; keel hatchet-shaped and obtuse; wings shorter than the keel, oblong, auricular at base; stamens 9 and 1: pod linear and many-jointed (and in this differing from Carmichælia). *N. Carmichǽliæ,* Hook. f. Pink Broom. Much-branched, to 10 ft. high, the branches glabrous and bearing alternate scales, the lvs. (only on young plants) 1-foliolate and orbicular or obcordate: racemes 1–2 in. long, bearing pink fls.: pod about 1 in. long. S. Isl. of New Zeal. B.M. 6741. G.C. III. 42:146. Gn. 71, p. 428; 74, p. 143.—A rare and local plant in New Zeal., blooming there in summer (Dec.–Jan.). Hardy in the open at the Kew Gardens, England.

NOTỸLIA (*back* and *hump,* alluding to a lump or protuberance on the column). *Orchidàceæ.* About 20 Trop. American orchids of the Vandæ group, little grown. They need warmhouse treatment. Small low plants, with plane coriaceous or fleshy lvs.: fls. inconspicuous, white, greenish or yellow, on radical racemes; sepals equal, narrow, erect or becoming spreading, free or the 2 lateral ones connate; petals resembling the sepals; lip unguiculate, entire, sometimes slightly adnate to the column; pollinia 2, waxy, not appendaged. *N. bícolor,* Lindl. "Whole plant not more than an inch and a half high: lvs. generally about 5, equitant, stiff, acuminate, scimitar-shaped, scarcely half the length of the fl.-spikes." Sepals white, and petals lilac with blue spots at base, lip lilac: spikes drooping. Guatemala. B.M. 5609. *N. trisépala,* Lindl. & Paxt. Epiphytic: pseudobulb ½in. long, 1-lvd.: lvs. oblong, to 3 in.: scape pendulous, about ½ft. long, with a many-fld. raceme of pale green very small fls. with scoop-shaped lip. Mex. B.M. 8306. *N. sagittífera,* Hook. (*Pleurothállis sagittífera,* HBK. *N. multiflòra,* Lindl.). Stemless parasite: lvs. distichous, deciduous, oval-lanceolate, nerveless: spikes axillary, many-fld., cernuous, the fls. bright rose-color. Guiana. L. H. B.

NÙPHAR (from the Arabic). *Nymphǽa* of some authors. *Nymphæàceæ.* Spatter-Dock. Yellow Pond-Lily. Several aquatic plants of the North Temperate Zone, with stout rootstocks creeping in the mud.

Leaves large, cordate-ovate or sagittate, some of which may be submerged and others either floating or standing erect above the water: fls. usually standing above the water, yellow or purplish, single on the scapes, the 5 or more large concave sepals constituting the showy part of the fl.; petals mostly numerous, small and simulating stamens, the latter numerous and short; ovary short, globular-ovoid, with 8–24 stigmas forming rays on its top: fr. an emersed caps.—Most of the nuphars are N. American. They grow in stagnant pools or on the margins of slow-running mud-bottom streams. Several species have been offered by dealers, but most of them have small value for the cultivator, although the foliage effects of *N. advena* may be striking. For cult., see *Nymphæa* and *Aquatics.*—The N. American species are monographed by Miller & Standley in Contrib. U. S. Nat. Herb. XVI, part 3 (1912). The nomenclature is discussed under Nymphæa.



2536. Nuphar advena. (×⅙)

A. *Lvs. mostly cordate-ovate.*

B. *Plants strong and large.*

ádvena, Smith. Common Spatter-Dock. Cow Lily. Fig. 2536. Lvs. large (about 1 ft. long), varying from roundish to ovate or almost oblong, thick, with a deep and mostly open basal sinus, the lower surface often pubescent; petioles terete; submerged lvs. usually wanting: fls. 2–3 in. across, more or less globular (not wide opening), yellow, mostly tinged with green or brown; petals shorter than the stamens, fleshy and truncate; sepals 6; stigma nearly entire, yellow or pale red, 12–24-rayed. N. Y., southward and westward. Mn. 1:17. G.C. II. 20:557 V. 2:197. Var. **variegàtum,** Engelm., with floating lvs. only (none erect), closed sinus, petioles flat on one side and fls. partly purple, occurs from New Bruns. to Brit. Col., Iowa, N. Ohio, and the mountains of Pa.

rubrodíscum, Morong. Lvs. somewhat smaller; submerged lvs. usually present: fls. 1–1½ in. across, yellow; sepals 5–6; stigma crenately toothed, bright red or crimson, 9–13-rayed. New Bruns. to Mich. and Pa.

polysépalum, Engelm. Larger than *N. advena*, the lvs. three-fourths as broad as long, erect in shallow water and floating in deep water: fls. 4–5 in. across, yellow, the sepals 9–12, and the petals 12–18, cuneate. Colo., Wyo. and northwestward.

lùteum, Sibth. & Smith. EUROPEAN YELLOW POND-LILY. Lvs. cordate-ovate, floating or rising little above the water; petiole triangular: fls. yellow, somewhat fragrant, smaller than those of *N. advena*, the sepals 5, petals very numerous; stigmas 10–30-rayed, with entire margin. Eu.

BB. *Plant slender, often delicate.*

mínimum, Reichb. (*N. pùmilum*, Smith). Slender: lvs. small, oblong, with a deep sinus and spreading lobes; petiole slender, 2-edged: fls. 1 in. or less across, yellow; sepals 5; petals 9–12; stigma 8–12-rayed, yellow, margin prominently indented. Eu.—Easily cult. and free-flowering.

microphýllum, Pers. (*N. Kalmiànum*, R. Br.). Very slender, with prominent submerged lettuce-like lvs., the emersed ones floating and only 3 or 4 in. long: fl. 1 in. or less across, yellow, with 5 sepals and thin spatulate petals; stigma 7–10-rayed, dark red. New Bruns. to Pa. and Minn. and southward.

AA. *Lvs. long-sagittate or narrow-oblong.*

sagittæfòlium, Pursh. Rather stout: emersed lvs. floating, about 1 ft. long and 2–3 in. wide, sinus open; submerged lvs. similar in shape, crispate, numerous: fls. 1 in. across, yellow, the sepals 5, the petals spatulate; stigma 11–15-rayed: fr. almost cylindric. N. and S. C.

japónicum. DC. Similar to the last. Submerged lvs. large, crisped: fl. 2–3 in. across: fr. flask-shaped. Japan. —A form with red-tipped stamens and sepals is cult.

HENRY S. CONARD.

NURSERY: in horticulture, an establishment for the rearing of plants. Properly, a nursery exists for the rearing of any kind of plant, but in America the word is restricted to an establishment devoted to the growing of hardy, more particularly woody plants. This is because of the early and great development of orcharding and tree-planting and the relative infrequency at that time of glass structures and private estates employing gardeners.

In North America the nursery business, as we now know it, is practically an institution of the last century, although there were nurseries more than a century ago. Consult pages 1516–1518 for an historical sketch of the nursery business; also in Vol. III the biographies of nurserymen, as Barry, Berckmans, Brackett, Bush, Cole, Conard, Dartt, Douglas, Downer, Ellwanger, Garey, Heikes, Hogg, Hoopes, Hovey, Kenrick, Kerr, Lewelling, Manning, Meehan, Moon, Munson, Parsons, Prince, Ragan, Reasoner, Rock, Roeding, Saul, Saunders, Shinn, Smith, Stark, Teas, Thomas, Wharton, Woolverton, and others.

As early as 1768, according to J. H. Hale, the New York Society for Promotion of Arts awarded Thomas Young a premium of £10 for the largest number of apple trees, the number being 27,123 But the large trading nursery developed simultaneously with the great orchard-planting industry which began in western New York and extended westward, and, since the Civil War, to the southward. The largest nursery center of North America, considering the number of persons engaged and the variety of stock grown, is western New York, with headquarters in Rochester. Nearly one-ninth of all the nurseries enumerated in 1890 were in New York state, and these establishments employed a capital of over $12,000,000. In 1909, New York still led in the value of nursery products. Very extensive nursery enterprises are now established in many other parts of the country, and it is probable that the center of the nursery business will move westward.

In America, nursery stock is grown on a broad or extensive rather than intensive scale. This is particularly true of fruit-trees. These trees are to be set in wide and open orchards, and the nursery practices are therefore very unlike those that obtain in Europe. In the latter country, for example, fruit-trees are trained in the nursery row to assume definite shapes. Some are trained for standards,—to grow to one straight, bare trunk. Others are trained for bush specimens, some for growing on walls and espaliers, some with round heads, some with conical heads, and the like. It is the pride of the American nurseryman, however, that his rows shall be perfectly even and uniform. Any break in this uniformity is considered to be a blemish. If every tree could be a duplicate of every other, his ideal would be attained. Ordinarily, fruit trees are trained to single stems, the top starting at 2 or 3 feet from the ground.

All fruit trees are budded or grafted. In early days, piece root-grafting the apple was a common practice in the eastern states; but it has gradually given way to budding and thereby a top is supplied with one whole strong root. In some places, however, root-grafting is still popular, partly because more than one tree may be made from an individual root, and partly because it allows the operator to use a long cion and to put the foster root far below the surface, thereby allowing the cion to send out its own roots and causing the tree to become own-rooted and to have a known hardiness.

In the use of whole roots, rather than pieces, there is apparently little or no difference in the orchard between the budded and grafted trees; but when grafting is performed on pieces of root, the results are likely to be unsatisfactory. Some varieties of apple, among which may be mentioned Grimes Golden, are not long-lived, being subject to collar-rot or other disabilities. To correct this fault, nurserymen double-work these weak varieties on the bodies of hardy long-lived, resistant trees such as Northern Spy and others.

There are many diseases and pests in the growing of all kinds of nursery stock, and these are now treated in official publications of government and experiment stations. The extent of these dangers has resulted in special laws and regulations to control the spread of pests and diseases. See *Inspection*, page 1647.

The most widespread and fundamental difficulty, however, is the inability to grow many crops of trees on the same land with good results. In fact, in the case of fruit-trees, it is usually considered that land which has been "treed" is therefore unfit for the growing of other fruit stock until it shall have rested in clover or other crops for a period of five years or more. Ornamental stock is often grown continuously on the same land with good results, even when the same species is grown. This is largely due to the fact that ornamental stock is sold by its size and not by its age, and therefore rapidity of growth is not so important as it is in the case of fruit-trees. It has been supposed that this necessity of rotation is due to the exhaustion of certain plant-food elements from the soil. It has been found by experiments, however, that such is not the case. The chief difficulty seems to be physical. Lands that are devoted to nursery stock for one crop, which is from two to five years, becomes void of humus, and the digging of the stock when the land is wet or unfit to be worked tends to impair the physical character of the soil. Experiments have shown that commercial fertilizers will not always reclaim lands which have been treed, whereas barn manures and green crops may go very far towards revitalizing them. As a result of inability to grow vigorous stock on treed land, a large part of the nursery stock of the country, particularly fruit trees, is grown on rented land. On the nurseryman's central grounds a variety of stock may be grown, chiefly ornamentals, but the larger part of the commercial fruit stock is farmed out to persons who are willing to rent their land for this purpose and who will give the requisite attention to the growing trees.

The industry has developed special tools without which nursery stock cannot be grown on a commercial scale. The simplest of these are budding- and grafting-knives of various kinds to meet the needs of different plants and the whims of users. There are also special hoes for planting and spades for digging, the latter with strongly reinforced handles and heavy blades of the best steel. Several tools in common use in subsoiling and cultivating are peculiar to nursery work. Still more specialized are the tree-diggers, requiring considerable power, drawn usually by four to eight teams, by traction engines, or by stationary engines at the end of the row which draw the digger by winding up a cable on a drum. Fall digging makes it necessary to strip the leaves of many trees, a task formerly performed by hand, but many growers now strip in a specially made machine after the trees are dug. Besides these, various devices are used in packing and boxing.

2537. View in an American apple tree nursery.

Winter storage. (U. P. Hedrick.)

Nurserymen in the North almost universally dig tree-, bush- and vine-fruits, as well as many ornamentals, in autumn and store through the winter in frost-proof houses of one kind or another. The best of these houses are built much as are cold-storage plants—in fact, some have facilities for refrigeration. By far the greater number of them, however, are storage cellars. The objects gained by winter storage are protection against mice and rabbits, prevention of injury through freezing and the wide fluctuations in temperature in northern winters, and greater convenience in making spring shipments. The most satisfactory results are secured when the stock is kept at a uniform temperature as near freezing as possible. Thus, at 28° to 34° F., above zero, very little ventilation is necessary, the trees dry out and shrivel but little, there is a minimum tendency to mildew, and packing material about the roots and spraying with water are usually not necessary. At lower temperatures, injury from freezing begins, and at higher ones the storage-house must be ventilated, the trees sprayed, their roots protected, and fungi do serious damage. Undoubtedly the storage of stock benefits the nurseryman more than the fruit-grower; for it is because of the drying out, more or less of which always takes place, or other injury in poorly managed storage, that trees so often come to the grower with barely the breath of life.

The extent of the nursery business.

Statistics covering the general range of the United States nursery business were published in Bulletin No. 109 of the Eleventh Census (for 1890). The census enumerated the items of 4,510 nurseries, occupying 172,806 acres and representing a valuation of $41,978,835.80. The total capital invested was about $52,500,000. These establishments employed 45,657 men, 2,279 women, and 14,200 animals. The total number of plants and trees was 3,386,858,778, which figure does not include unenumerated plants on 1,477 acres of nursery grounds. Of this enormous total, fruit trees comprised 518,016,612 plants, and grape-vines and small-fruits 685,603,396. Apple trees alone, the highest figure given for a single species, numbered 240,570,666. It is probable that these early figures are not comparable in statistical value with those of succeeding censuses. It would be interesting to speculate as to the destiny of these trees and plants. It is safe to assume that each plant in this uncountable number was the subject of thought and solicitude on the part of the propagator; yet it is probable that not one in a hundred has lived to bring satisfactory reward to the buyer. It has been estimated that the apple trees standing in orchards in the United States at the close of the century were 100,000,000, or less than half the number growing in the nurseries in 1890. The elements of loss are many, but the greater part of the failures occur after the stock has passed to the hands of the final purchaser.

In the Twelfth Census (1900), "there were 2,029 commercial nurseries in the United States. Within the past decade many small nurseries have been consolidated and numerous others have been absorbed by the larger companies." "In many of the western states the owners of large orchards propagate from the standard varieties they have on hand the stock they require in enlarging their acreage of fruit trees. This has not been taken into account in compiling the statistics of nurseries because the income from this labor would be credited to sale of fruit and not to sale of trees." The total area was 165,780 acres, with 137,459 acres, or 82.9 per cent, improved. The average size of the nursery establishments was 81.7 acres, although a number of 500-acre tracts were operated. "The value of land, buildings, and other improvements was $18,144,073, the former value being $13,880,820 and the latter $4,263,253. The average value an acre of the land was $84. The value of buildings was much smaller for the nursery establishments than for the florists' establishments, and the value of live-stock much larger. This is due to the fact that nursery operations are much the same as in other farming. The value of implements was $539,895 and of live-stock, $462,013. The total value of products was $10,086,136 and $139,512 was expended for fertilizers and $2,305,270 for labor. One of the heaviest expenses of the nursery growers was that for labor, the amount constituting 22.9 per cent of the value of the product, a much larger proportion than is involved in the raising of other crops, except flowers and plants. The total value of products comprised $9,231,503 from nursery stock and $854,633 from general farm produce. Distributed among the 2,029 establishments reporting, it gives an average value of product of $4,971. The value of products fed was $192,999, a considerably larger proportion than for the florists.

"Of the several geographic divisions, the North Central ranks first, many new nurseries having been established to meet the greatly increased demand for nursery products in the West. In the North Central division there were 836 establishments, with a total value of products not fed to live-stock of $3,892,668.

The number of establishments and the value of products not fed to live-stock for the other divisions are: North Atlantic, 496, $3,076,241; South Central, 287, $1,347,253; Western, 241, $944,289; South Atlantic, 169, $825,685. New York leads in the quantity of nursery stock produced, being credited with over half of the total reported for the North Atlantic division. For many years the state has been prominent in this industry, it now having 237 establishments and products valued at $1,703,354. Some of the other leading states, in value of products, are: Iowa, $636,543; Illinois, $610,971; Ohio, $538,534; California, $533,038; and Pennsylvania, $515,010.

The Thirteenth Census (1910) reports the acreage in nursery products in 1909, as 80,618, "showing an increase of 35.5 per cent since 1899, while the value of the products more than doubled during the decade, amounting to $21,051,000 in 1909. The average value per acre increased from $170.17 in 1899 to $261.12 in 1909. Of the total value of nursery products 98 per cent was reported by 2,470 special nursery establishments, the aggregate value for such establishments being $20,620,000, and the average per establishment $8,348. The value of nursery products in 1909 was over $1,000,000 in every division except New England and the Mountain divisions. The Middle Atlantic division, with a product of $4,355,000, ranked first, followed in order by the West North Central and Pacific divisions each with a product valued in excess of $3,000,000. The three leading states in this respect were New York, with $2,703,000; California, with $2,135,000; and Texas, with $1,236,000; no other state producing as much as $1,000,000 worth."

The nursery interests of this country are represented in a strong organization known as the American Association of Nurserymen, which holds a movable annual meeting in June and publishes a report (see page 1553). There are also societies representing geographical regions. At the present time, there is one periodical devoted to the nursery business, "The National Nurseryman," which is published monthly at Rochester, New York. The American current book writings devoted specifically to the business are Fuller's "Propagation of Plants" and Bailey's "Nursery-Book."

L. H. B.

NUT-CULTURE. Seeds with a hard shell and edible kernel, which are classified colloquially under the head of nuts, are borne chiefly upon trees or shrubs. A few species of annual plants furnish nut crops. In most parts of the world nuts have been collected chiefly from wild seedling trees, but in some countries the hazel, the almond, and the walnut in particular have been grown in orchard form since very early times. Such grouping offers better facilities for cultivation and for gathering of the crops.

It is probable that the almond, which is very easily budded, has been subjected to that process since the days of the Romans. More recently the hazels and the walnuts have been propagated by budding and by grafting in the European countries. The larger part of nut orchards, however, have consisted of seedling trees of selected varieties. In the latter part of the nineteenth century there developed a widely extended movement, including several countries, toward grafting or budding particularly desirable varieties or species of nut-bearing trees or shrubs upon appropriate stocks. A still more advanced procedure,—that of hybridizing,—for the purpose of combining characteristics of especially desirable kinds, belongs almost peculiarly to the twentieth century. Nut-bearing trees which are chiefly wind-pollinized have been so extensively crossed in nature that few of them breed true to seed. They are much like the apple in this respect. The new movement of artificial pollinizing promises to accomplish for the nut-tree what it has accomplished for many other kinds of fruits. A notable development of the industry of nut-raising may be anticipated as a result of the application of modern methods.

Some species of trees, like the coconuts and the nut-bearing pine trees, apparently gain little or nothing from cultivation. Almonds, chestnuts, hickories, hazels and walnuts, on the other hand, are remarkably susceptible to influences of cultivation, and they respond with crops which are valuable largely in proportion to the degree of skilled attention which has been given by the horticulturist. Species of trees which have not as yet been cultivated for man's purposes, although valuable in some cases for mast crops for animals, will presumably be given much more attention in the future. Certain kinds, like the beeches and the oaks, may eventually furnish large quantities of food for man. Acorns, while rich in protein, fat and starches, contain in addition disagreeable elements like berberine or tannin in excess. These elements may be bred out to a greater or less extent by horticulturists. The horse-chestnuts of various species which bear heavy crops of nuts, valuable in food-content, are little used except by the Indians, who crush the nuts and wash out the soluble elements which are undesirable. It is probable that chemistry will eventually solve the question in such a way as to allow this group of trees to be grown for food purposes more generally.

Among the desirable kinds of nut-trees which have already been subjected to cultivation, it is found that grafting and budding bring out certain characteristics belonging to those of other fruit-trees, when subjected to the same process. There is apparently a tendency toward precocious bearing, and the grafted or budded nut-trees appear to be more prolific than others, and perhaps to be shorter-lived in consequence. A number of species of nut-trees which do not bear naturally until they are fifteen years or more of age as seedling trees, may begin to bear in one to three years after grafting or budding upon other stocks.

The methods of grafting or budding are in general those which are employed for other fruit-trees, but rather more expert work is required on the part of the horticulturist, and several factors have to be taken into consideration. In grafting or budding nut-trees which have particularly hard wood, very accurate work is required for the purpose of getting the cambium layers of stock and of insert neatly adjusted. The slow callusing of hardwood trees of this group requires particular care in the method chosen for protecting the inserts against drying out before granulation is completed. Some of the nut-trees, walnuts particularly, have such a free flow of sap that the method of placing inserts must be so adapted that this sap is allowed to escape freely, otherwise the dammed sap decomposes and destroys the callus.

The question as to whether grafting or budding is particularly desirable for any one species of nut-tree has not yet been determined. Some of the nut-tree growers in temperate regions prefer grafting in the spring, while others are convinced that August budding gives best results. Under these circumstances one is probably dealing with a matter of individual proficiency and skill, rather than with any fundamental principle in plant physiology which is involved in the question. Cions which are to be employed for spring grafting of nut-trees are best cut in the autumn. They may be stored in densely packed leaves or kept in cold storage until the following season. Sometimes they may be buried in sand. There is danger from the effects of too much moisture when cions are kept in sand, because the protoplasm of buds becomes senescent or undergoes chemical change when carrying a full charge of water. For August budding, two methods are employed. The leaves of the prospective bud-stick are cut off, leaving the petioles in place. At the end of a few days these petioles usually separate and fall away, leaving buds which are more readily handled. Other orchardists prefer to leave the petiole in connection with the bud and to transfer both directly to the stock. In any case it is important to make use of one principle,—the principle of bringing the bud to a state of rest for a few days. This is best accomplished by placing the green bud-sticks in the ice-house or in cold storage for three or four days. The effect of the cold is to bring the life processes in the buds to a pause, and then when transferred to stocks the buds start off into activity in a more kindly way than when transferred without a resting-period.

The choice of grafting-stocks is one of considerable importance. Almost any species or variety of nut-tree may be grown upon stocks of allied species and varieties, but in dealing with the hickories it is desirable to note the wide variation in character and texture of wood between different species. Thus the pecan, an open-bud species, will perhaps be found to thrive best when grown upon stocks of the bitternut (another open-bud species), excepting when it is more desirable for any reason to place a variety of pecan upon stocks of its own species. The shagbark hickory appears to do best upon stocks of shagbark, mockernut, shellbark or pignut. In chestnut-grafting, the various European, Asiatic and American examples are best grown upon stocks of their own kinds respectively. Some of the Asiatic species, for example, do not make firm ligneous union at the site of an insert upon an American stock. American chestnuts grafted upon European kinds are prone to make excessive growth without firm ligneous union, at least during the first two years. Sometimes wild nut-trees are grafted or budded with particularly desirable kinds, and this may be profitably accomplished if the wild trees are well headed back during the winter time, and new sprouts allowed to start in the spring. Grafting or budding is done upon the new sprouts subsequently. This work demands very much attention on the part of the horticulturist, because the large quantities of new shoots which start out from a mature tree may deprive grafted or budded sprouts of their sap. When the grafting or budding is to be done upon small stocks in the nursery, there is some question as to whether these stocks may be best grown where they are to remain permanently, or whether it is desirable to subject them to cultivation in close form for two or three years, and then transplant.

There is a tradition among horticulturists to the effect that nut-trees in general are not readily transplanted. This is not strictly true, but it includes the idea that much more care must be exercised when transplanting species of trees which have not as yet been brought under subjection through many generations of cultivation. The Stringfellow method of severe trimming back of the head and root, without any attempt at saving small fibrous roots, has been the most successful method with some horticulturists when nut-tree stocks were to be transplanted.

The choice of soil is an important matter in the growing of nut-trees. Chestnuts and hazels, for example, will thrive in soil that is somewhat acid, while walnuts and some of the hickories are insistent upon having neutral or alkaline soil. Species which naturally prefer neutral or alkaline soil will thrive very well as older trees upon soil that is slightly acid, provided that a little lime be added to the soil during the first four or five years of growth of the tree. Nut-trees, for the most part, when grown in orchard form, should be given the character of soil which wild trees of the same species are known to prefer. Lime in the soil is thought to improve the quality of many of the nuts, and in the best walnut orchards of France it is sometimes applied annually, even upon soil which is already neutral or alkaline in reaction.

Among the nut-bearing annual plants, various species of lotus and the water caltrops furnish an important food-supply in some parts of the Orient, but these are not as yet subjected to cultivation, and they have been neglected as sources of food-supply in America, although they are grown here in many places chiefly for their flowers or as curiosities. Large areas of our shallow fresh waters are suitable for growing such crops of the water calthrops and several species of lotus. The peanut, as a nut-bearing annual plant, is being cultivated successfully over an increasingly large area in different countries, and promises to furnish a permanently valuable food-supply.

The nuts of trees and shrubs which are to be planted require treatment somewhat different from that of other seeds. In nature they are prone to await suitable conditions of warmth and moisture which are quite out of the ordinary, before sprouting. In temperate regions the most successful method, perhaps, consists of storing them for the winter in cages made of galvanized wire about 8 inches deep, sunk about 4 inches beneath the surface of the ground, and the interior of the cages filled with sand to the ground-level. Nuts which are to be grown in the following season are pressed into this sand in rows, closely together but not wholly covered with sand. A loose mulch of leaves is tossed over them and the wire cover of the cage closed in order to protect them against rodents. These nuts are allowed to freeze and thaw during the winter and spring. In the spring the mulch is removed, allowing the exposed side of each nut to be warmed by the sun while the buried part is kept moist. Under such conditions almost every nut of species belonging to temperate regions will sprout. As rapidly as the nuts sprout, they are transferred to the nursery row and cultivated for two or three years before being transferred to permanent sites as seedlings or as grafted stocks.

For illustrations of methods of budding nut-trees, see page 1366, Volume III; also the article *Pecan*.

Robert T. Morris.

Culture of the different kinds of nuts.

From the earliest times, nuts have been used as an article of food in North America. The prehistoric tribes left evidences of their use in the specimens which were buried with their remains. When the white settlers came, they found several kinds of nuts growing wild and bearing abundantly, and thought to introduce the cultivated nuts of Europe along with fruits and farm crops that seemed to flourish in the virgin soil. But little success seemed to attend their early effort, largely because of the unsuitability of the varieties tested. The sweet almond and the hazels were found to be of this character, and the few experiments with the European walnut and chestnut, where they did succeed, were not followed up by extensive plantings for many years. Nor were any of the native nuts brought under cultivation until very recently. Now there are many orchards and groves of both foreign and native nuts, some of which are already yielding profitable crops.

The almond (*Prunus Amygdalus*).

Among the first nuts to be tested were the cultivated almonds. All the experiments up to the present day lead to the conclusion that the choice varieties are not suited to any section east of the Rocky Mountains, except, perhaps, in southwestern Texas and New Mexico. The close relationship to the peach would cause us to expect that it would succeed wherever that fruit does; but the trees of the choice varieties are too tender to endure any but very mild climates, and the fruit-buds are still more tender. The chief failing, however, is the habit of very early blooming, which causes the crop to be cut off by spring frosts, except in peculiarly favorable localities. There are differences in the ability of the varieties to endure cold, and in time of blooming, even where they are counted a success. Not until seedlings were grown and tested, from which selections were made of suitable kinds, did the growing of this nut prove profitable.

At the present time the culture of the almond is confined chiefly to California. To some extent it is grown in Utah, Idaho, Arizona and New Mexico, and fair crops of the highest quality in all respects are grown there. There are single orchards in California of hundreds of acres in extent. The average crop of the region is estimated to be about 3,000 tons or 6,000,000 pounds, and in view of the large quantities of almonds imported there is room for a large increase in production. This is being met to a considerable extent by extensive plantings in California. It is thought that the production of new seedlings will still further overcome the weak points already mentioned, and materially extend the culture of really choice varieties to some extent. The varieties being grown are nearly all of California origin and are Nonpareil, I X L, and Ne Plus Ultra, and are esteemed for market in the order named. Drake, Texas Prolific and Languedoc are also prized, especially for shelling, but their price is not equal to that of the others named. The methods of planting and cultivation of the soil are about the same as for the peach. Twenty to twenty-five feet is a good distance apart for planting the trees in rich soil; sometimes they are set as much as thirty feet apart. In the state of California, they are frequently set in the quincunx form. See also *Almond*, Volume I.

The walnuts.

American walnuts.—The kernels of all species of the walnut family are liked because of their rich and delicious flavor; but some of them are so small and difficult to get out of the shell that they are of little or no commercial value. Our native black walnut, *Juglans nigra*, and butternut, *J. cinerea*, are of this character. At present there are very few trees of either species that are grown for their nuts; but there are some prospects of improvement in this direction.

Asiatic species.—Within the last forty years there have been introduced from Japan two new walnuts, *J. Sieboldiana* and var. *cordiformis*, and from Manchuria one, *J. mandshurica*. These make beautiful and stately trees, but the nuts of all but *J. Sieboldiana* var. *cordiformis* have too thick shells to be of much value. See *Juglans*.

Persian species.—The Persian walnut, *J. regia*, which has long been called English walnut and by several other titles, has been cultivated for many centuries for its thin-shelled and richly-flavored nuts. It is a native of Persia and the regions about the Caspian Sea. The Greeks and Romans took it to southern Europe before the Christian era. It was brought to America in the early settlement of the country, but did not succeed everywhere, and the few trees that survive in the eastern states have been mostly neglected. Some of them have borne nuts abundantly and others have not. Unproductiveness has generally been due to the isolation of the trees and the inopportune times of the blooming of the flowers of the two sexes. These isolated trees are scattered over the eastern states from New York to Georgia, and rarely beyond the Appalachian mountain chain, because of the more uncongenial climate there.

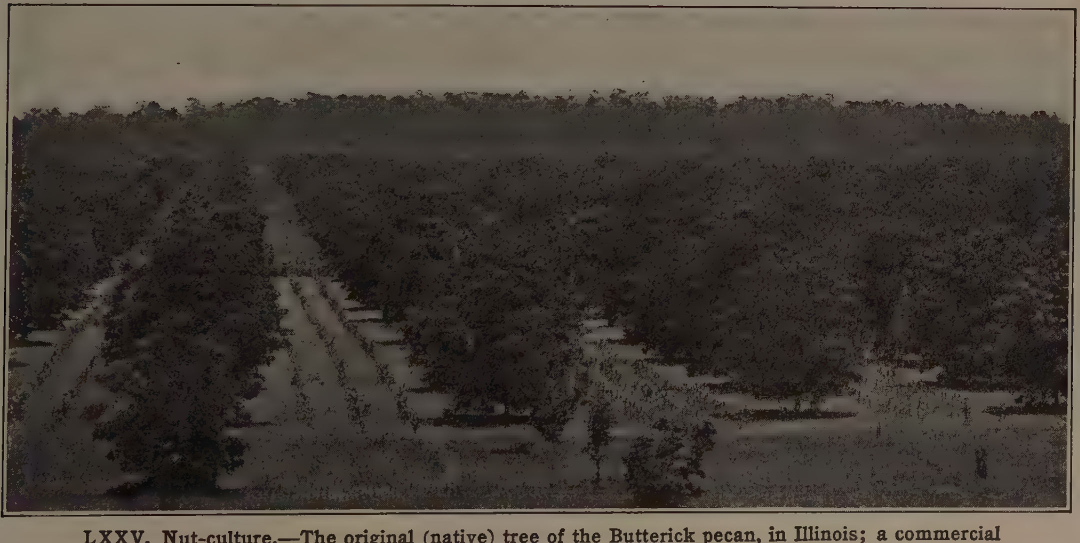
Regions of successful culture.—On the Pacific coast the Persian walnut is a great success, especially in southern California. True enough, there are some failures, but they are mostly due to lack of proper pollination, a matter which can and will soon be generally understood and overcome. There are extensive orchards already in bearing, and with the advantages which are now being afforded by the introduction of the best varieties from Europe and the origination of improved seedlings, the walnut industry is sure to advance rapidly in that region. The soil of the richer valleys of the Pacific slope is just what is needed, and where there is an abundant supply of water a few feet under the surface there is no need of irrigation. But in poor, dry soil it is folly to expect success. The crop of California alone, in 1910 was about 10,000 tons or 20,000,000 pounds, or 1,000 carloads of 20,000 pounds each. It is confidently expected that California alone will, within a few years, produce all that our home markets require. Recently a very deep interest has developed in walnut-culture in the Atlantic States, as some of the hardiest and most fruitful seedling trees have come to be appreciated, are given varietal names and are being propagated by the nurseries. As yet there are very few trees planted out in orchard form, but there are a few small orchards of such trees, mostly in New York, New Jersey and Pennsylvania, and there are larger ones of seedlings of these improved strains, some of which are in profitable bearing. There seems to be good reason for believing there will be a thriving industry in walnut-culture in the Atlantic States and possibly farther to the westward within a few years to come. But the experiments with *J. regia* have not been very favorable to it in the central or Mississippi Valley regions west of the Appalachian Mountain chain, perhaps owing to the changeableness of the climate.

Propagation.—The larger number of bearing trees are seedlings, but those grafted or budded with choice varieties are far preferable, and such trees will form the walnut orchards of the future. The native black walnut, *J. nigra*, is the species used as a stock principally in the eastern states and it serves the purpose very well. *J. rupestris*, a species native in Texas and adjacent regions, is also used as a stock, especially in the South, and the varieties of *J. regia* grow very well on it. This native species is closely allied to *J. californica*, which is now used in California, Oregon and Washington as a walnut stock more than any other species. *J. cinerea* is being tested in a small way for this purpose, and so are the Asiatic species, but so far with uncertain results. The planting of seedling walnut orchards is giving way to those of the named varieties, of which there are many and among them several that have proved to be reliable bearers and their nuts of standard commercial value. Although some seedlings are grown and sold by the nurseries, they are becoming unpopular. There are a few small nurseries both East and West now devoted almost entirely to the growing of grafted and budded walnut trees.

Planting and culture.—The distance for the trees to stand apart in the orchard is from 40 to 60 feet, according to the vigor of the variety and the richness of the soil. Clean tillage is best for the trees until they reach bearing age, when the ground may be seeded to some grass that does not make a compact sod. If hoed crops are grown between the trees until that time, it will do no harm and economize the space. Almost no pruning is needed for this tree, except to keep the branches from getting so low as to interfere with tillage. The trunk should be 4 to 5 feet high. See *Walnut*, Volume VI.

The chestnuts.

American species.—Like the walnuts, our native chestnuts are not so desirable for market purposes as those from foreign countries. The wild American chestnut, *Castanea dentata*, is richer in quality than any foreign kind, but the size is less than half that of the introduced nuts. Throughout the larger part of the eastern United States, and extending into lower Canada, there are untold millions of native chestnut trees, yielding a wealth of nuts that find ready sale in the markets, so far as they are gathered; but the prices are only about half those of the large cultivated and imported product. At the present time there are but



LXXV. Nut-culture.—The original (native) tree of the Butterick pecan, in Illinois; a commercial pecan plantation in Georgia.

few attempts made to cultivate this species. Some of the choice varieties with the largest nuts are being collected for experiment, and there is reasonable prospect that by hybridization and selection of seedlings varieties may yet be secured combining the vigor and hardihood of the wild trees with the characteristic natural sweetness and large size of the foreign nuts. Within the last few years, there has been developed at least one very choice variety of our native species that is surpassing in general desirability to all others, either native or foreign. This is an accidental seedling that originated from among a lot of nuts planted by Charles A. Green in his nursery near Rochester, New York. It was sent to E. A. Riehl, of Alton, Illinois, and it grew vigorously and when it came to bear, to his surprise the nuts were very much larger than those of the average of the American species, although possessing the natural outward appearance and sweetness of kernel that are characteristic. This variety was named the Rochester. The nuts nearly all ripen at one time and part from the burs easily. Some of its seedlings are said even to surpass the parent.

The chinquapin, *C. pumila,* is the smallest of the chestnut family, in size of both nut and tree. Rarely is it anything more than a mere bush. It has rarely been cultivated, although the bushes are productive, the nuts of good quality and ripen very early.

European species.—The Old World chestnut, *C. sativa,* has been under cultivation almost as long as history goes. It was brought to America in the first century of its settlement by Europeans; but not until within the last twenty-five years has there been more than an occasional tree found on our shores. The accidental finding of a chance seedling, which was finally named Paragon and sent out to the public about 1887, and the bringing to notice of the Ridgeley shortly before that time, were the means of exciting the first general interest in chestnut-culture in America. Both these kinds, and a great many more named varieties, are now being propagated and scattered far and wide. They are all of large size but not so sweet as our native chestnuts, and generally have bitter skins. The trees are of robust character and very productive, but more tender than our natives.

Japanese species.—About the time that the European species was becoming popular in America, attention was drawn to a number of seedlings from nuts that had been brought from Japan during several previous years. The most of them were larger than any that had been known before, either in this country or in Europe. Many of them are now named and widely distributed. Some of the smaller varieties are exceedingly early in ripening. Nearly all of them begin to bear at an early age and are even more productive than the average of the European species. In quality, the nuts of most of them are not so sweet as the European kinds. The habit of growth is less vigorous than that of other chestnuts and the foliage much smaller.

From these two foreign species have been obtained nearly all of our varieties that up to this time are worthy of general cultivation, except the Rochester. They vary from seed much as do most other improved varieties of fruits, and grafting and budding must be practised, which are exceedingly difficult successfully to perform on the chestnut, as is the case with all other nut-trees. They will both unite fairly well with our native stocks; although sometimes the union is imperfect and the top breaks off.

Grafting.—The most successful method of propagating nut-trees, so far as the writer has experimented or learned otherwise, is late bark-grafting. This requires that the cions be cut before there is any possibility of the buds starting, and put in some very cool place until after the stocks have begun to leaf out. The stocks are then cut off as for cleft-grafting, but the bark only is split with a knife for an inch or more at the top of the stock. The cion is trimmed to a long wedge, all from one side. The point of this wedge is introduced under the bark at the top of the slit and gently forced down until the cut surface of the cion is even with the top of the stump. It is then tied fast with a string and the wound securely waxed. Large trees may thus be top-worked in their branches with considerable success. Small stocks should be grafted just under the surface of the ground and banked nearly to the top of the cion.

Stump groves.—In several cases, large tracts of chestnut stump lands have been grafted over to the improved varieties of the foreign species with good success. All other trees should be cleared away and only two or three of the strongest sprouts left on each stump. These should all be grafted and allowed to grow until it is sure that there will be a sufficient stand, when those that are not needed should be cut away. In future years more may be cut away to give the remaining trees ample room.

Chestnut orchards.—The best results are said to be attained in chestnut-culture by planting grafted trees on open land, about 40 feet apart and in regular orchard form. This plan admits of giving the trees good tillage until they have attained large size, when grass may be sown and stock allowed to graze it, except when the nuts are falling. Such orchards are said, by those who have tried them in comparison with grafted sprouts, to yield more than twice as much to the acre. Well-drained sandy or shaley lands are the best for the chestnut.

Pests.—A fatal fungous disease has become very prevalent within recent years in the eastern United States. It began on the North Atlantic coast and has gradually moved southwestward until there is scarcely a locality north of southern New Jersey and Pennsylvania where it is not prevalent. In some places the cultivated and wild chestnut trees have been practically exterminated. There seems to be no practicable means of combating this disease, and it is feared that the entire area in the eastern states where the chestnut is found will be reached by it and may be ravaged. Another enemy of chestnut-culture is the weevil. In some cases the nuts are so badly infested that they are practically worthless. The eggs from which the larvæ develop are laid by long-snouted beetles while the nuts are growing, and by the time they are mature most of the eggs are either hatched or nearly ready to hatch. By treating the nuts with the fumes of bisulfide of carbon the eggs or larvæ can all be destroyed. Scalding with boiling water for about ten minutes will also kill them, but it also destroys the germinative power of the nuts and necessitates drying them. Outside the native chestnut area, there are no weevils as yet. See *Castanea* and *Chestnut.*

The pecan (Carya Pecan).

In the wild state.—Of all our native nuts the pecan is the best. Its natural habitat is the lower Mississippi basin, from Iowa to the Gulf coast, but it will grow equally well in any climate and soil of approximately the same character. The tree is almost as hardy as any of the other hickories, except some of its more southern varieties. In size the tree varies from medium, on land of ordinary fertility, to gigantic proportions on the rich river and creek bottoms. The nuts vary in size and shape from round and ½inch in diameter to oblong and 2 inches in length. The kernels are exceedingly rich and sweet, and the shells usually thin. Pecans are found in all confectionaries, and bring almost as high prices as any of the imported nuts. The largest quantities of native nuts are secured from Texas and Louisiana. Millions of pounds are gathered annually in those states and sold to dealers, thus bringing a handsome revenue to many persons of moderate means.

Under cultivation.—The decrease of the wild product from the cutting down of the trees, and the better prices obtained from large, thin-shelled nuts have induced the planting of pecan orchards. The nuts sprout readily, and the trees are of easy growth, with reasonable care, in proper soil and climate. Orchards of 10 to 1,000 acres are planted in the southern states. There are many smaller orchards planted in nearly all the states from Virginia to Missouri and California, southward. The line of 40° north latitude is about the limit of successful pecan-culture, and the region from 35° southward is much better. The nuts do not fill and ripen well where the growing season is short. It has been learned that by cutting back the tops of wild trees (thus causing an abundance of sprouts), and then budding in August or September, large trees may be quickly transformed into such as will produce the highest grade of nuts.

Planning the orchard.—There is a division of opinion as to the advisability of planting the nuts where the trees are to stand and rearing them for a year or more in a nursery. Both ways are good, but each has its advantages. If the former of these plans is followed, then two or three nuts should be planted where each tree is to stand and a cedar or cypress stake driven at the spot. Pine stakes are said to induce worms to attack the little pecan trees. A still safer plan is to inclose the little seedlings in narrow boxes about a foot high, made of cypress boards. This secures them from the depredations of rabbits, which sometimes prove very destructive. By this plan there is no labor or danger of loss by transplanting. All but one of the trees should be removed after two or three years' growth. If the nursery method is followed, the transplanting should be done at one of these ages. Mulching the trees with old trash is very beneficial to them.

2538. Coconut, the most important of tropical nuts.

Propagation.—Grafted or budded trees are far preferable to seedlings, because of the certainty of the variety, convenience of gathering the nuts at one time, and the advantage of having an even and high grade to sell. The same difficulty is met with as in case of the chestnut—the trouble and expense of securing grafted or budded trees. However, it has been found that both these methods of propagation are reasonably successful in skilful hands. Either the cleft-, tongue- or bark-graft will succeed, but the two former styles do better on small stocks just below the surface of the soil than above. Probably the most universally successful method of propagating the pecan is that of the bark-graft, although experienced nurserymen more largely employ the patch-bud. Trees with unions a foot or more above ground are much less subject to winter injury than are root-grafted trees.

Planting and cultivation.—The distance for planting should not be less than 50 feet between trees, because they get to be very large, and 80 to 100 feet is better. Thorough tillage will pay abundantly and should never be neglected while the trees are young. Farm crops, such as corn, cotton and potatoes, may be grown between the trees until they begin bearing, which is from 6 to 12 years from planting.

Varieties.—There have been wonderful developments in the discovery and production of choice varieties of the pecan within the last twenty-five years, and especially within the last decade. The first variety to become popular and one which is now held in high esteem is the Stuart. It originated from a nut planted on the coast of Mississippi and was brought before the public by the late W. R. Stuart of Ocean Springs, Mississippi, after whom it was named. The next one of note to be brought forward was the Van Deman, which originated from a nut planted in St. James Parish, Louisiana, near the bank of the Mississippi River fully fifty years ago. The tree is yet in full vigor and bearing abundantly. These two varieties have been the parents of thousands of seedlings, some of which have become famous already and others are constantly coming forward, even of the second and third generations. Among the principal varieties now being grown in the South, are the Alley, Bradley, Colorado, Curtis, Delmas, Frotscher, Halbert, Kincaid, Moneymaker, Pabst, President, San Saba, Schley, Sovereign, Stuart, Success, Taylor, and Van Deman. The best of the northern varieties are the Busseron, Butterick, Greenriver, Indiana, Major, Niblack, Norton, Posey, and Warrick. With the exception of the Norton, which originated in eastern Missouri, the varieties of this latter group are from the vicinity of Evansville and Vincennes. See *Carya* and *Pecan.*

The coconut (Fig. 2538).

There is comparatively little territory on the continent of North America where the coconut will grow; viz., a small portion of Florida and the warmer coast regions of Mexico. In the warmer parts of California the climate does not seem to be sufficiently humid. In the vicinity of Lake Worth, and Biscayne Bay, Florida, there are many bearing trees, and along the east coast and adjacent islands from there to Key West, and as far north on the west coast as Charlotte Harbor, there are many thousands of coconut trees growing. In central Florida the climate does not seem to be suitable. Proximity to the sea in all countries seems to suit the coconut best. It will flourish in almost any soil, although the richer the better, but a warm and humid atmosphere is indispensable.

Origin of coconut-growing in America.—The oldest coconut trees in Florida were probably chance seedlings which came from nuts that washed ashore from the sea long years ago. Such trees are very rarely found. There are also a few old trees that grew from nuts planted by settlers at Key West and other places along the coast. The chief cause of the impetus to coconut-growing was the wrecking of the Spanish bark Providencia, laden with coconuts, on the beach near Lake Worth, Florida, January 9, 1878. Many thousands of the nuts were gathered from the surf and planted for many miles up and down the coast. The trees grew so rapidly and began to bear so soon, usually at from six to eight years from seed, that visions of wealth tempted many more into planting groves. One near Biscayne Bay consisted of about 4,000 acres, in which were 300,000 trees. Another at Cape Sable contained 42,000 trees, and there are many more of less extent.

Present status.—Cold waves and occasional frosts have injured many of the coconut trees, in some cases killing them outright. In general, the trees bear good nuts in reasonable quantity, but in a business way the industry is uncertain, owing to danger from frosts and the cheapness of imported nuts. As an interesting novelty, the coconut in southern Florida is an eminent success. See *Coconut.*

Nut-culture in New Mexico. (C. P. Wilson.)

In the newer parts of the country to which commercial nut-growing is adapted, the development of this industry will be coincident with that of the country itself rather than an addition in after years. As an indication of the outlook on nut-culture in new regions, this note is inserted on the industry in New Mexico; and what is said of this state will undoubtedly apply very well to Arizona and adjacent regions.

Much attention has not been given, so far, to nut-culture in this state, though a few small experimental orchards of pecans, as well as a number of almond and Persian (English) walnut trees, have been set out. Most of these are in the irrigated valleys of the southern part of the state. The climate of this state is well suited for the heavy fruiting of pecan trees that have originated near the western limit of the region to which this species is indigenous. Many of the large seedling trees to be found in different parts of New Mexico are very prolific. However, most of the early attempts to transplant either the seedling trees or those that had been budded or grafted were unsuccessful. This appears to have been due largely to the fact that sufficient precautions were not taken to prevent the young trees from dying back during the dry winters that usually prevail in this part of the Southwest. Attempts along this line during the past few years have been more successful, and it is believed that, by keeping the ground very moist during the winter, much of the damage can be prevented. Hilling up the soil around the trees of some varieties the first few winters after transplanting would also, no doubt, be advisable, as an additional protection. It is doubtful whether the pecan will do well where there is much alkali, or where the water-table is within 8 or 9 feet of the surface. Growth will probably be better on land that has been cultivated for several years than on new ground. Varieties suitable for southern New Mexico are the Sovereign (Texas Prolific), Hollis, and Halbert; while for the northern part of the state, sorts that originated farther north, such as the Indiana, Kentucky, and Warrick, might do better. Coast varieties and southern varieties that originated east of Texas are not recommended at present for any section of the state, though some of these might do fairly well. It is probably better to transplant the budded or grafted trees, rather than to grow the seedlings with the idea of topworking them later. While the pecan can be budded in this climate, the operation has to be conducted carefully if success is to be expected.

It is quite possible, or even probable, that varieties of Persian walnuts will, in time, be found that will grow well in this state. The climate of New Mexico is not so well suited to the Persian walnut as to the pecan. The leaves of the former are inclined to sunburn during the summer, and some injury may occur to the young growth during the winter or early spring. There are at present a few trees in the southern half of the state that are in bearing. Some of the nuts are of good size, but no data are available concerning the yield.

The early blooming habit of the tree prevents the production of almonds on a larger scale. However, recent experiments have proved that a few of the commercial varieties of almonds are little, if any, earlier in this respect than the Elberta peach; though most of the almonds bloom entirely too early to be of any importance in this region. The tree grows well in the irrigated valleys.

There seems to be no record of experiments having been conducted with chestnuts, but on account of the fact that New Mexico soils, on the whole, are rich in lime, this tree would probably not do well. It is also doubtful whether filberts could be grown successfully in this climate.

Literature.

There are several American publications devoted exclusively to nuts: Stewart, H. L., "The Pecan and How to Grow It," 1893; "Nut Culture in the United States," 1896, being a bulletin of the Division of Pomology, United States Department of Agriculture; Fuller, "The Nut Culturist," 1896; Lelong, "California Walnut Industry," 1896; Parry, "Nuts for Profit," 1897; Risien, "Pecan-Culture for Western Texas," 1904; Hume, "The Pecan and its Culture," 1906; Wight, "Pecans," 1906; Price, E. M., "The Walnut," 1910; Allen, W. F., "English Walnuts," 1912.

An important part of the current literature of nut-culture is contained in the reports of special societies. The National Nut-Growers' Association issues publications: see page 1554, Volume III. The Northern Nut-Growers' Association issued the Report of its Third Annual Meeting in 1912, comprising a publication of 140 pages; secretary and treasurer, Georgetown, Conn. There are also journals devoted wholly or in considerable part to nut-culture: See periodical list, pages 1560, 1561, Volume III.

H. E. Van Deman.

NUTMEG: *Myristica.*

NUTS. In popular usage a nut is a hard vegetable product, usually a fruit, inclosing an edible part within a shell; and the edible kernel or meat is released by breaking the integument. Technically or botanically, a nut is a hard and indehiscent one-seeded pericarp arising from a compound ovary; but it is hardly to be expected that this very special use can prevail as against the long-established popular usage. In this article, the word nut is understood in its popular or usual application; it may be difficult to define, but it is readily understood.

The purpose of this catalogue, by C. A. Reed, is to name and describe all the nuts that are likely to be found in commerce in this country or which may be subjects of rather common inquiry. Not all of these nuts are grown or cultivated in this country and therefore some of the genera may not be found elsewhere in the Cyclopedia; that is to say, this is not a cultural article but only descriptive and is independent of any alphabetical entries elsewhere in the work. For the cultivation of nuts as practised in North America, see the article *Nut-culture.*

L. H. B.

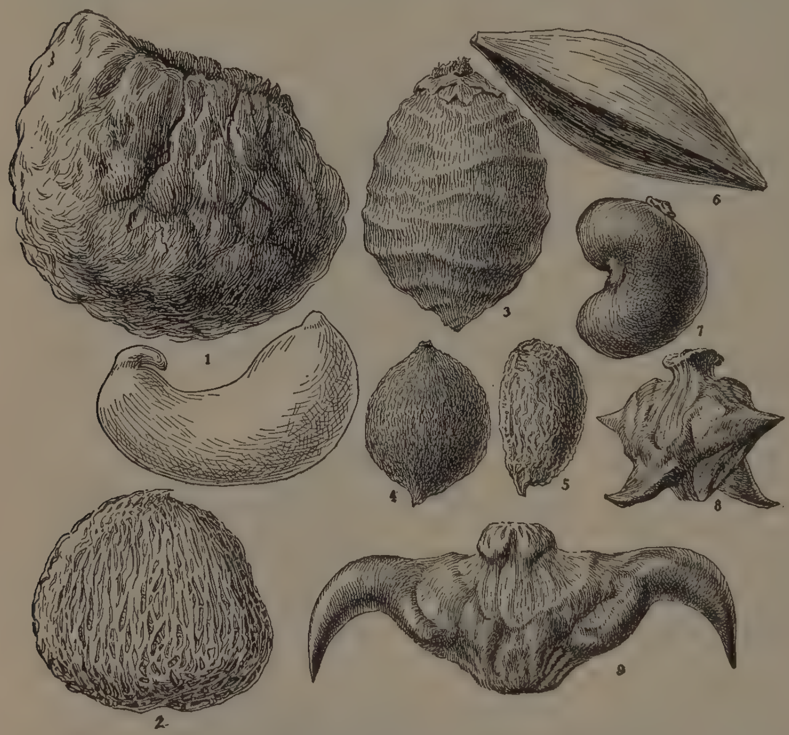
Æsculus Hippocastanum. Horse-Chestnut. *Hippocastanaceæ.* Inedible seeds, about equal in size to the largest of the European chestnuts, but less regular in form and having a somewhat stronger and more shining shell. Borne in a one- to three-celled prickly pod. The fruit of an ornamental tree familiar in the North Temperate Zone, of both the Old World and the New.

Aleurites spp. Wood-oil Nuts of China and Japan. Lumbang of the Philippines. Candle-Nut of the tropics. Tahiti, Spanish, or Country Walnut. *Euphorbiaceæ.* Irregularly rounded to spheroidal nuts, from 1 to 2 inches in diameter, ranging in color from mottled gray to nearly black, and having a hard but brittle shell, about ⅛ inch in thickness. Borne in fruits, 2 or 3 inches in diameter, containing about five nuts each. From the kernels of these nuts, which are considered edible only from certain species, and when half-ripe and roasted, there is obtained a valuable oil, known as country walnut oil, artists' oil, kekune (Ceylon), or kukui (Sandwich Islands) oil. Used medicinally, this oil has strong purgative properties; more largely, it is used in paints and varnishes, where it is said to have a very quick-drying and hardening effect. The cake which remains after the oil has been expressed is used as a cattle-food and as a fertilizer. To a large extent, the nuts are strung on the fibers of a palm leaf and used as an illuminant by the natives where the species are grown.

The genus is native to the milder parts of the North Temperate, and the northern portion of the Tropical Zone of the Orient. The Office of Foreign Seed and Plant Introduction has introduced the wood-oil trees into the southern states and California, where their culture promises to become an important industry.

The following list includes the more important species and several of the common names by which the fruits are known: *A. Fordii*, Chinese wood-oil nut, tung yu; *A. molluccana* (*A. triloba*), candlenut, Spanish walnut, Tahiti, or country walnut, kukui of Hawaii; *A. montana*, Mu-yu wood-oil.

Anacardium occidentale. CASHEW. CACHEW. ACAJOU. CAJA. CAJOU. MONKEY-NUT. *Anacardiaceæ*. Kidney-shaped nuts, an inch or more long, by about ⅞inch wide and more than ½inch in thickness, with a double outer shell, between which is an oily, dark brownish fluid, very acrid and possessing extremely poisonous properties similar to those of poisons ivy and sumac, to which the species is closely related. The outer shell is smooth and ivory-like in appearance, rigid and tough but thin and easily cut. The kernels are firm, sweet, and very agreeable when roasted. The nuts are formed on the end of a fleshy pear-shaped pedicel. Figs. 33, 192, Vol. I.



2539. *1*, Caryocar, husk above, nut below; *2*, Telfairia; *3*, Betel-nut, Areca; *4*, Gevuina; *5*, Pistacia; *6*, Pili-nut, Canarium; *7*, Semecarpus; *8*, Trapa natans; *9*, Trapa bispinosa. (×⅜)

Cashew-nuts do not appear in the market until after the poisonous properties have been entirely dispelled by roasting and the wholesome kernels have been separated from the shells. The species is native to the West Indies. It is now cultivated to a very large extent throughout the American tropics, both north and south of the equator.

Apios tuberosa. GROUNDNUT. WILD BEAN. *Leguminosæ*. The numerous, dark brown, fleshy tubers from 1 to 2 inches in length, by 1 to 1½ inches in diameter, and of somewhat irregular, oval or rounded form, which are borne on the rootstocks of an elegant twining perennial. Little use is made of these tubers, although they are said to have a rich nutty flavor when properly prepared. The species is native to lowlands of the eastern part of the United States, from Pennsylvania on the north, to Georgia on the south. Fig. 233.

Arachis hypogæa. PEANUT. GOOBER. PINDAR. GROUNDNUT. GROUND PEA. MANILA-NUT. MONKEY-NUT. *Leguminosæ*. Familiar straw-colored, oblong nuts, with thin fibrous, papery shells, rounded at the ends, and constricted at the middle, common at all fruit-stands. They are the seeds of a low-growing annual which pushes its pods under ground while they are maturing. Extensively cultivated in the southern part of the United States and elsewhere that seasons permit.

The constriction at the middle forms a partition between the two end chambers, each of which contains a single nutritious kernel. These are most commonly eaten when roasted, although to a large extent they are used when raw or boiled. The nuts are very rich in a valuable oil, useful in cooking and in the making of salads.

Areca Catechu. BETEL-NUT. ARECA-NUT. PINANG. *Palmaceæ*. Fig. 2539. The seed of an eastern tropical palm, which in size, general character and color much resembles the ordinary nutmeg. In form the "nuts" are not unlike the acorns of white oak, except that they are more rounded at the apex. To an enormous extent, betel-nuts are dipped in lime, wrapped in betel leaves (Piper betle) and chewed by the natives of the tropics, especially of India and the Philippines. The effect of betel-chewing is much the same as that of tobacco-chewing in this country. Fig. 367.

Attalea Cohune. COHUNE-NUT. CAHOUN-NUT. *Palmaceæ*. The oval or fusiform seeds of the cohune palm of Central America. Typical specimens measure from 2 to 2½ inches in length, by about 1½ inches in greatest diameter. Within the shell, which is fully ⅛ inch in diameter and very hard, is a single elliptical kernel. Cohune-nut oil has long been used in the manufacture of soap and as an adulterant for coconut oil. At present "There is practically an unlimited demand for all of these (palm) oils in the European margarin trade, where they are now preferred to oleo oil and neutral lard as a hardening ingredient."—"Daily Consular and Trade Reports," June 27,1914.

Attalea funifera. COQUILLA-NUT. *Palmaceæ*. Seeds of a rich brown color, 3 or 4 inches long, oval and of very hard texture. Used as a substitute for ivory in the manufacture of door-knobs, umbrella handles, buttons and various other commodities of the household. From a lofty South American palm. Fruits borne in large clusters.

Bassia latifolia (*Madhuca indica*). ILLIPE- or ILLUPE-NUT. *Sapotaceæ*. The long-oval, smooth-surfaced, coffee-colored seed of a tree native to the East Indies. Typical seeds measure approximately 1½ inches in length by ½ inch in diameter. According to the "Daily Consular and Trade Reports," "Illipe-nuts are used to manufacture an edible oil similar to lard." This report further says: "There are two crops a year, one large and one small. The large crop is now (August 12) nearly finished and a new crop will come in from March to June, 1912."

Bertholletia excelsa. BRAZILNUT. BUTTERNUT. NIGGER-TOE. CREAM-NUT. PARA-NUT. CASTANEA or CASTANA (corruption of "Castanha," Portuguese word for chestnut). JUVIA-NUT. *Myrtaceæ*. The seeds of certain very large, uncultivated trees, common to great areas of the river-bottom sections of northern Brazil. Grown in a spherical or pear-shaped capsule of 2½ or 3 inches in diameter, having a hard, woody, outer wall, within which are encased from eighteen to twenty-four of the nuts. The capsule is covered with a dark brown outer husk greatly resembling that of the walnut.

The nuts which are sharply triangular, measure from 1½ to 2 or more inches in length, by ½ to 1 inch in greatest diameter. They have a single, solid kernel, sweet and very good, which is protected by a somewhat rough, rigid but thin shell, to which it often closely adheres. Fig. 543.

Received into this country for consumption in enormous quantities during the months of spring and early summer, and held in storage until the following season.

Brosimum Alicastrum (*Piratinera Alicastrum*). BREAD-NUT of Jamaica. *Moraceæ*. The small roundish, yellow or brownish seeds, an inch or less in diameter, of a large tropical American tree. These seeds are borne singly or sometimes two in a thin paper-like, but stout shell, with smooth and somewhat granular surface. They are edible only after cooking or roasting.

Bunium Bulbocastanum. LOUSY-NUT. EARTH-NUT. EARTH-CHESTNUT. HAWK-NUT. KIPPER-NUT. PIG-NUT. AR-NUTS. YER-NUTS. JUR-NUTS. *Umbelliferæ*. Small nut-like tubers which form on the roots of plants of this species. They have a sweetish taste and are eaten by children, either raw or roasted. Rather too acid for adults unless roasted. From western Europe.

Butyrospermum Parkii. SHEA-NUT. *Sapotaceæ*. The shea-nut is the seed of an extensive African tree (butter tree) which according to Consul W. J. Yerby, "Daily Consular and Trade Reports," in Sierra Leone, British Africa, grows to a height of over 40 feet. "The nut," he says, "is of about the size and shape of a walnut, but is covered with a smooth skin resembling that of a Spanish chestnut, which can be pulled off in the same way when fresh. Inside this skin is a soft kernel of a light yellow color when fresh, and chocolate color when dry, which contains a large proportion of fatty material, that when extracted is called shea butter.

"The outside fleshy pulp, whose weight is approximately equal to that of the nut, rots away in time and splits, leaving the nut exposed. The natives hasten its removal by burying the freshly gathered fruit in a pit for some days. The nuts, divested of their outer covering (pulp), are dried, either by being placed in the sun for about twelve days or by heating in an earth oven. In this process the nut loses 30 to 40 per cent of its weight. The skin is removed and the kernel remains. The shea-butter content of the decorticated kernel is 40 to 60 per cent of this weight of the kernel."

Regarding this butter, Yerby continues that "Purified shea-butter is edible and suitable for use in the preparation of artificial butter by chocolate manufacturers, etc., and the principal European demand will be for this purpose."

Shea-butter is used in the making of certain soaps but according to Yerby, "The high percentage of free fatty acids renders shea-butter unsuitable as a lubricant."

Calodendrum capensis (*Pallasia capensis*). Cape Chestnut. Wild Chestnut. *Rutaceæ.* The shining black, irregularly rounded, and somewhat wedge-shaped, seed of a subtropical tree of southern Africa, of about ¾inch in length. These seeds have a stout but thin shell and a single farinaceous kernel, which resembles somewhat the texture of a chestnut. Cultivated mainly as an ornamental.

Canarium luzonicum. Pili (Pee-Lee)-Nut. Philippine-Nut. Luzon-Nut. Java Almond. Phillo-Nut. *Burseraceæ.* Fig. 2539. The smooth, hard-shelled, triangular seed of a tree native to the Philippine and other Pacific Islands of the far East, which has recently become very common in the American markets, sometimes separate, but more often in "mixed" nuts. The natural color of these nuts is a light brown, varying somewhat on different parts of the nut. As oftenest seen in the market, it is of a uniform reddish color, given it by an artificial dye, which may readily be detected with a moistened finger.

These nuts are inclined to be slender, sometimes attaining a length of 2½ inches and a middle diameter of but ¾ to ⅞ of an inch, though sometimes they are short and blunt-pointed with about the same diameter. Typical specimens taper gracefully from near the middle into long, sharp-pointed ends. Inside the shells, which are exceedingly difficult to crack, are single kernels said to be of excellent quality in good specimens, but which as commonly appear in our markets are well below that of most other nuts.

The use to which pili-nuts are most commonly put is that of food, but it is said that to a more or less important extent, they are used in the manufacture of certain kinds of baby foods, emulsions, and the like.

Carya spp. Hickory-Nuts. *Juglandaceæ.* The seeds of one of the most important groups of American trees, representative species of which are indigenous to nearly every section of the central, eastern and southeastern parts of the United States. With the exception of a few which are very astringent, the nuts of all species are edible; some being among the choicest nuts of the market. Of the better known species, with the exception of the nuts of the pecan (*Carya Pecan*) and of the water-hickory, or bitter pecan (*C. aquatica*), hickory-nuts as a rule are inclined to be globular in form, sometimes of smooth surface, or with but faint ridges, but very often with sharp ridges and therefore distinctly angular. The color range of hickory-nuts includes almost white, creamy white, and light or dark brown, with gradations between. The shells vary in thickness from extreme paper-like thinness, characteristic of certain varieties of pecans, to extreme thickness and hardness, common with the mocker-, or bull-nut (*C. alba*). The kernels are formed in two distinct halves or cotyledons, separated from each other by a partition which may be thick, thin or papery, hard or corky, or a variation of any of these.

The following list includes the names of the more important species and their common names: *C. alba*, mocker-nut, bull-nut, big-bud hickory; *C. aquatica*, water-hickory, bitter pecan; *C. cordiformis*, bitter-nut, swamp-hickory; *C. glabra*, pig-nut; *C. lacinosa*, big shellbark, bottom shellbark, big shagbark, scalybark, king-nut, white walnut; *C. myristicæformis*, nutmeg-hickory; *C. ovalis*, small pignut, false shagbark; *C. ovata*, shagbark, little shagbark, little shellbark, little scalybark, white walnut, walnut, tuscatine; *C. Pecan*, pecan, Illinois-nut. Figs. 823–831; 1836–7.

Caryocar spp. Peruvian Almond. *Caryocaraceæ.* Fig. 2539. A nut, in many respects resembling the chestnut, from at least certain districts in Peru and western Brazil, which has probably not yet appeared in this country except in botanical collections. The kernel, which is about equal in size to that of the Brazil-nut, is borne singly in a bur resembling that of a rather small chestnut bur with very short spines, is somewhat kidney-shaped, and has a handsome rich brown color. In fineness of texture and in richness of flavor, this nut is said to excel any other nut of the tropics. It is most highly prized by the natives. Messrs. Bennett, Day & Company, importers in New York, now contemplate the making of inaugural shipments into this country during the coming season (1915–16).

There are said to be at least ten species of Caryocar. Of these, two from Guiana, both of which are called Guiana butternuts, are *Caryocar butyrosum*, pekea-nut, and *C. nuciferum*, souari or butternut.

Castanea spp. Chestnut. *Fagaceæ.* Reddish brown, irregularly obovate, or obconic nuts, ranging in size from ¼ to 2 inches in greatest thickness, having thin papery shells, and being borne in stiff brown burs, thickly covered with stiff, short or long, single or compound, sharp spines. The fruits of an important genus, well known in many parts of the North Temperate Zone in both the Old World and the New. Kernels of the small American and Chinese chestnuts, and of the small chinquapins, are of excellent flavor; average European chestnuts are of fairly good flavor, by comparison, while the Japanese chestnuts are usually of very inferior quality, except when boiled, roasted, or otherwise prepared.

The names of the principal species bearing nuts of importance are as follows: *C. alnifolia*, creeping chestnut, southeastern United States; *C. crenata*, Japan chestnut, Japan; *C. dentata*, American chestnut, northeastern United States; *C. mollissima*, Chinese chestnut, China and Korea; *C. pumila*, chinquapin or dwarf chestnut, eastern and central United States; *C. sativa*, European, French, Spanish or Italian chestnut, Europe. Figs. 833–835; 911–917.

Castanospermum australe. Moreton Bay Chestnut. Australian Chestnut. *Leguminosæ.* Seeds of an Australian plant, much the size of European chestnuts and having a chestnut-like flavor. The nuts which are somewhat rounded, spheroidal or flattened in form, are borne in pods an inch or more in thickness, and 6 or 8 inches in length. To some extent these nuts are roasted and eaten by the natives but are not altogether pleasant. To a limited extent this species has been introduced into southern California.

Cocos nucifera. Coconut. *Palmaceæ.* The well-known roundish or oval, nut-like seed, 3 or more inches in diameter, of a palm widely grown throughout all tropics. From the nuts, which are borne incased in very thick fibrous husks, is obtained the world's greatest food-supply. The flesh is wholesome either green or ripe, and either raw or cooked. The milk affords a very refreshing drink and the dried flesh, called "copra," is exported in enormous quantities. Coconut oil is one of the chief articles of export from the tropics. It is used in the manufacture of transparent and "marine" soaps. It is also largely used in pharmacy as a substitute for lard because of its less tendency to rancidity. Figs. 1011–1015.

Cola acuminata (*Cola*, or *Bichea, acuminata*). Cola. Kola. Bissey-bissy. Korra. Kolla. Gorra. Goora. Guru. Temperance-Nut or Ombene-Nut. Soudan Coffee. *Sterculiaceæ.* The seeds of a large African tree, from which is obtained the stimulating drink, long used in the tropics and now very common as a summer drink in this country. The seeds are borne in long pods, containing from five to twelve seeds each. The cola-nut is described in the "United States Dispensatory," as being "irregular in form, reddish gray in color, from ¾ of an inch to 1¼ inches in length, flattened and rounded upon one surface, irregularly scooped or unfolded upon the other surface, the nut being apparently a cotyledon marked above with another cotyledon which it has embraced."

Corylus spp. Hazel-Nut. Filbert. Cob-Nut. *Betulaceæ.* The seeds of a plant usually of shrubby habit of growth, but with at least one exception (*C. Colurna*), developing into a large tree, which is well known throughout much of the North Temperate zone in both the Old World and the New. Form globular, short, flattened, or oblong-flattened, the oblong types usually being wedge-shaped at the apex, and all types having a large light colored scar covering the whole of the basal end, marking the point of attachment. In color the hazels somewhat resemble the chestnuts but are of a lighter and more yellowish brown. Within the shell, which is usually thin and easily cracked is a single, dry, tough, or firm kernel, usually of sweet and agreeable flavor. Figs. 1073–1075; 1788.

The following include the principal species which are now looked upon as being of cultural importance: *C. americana*, American hazel, northern United States and Canada; *C. californica*, California hazel, western United States; *C. rostrata*, beaked hazel, northern United States and Canada; *C. Avellana*, European hazel, hazel-nut, nuttal tree, bread-nut, filbert, filberd, filbeard, philbert or cob-nut, southern Europe; *C. Colurna*, Constantinople hazel, Asia Minor, China; *C. maxima*; (*C. tubulosa*), Lambert's filbert, Europe.

Crescentia Cujete. Jicara-Nut. *Bignoniaceæ.* According to Fuller, in the "Nut Culturist," the name jicara-nut is applied locally in some of the Central American states, to the fruit of the evergreen calabash tree. Fruits vary greatly in both size and form, some being small and others from 18 to 20 inches in diameter. Some are symmetrical while others are of quite irregular form, but typical specimens are globular. They have a hard outer shell and an inner pulp which supports the seeds. The empty shells are used as drinking vessels and because of their ability to resist fire are considerably used as kettles for culinary purposes. Fig. 1106.

Cyperus esculentus. Chufa. Earth Almond. Rush-Nut. Edible Rush. *Cyperaceæ.* The small edible tubers of a sedge plant which, to a considerable extent, are grown in warm climates as a food for swine. Native to southern Europe. For fuller account, see *Chufa* and *Cyperus esculentus* in Volume II. Figs. 959; 1194.

Durio zibethinus. Durian-Nut. *Bombacaceæ.* The seed of a large forest tree of the East Indies and the Malay Peninsula, resembling the American elm somewhat in general appearance. According to Lindley, in "The Treasury of Botany," "The fruit varies in shape, being either globular or oval, and measures as much as 10 inches in length; it has a thick hard rind, entirely covered with very strong sharp prickles, and is divided into five cells, each of which contains from one to four seeds rather larger than pigeon's eggs and completely enveloped in a firm luscious-looking, cream-colored pulp, which is the edible portion of the fruit."

Lyons, in "Plant Names, Scientific and Popular," says that the fruit is "delicious in flavor, but of intolerable odor."

The seeds are roasted and eaten as are chestnuts. Numerous efforts have been made to establish this plant in Florida but thus far without success, due partly to the difficulty in shipping the tender plants, and also because of the inability of the species to endure the Florida climate. See also *Durio*, page 1081; Fig. 1366.

Elæis guineensis. Palm-Nut. *Palmaceæ.* The small irregularly formed seeds of a tropical African palm, famous for its production of palm-oil or palm-butter, as it is also called, which is largely used in the manufacture of soap and to some extent as a coloring-matter for oleomargarine. Nuts measure from 1 to 1½ inches in length by about ¾inch in greatest thickness. They are very hard, have a thick ivory-like flesh and a small cavity in the center. The nuts are encased in a fibrous covering which contains the oil. According to the Kew Bulletin, "Three varieties of nut trees are distinguished, having orange, red, and black nuts respectively, the first having the finest oil but small kernels, the others less oil but large nuts." The oil is extracted by boiling the nuts.

Lindley, in the "Treasury of Botany," says that of the shells, which are very hard and capable of taking a high polish, the negroes make rings and other ornamental articles.

Euryale ferox. Fox-Nut. Gorgon- (Greek meaning terrible) Nut. *Nymphæaceæ.* The spiny-covered edible seeds of a handsome, floating water-plant of eastern India. Believed by the Hindoo physicians to possess certain medicinal properties. It has long been cultivated in China and now to a considerable extent is common in the milder portions of the temperate United States.

Fagus grandifolia. American Beech-Nut. *Fagaceæ.* Small triangular seeds which in form and general appearance greatly resemble overgrown seeds of buckwheat. In character of shell and in flavor of kernel, beech-nuts greatly resemble the chestnut. Owing to the tediousness of separating the kernel from the shell, these nuts are not so largely harvested as undoubtedly would otherwise be the case. Figs. 1474–5.

From the seeds of the European beech (*Fagus sylvatica*), which also are edible, there is obtained a valuable oil, used as food and in the manufacture of soaps and as an illuminant.

Fusanus acuminatus (*Mida acuminata*). Quandong- or Quandang-Nut. *Santalaceæ.* The spherical, yellowish, rather thick-shelled seeds of an edible Australian tree-fruit called the "native peach." Of about the size of marbles. Surface covered with numerous small but deep pits. Kernel single. The fruit is quite edible and is locally used as a preserve.

Gevuina Avellana. Chilian-Nut. Chile Hazel. Avellano. *Proteaceæ.* Fig. 2539. Small seeds of an evergreen tree from Chile. Globular in form, with smooth, tough shell and a kernel much like that of a hazel in both appearance and flavor. Seeds borne within a coral-red fruit. Cultivated to some extent in California.

Ginkgo biloba. Ginkgo-Nut. *Ginkgoaceæ.* The oval, creamy white seeds of the ginkgo or maidenhair tree from China and Japan, which, to a considerable extent, is a familiar ornamental tree in temperate America. The nuts measure about ⅞inch in length, by ⅝inch in width, by ½inch in thickness. They have smooth and thin, but stout shells, within which are single green-colored kernels of rather sweetish flavor. When roasted, the kernels are said to be very palatable and are highly prized by the Chinese. At best, however, ginkgo nuts are inferior to most of the nuts on the market and are therefore not popular with the American people. Figs. 1640–42.

The fruit of the ginkgo considerably resembles that of the native persimmon in color, size and character, but differs from it in that the ginkgo flesh is of a disagreeable odor.

Guilandina Bonduc. Nicker. Nickar. Bonduc-Nut or Bezoar-Nut. *Leguminosæ.* The blue-gray, irregularly rounded, smooth-surfaced, beautiful seeds of a climbing legume of the tropics. The seeds are somewhat less than an inch in greatest diameter and have very hard shells. They are used as beads and to some extent for medicinal purposes.

The species has a very wide distribution caused by the seeds being transported by ocean currents; their imperviousness enabling them to be carried by waves for an indefinite length of time.

Hybrid nuts of the family *Juglandaceæ.* Such crosses as the pecan with some other species of hickory; the Persian walnut with some species of black walnut; the eastern American black walnut with one or the other of the California black walnuts are not infrequently met with in nature. The trees resulting from such crosses are very un-uniform in their character and rate of growth, some being extremely slow to develop and others very rapid, while others range between these extremes. A number of the pecan and hickory crosses have attracted considerable attention, because of their vigor of growth and production, but none of commercial importance has yet come to public attention. Such crosses are known as "hicans." The more rapid-growing of the walnut hybrids are much in use as stocks for cions of the Persian walnut of California. Ordinarily the walnut hybrids bear very light crops and the nuts are of little value. See *Juglans.*

Crosses between the eastern and either of the California black walnuts are called Royal and those between any of the black and the Persian walnuts are called Paradox.

Hyphæne crinita. Hyphæne-Nut. Doum-Nut. Doom-Nut. Dom-Nut. *Palmaceæ.* The seeds of a slow-growing African palm. From specimens received at the Office of Seed and Plant Introduction, Department of Agriculture, it appears that there are at least two quite different types of nuts appearing under this name, both of which have been considerably employed as substitutes for the more expensive ivory-nuts (*Phytelephas Seemannii*) of South America. Nuts of one of these types are of a light yellowish outer color, irregularly jug-shaped, approximately 2 inches thick by 2½ inches long, and covered with a smooth-surfaced fibrous husk ⅛ inch thick. Nuts of the other type are somewhat larger, less regular in form, and of a buff-color, but having much the same sort of outer husk and inner characters. The thick wall of pure white, hard flesh within the woody shell of each is used in the making of buttons, but reports from American and German manufacturers are to the effect that buttons of this material are much inclined to warp and shrivel.

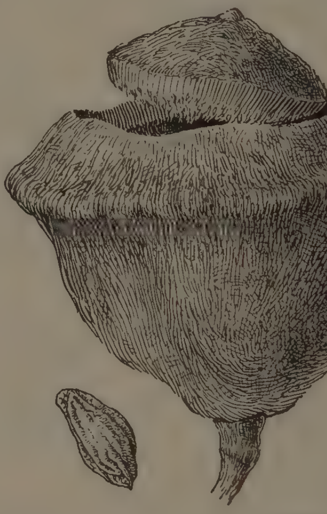
Inocarpus edulis. Tahitian, South Sea, Fiji, Polynesian, or Otaheite Chestnut. *Leguminosæ.* The seed of a tree native to the South Sea and neighboring islands. Borne singly in flat, fibrous pods, having a smooth outer surface. They are thin and somewhat wedge-shaped. Typical specimens measure approximately 2 by 1¾ by ¾ inches. When prepared by roasting or boiling, these nuts are said to have a chestnut-like flavor.

Jatropha Curcas. Physic-Nut. French Physic-Nut. Barbados-Nut. Purging-Nut. *Euphorbiaceæ.* Small, oblong, rounded seeds of about ¾ inch long, 7/16 inch wide, by ⅜ inch thick, of a slatish color, and having a thin strong shell, of a shrubby, tropical American tree. From the kernel, which is white and solid, there is obtained a strong purgative oil (curcas oil) which is also used for illuminating purposes. To some extent, this tree is grown in the warmer parts of the United States, but probably only as an ornamental.

Jubæa spectabilis. Coquita-Nut. Juba-Nut. Coker-Nut. Dwarf Coconut. Monkey's Coconuts. *Palmaceæ.* Small globular nuts 1 inch or less in diameter, having a smooth-surfaced, rather thick and very hard shell, within which is a flesh and open center much like that of the common coconut. The seeds of the wine palm of Chile. Consul Clement S. Edwards, in the "Daily Consular and Trade Reports," says: that "Coquito-nuts (little coconuts) are found in this region (Mexico), but the entire amount gathered is taken by the local soap manufactories, the managers of which are constantly complaining that they cannot procure sufficient material from this (Acapulco) neighborhood for their needs."

Juglans spp. Walnut. Butternut. *Juglandaceæ.* The nuts of a very important group of trees, representative species of which are found in many parts of the world, usually in the temperate zones. To this group, which is closely related to that of the hickories, belongs the well-known Persian, or more commonly called "English" walnut, the California product of which alone is annually worth more than double that of any other nut now grown in this country.

As with nuts of the hickory species, the walnuts vary greatly in size, form, thickness of shell, and, except in abnormal cases, which are very rare, the kernels are formed in two distinct halves, or cotyledons. The kernels of both are rich in valuable oils, which doubtless eventually will come into general use in the making of salads and for other purposes of cooking, but which are now used mainly in arts and paints, and as illuminants or lubricants. In color, the walnuts range from the light yellow or orange of the Persian walnut to the dark brown or black, of the black walnut. With the exception of the butternut, or the "white walnut," as it is quite largely known, which is fairly cylindrical, and about one-third longer than thick, and which has a rough sharp-pointed surface, the several species of American walnuts and a number of the foreign walnuts, are spherical or spheroidal in general form.



2540. Great nut of a lecythis, or monkey-pot. (×¼)

The usual difficulty with which the kernels are separated from the thick shells of the common butternut and black walnuts has prevented the nuts of either species from becoming generally popular on the market. Horticulturally speaking, there are now no recognized varieties of butternuts and but very few of black walnuts.

The list which follows includes practically all of the better known species of walnuts with their common names. For fuller accounts of each species, see Volume III: *J. australis,* Australian black walnut; *J. boliviensis,* Bolivian black walnut; *J. californica,* California black walnut (southern type); *J. Sieboldiana* var. *cordiformis,* Japanese walnut, heart-nut; *J. cinerea,* butternut, white walnut; *J. Hindsii,* California black walnut (northern type); *J. major,* Arizona black walnut; *J. mandshurica,* Japanese walnut, Manchurian walnut; *J. nigra,* American black or eastern black walnut; *J. regia,* Persian, English, Royal, Italian, Madeira, European, French, Chile, Caucasian, Manchurian, Circassian walnut; *J. rupestris,* Texas walnut, New Mexico walnut; *J. Sieboldiana,* Japanese walnut. Figs. 2011–2019.

Lecythis spp. Sapucaia- or Sapucaya-Nut. Paradise-Nut. Monkey-pot-Nut. *Myrtaceæ.* Fig. 2540. An oblong, irregularly shaped, though somewhat triangular nut, with irregular, longitudinal grooves over its whole surface, and having a rather thick, cork-like shell, which may be easily cut, and a single solid kernel, which considerably resembles that of the Brazil-nut (*Bertholletia excelsa*) to which it is closely related, but than which it is of much finer texture and of more delicate, pleasing flavor.

A quart or more of these nuts are borne in a heavily walled capsule of urn-shape, measuring from 6 to 8 inches in diameter at the middle, in the top of which is a perfectly fitting lid, from 2 to

4 inches across, which is said to be automatically thrown off with a sharp sound, by the contraction of the capsule at maturity. As the weight, which at that time must be from five to eight pounds, has caused the capsule to assume an inverted position, the nuts are scattered upon the ground. The scramble which follows of the monkeys and other small animals of the forest, to be first upon the scene for the nuts, has given this capsule the name of "monkey-pot," and the group of closely related species having similar capsules the name of the "monkey-pot group."

These species are native to much the same districts of South America as is the Brazil-nut.

Litchi chinensis (*Nephelium Litchi*). Litchi. Litschi. Lichi. Leechee. Litchee. Chinese-Nut. Chinese Hazel. Dawa-Nut. *Sapindaceæ.* A brown-colored, warty appearing fruit, in size and form resembling that of a strawberry, with an outer thin, papery shell, within which is a central smooth hard-shelled seed, surrounded by a brownish pulp of a delicious, subacid flavor. The fruit of a low-growing, tender tree, native to China. Under test for some years in Florida and in California.

Macadamia ternifolia. Queensland-Nut. Australian Hazel-Nut. Australian-Nut. *Proteaceæ.* A globular smooth-surfaced nut, of a light, yellowish brown color, 1 inch or less in diameter, with a very hard, rather thick shell, within which is a single kernel, resembling in form that of a hazel, to which it is greatly superior in richness and flavor. The fruit of an evergreen tree from Australia. There are a few trees of this species in California. Fig. 2241.

Manketti nuts. Mentioned in the "Daily Consular and Trade Reports," October 23, 1912, as having comprised a trial shipment of 22,500 pounds, which had recently been made to Europe from German southwest Africa, with a view to testing their commercial value. The nuts were said to have been gathered from wild trees in the neighborhood of Tsumed. According to this report, "It is said that the natives and bushmen eat the fruit without any ill effects." Efforts to find reference to the name "manketti" in botanical works have thus far met with failure. It is suspected, however, that the article from which this citation was taken had reference to the palm-nut, *Elæis guineensis.*

Mauritia flexuosa. Miriti- (Me-rish-i-e), Ita- (I-te) Palm-, or Buriti-Nut. *Palmaceæ.* The wine-colored seed, with flattened ends, of a lofty tropical American palm. This seed, which is about equal in size to that of the Persian walnut, is covered with very regular, close-fitting scales, underneath which is a tough shell, encasing a single ivory-like, globular, and farinaceous kernel about 1 inch in diameter. Much used as a food by the natives.

Moringa oleifera (*M. pterygosperma*). Ben-Nut. *Moringaceæ.* The seeds of a species of small tree native to tropical Asia, from which is expressed the ben-nut oil, largely used in the manufacture of perfumery. Seeds small, papery white, winged, triangular and resembling buckwheat grains in form. Figs. 2387, 2388.

Nelumbo lutea. Nelumbo. Nelumbium. American Lotus. Water Chinquapin. Water-Nut. Rattle-Nut. *Nymphæaceæ.* The small dark blue, nearly spherical seed of the American lotus or great water lily. About ½ inch in diameter, with smooth surface and a strong shell, within which is an edible kernel. *Nelumbo nucifera* is eaten in China as a nut.

Ophiocaryon paradoxum. Snake-Nut of Guiana. *Sabiaceæ.* Described by Fuller, viz.: "A large, roundish fruit, about the size of a black walnut, the product of a large tree of the soapberry family, native of British Guiana. This nut takes its name of 'snake-nut' from the peculiar form of the embryo of the seed, which is curled up spirally.

"The Indians, thinking there must be some virtue in form, use these nuts as an antidote for snake-bites, although so far as known to science they do not possess any medicinal properties."

Panax trifolium. Ground-Nut. *Araliaceæ.* The globose, pungent-tasting nut of the dwarf ginseng of the northern states. Of about the size of a radish.

Parkia africana. Nitta- or Nutta-Nut. *Leguminosæ.* Edible seeds, borne within the long clustered pods of the African locust tree. The pods, containing a sweetish farinaceous pulp within which the seeds are imbedded, are eaten entire, as is the carob or St. John's bread.

Pasania cornea. Edible Acorn. *Fagaceæ.* The seed of an evergreen tree of China, closely related to the oak. Now being tried out in this country by the Office of Foreign Seed and Plant Introduction, which says regarding it: "The nuts are as thick-walled as hickory-nuts; the kernels are white and of characteristic shape, and have a sweet, very agreeable flavor. In China, they are sold on the markets as are chestnuts here."

The nuts are very broad in proportion to their length, presenting a flattish appearance.

Pasania cuspidata. Edible Acorn. *Fagaceæ.* Described by the Office of Foreign Seed and Plant Introduction, by which it is being tested in this country, with stock from a Yokohama nursery, as being "A small acorn, edible and sweet, when ripe or after frost, boiled or roasted." From Formosa, Korea, and milder parts of China.

Phytelephas Seemannii. Ivory-, Tagua-, Taqua-, or Vegetable Ivory-Nut. Negro's-Head. *Palmaceæ.* The rounded, somewhat wedge-shaped seeds, or nuts of a low-growing reclining Central American palm, which in size and form greatly resemble very large chestnuts. Each nut is covered with a smooth, thin but strong shell of a light yellowish color, mottled with brown. The flesh is solid, pure white or creamy white, and capable of taking a very high polish. When cut or turned, they are used as a substitute for ivory in the manufacture of buttons, toys, and various kinds of ornamental work.

These seeds are borne in large compound chambers compactly joined together into heads a foot or more in diameter and covered with a sharp thorny surface, of a gray color. Each chamber contains from four to nine of the nuts, each of which is encased within its own shell.

The manufacturing of useful articles from ivory-nuts for the household is a very important industry in Germany, Hamburg being one of the chief centers.

Pinus spp. Pine-Nut. Indian-Nut. Piñon (Pin-yon). Pignolia. Pignon. *Pinaceæ.* The seeds of a considerable number of both foreign and American pines having rich, edible kernels which form an important article of food in many sections where the species are indigenous. Probably the largest of edible pine seeds are those of the Araucarian pines of Chile, of which there are several species. Not infrequently, seeds of these pines exceed 2 inches in length.

Of commonest appearance in our American markets are the seeds of the stone pine, *P. Pinea*, of southern Europe, which are sold under the names of "pignolia," or "pine-nuts," and to an increasing extent under the Mexican name "piñon," which originally was applied only to the seeds of certain American pines of the Southwest. As marketed, these nuts usually appear without the shells, in which condition they greatly resemble puffed rice.

Although some 12 or 15 species of American pines yield edible nuts, their product is seldom seen in any but the western markets, as it is largely consumed locally by the Indians of the Southwest and the Mexicans. These nuts are known as "piñons," "pine-nuts," and "Indian-nuts."

While none of the seeds of the American group are large, they vary greatly in size, form, and color. In flavor of kernel they are much alike. Usually they are irregular in form, longer than thick, sometimes slender but generally of about the same diameter each way. They range from ⅛ to ⅞ inch in length. In color they run from a light yellow, on one side at the basal end, to a brownish black at the opposite end, with a coffee-brown probably predominating.

The following list includes the names of the more important pines which bear edible nuts: *Araucaria braziliana*, Chile; *A. imbricata*, monkey puzzle, Chile; *Pinus albicaulis*, white bark pine, western United States; *P. cembroides*, Arizona piñon, southwestern United States; *P. Coulteri*, big-cone or Coulter's pine, western United States; *P. edulis*, piñon, southwestern United States; *P. Jeffreyi*, black pine, western United States; *P. Lambertiana*, sugar, shade, gigantic, or purple-coned pine, western United States; *P. monophylla*, single-leaf, or gray pine, western United States; *P. monticola*, mountain, finger-cone, or western white pine, western United States; *P. Parryana*, Parry's pine, or Mexican piñon, western Mexico; *P. Pinea*, stone pine, seeds called pine-nuts, pignolia, piñon, and pignon, southern Europe; *P. Sabiniana*, digger or gray-leaf pine, western United States; *P. Torreyana*, Torrey, Soledad, or Delmar pine, southern California.

Pistacia vera. Pistache. Pistachio-Nut. Green Almond. Fistiche. *Anacardiaceæ.* Fig. 2539. A small nut about ¾ inch long and slightly more than half as thick, which usually appears in the market with its thin, brittle shell partially split open, and with its kernel having a distinct salty taste. This is the seed of a Syrian tree which has been split open while maturing and which later has been roasted and salted. Typical kernels are of a distinct greenish color throughout and have a mild agreeable flavor. When ground, these kernels are used to a very large extent to afford the color and flavor of certain confections, especially ice-cream.

Trees of *P. vera* are fairly common in nut orchards of interior southern California, New Mexico and western Texas.

Prunus Amygdalus. Almond. *Rosaceæ.* Familiar products in all nut markets. To a considerable extent the form of the almond resembles that of an oyster-shell, although there is a very great variation in the length and width of the nuts of different varieties. Some are long and narrow, others short and thick, while still others range between. The shells of some are very thin, breaking readily when crushed together with one hand. These are called paper-shells. Others, called hardshells, require a sharp blow with a hammer for cracking. Almonds ranging between the hard and the paper-shells are called soft-shells. As they appear in the markets, almonds usually are of a uniform light yellowish color, which has been given them by artificial bleaching. The normal color is of a rather dull yellow, or as in the case of the hardshells, a brown closely resembling that of a peach pit.

At present the almond is the third most important nut crop in the United States, the first being that of the Persian or English walnut, and the second, the pecan. The entire output from this country is produced from beyond the Rocky Mountains, mainly from the Sacramento Valley of California.

Pterocarya fraxinifolia. Winged Walnut. Caucasian Walnut. *Juglandaceæ.* Small, angular, winged seeds, having hard shells, of a tree, native to western Asia. Of no economic importance. This and several other species of Pterocarya are employed to a considerable extent as ornamentals in the milder portions of temperate America.

Pycnocoma macrophylla. Bomah-Nut. Boma. Bome. *Euphorbiaceæ.* The seed of an African shrub used in tanning, and which yields a fixed oil.

Pyrularia pubera. Buffalo-Nut. Oil-Nut. Elk-Nut. *Santalaceæ.* The small seed of a pear-shaped drupe, which is the fruit of an eastern American shrub native from Pennsylvania to Georgia. About 1 inch long, subglobose, thin-shelled, and containing a kernel rich in oil and of a strong acid flavor. Without economic value.

Sapium sebiferum (*Stillingia sebifera*). Tallow-Nut. Chinese Tallow-Nut. *Euphorbiaceæ.* The whitish colored fruits, about ⅛ inch in diameter, of a Chinese tree. Borne singly in three-chambered capsules. The nuts consist of relatively large, brown seeds, having hard shells with a thick coating of a fatty substance, which is used in various ways as a substitute for animal tallow. From China and Japan.

Semecarpus Anacardium. Marking-Nut. Marany-Nut. Marsh-Nut. Oriental Cashew. *Anacardiaceæ.* Fig. 2539. The black, lobe-like, somewhat contorted seed of about 1 inch in length, by ¾ inch wide, and ⅜ inch thick, of an evergreen tree native to the warmer parts of Asia. A very useful ink is made by mixing lime with the green juice of these seeds. It is said that to a considerable extent the natives roast and eat these seeds.

Unless roasted, these nuts should be handled with great precaution, as in the raw condition they possess extremely poisonous properties similar to those of the American poisons, ivy and sumac, and the cashew, to which it is closely related.

Staphylea trifolia. American Bladder-Nut. *Staphyleaceæ.* The fruit of a shrub common in eastern and northern United States. Triangular in form, measuring from 1¼ to 1¾ inches in length by about ¾ inch in width, covered with a thin papery shell of a reddish brown or buckwheat color, and having a rather long, sharp point at the apex. Fruit three-celled, each cell containing several (usually three) small, smooth and very hard shining seeds. Fruits remain on shrubs during winter. Of use only as ornamentals.

Strychnos potatorum. Clearing-Nut. Indian Gum-Nuts. Water-filter-Nut. *Loganiaceæ.* The seed of an oriental tree, which is largely employed by the natives because of its power of causing impurities in water to settle to the bottom. Receptacles in which water is to be placed are vigorously rubbed with one of the nuts; later the water is poured in and the impurities quickly unite together at the bottom, leaving the water perfectly clear.

Telfairia pedata. Tabebuia. *Cucurbitaceæ.* Fig. 2539. The thin, broad seed, in form resembling a longitudinal section of a shortened tulip bulb, of a rapidly growing tropical climber from Africa. Typical specimens measure about 1¼ inches in length, by slightly more in width, and about ⅜ inch in thickness. They are covered with a tough fibrous seedcoat of a straw-color. Within this is a solid palatable kernel, resembling the Brazil-nut greatly in texture and somewhat in flavor.

Terminalia Catappa. Tropical Almond. Demarara Almond. Malabar Almond. Myrobolan-Nut. Tavola-Nut. *Combretaceæ.* The oblong, broad-oval, smooth-surfaced seed, with a sharp ridge marking the sutures on the two sides, of a very tall deciduous tree of southern Asia. The long and very slender kernel, encased within the thick porous husk of this seed is said to have an almond-like flavor.

Theobroma Cacao. Chocolate-Nut. Chocolate-Bean. *Sterculiaceæ.* The dark reddish brown, bean-like seeds of a small genus of tropical America which affords the cacao butter of commerce. These seeds are about ⅞ inch long, by ½ inch wide and ⅜ inch thick.

Thespesia populnea. Portia-Nut. *Malvaceæ.* The small obovoid brown seeds of a tree, native to tropical parts of the Old World. Seeds have a netted veined surface, yellowish brown pubescence on inner edges, especially at apex, and a thin but stout shell. Portia-nuts yield an oil used as an illuminant.

Torreya nucifera. Torrey-Nut. False Nutmeg. *Taxaceæ.* The small brown-colored, somewhat mottled, thin-shelled, oblong-oval seeds, of a good-sized coniferous tree native to Japan. Eaten either raw or roasted.

Trapa natans. Water Chestnut. Water Caltrops. Water-Nut. Horn Chestnut. Jesuit Chestnut. *Trapaceæ.* Fig. 2539. The seed of a water-plant of southern Europe, much sought after by the natives for their agreeable kernels which become inedible with the hardening of the shell. In form, these nuts are very irregular, measuring from 2 to 3 inches between the tips of the short stout horns, and about 1 inch in depth through the irregularly shaped head of the nut. These nuts are of a slatish brown color and their surface is quite smooth.

Trapa bispinosa. Singhara-Nut. *Trapaceæ.* Fig. 2539. Southern Asia and northern Africa. According to Watt, in the "Commercial Products of India," "This aquatic plant has been grown in India from the most ancient times. . . . In certain parts of the country the kernels are ground down and employed for making the colored powder (gulal) used during the Holi festival." They are also used medicinally and as a staple article of food.

In growing, the nuts "mature under water" and are "gathered in November and December." In certain sections it is "extensively cultivated, e. g., in Kashmir, the United and Central Provinces, etc.

"The kernel abounds in starch, and is eaten either raw or cooked, especially by the Hindus. It may be boiled whole, after soaking a night in water, roughly broken up and made into a sort of porridge, or ground to meal and into chapattis."

THE COMMON NAMES OF NUTS WITH THEIR TECHNICAL EQUIVALENTS, UNDER WHICH THE NUTS ARE DESCRIBED.

Acajou	*Anacardium occidentale.*
Acorn, edible	*Pasania cornea.*
Acorn, edible	*Pasania cuspidata.*
Almond (of commerce)	*Prunus Amygdalus.*
Almond, Demarara	*Terminalia Catappa.*
Almond, earth	*Cyperus esculentus.*
Almond, green	*Pistacia vera.*
Almond, Java	*Canarium luzonicum.*
Almond, Malabar	*Terminalia Catappa.*
Almond, Peruvian	*Caryocar sp.*
Almond, tropical	*Terminalia Catappa.*
Areca-nut	*Areca Catechu.*
Ar-nut	*Bunium Bulbocastanum.*
Australian-nut	*Macadamia ternifolia.*
Barbados-nut	*Jatropha Curcas.*
Beazor-nut	*Guilandina Bonduc.*
Beech-nut	*Fagus grandiflora.*
Ben-nut	*Moringa oleifera.*
Betel-nut	*Areca Catechu.*
Bissy-bissy-nut	*Cola acuminata.*
Bitter-nut	*Carya cordiformis.*
Bladder-nut, American	*Staphylea trifolia.*
Boma-nut	*Pycnocoma macrophylla.*
Bomah-nut	*Pycnocoma macrophylla.*
Bome-nut	*Pycnocoma macrophylla.*
Bonduc-nut	*Guilandina Bonduc.*
Brazil-nut	*Bertholletia excelsa.*
Bread-nut	*Brosimum Alicastrum.*
Bread-nut	*Corylus Avellana.*
Buffalo-nut	*Pyrularia oleifera.*
Buriti-nut	*Mauritia flexuosa.*
Butternut	*Bertholletia excelsa.*
Butternut	*Caryocar nuciferum.*
Butternut	*Juglans cinerea.*
Butternut, Guiana	*Caryocar sp.*
Butter tree	*Butyrospermum Parkii.*
Cachew-nut	*Anacardium occidentale.*
Cahoun-nut	*Attalea Cohune.*
Caja-nut	*Anacardium occidentale.*
Cajou-nut	*Anacardium occidentale.*
Candle-nut	*Aleurites molluccana.*
Cashew-nut	*Anacardium occidentale.*
Cashew, oriental	*Semecarpus Anacardium.*
Castana	*Bertholletia excelsa.*
Castanea	*Bertholletia excelsa.*
Chestnut, American Sweet	*Castanea dentata.*
Chestnut, Australian	*Castanospermum australe.*
Chestnut, Cape	*Calodendrum capensis.*
Chestnut, Chinese	*Castanea mollissima.*
Chestnut, creeping	*Castanea alnifolia.*
Chestnut, dwarf	*Castanea pumila.*
Chestnut, earth	*Bunium Bulbocastanum.*
Chestnut, European	*Castanea sativa.*
Chestnut, Fiji	*Inocarpus edulis.*
Chestnut, French	*Castanea sativa.*
Chestnut, horn	*Trapa natans.*
Chestnut, horse	*Æsculus Hippocastanum.*
Chestnut, Italian	*Castanea sativa.*
Chestnut, Japanese	*Castanea crenata.*
Chestnut, Jesuit	*Trapa natans.*
Chestnut, Moreton Bay	*Castanospermum australe.*
Chestnut, Otaheite	*Inocarpus edulis.*
Chestnut, Polynesian	*Inocarpus edulis.*
Chestnut, Spanish	*Castanea sativa.*
Chestnut, South Sea	*Inocarpus edulis.*
Chestnut, Tahitian	*Inocarpus edulis.*
Chestnut, water	*Trapa natans.*
Chestnut, wild	*Calodendrum capensis.*
Chilean-nut	*Gevuina Avellana.*
Chinese-nut	*Litchi chinensis.*
Chinese tallow-nut	*Sapium sebiferum.*
Chinquapin	*Castanea pumila.*
Chocolate-nut	*Theobroma Cacao.*
Chufa	*Cyperus esculentus.*
Clearing-nut	*Strychnos potatorum.*
Cob-nut	*Corylus Avellana.*
Coconut	*Cocos nucifera.*
Coconut, dwarf	*Jubæa spectabilis.*
Coconut, monkey's	*Jubæa spectabilis.*
Cohune-nut	*Attalea Cohune.*
Coker-nut	*Jubæa spectabilis.*
Cola-nut	*Cola acuminata.*
Coquilla-nut	*Attalea funifera.*
Coquita-nut	*Jubæa spectabilis.*
Cream-nut	*Bertholletia excelsa.*
Dawa-nut	*Nephelium Litchi.*
Doom-nut	*Hyphæne crinita.*
Doum-nut	*Hyphæne crinita.*
Durian-nut	*Durio zibethinus.*
Earth-nut	*Bunium Bulbocastanum.*
Edible rush	*Cyperus esculentus.*
Elk-nut	*Pyrularia oleifera.*
Filbeard	*Corylus Avellana.*
Filberd	*Corylus Avellana.*
Filbert	*Corylus Avellana.*
Filbert, Lambert's	*Corylus maxima.*
Fistiche-nut	*Pistacia vera.*
Fox-nut	*Euryale ferox.*
French physic-nut	*Jatropha Curcas.*
Ginkgo-nut	*Ginkgo biloba.*
Goober	*Arachis hypogæa.*
Goora-nut	*Cola acuminata.*
Gorgon-nut	*Euryale ferox.*
Gorra-nut	*Cola acuminata.*
Groundnut	*Apios tuberosa.*
Groundnut	*Arachis hypogæa.*
Groundnut	*Panax trifolium.*
Ground pea	*Arachis hypogæa.*
Guru-nut	*Cola acuminata.*
Hale-nut	*Corylus Avellana.*
Hawk-nut	*Bunium Bulbocastanum.*

Hazel, American	*Corylus americana.*
Hazel, Australian	*Macadamia ternifolia.*
Hazel, beaked	*Corylus rostrata.*
Hazel, California	*Corylus californica.*
Hazel, Chile	*Gevuina Avellana.*
Hazel, Chinese	*Litchi chinensis.*
Hazel, Constantinople	*Corylus Colurna.*
Hazel, European	*Corylus Avellana.*
Hazel-nut	*Corylus sp.*
Heart-nut	*Juglans cordiformis.*
Hickory, big bud	*Carya alba.*
Hickory, big shellbark	*Carya laciniosa.*
Hickory, bitter-nut	*Carya cordiformis.*
Hickory, bottom shellbark	*Carya laciniosa.*
Hickory, bull-nut	*Carya alba.*
Hickory, false shagbark	*Carya ovalis.*
Hickory, king-nut	*Carya laciniosa.*
Hickory, little scalybark	*Carya ovata.*
Hickory, little shagbark	*Carya ovata.*
Hickory, little shellbark	*Carya ovata.*
Hickory, mocker-nut	*Carya alba.*
Hickory, nutmeg	*Carya myristicæformis.*
Hickory, pignut	*Carya glabra.*
Hickory, scalybark	*Carya laciniosa.*
Hickory, scalybark	*Carya ovata.*
Hickory, shagbark	*Carya ovata.*
Hickory, shellbark	*Carya laciniosa.*
Hickory, small pignut	*Carya ovalis.*
Hickory, swamp	*Carya cordiformis.*
Hickory, water	*Carya aquatica.*
Hyphæne-nut	*Hyphæne crinita.*
Illinois-nut	*Carya Pecan.*
Illipe-nut	*Bassia latifolia.*
Illupi-nut	*Bassia latifolia.*
Indian-nut	*Pinus sp.*
Indian gum-nut	*Strychnos potatorum.*
Ita palm-nut	*Mauritia flexuosa.*
Ivory-nut	*Phytelephas Seemannii.*
Jesuit's chestnut	*Trapa natans.*
Jicara-nut	*Crescentia Cujete.*
Juba-nut	*Jubæa spectabilis.*
Jur-nut	*Bunium Bulbocastanum.*
Juvia-nut	*Bertholletia excelsa.*
Kipper-nut	*Bunium Bulbocastanum.*
Kola-nut	*Cola acuminata.*
Kolla-nut	*Cola acuminata.*
Korra-nut	*Cola acuminata.*
Kukui	*Aleurites molluccana.*
Leechee	*Litchi chinensis.*
Lichi	*Litchi chinensis.*
Litchee	*Litchi chinensis.*
Litchi	*Litchi chinensis.*
Litschi	*Litchi chinensis.*
Lotus, American	*Nelumbo lutea.*
Lousy-nut	*Bunium Bulbocastanum.*
Lumbang	*Aleurites sp.*
Luzon-nut	*Canarium luzonicum.*
Madeira-nut	*Juglans regia.*
Manila-nut	*Arachis hypogæa.*
Manketti-nut	*Manketti nut.*
Marany-nut	*Semecarpus Anacardium.*
Marking-nut	*Semecarpus Anacardium.*
Marsh-nut	*Semecarpus Anacardium.*
Miriti-nut	*Mauritia flexuosa.*
Monkey-nut	*Anacardium occidentale.*
Monkey-nut	*Arachis hypogæa.*
Monkey-pot-nut	*Lecythis sp.*
Monkey's coconut	*Jubæa spectabilis.*
Mu-yu	*Aleurites molluccana.*
Myrobalan-nut	*Terminalia Catappa.*
Negro's head	*Phytelephas Seemannii.*
Nelumbium-nut	*Nelumbo lutea.*
Nelumbo-nut	*Nelumbo lutea.*
Nickar-nut	*Guilandina Bonduc.*
Nicker-nut	*Guilandina Bonduc.*
Nigger-toe	*Bertholletia excelsa.*
Nitta-nut	*Parkia africana.*
Nutta-nut	*Parkia africana.*
Oil-nut	*Pyrularia oleifera.*
Ombene	*Cola acuminata.*
Palm-nut	*Elæis guineensis.*
Para-nut	*Bertholletia excelsa.*
Paradise-nut	*Lecythis sp.*
Paradox	*Hybrid walnut.*
Peanut	*Arachis hypogæa.*
Pecan	*Carya Pecan.*
Pecan, bitter	*Carya aquatica.*
Pekea-nut	*Caryocar nuciferum.*
Philbert	*Corylus Avellana.*
Philippine-nut	*Canarium luzonicum.*
Phillo-nut	*Canarium luzonicum.*
Physic-nut	*Jatropha Curcas.*
Pignolia	*Pinus Pinea.*
Pignon	*Pinus Pinea.*
Pig-nut	*Carya glabra.*
Pig-nut	*Bunium Bulbocastanum.*
Pili-nut	*Canarium luzonicum.*
Pili-nut	*Canarium ovatum.*
Pinang	*Areca Catechu.*
Pindar	*Arachis hypogæa.*
Pine-nut	*Pinus sp.*
Pinon	*Pinus sp.*
Pistache	*Pistacia sp.*
Pistachio	*Pistacia sp.*
Portia-nut	*Thespesia populnea.*
Purging-nut	*Jatropha Curcas.*
Quandang	*Fusanus acuminatus.*
Quandong	*Fusanus acuminatus.*
Queensland-nut	*Macadamia ternifolia.*
Rattle-nut	*Nelumbo lutea.*
Royal-nut	*Juglans regia.*
Royal-nut	*Walnut hybrid.*
Rush-nut	*Cyperus esculentus.*
Sapucaia-nut	*Lecythis sp.*
Sapucaya-nut	*Lecythis sp.*
Shea-nut	*Butyrospermum Parkii*
Singhara-nut	*Trapa bispinosa.*
Snake-nut	*Ophiocaryon paradoxum.*
Souari-nut	*Caryocar nuciferum.*
Tabebui	*Telfairia pedata.*
Tagua-nut	*Phytelephas Seemannii*
Taqua-nut	*Phytelephas Seemannii.*
Tallow-nut	*Sapium sebiferum.*
Tavola-nut	*Terminalia Catappa.*
Temperance-nut	*Cola acuminata.*
Torrey-nut	*Torreya nucifera.*
Tung-yu	*Aleurites Fordii.*
Tuscatine	*Carya ovata.*
Vegetable, ivory-nut	*Phytelephas Seemannii.*
Walnut, American black	*Juglans nigra.*
Walnut, Arizona	*Juglans major.*
Walnut, Australian	*Juglans australis.*
Walnut, black	*Juglans californica, Hindsii, major, nigra* and *rupestris.*
Walnut, Bolivian	*Juglans boliviensis.*
Walnut, California black	*Juglans californica* and *Hindsii*
Walnut, Caucasian	*Pterocarya fraxinifolia.*
Walnut, Chile	*Juglans regia.*
Walnut, Circassian	*Juglans regia.*
Walnut, country	*Aleurites molluccana.*
Walnut, eastern black	*Juglans nigra.*
Walnut, English	*Juglans regia.*
Walnut, European	*Juglans regia.*
Walnut, French	*Juglans regia.*
Walnut, Italian	*Juglans regia.*
Walnut, Japanese	*Juglans cordiformis, Sieboldiana,* and *mandschurica.*
Walnut, Madeira	*Juglans regia.*
Walnut, Manchurian	*Juglans regia* and *mandshurica.*
Walnut, New Mexico	*Juglans rupestris.*
Walnut, Paradox	*Juglans hybrid.*
Walnut, Persian	*Juglans regia.*
Walnut, royal	*Juglans hybrid.*
Walnut, royal	*Juglans regia.*
Walnut, Spanish	*Aleurites molluccana.*
Walnut, Tahiti	*Aleurites molluccana.*
Walnut, Texas	*Juglans rupestris.*
Walnut, white	*Juglans cinerea.*
Walnut, white	*Carya laciniosa.*
Walnut, white	*Carya ovata.*
Walnut, winged	*Pterocarya fraxinifolia.*
Water caltrops	*Trapa natans.*
Water chestnut	*Trapa natans.*
Water chinquapin	*Nelumbo lutea.*
Water-filter-nut	*Strychnos potatorum.*
Water-nut	*Nelumbo lutea.*
Water-nut	*Trapa natans.*
Wood-oil-nut	*Aleurites Fordii.*
Yer-nut	*Bunium Bulbocastanum.*

C. A. Reed.

NUTTÁLLIA: *Osmaronia.*

NYCTÁNTHES (*night flower:* blooms toward night and fls. fall at morning). *Oleàceæ.* One species, a small tree or shrub of India but now spontaneous in some other countries, sometimes planted in warm regions or grown under glass for its numerous white very fragrant flowers.

The species is **N. Árbor-trístis,** Linn., literally the "tree of sadness" because it blooms only at night; it is also known as the "night jasmine." Nyctanthes is much like Jasminum and some of the early names belong under that genus; it differs in its capsular fr. Lvs. opposite, ovate, cordate, short-stalked, entire or dentate, scabrous: branches 4-angled: fls. few in a sessile involucrate cluster or head, which are disposed in dichotomous cymes; corolla whitish, the tube orange, salverform, the lobes 4–8; stamens (anthers) 2, nearly sessile near the top of the tube; ovary 2-celled, the style short and stigma 2-lobed: caps. roundish, ¾ in. long, with one erect seed in each of the 2 cells. B.M. 4900. B.R. 399.—It is an interesting plant, but little grown in our territory; blooms in summer; prop. by firm cuttings in sand with bottom heat. Reaches 30 ft. in India.

L. H. B.

NYCTERÌNIA: *Zaluzianskya.*

NYCTOCÈREUS (*night* and *cereus*). *Cactàceæ.* A slender cactus, at first erect, then clambering, with few branches; the st. has many low ribs with closely set areoles producing 10 or more acicular spines: fls. large, nocturnal, white; tube and ovary covered with small bracts, producing in their axils small clusters of spines: fr. red; seeds black.—Several species are known. They are among the several kinds of night-blooming cereus. See *Succulents.*

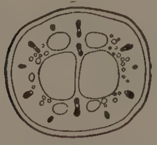
serpentìnus, Brit. & Rose (*Cèreus serpentìnus,* DC.). Sts. 5–8 ft. long, slender, flexuous; ribs 10–13, low, obtuse; spines acicular: fls. 6 in. long. Mex. B.M. 3566.

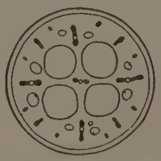
guatemalénsis, Brit. & Rose. A recently described species which has been widely intro. into Eu. and is being grown to some extent in this country. It grows easily in cult. It is not so tall as *N. serpentinus,* but the tips of the sts. are inclined to bend over and take root and start new plants. J. N. Rose.

NYMPHÆA (from *Nympha,* in Greek and Roman mythology, a nature-goddess). Syn., *Castàlia. Nymphæàceæ.* Water-Lily. Pond-Lily. Nymphea. The most showy of aquatics (except Victoria), inhabiting the North and South Temperate and Tropical zones.

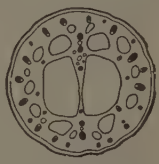
Herbs, perennial by horizontal or erect rootstocks or tubers, rooting in mud, covered by 3 in. to 6 ft. of water (rarely in bogs not submerged): lvs. floating, or when crowded rising a few inches above the water, round or oval, entire or dentate or sinuate, fissi-cordate, often sub-peltate, 2 in. to 2 ft. across: fls. mostly showy, white, yellow, blue, and red, in all shades, 1–12 or 14 in. across; sepals 4; petals and carpels many; stamens numerous; pistil with a broad cup-like depression in the center of the fl., surrounded by a ring of fleshy processes, the carpellary styles, and with a knob at the center.—About 40 well-marked species, with numerous local varieties and many cult. hybrids.

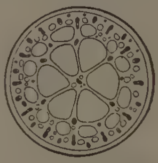
The petals and stamens of Nymphæa appear to be attached to the sides of the ovary; but this surface is to be considered as the outside of a cup-like receptacle, its cavity being completely filled by the radially placed carpels, with whose backs it is fused. Several species show easy gradations from sepal to petal and from petal to stamen, thus illustrating the homology of floral parts. The peduncles and petioles are traversed by a number of longitudinal air-canals, from whose walls star-shaped cells and rounded cell groups project inward; in the walls of these stellate internal hairs, are imbedded numberless minute crystals of calcium oxalate; they are objects of great beauty in microscopical sections. The distribution of these, as also of the air-canals, differs in different species. (Figs. 2541 to 2544.) Three types of leaf may be distinguished: (1) Very thin and fragile submerged leaves on short petioles; (2) floating leaves, thicker in texture, with stomata and palisade cells on the upper surface only; (3) aërial leaves, leathery in texture, sometimes, at least, bearing stomata on the under surface.


2541. Transverse section of petiole of Castalia group.


2542. Transverse section of peduncle of Castalia group.

The leaves spring from the rhizomes in spiral orders of varying complexity, from two-fifths up. The growing apex of the stem is protected by the colorless stipules and a dense growth of long fine hairs. A group of roots comes off from the stem just below each leaf. The flowers are extra-axillary, arising as members of the leaf spirals or in a spiral of their own. The rhizomes of species which dry off in the resting season (Lotos, Hydrocallis; Apocarpiæ) become protected by a strong corky bark; others remain continually in a state of more or less active growth.


2543. Transverse section of petiole of Lotos group.


2544. Transverse section of peduncle of Lotos group.

Habits of opening.—The flowers of every species open and close at a particular time each day, so that in a pond with eighteen or twenty kinds there is some change taking place at almost all hours. The hours of blooming are fairly regular, though the tropical species are more sluggish in cool weather, and the hardy ones are irregular in very hot times. Each flower opens from one or two to five or seven successive days (or nights), being about an hour later to open and an hour earlier to close on its first than on subsequent days. The flower then goes down into the water by a spiral coiling of the peduncle (or simply bending over if in shallow water), where the seed ripens. When in six to ten weeks the pod matures and bursts, the seeds rise to the water-surface and float for several hours by means of a buoyant aril. This finally decays and drops the seed at some distance from the parent. To secure these, the floating seeds may be dipped up in a wire sieve, or better, the pods may be inclosed in muslin or cheesecloth bags before ripening, all of the seeds being thus secured.

The hybrids.—The species of a single group hybridize very readily among themselves, and in the Lotos and Fucastalia groups the hybrids are more or less fertile. By means of this condition all shades of color have been obtained, from the pure white *N. Lotus* var. *dentata* to the dark crimson-red *N. rubra.* In this group and in Castalia varieties have so multiplied of late and fanciful names have been so freely given that an accurate classification of all of them is no longer possible. In the Brachyceras group, hybrids occur almost certainly if *N. zanzibariensis* is grown in the same pond with others of the group; thus have originated some very fine varieties. Outside of single groups, no genuine hybrids have yet been produced. Between the apocarpous and syncarpous species, a hybrid would be impossible. Authorities differ as to the best time to transfer pollen. Certain it is that the flowers are pistillate on the first day of opening, the pollen being shed on succeeding days or late on the first day. Some say that pollination should take place in the early morning hours, about daybreak; others consider the time most favorable just as the flower is closing for its first time.

Trouble with the names.—The water-lilies and yellow pond-lilies or spatterdocks were together included by Linnæus under the genus name Nymphæa. In 1805 Salisbury first separated these two parts of the genus. The water-lilies he called Castalia and the spatterdocks Nymphæa. J. E. Smith, writing two years later, disregarded Salisbury's work and called the two groups Nymphæa and Nuphar respectively. Thus Castalia, Salisb.=Nymphæa, Smith, and Nymphæa, Salisb.= Nuphar, Smith. Salisbury, contrary to good usage and the present International Rules (article 45), coined a new name for the group containing the larger number of species, and arbitrarily changed nearly all of the specific names. His names, however, never came into general use, but Smith's were generally adopted. Strict adherents of the "law of priority" have recently revived the generic names of Salisbury. The principle of fifty years of accepted usage may well be extended to this case, making it unnecessary, as it is also unfortunate, to revive the old name Castalia for these well-known and popular plants, which are habitually monographed under Nymphæa. The name Castalia is not adopted by most European botanists. Briquet, of the international committee on nomenclature and under whose name the international rules are issued, writes the author that the rules definitely mean to authorize Nymphæa rather than Castalia.

Until the first edition of this Cyclopedia, several specific names were confused, but this difficulty is mostly corrected now. In reading of aquatics prior to 1900, it is well to remember that many British botanists include all blue water-lilies of the eastern hemisphere (or all except the Australian forms) under the name *Nymphæa stellata*. *N. cærulea* of B. M. 552 and *N. scutifolia*, DC., are really *N. capensis*. The true *N. cærulea* was long known in American gardens as *N. scutifolia* (Tricker, "Water Garden," 1897). *N. ampla* of gardens may be either *N. amazonum* or *N. Lotus* var. *dentata* (see "Waterlilies: A Monograph of the Genus Nymphæa;" by H. S. Conard. Carnegie Inst. Publication No. 4).

The true Egyptian lotus.—Among common names the term "lotus" has been remarkably misapplied. It seems to be consistently used among us for the genus Nelumbo, *Nelumbo nucifera* being generally styled "Egyptian" or "sacred lotus." Historically this is entirely wrong. Nelumbo is not native in Egypt, and is not now found there in a wild state. It was cultivated extensively along the Nile in the Roman period, probably for food, and the flower is supposed to have furnished the design for one form of capital of the Egyptian columns. It is a native of southeastern Asia; is found near temples and carved on the walls of cave-temples in Hindustan, showing a veneration, which it shares, however, with *Nymphæa stellata*, *N. rubra* and *N. Lotus*. Nelumbo seems to have been regarded as sacred about temples in Japan and China. In Egypt, however, *Nymphæa cærulea* and *N. Lotus*, the "blue lotus" and "white lotus," are indigenous. The root (rhizome) of the former is said to have been pointed out as edible by Isis—or by Menes; its flowers, buds and leaves are often depicted on the monuments, the first sometimes in color. The flowers are figured among offerings under the fourth dynasty (3998–3721 B.C.), and the plant is certainly known from the fifth dynasty. Petals of this and of *N. Lotus* were found in the tomb of Rameses II, the Pharoah of the Israelitish captivity. *N. Lotus* was less regarded than *N. cærulea* in Egypt, though an object of veneration in India. Herodotus and other ancient writers speak of these water-lilies indiscriminately as the "lotos" of the Egyptians. With these facts, and the additional one that, except as referred to above, Nelumbo never appears in Egyptian carvings, the identity of the sacred lotus cannot be doubted. But the erroneous use of the word lotus is deeply rooted and may never be supplanted, and it is necessary to remember that the so-called "Egyptian lotus" is not the plant of the tombs and monuments. (The lotus of Tennyson's poem, "Lotus Eaters," is still another plant, a shrub or tree, which hangs out over the water; and the genus Lotus [which see] is distinct from all of these.)

The Marliac hybrids.—Two types of hardy free-flowering hybrids akin to *N. alba* and its variety *rubra*, but of uncertain parentage, have been introduced since 1888, one of sturdy habit, raising its leaves (4 to 8 inches across) and flowers (3 to 6 inches across) well out of the water when crowded, the other slender in growth, the leaves (3 to 6 inches across) and flowers (2½ to 4 inches across) usually floating. From 1888 to 1900 all of these superb varieties were introduced by M. Latour-Marliac of Temple-sur-Lot, France, whose methods, however, remain a mystery. Excellent culture combined with careful selection and wise hybridization have brought about these magnificent results. The first or Marliacea group seems to involve *N. alba* as one parent. The second started with a hybrid of *N. alba* var. *rubra* and *N. tetragona* known as *N. Laydekeri* var. *rosea*, to which is added in varying degrees blood of *N. alba* var. *rosea* and *N. mexicana*. But this does not adequately account for the whole group. Nearly all kinds of both groups are entirely sterile.

Important species.—The following account, which contains 200 varieties and about 48 synonyms, may seem rather formidable to the beginner, but the species of first importance are only eight in number: *N. Lotus*, *N. rubra*, *N. tuberosa*, *N. odorata*, *N. alba*, *N. mexicana*, *N. flavo-virens* and *N. zanzibariensis*. The greater number of the other names represent garden varieties and hybrids. It is impossible for any form of arrangement to be clear and logical on the one hand, and exhibit natural relationship on the other, at least, in a genus so greatly modified in cultivation. However, the true species may be distinguished in the treatment, the derivatives being apparent by description or hybridization sign (×) or otherwise.

The best water-lilies for amateurs.—Tender day-blooming kinds: *N. pennsylvania*, light blue; *N. zanzibariensis*, deep blue; *N. flavo-virens*, white; Mrs. C. W. Ward, pink; *N. Daubeniana*, dwarf, blue. Tender night-blooming kinds: *N. dentata*, white; *N. Omarana*, magenta; Frank Trelease, dark crimson. Hardy kinds: *N. chromatella*, yellow; *N. tetragona helvola*, dwarf yellow; *N. Gladstoniana*, white; *N. tetragona*, dwarf white; W. B. Shaw, pink; *N. Laydekeri rosea*, dwarf pink; Wm. Falconer, dark red.

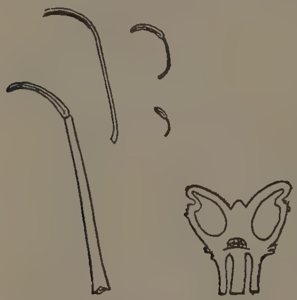
Cultivation of water-lilies. (William Tricker.)

Water-lilies or nympheas are among the most royal, gorgeous, diversified, and universally admired plants in cultivation. No class of plants in our public parks can compete with them in attracting the people. Moreover, America is the most highly favored country in the world for the cultivation of aquatic plants. Ours is the only country which can have so rich and continuous a display of aquatics in flower from April to October in the open without artificial heat. In parks and private gardens are to be seen, flowering early in spring, all native nympheas, and others from Europe and Asia. The species begin to flower in April and continue until early fall, when a number of the hardy hybrids continue to flower uninterruptedly until the end of the season. In the central states and southward, the hardy varieties decline when tropical weather sets in, and the nights and days are hot. In the eastern states, and especially near the coast, where the nights are cool, the season is much longer, and the color of some of the pink varieties is more intense. Following the hardy nympheas come the nelumbiums in all their oriental splendor, brightening the summer season, and bridging over the declining period of the hardy nympheas and the approaching season of the tropical nympheas which arrive at maturity toward the latter end of July or beginning of August, and continue until fall. Finally the grandest of all aquatic plants, *Victoria regia*, may be seen in America growing in a natural pond, and producing its chaste flowers as late as the middle of October.

America is rich in native species of nymphea, and it is the only country which has native white-, pink- and yellow-flowered kinds. Of the American nympheas there are about five that are best known. The common white water-lily is *Nymphæa odorata*. Its variety *rosea* is the Cape Cod pink water-lily. *N. tuberosa* (syn. *N. reniformis*) is a white-flowered species, inhabiting the western lakes. The yellow kind, *N. flava*, is indigenous to Florida and other southern states, but is hardy in New Jersey and southern New York. Another southern kind is the white-flowered *N. odorata* var. *gigantea*. In addition to the above well-known kinds, there are several distinct forms and hybrids.

The commencement of the cultivation of aquatics in

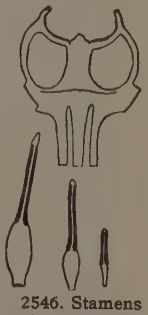
America led to the commingling of species, especially of *N. odorata* and *N. tuberosa*. The result is that in several sections are to be found many similar varieties, and forms of both white and pink, some of which are valuable, being distinct in color and having large, handsome, fragrant flowers, while a host of others are worthless, so far as distinct varieties are concerned. *N. tuberosa* is known as the largest and purest white water-lily, distinct in foliage, flowers and rootstock. This species has proved to be the most susceptible of cross-fertilization. One great hindrance to the cultivation of such half-breeds, is that most of them produce seed. The seedlings are either white or pink, and seldom, if ever, like the parent plant. There are in different sections of the country distinct forms of *N. tuberosa*, some having long, narrow petals and slightly fragrant flowers, others again having broad incurving petals, forming handsome cup-shaped highly fragrant flowers; still others have very full flowers, quite double, the numerous petals crowding each other until the reflexed sepals inclose the stalk, forming spherical flowers like balls of snow. *N. tuberosa*, in any of its forms, should not be planted in a small pond with other nympheas, for it is such a rampant grower that in a short time it will smother the less vigorous kinds. This species delights in plenty of space, and water 2 to 3 feet deep, with soil of a tenacious character. However, it will thrive in almost any soil, and is well adapted for naturalizing in lakes and ponds. Attempts at naturalizing or cultivating on a small scale have not been very satisfactory; but the species will well repay any extra care to establish it in desirable localities.



2545. Stamens and vertical section of ovary of Anecphya group.

Two or three species are indigenous to continental Europe, notably *N. alba*, the well-known English white water-lily, *N. candida*, the white Bohemian water-lily, and *N. alba* var. *rosea*, the Swedish water-lily. The last named is the only disinct or true red-flowered, hardy species. Still another species, which has played a very important part with specialists of the present day, is *N. tetragona* (*N. pygmæa*), from China and Japan.

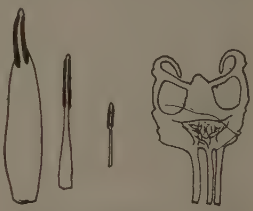
Nymphæa odorata was introduced into England during the eighteenth century, and was probably the first foreign nymphea to reach that country. Other species followed later, mostly tropical; but, although the English people were ardent horticulturists and lovers of the beautiful in nature over a century ago, nympheas never became popular, and remained a neglected class of plants until a few years ago, when N. Marliac, of Temple-sur-Lot, France, conceived the idea of crossing the English white water-lily with the well-known Cape Cod pink water-lily, and the Florida yellow variety. Nothing in the horticultural world has created more surprising results in the blending of the American and English species. These species have been the progenitors of numerous varieties, which have made this class of plants the most popular and desirable of all aquatic decorative subjects, and within reach of all. Their popularity has kept constantly increasing and ever heightened by new additions. America, also, has contributed its quota to the list of novelties, and some of these are unsurpassed by any European introductions.



2546. Stamens and vertical section of ovary of Brachyceras group.

From the apparently simple conditions under which our native species are found growing, many amateurs have concluded that all these plants require is water and possibly some mud to keep the roots in. Many attempts have been made to grow these plants in pails and tubs, with inevitable failure as a result. Professional gardeners, also, have made grievous errors, for, while they have used every means to secure fine specimen plants of flowers, vegetables and luscious fruits, they have usually given meager attention to water-lilies, and have not supplied half their wants. Water-lilies, all nympheas, succeed best when grown, as near as possible, under their existing natural conditions; these are a rich alluvial soil in abundance, water, and clear uninterrupted sunlight. Where natural ponds exist these conditions are found, but often there is a deficiency of light, caused by shade trees. Let the trees remain, but choose open spots for the nympheas. They may be planted on the margins of sluggish streams, in bays and sheltered nooks.

Where artificial ponds are used, the most satisfactory method is to build solid walls of reinforced cement, with a concrete bottom, provided with an outlet and overflow. In all cases make the pond as large as existing means will allow, not for a moment considering it possible to be too large. One method of providing for the sustenance of these plants is to place a layer of soil in the bottom of the pond from 9 to 12 or more inches deep. This will suit the plants admirably. Artificial ponds are usually constructed in a conspicuous spot, where everything is required to be well kept. In such situations it is necessary occasionally to take off some dead leaves, or cut a few choice flowers, and if they cannot be reached from the edge of the pond, the attendant must wade in after them. The result is that the water, which should always be clear, is muddy, and when it settles there is a muddy deposit on the leaves that makes them very unsightly. Moreover, this treading in the soft soil breaks numerous roots. To avoid these and other attendant evils, place the soil in boxes from 3 to 4 feet square, and 1 foot deep, and in these plant one single plant of the vigorous and moderate growers, allowing ample space between the boxes. One plant of any tropical water-lily in such a box, or three of smaller species, will require 50 to 100 square feet of water surface, as will also strong hardy nympheas, since these may remain two years undisturbed, although some of these are best replanted every season. The pond should be 2 to 2½ feet in depth. The soil should be a strong loam, the top-soil from a pasture composted with cow-manure in proportion of one-third. This should be prepared six months, at least, before planting time. This soil is suitable for all aquatic plants. In any case, when filling the boxes or placing the soil in bottom of pond, tread moderately firm and cover with an inch of sand. The water may be spring-water, rainwater or that from any available source. The clearest spring-water will soon turn green from exposure to the sun and air, but after fermentation settles clear. Do not place the plants in a newly constructed pond or basin immediately after it is finished, as the caustic property of the cement will injure the plants. Wash the new construction thoroughly and then supply it with clean fresh water. Planting of the hardy varieties may be done in April and May, according to the latitude and earliness or lateness of season. The conditions should be conducive to active growth at once.



2547. Stamens and vertical section of ovary of Castalia group.

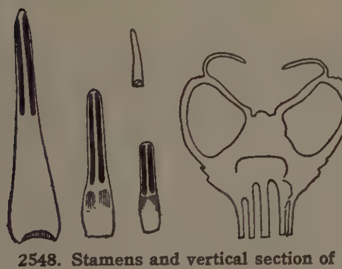
Tropical nympheas should not be planted until there is evidence that summer has come. Hardy nympheas may be planted in spring and summer (not in autumn); late planting is better than deferring till next spring, as the plants under such conditions will get established before autumn closes, and the plants will start naturally in spring, receiving no check.

The above method of construction and cultivation is to be commended, but other methods are adopted with a fair degree of success, but with attendant evils which are discouraging and at times very annoying and costly. Tanks or artificial ponds may be constructed with cement, digging the pond the desired size, having sloping sides and afterward lining the same with concrete and finishing with a facing of cement. However, such a pond will not stand the effects of hard freezing weather even if protected; and what is worse, the new or freshly removed soil will settle during the season, and the pond is very likely to spring a leak.

Another method of construction is to line the pond with well-tamped clay, from 4 to 6 inches thick, afterward covering with 2 inches of sand. The labor for such construction is expensive, however, the clay may not be good, and the pond is likely to be muddy; it is now better to build of cement.

There are yet the advocates for tub-culture. Plants will grow in tubs, and as soon as the plant-food is exhausted, which is often at an early date, the plants exist awhile and then draw out a miserable, exhausted and discouraging career. Fountain basins are often made the receptacles for nympheas. There they may be grown if the right conditions are accorded them, but there must not be a stream or spray of water running all the time, as the water may be cold, chilling the plants and checking their growth.

Nympheas have insect pests like other cultivated plants. Aphides are sometimes troublesome. The best remedy is their natural enemy, the "lady-bugs" or "lady-birds." A colony of these voracious insects makes short work of the aphides, as do also the lace-winged flies. An insect of recent acquaintance with nympheas is a leaf-miner, the larva of a small fly, which cuts channels through the leaf in all directions. Sometimes only a few of these are in evidence; at other times the leaves are fairly alive with them. The trouble is easily detected. A simple remedy is kerosene emulsion, applied with a fine spray at evening after the flowers are closed. Another troublesome insect is a leaf-cutter, *Hydrocampa obliteralis* (or *proprialis*). The larva cuts out pieces of the leaf and hides between two pieces, which makes a kind of tent. In this tent the larva moves about. At first it moves slowly, but as it nears maturity the larva becomes ravenous and then eats the surface of the leaves near the center, and cuts off much larger pieces of the leaf. The best remedy is a lamp trap for the mature insect. Frogs and dragon-flies will catch numbers of them. Arsenate of lead spray will destroy the larvæ.



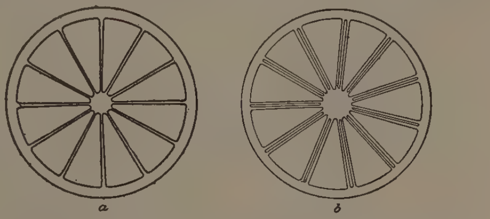
2548. Stamens and vertical section of ovary of Lotos group.

Nympheas are also subject to a fungous disease, a leaf-spot which is easily discerned after a spell of warm, humid weather. The leaves are scorched and crumpled, the plant is denuded of its foliage; new leaves are weak and smaller, and so too are the flowers, if indeed there are any. This disease must be checked at once or the plants will be severely set back, if not ruined. A remedy is bordeaux mixture. Use a fine spray, and dilute the mixture to half the strength recommended for most plants. It is best to spray twice with a weak solution rather than to spray once with a too strong solution and to damage the foliage. A light dusting on the leaves with carbonate of copper will soon remedy the trouble.

In winter, tender nympheas should be kept in tanks or tubs under glass. For hardy species, cover the tank with boards and pile on dry leaves, coarse hay or other material; or the roots may be taken out and buried in a sheltered place.

Water-lilies in California. (Edmund D. Sturtevant.)

The culture of nympheas in California presents fewer difficulties than in the eastern states. The varieties which are hardy in the East flourish equally well and bloom for a longer period. In frostless localities, especially where the lemon tree is free from injury, such tender varieties as *Nymphæa devoniensis*, *N. dentata* and *N. zanzibariensis* may be left in the open pond during the winter. In colder localities, the tubers should be removed to warmer quarters in November to remain until spring. If a greenhouse is not available, a small pool built in such a manner that it can be covered with hotbed sash will afford suitable protection. Very little room is needed for these when they are dormant. The manner of cultivating both the hardy and tender varieties is much the same in California as in the eastern states. For growing a small collection, a pool 8 or 10 feet across may be made by excavating 2 or 3 feet, making the walls of concrete, brick or stone, and covering the bottom with concrete. The best quality of cement should be used for all the work. An overflow pipe should be put in and so arranged that the pool may be emptied when occasion requires. Basins 20 or 30 feet in diameter, or even larger than this, are desirable for growing a good collection. In a small pool, wooden boxes 10 inches deep and 18 inches to 2 feet square may be used to hold soil for the plants. In a large basin some of the boxes may be 3 or 4 feet square. While most aquatics will flower freely in contracted quarters, they will attain greater perfection and produce much larger flowers if they have abundance of room.



2549. Transverse section of ovaries. ***a*, syncarpous, *b*, apocarpous.**

Most of these plants are gross feeders, and it is well-nigh impossible to make the soil too rich for them. It is not necessary to go to a swamp or natural pond to obtain what is suitable. Any soil that will grow good vegetables will, if properly enriched, grow water-lilies. A compost, consisting of two-thirds good soil and one-third thoroughly decayed cow- or stable-manure, with a sprinkling of bone-meal, is recommended. A dark friable loam, which is intermediate between "adobe" and sandy loam, is desirable for this purpose. The tenderest varieties, such as *N. devoniensis* and *N. dentata*, will flower for a long period without any forcing; but if started into growth in March in a greenhouse or hotbed and planted in the pond in May, there will be a great gain in the length of the flowering season. The soil for the tender varieties should be renewed every year, and that for the hardy ones every two years.

If aphides or the pest known as the leaf-roller make their appearance, the leaves, should be sprayed with kerosene emulsion very much diluted, using one part emulsion to fifteen of water. If large ponds or lakes with a natural earth bottom are used for growing water-lilies, care must be taken that noxious weeds do not get a foothold. Cat-tails (*Typha latifolia*) and "tules" or bulrushes are troublesome if not destroyed when they first make their appearance. Palms, both fan-leaved and feathery, giant bamboos, musas, strelitzias, papyrus, giant grasses, fatsia and caladiums are among the things which can be used to ornament the surroundings of the water-garden.

The genus Nymphæa divides itself readily into two main divisions, which again are subdivided into five subgenera as follows:

Section I. Apocarpiæ. Carpels free at the sides, united at their edges to the central column of the fl. and at their backs to the receptacle: outermost stamens ripening first, innermost last: rhizome ovate, stoloniferous.—Tender day-bloomers: fls. on strong scapes 4–12 or 14 in. above the water (*Lytopleura*, Casp.).

Subgenus I. Anecphya. Stamens all slender, half as long as the petals, almost without any appendage (Fig. 2545): carpellary styles wanting: fls. blue, rosy or white.—Two species, in N. Austral.

Subgenus II. Brachyceras. Outermost stamens with an appendage above the anther (Fig. 2546): carpellary styles short, triangular: fls. white, blue, pink or yellow.—About 15 species in the tropics all around the world.

Section II. Syncarpiæ. Carpels entirely fused together (*Symphytopleura*, Casp.).

Subgenus III. Castalia. Sepals not evidently nerved: carpellary styles flat, linear: outer stamens petaloid; innermost stamens first to ripen, their filaments short, narrower or but slightly wider than the anthers (Fig. 2547).—Hardy or half-hardy day-bloomers: fls. white, pink, red or yellow. In the entire North Temperate Zone, excepting the Pacific slope of N. Amer.

Subgenus IV. Lotos. Sepals prominently veined; a space between the insertion of the petals and stamens; stamens broad, flat, rounded at apex (Fig. 2548): carpellary styles linear: lvs. sharply dentate: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. red or white on strong scapes 3–12 in. above the water, opening on 4 successive nights. Two or 3 species in S. Eu. and Asia and N. and Cent. Afr.

Subgenus V. Hydrocallis. Sepals not evidently nerved: carpellary styles long, club-shaped: petals in alternating circles of 4: stamens much as in Castalia, all opening about the same time: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. creamy white. About 9 species in Trop. Amer.

The initial C in the synonymy=Castalia.

INDEX.

alba, 1, 20, 23, 24, 25.
albida, 26.
amazonum, 34.
ampla, 7.
Andreana, 28.
Arnoldiana, 33.
atropurpurea, 25.
aurora, 28.
azurea, 9.
Banksii, 2.
berolina, 10.
biradiata, 23.
Bissetii, 33.
blanda, 36.
Boucheana, 33.
Brakeleyi, 21.
Brownii, 2.
cærulea, 4, 8.
calliantha, 11.
candida, 23.
candidissima, 24.
capensis, 8,
carnea, 26.
caroliniana, 20, 21.
Casparyi, 1, 25.
chromatella, 15.
chrysantha, 28.
cælestina, 9.
colorans, 33.
colossea, 26.
columbiana, 33.
Daubeniana, 5.
Deaniana, 33.
delicata, 21, 24.
delicatissima, 33.
dentata, 30.
dentato-lotus, 29.
devoniensis, 33.
eastonensis, 29.
eburnea, 20.
edulis, 29.
elegans, 3.
Ellisiana, 27.
exquisita. 19.
fennica, 16.
flava, 12.
flavo-virens, 11.
formosa, 28.
Froebelii, 25.
Gardneriana, 36.
Gerardiana, 7.
Gibertii, 36.
gigantea, 1, 20.
Gladstoniana, 26.
gloriosa, 25.
gracilis, 1, 11.
gracillima, 20
grandiflora, 13, 30.
graziella, 28.
Harrisiana, 24.
helvola, 14.
Hermosa, 19.
Heudelotii, 11.
himalayensis, 16.
Holtzei, 2.
Hookeri, 1.
Hudsoniana, 1.
indica, 33.
Jamesoniana, 36.
Jessieana, 19.
kewensis, 33.
Krumbiegelii, 33.
lactea, 17.
Lælia, 33.
lasiophylla, 36.
latifolia, 20.
Laydekeri, 27, 28.
Listerii, 9.
Lotus, 29.
Luciana, 21.
lusitana, 26.
magnifica, 30.
Mariæ-Legrangei, 33.
Marliacea, 15, 26, 27.
maxima, 22, 24.
mexicana, 12.
Micheliana, 33.
micrantha, 5.
minor, 18, 23.
Mooreana, 15.

INDEX, CONTINUED.

Moorei, 15.
nitida, 23.
nivea, 20.
nobilissima, 26.
odorata, 13, 17, 18 19, 20, 21, 22.
Omarana, 33.
orientalis, 16.
Ortgiesiana, 30.
Ortgiesiano-rubra, 33.
oxypetala, 36.
Parkeriana, 20.
pennsylvania, 7.
perfecta, 21.
plena, 22.
plenissima, 24.
pubescens, 31.
pulchella, 7.
pulcherrima, 7.
pumila, 18.
punicea, 28.
purpurea, 25, 33.
pygmæa, 14, 16.
Rehneltiana, 2.
reniformis, 22.
repanda, 2.
Richardsonii, 22.
Robinsonii, 28.
robusta, 22.
rosacea, 19.
rosea, 1, 9, 19, 21, 25, 26, 27.
rubicunda, 33.
rubra, 19, 21, 25, 33.
Rudgeana, 35.
salmonea, 21.
sanguinea, 27.
scutifolia, 8.
Seignoretii, 28.
semiaperta, 23.
serrata, 2.
Smithiana, 33.
solfatare, 28.
somptuosa, 26.
speciosa, 7, 21.
sphærocarpa, 25
splendens, 24.
stellata, 4, 6, 10.
stenaspidota, 36.
Stuhlmannii, 11.
Sturtevantii, 33.
suavissima, 21.
sulfurea, 11.
sulphurea, 13.
superba, 17, 21, 30.
tenerinervia, 36.
tetragona, 2, 14, 16, 27.
thermalis,29.
tuberosa, 21, 22.
tulipifera, 33.
turicensis, 21.
versicolor, 6.
violacea, 2, 9.
vomerense, 16.
zanzibariensis, 9.
Zenkeri, 32.

Section I. Apocarpiæ.

SUBGENUS I. ANECPHYA.

1. **gigantèa,** Hook. (*Castàlia gigantèa*, Brit.). Lvs. narrowly peltate, elliptic or ovate, margin sinuate-dentate, sinus open; under surface brownish pink to purple; 18 in. across: fls. light blue, open 7 days from 9 A.M. to 6 P.M., 6–12 in. across; sepals pure green; petals 18–50, dark blue at tip, shading to nearly white at base; stamens 350–750; filaments mostly filiform; anthers bright yellow. Austral. B.M. 4647. F.S. 7:751. G.C. III. 28:77; 34:63; 53:422 (var. *Hudsoniana*). Gn. W. 20, suppl. Sept. 5 (var. *Hudsonii*). G.W. 1:122; 9:447; 15:511. Gn. 64, p. 114 (var. *Hudsonii*).—The most delicate and lovely, and withal one of the largest of the genus. The original large-flowering type (sometimes called var. *Hoòkeri*) is difficult to cult. The form now in gardens is smaller and easier to manage; it is called by Henkel *N. Caspáryi*, and in Austral. is sometimes called *N. grácilis*. White and pink forms (*N. álba* and *N. ròsea*, Benth. & Muell.) occur in Austral. An English var. *Hudsoniàna*, said to be a cross with *N. stellata* is evidently only a seedling of *N. gigantea*.

2. **violàcea,** Lehm. (incl. *N. Hòltzei*, Rehn. & Henk. *N. Rehneltiàna*, Henk. *N. Bròwnii*, Bailey. *N. Bánksii*, Cunn. *N. serràta*, Muell. *N. repánda*, Muell.). Smaller: sepals marked with black lines: lvs. wavy margined or almost entire. Cape York Peninsula.—A beautiful white form of this is called "Eleonore." A very small white one from Arnheim's Land was misnamed *N. tetragòna* by Baron von Mueller.

SUBGENUS II. BRACHYCERAS.

A. *Lvs. entire or slightly wavy at base.*

3. **élegans,** Hook. (*C. élegans*, Greene). Fig. 2551. Lvs. narrowly peltate, orbicular to ovate; margin entire or with 5 or 6 small scattered teeth; under surface dark purple; 7 in. across: fls. pale violet; 3–6 in. across, open 3 days from 8 A.M. to 1 P.M.; buds ovate; sepals marked with black lines and dots; petals ovate, obtuse, 12–20; stamens stout, about 75, yellow; appendage a mere tip; filaments broad. Mex., Texas. B.M. 4604. J.F. 2:180. G.F. 8:206 (adapted in Fig. 2551).

4. **cærùlea,** Sav. (*C. cærùlea*, Woodv. & Wood. *N. stellàta*, Casp., etc.). Blue Lotus of Egypt. Lvs. narrowly peltate, oval, entire or slightly sinuate at base; under surface green, with dark purple blotches, purplish at margin, 12–16 in. across: fls. 3–6 in. across, open 3 days from 7.30 A.M. to 12 M.; buds conical; sepals thickly marked with black lines and dots; petals 14–20, lanceolate, acute, light blue above, basal half dull white; stamens 50–70; outer filaments broad, yellow; appendage long ($\frac{3}{16}$in. on outer stamens), pale blue. Egypt, N. and Cent. Afr. Ann. Mus. Paris, Vol. I (1802), p. 366 c.p. F.S. 7:653.—Free grower and bloomer but not showy. Forms occur in Afr. with pure

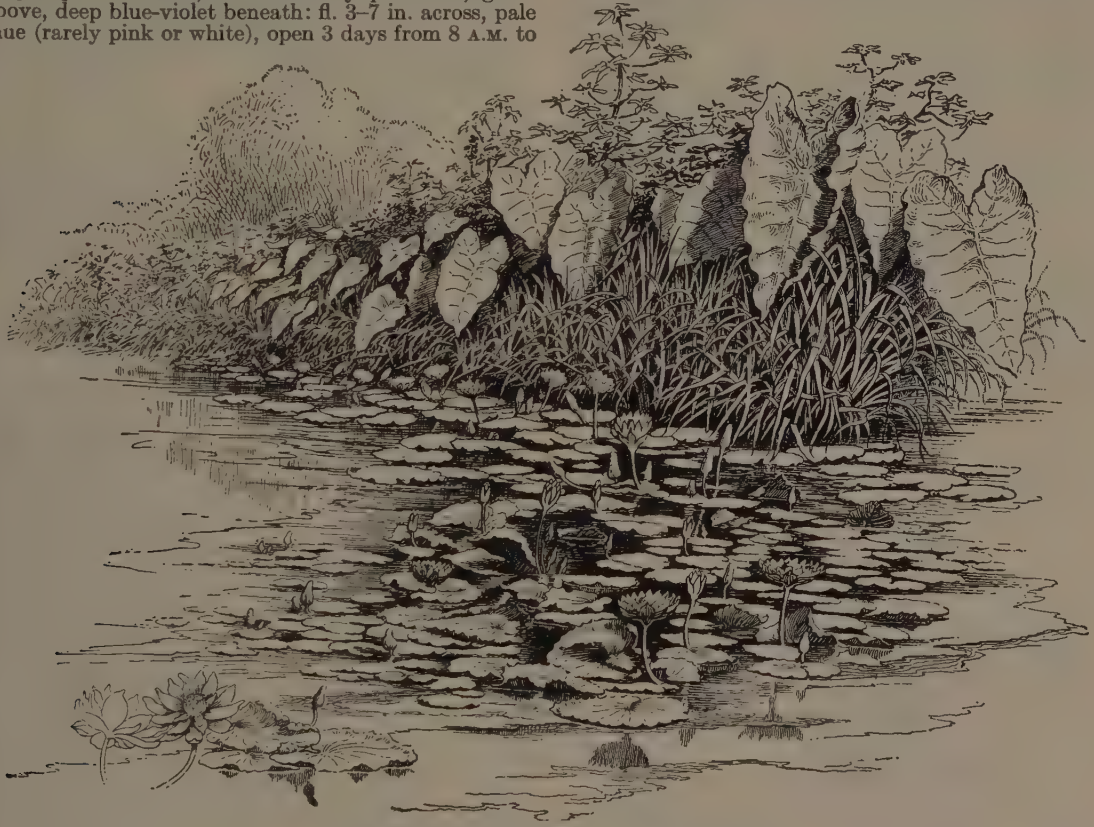
white or bright red fls., and some without spots on the calyx.

5. **micrántha**, Guill. & Perr. Lvs. elliptic, entire in apical half, rest of margin sinuate; sinus deep; lobes spreading, much produced and acuminated, bearing bulbs which produce new plants at the top of the petiole; under side of lf. green, tinged with purplish brown and minutely dotted: fls. small, white, 3–5 in. across; calyx pale green, unspotted; petals lanceolate, very acute. West coast of Afr. B.M. 4535.—*N. Daubeniàna*, Hort., intro. in 1912 by W. Tricker, is a pale blue form of this, possibly a hybrid with *N. cærulea*.

AA. *Lvs. distinctly or deeply sinuate.*

B. *Sepals marked with black dots and lines.*

6. **stellàta**, Willd. (*C. stellàta*, Woodv. & Wood, incl. *N. versicolor*, Roxbg.). BLUE LOTUS of India. Lvs. elliptic-orbicular, rather broadly peltate; margin irregularly repand-dentate; lobes scarcely produced; green above, deep blue-violet beneath: fl. 3–7 in. across, pale blue (rarely pink or white), open 3 days from 8 A.M. to 2 P.M.; buds ovate; sepals with minute blackish dots; petals 11–14, dull white at base; stamens 33–54; appendage blue; anthers and filaments pale yellowish. S. and E. Asia. Andr. Bot. Rep. 5:330. B.M. 1189 (pink); 2058. R.H. 1855:261. F.S. 8:854. Gn. 54, p. 97; 56, p. 277. G.M. 41:607.—White and pink forms occur in India.



2550. Nympheas in an effective and natural setting.

7. **ámpla**, DC. (*C. ámpla*, Salisb.). Lvs. narrowly peltate, suborbicular, sinuate or nearly entire, with small black spots above and below, 6–15 in. across: fls. white, 3–8 in. across; sepals coriaceous, ovate-lanceolate, acute; petals 7–21, lance-ovate; stamens 30–190, outermost ones much longer than innermost. Texas, south to W. Indies and Brazil. Fl. Brasil. 77:129, pl. 28–30. B.M. 4469.—Very near kin to *N. gracilis* and *N. flavovirens*. Vars. **speciòsa** and **pulchélla** are medium- and small-sized forms. Var. **Gerardiàna**, Hort. Fls. raised above water, very large, white and yellow anthers.

Two garden hybrids may be described here: *N. pulchérrima*, Tricker (N. cærulea × N. capensis?). Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface green, densely blotched with purplish black; margin purplish red; 16 in. across: fls. light blue, 10–12 in. across; buds sharply conical; petals 22, lance-ovate, whitish at base; stamens about 140, appendaged. G.C. III. 28:273. G.M. 55:703.—*N. pennsylvània*. Conard (N. cærulea × N. zanzibariensis). Fls. large, deeper blue, open from 8 A.M. to 5 P.M.; petals 23; stamens 140.—The best blue in this group.

BB. *Sepals without black markings.*

8. **capénsis**, Thunb. (*N. scutifòlia*, DC. *N. cærùlea* of B.M. 552). CAPE BLUE WATER-LILY. Lvs. rather narrowly peltate, orbicular-ovate, strongly sinuate-dentate; angle of lobes produced, acuminate; 12–16 in across: fls. rich sky-blue, 6–8 in. across; open 4 days from 7 A.M. to 4 P.M.; buds ovate; sepals pure green outside, whitish within; petals 20–30, lower third nearly white, narrowly elliptic; stamens about 150; filaments yellow, outermost ones broad, innermost filiform; appendage and back of outer anthers blue. S. Afr. Andr. Bot. Rep. pl. 197. F.S. 6:645.—A very desirable species.

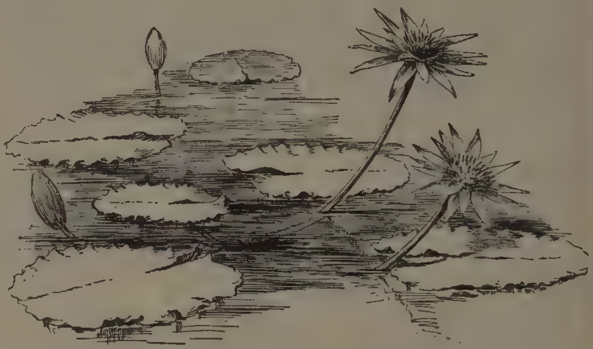
9. Var. **zanzibariénsis**, Casp. (*N. zanzibariénsis*, Casp.). Lvs. somewhat peltate, orbicular or orbicular-ovate, margin closely sinuate-dentate; angle of lobes scarcely pointed; under surface more or less suffused violet; 8–15 in. across: fl. 6–12 in. across, open 3–5 days from 11 A.M. to 5 P.M.; sepals green outside, margins purple, deep purplish blue within; petals 18–24, oblong, obtuse, deep blue; stamens 136–242, appendage dark blue; back of anther dark crimson-violet; outer filaments obovate and yellow. Zanzibar. B.M. 6843. Gn

25:210. R.H. 1897, p. 328. Var. **azùrea,** light blue, and var. **ròsea,** pink, are otherwise like the type, but open earlier in the morning; they come up promiscuously from seed of the type or of one another.—As now cult., the var. *zanzibariensis* shows the greatest variation in color of sepals and petals, as well as in shape and number of petals and stamens. The petals vary from obovate to elliptic-lanceolate. Colors shade from the deep purplish blue of the type to pale azure on one hand, or to purple, pink, and almost red on the other. The inner surface of the sepals varies from greenish white to almost pure white, or shaded toward the tip with pink, red, pale blue, or deep blue-purple. All combinations of sepal and petal coloring occur, apparently without any correlation. Many of these forms have been named, e.g., Amethyst, L. Dittmann, Kobald, Countess of Warwick, Lord Brooks, *N. Lísterii, N. z. violàcea, N. z. cœléstina,* etc. They can be reproduced true only by offsets. A small percentage of seedlings resemble the parents.

10. × **berolìna,** Hort. (*N. capénsis* × *N. zanzibariénsis? N. stellàta,* Berlin variety). Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface dark purple; 8–16 in. across: fls. deep blue, open 3–5 days, from 9 A.M. to 4 or 5 P.M., 6–8 in. across; sepals green outside, blue within; petals 15–20, narrow, acute; stamens 60–100; appendage blue.—Free bloomer, strong grower; sterile. Originated many years ago in Germany, probably with Caspary.

11. **flàvo-vìrens,** Lehm. (*N. grácilis* of gardens, not Zucc.). Fig. 2552. Lvs. narrowly peltate, deeply and irregularly sinuate or nearly entire, suborbicular; angle of lobes rounded; under surface pure green (or purplish in hybrids); 15–17 in. across: fls. white, 6–8 in. across; sepals pure green; petals 16–20, acuminate; stamens about 60, deep yellow; outermost filaments short, broad, petaloid; anthers with long yellowish appendage. Mex. —Crossed with *N. capensis* var. *zanzibariensis,* this species has yielded a progeny showing much the same variation as is shown by *N. zanzibariensis* itself. These are distinguished from forms of the latter by their more slender and acute petals and sepals, and smaller number of floral parts. They propagate easily from the tubers, bloom very freely, and include the best of the tender, day-blooming nympheas. The deepest blue is Grossherzog Ernst Ludwig; Wm. Stone is bright blue; Mrs. C. W. Ward, pink; *N. gracilis rubra,* red. Several other named forms have been offered, e.g., Antoine Chaize, A. Siebert, *N. gracilis rosea.*

2551 Nymphæa elegans. A blue Mexican water-lily.



2552. Nymphæa flavo-virens.

Of other members of Brachyceras, the following should be mentioned: *N. Heudelótii,* Planch. Fl. 2–2½ in. across, pale blue: lvs. 2–4 in. Senegambia.—*N. calliántha,* Conard. Fl. 4–7 in. across, blue or pink: lvs. 6–12 in. Cent. Afr.—*N. sulfùrea,* Gilg. Fl. 2–3 in. across, cadmium-yellow: lf. 2–3 in. S. Cent. Afr.—*N. Stuhlmánnii,* Schw. Fl. 5–6 in. across, sulfur-yellow: lf. 10–12 in. Cent. Afr. The origin and relations of the true N. gracilis, Zucc., are uncertain; it is not in cult.

SECTION II. SYNCARPLÆ.

SUBGENUS III. CASTALIA.

A. *Fls. yellow (Xanthantha and hybrids).*

B. *Spreading by runners (natural species).*

12. **mexicàna,** Zucc. (*C. mexicàna,* Coulter. *N. flàva,* Leitner). Floating lvs. ovate, margin obscurely and finely sinuate, dark green above, beautifully blotched with brown; under surface dark crimson-brown, with small blackish dots; when crowded the lvs. rise 3–5 in. above the water, are orbicular, cup-shaped by overlapping of the straight sinus-margins, entire, 3–5 in. across, dark green and shining above, under surface bright green, with fine purplish brown mottlings: fls. 4 in. across, raised 4–5 in. above the water, bright canary-yellow, open from 11 A.M. to 4 P.M.; petals 23, grading in size and shape insensibly into the stamens, which are about 50, light golden yellow: rhizome erect, tuber-like, discoid, plane beneath, 3–5 in. diam.; runners terete, ½in. thick, white, rooting at the tip and sending up lvs.; the young plant flowers in a few weeks and again sends out runners. Fla., Mex. B.M. 6917. Gn. 23:334; 27, p. 439; 52:445.—Hardy as far north as New York "in 2 ft. of water, covered with boards and a few leaves." Mexican stock is stronger and blooms more freely than that from Fla. Rose considers them distinct species.

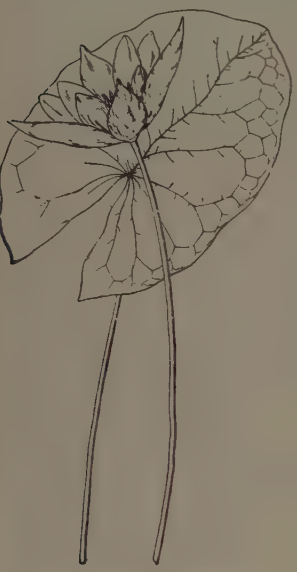
BB. *Without runners (hybrids).*

13. × **odoràta** var. **sulphùrea** (*N. sulphùrea,* Hort.). Lvs. all floating, 4–6 in. across, like those of *N. odorata,* but blotched with brown: fls. light yellow, 4–5 in. across, borne 2–4 in. above the water; open during the morning. One of Marliac's hybrids, doubtless *N. mexicana* × *N. odorata.* Hardy.—*N. odoràta sulphùrea grandiflòra* is a more recent and stronger-growing strain. G.L. 24:57.

14. × **tetragòna** var. **hélvola** (*N. hélvola* or *N. pýgmæa hélvola*). Lvs. floating, oval, 3–4 in. across, similar in shape to those of *N. tetragona,* blotched all over with brown: fls. floating, small, yellow, 2 in. across, open during the afternoon.—Probably *N. mexicana* × *N. tetragona.* Hardy.

15. ×**Marliàcea var. chromatélla** (*N. chromatélla*). Floating lvs. orbicular, much blotched with brown, 3–8 in. across; when crowded, the lvs. rise as much as 8 in. above the water, are dark green above, lighter beneath; petioles sometimes with longitudinal brown stripes: fls. bright yellow, 3–6 in. across; petals numerous, broad, concave; stamens deep yellow.—Probably *N. mexicana* ×*N. alba* (or *N. tuberosa*). Strong grower, free bloomer; a general favorite; perfectly hardy.

N. Moòrei (*N. Mooreàna*) is very similar to *N. chromatella;* believed to be *N. alba* × *N. mexicana.* —Probably as second or third hybrids of *N. mexicana* may be placed here Paul Hariot, clear yellow with delicate shadings of red at base of petals, and Sioux, rich brassy yellow, shaded red. Both have lvs. spotted reddish brown. They show some inheritance from *N. alba* var. *rubra* (see No. 28).



2553. Nymphæa tetragona.
(×½)

AA. *Fls. white, rosy or red.*

B. *Rhizome erect: fls. white (Chamænymphæa).*

16. **tetragòna**, Georgi (*C. tetragòna*, Lawson. *N. pýgmæa*, Ait.). Fig. 2553. Lvs. horseshoe-shape, entire, the lobes diverging, slightly produced and subacute, dark green above, inclined to brown blotching, reddish beneath, 3–4 in. across: fls. 1½–2½ in. across, open on 3 or 4 days from noon until 5 P.M..; base of fl. square; petals 13–17; stamens about 40, yellow. E. Siberia, China and Japan; also in N. Idaho and Ont. B.M. 1525. G.F. 9:134 (adapted in Fig. 2553).—The smallest nymphea in cult.; free bloomer; makes no side-shoots from the single crown, but grows readily from seed. Seed next to the largest of the genus. *N. fénnica*, Mela, is a form from Finland, and is offered by M. P. Andersen, Jönkoping, Sweden. It runs into purple-fld. varieties. Similar to *N. tetragona* and probably not botanically distinct. Requires cold water. *N. vomerénse* is a small white water-lily, said to be *N. alba* × *N. tetragona. N. orientàlis*, is a miniature plant with shining coppery green lvs. Japan. *N. himalayénsis*, is smaller than the type. Himalayas.

BB. *Rhizome horizontal, or, if not, fls. pink or red (Eucastalia).*

C. *Lvs. scattered loosely on the rhizome.*

17. **odoràta**, Ait. (*C. odoràta*, Woodv. & Wood). SWEET-SCENTED WATER-LILY. Lvs. nearly orbicular, entire, somewhat coriaceous, dark green above, purplish red when young; under surface deep red to reddish green or almost pure green; diam. 5–10 in.; lobes usually diverging, but often touching or slightly overlapping; petioles greenish or brownish: fls. (in the type) white, 3–5 in. across, open 3 days from 6 A.M. till 12 M.; sepals green, tinged with reddish brown; petals 23–32, ovate to lance-ovate; stamens 55–113, yellow; outer filaments broad, white, petaloid; seed medium-sized. E. U. S., common. B.M. 819 (small). Gn. 4, p. 368; 55, p. 179. V. 2:196; 19:9.—Varies greatly in size and color, approaching *N. tuberosa*. Garden forms selected for size of fl. are called var. **supérba** (*N. supérba*, Hort.) and **N. láctea.**

18. Var. **mìnor,** Sims (*C. odoràta* var. *mìnor*, Cock. *N. pùmila*). Lvs. deep red beneath (or green when aërial); lobes diverging; diam. 2–5 in.: fls. white, 2¼–3¼ in. across; sepals strongly purple-colored; petals 17–24; stamens 37–78. Same range as type; often a shy bloomer. B.M. 1652. A.G. 14: 112.—Sometimes grows where water recedes entirely in summer; usually in shallow water. N. Union is a garden form.

19. Var. **ròsea,** Pursh (*C. odoràta* var. *ròsea*, Brit. Var. *rùbra*, Hort.). CAPE COD WATER-LILY. Lvs. dark reddish on both sides when young, becoming green above: fls. pink, fading on the successive days of opening, 4 in. across. Cape Cod, Mass. B.M. 6708 (too pale). Var. **exquísita** is deeper in color of fl. and lf., and more easily grown. Vars. *rosàcea, Jessieàna* and *Hermòsa* are forms of var. *rosea.*

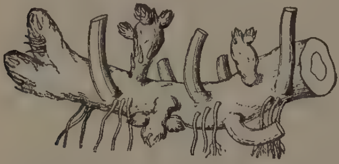
20. Var. **gigantèa,** Tricker (*C. odoràta* var. *gigantèa*, Fern.). RICE-FIELD WATER-LILY. Lvs. large, 12–16 in. across, green beneath, at times tinged purplish toward margin; edge often turned up; petioles green: fls. 4–7 in. across, pure white; sepals green; petals 24–31; stamens 69–120. Del. to Fla., Mex., Cuba, Brit. Guiana. —In this may be included *N. odoràta latifòlia*, Harper, *N. ebúrnea, N. caroliniàna nívea, N. gracíllima álba,* and *N. Parkeriàna*, Lehm.

21. × **caroliniàna,** Hort. (*N. odoràta caroliniàna* or *carolinénsis. N. odoràta supérba*, Rich. *N. tuberòsa supérba*). Lvs. entire, 12 in. across, sinus barely closed; green above, red beneath: fls. fragrant, 7 in. across; petals narrow, abundant, delicate rosy pink: rhizome stout.—Believed to be *N. odorata rosea* × *N. tuberosa.* The original type has given place to improved forms, such as *N. caroliniana perfecta, N. rosea,* and *N. salmonea* (*N. odorata perfecta* and *N. o. salmonea*), *N. odorata Luciana* (*N. Luciana*), *N. odorata suavissima* (*N. suavissima*), *N. odorata delicata, N. odorata turicensis,* and quite recently W. B. Shaw and Eugenia de Land. *N. Brakeleyi rosea* (*N. tuberosa rosea*) and *N. speciosa*

2554. Nymphæa tuberosa.
(×¾). No. 22.

belong here. *N. tuberosa* var. *rubra* of Sturtevant is a red form of this type, probably (*N. odorata rosea* × *N. tuberosa*) × *N. alba rubra*.

22. **tuberòsa,** Paine (*C. tuberòsa*, Greene. *N. renifórmis*, Walt.?). Figs. 2554, 2555. Distinguished from No. 17 chiefly by the numerous slenderly attached and spontaneously separating tubers, 1–3 in. long on the rhizome: lvs. when floating less coriaceous than in No. 17, and more veiny above; petioles marked with longitudinal brown stripes; no purple or red color about lvs. or sepals: fls. 4–9 in. across, pure white, open 3 or 4 days from 8 A.M. to 1 P.M.; petals broad, concave; seeds large (.44 cm. long). N. Cent. U. S. G.F. 1:366 (adapted in Fig. 2555), 367; 6:416 (good). Gn. 21:130; 52, p. 444. B.M. 6536 (poor).—A luxuriant grower; when crowded or in shallow water the lvs. and fls. rise 4–6 in. above the water; spreads rapidly by tubers. Moderate bloomer. Garden forms are *N. tuberosa robusta* and Helen Fowler. Var. **Richardsònii** (= var. *plèna*) has many more petals than the type. R.B. 40:101. Var. **máxima** (*N. odoràta máxima*, Hort.) is a form with round lvs. and closed sinus, the lobes curved out at the apex to a short point; petioles pubescent, with long hairs, with a few faint longitudinal brown stripes: fls. medium to large, pure white, somewhat cup-shaped. Lake Hopatkong, N. J.—Rather smaller than the type; possibly *N. tuberosa* × *N. odorata*. A diminutive form of *N. tuberosa* occurs near Trenton, N. J.



2555. Rootstock of Nymphæa tuberosa.

CC. *Lvs. crowded on the rhizomes; European species and hybrids.*

D. *Foliage green or reddish, not spotted with brown.*

23. **cándida,** Presl (*N. biradiàta*, Somm. *N. semiapérta*, Klinggraef. *N. álba mìnor*, DC. *N. nítida*, Sims?). Similar to No. 24: line of insertion of the sepals angular, projecting downward: lowest pair of veins of lf. (veins of the lobes) curved toward one another: all of the filaments broader than their anthers: fr. ovoid; seed large. Cent. and N. Eu.

24. **álba,** Presl (*C. álba*, Woodv. & Wood). Lvs. roundish, entire, floating, 4–12 in. across, red when very young; lowest pair of veins straight and diverging: rhizome black: fls. white (in the type), 4–5 in. across, open from 7 A.M. to 4 P.M.; petals broad, ovate, somewhat concave; angles of attachment of sepals rounded; filaments of innermost stamens not wider than the anthers: fr. more or less spherical; seed small. Eu. and N. Afr.—A robust species. In gardens, vars. called Albatross, *Harrisiàna*, Hermine, *delicàta* and *spléndens* may be found. Var. **candidíssima** (var. *máxima*, var. *pleníssima*) has lvs. orbicular, lobes strongly curved, overlapping, yellowish when very young: rhizome brownish, sometimes 3 in. through: fls. large, pure white, sterile.—The first nymphea to bloom in spring, continuing until frost. Very robust; a most desirable white variety.

25. Var. **rùbra,** Lönnr. (*C. álba rùbra*, Lönnr. *N. álba ròsea*, Hartm. *N. álba purpùrea*, Fries. *N. álba sphærocárpa rùbra*, Casp. *N. Caspáryi*, Carr.). Outermost petals rosy, intermediate intensely rosy, innermost deep carmine-red; anthers and stigma yellow; filaments and styles orange to deep red-brown; variable in depth and purity of color, deepening on second and third days of flowering. Lake Faver, Sweden. B.M. 6736 (stamens poor). R.H. 1879:230.—Difficult to grow, requiring cool water and subdued sunlight. About 15 named red water-lilies must be classed as forms of this variety. Var. **Froebélii** is the oldest of these and least adapted to cult. Jas. Brydon, *N. gloriòsa*, Wm. Falconer and *N. atropurpùrea* are favorites. See also No. 27.

26. **álba × odoràta ròsea.** Fls. large, cup-shaped, often raised above the water; petals broad, concave: lvs. large, dark green or purplish, rising above the water when crowded.—Robust, free-flowering plants, the color growing paler as the fl. ages; sterile. Three groups may be distinguished: (1) Fl. nearly white, flushed with rose; *N. Marliàcea álbida* (Gn. 78, p. 373), almost white; *N. Gladstoniàna*, white; Goliath and *N. lusitána*, very large, rosy. (2) Fl. light pink; *N. Marliàcea cárnea*, flesh-color; Wm. Doogue, Mark Hanna, *N. colóssea* (G. 34:609. G.M. 56:595). Leviathan, *N. somptuòsa* are very large forms, and very satisfactory. (3) Fl. rose-color; *N. Marliàcea ròsea*, *N. nobilíssima*, James Hudson.

DD. *Foliage more or less flecked with brown.*

E. *Petals never tinted yellow; color deepening with age of fl.*

27. **álba rùbra × tetragòna.** Rootstock usually erect and unbranched: lvs. small to medium size, dark green above with irregular brown spots: fls. small to medium size, pink or red.—Several garden forms, differing in size and color of fl., belong here: *N. Laydékeri ròsea*, fls. 2–3 in. across, pink changing to deep rose, opening about 11 A.M.; *N. Laydékeri ròsea prolífera*, a many-headed form. Of similar character, but larger in lf. and fl. (3–5 in. across) and colors from red to deep crimson are *N. Laydékeri lilàcea*, *N. L. fúlgens*, *N. L. lùcida*, *N. L. purpùrea*, *N. L. rùbra*, *N. Marliàcea ígnea*, *N. M. flámmea*, *N. M. rùbra punctàta*, *N. sanguínea*, *N. Ellisiàna*, Arethusa, Jas. Gurney, Jas. Brydon, Wm. Falconer, Mrs. Richmond.

EE. *Petals, especially the outer ones, more or less yellow.*

28. **álba rùbra × mexicàna.** Rhizomes erect: lvs. medium size (5–8 in.), brown-blotched: fls. 3–5 in. across, light yellow with pink center to orange, or red with yellowish tips and margins; the red color deepens as the fl. grows older. *N. Róbinsonii* is recognized by a notch midway of the sinus of the lf. *N. Seignorétii*, *N. Andreàna*, *N. auròra*, *N. chrysántha*, and *N. Laydékeri fúlva* are the older members of this group. With larger fls. and clearer colors are the recent N. Indiana, Comanche, Sioux, *N. solfatàre*, *N. graziélla*, Phebus, Phœnix, Paul Hariot. In this group may be placed Arc-en-ciel, Jean Forestier, *N. formòsa*, *N. punícea*.

2556. Nymphæa Lotus.

Redrawn from the old figure in Botanical Magazine (1804), showing an historical picture of the true white Egyptian lotus.

SUBGENUS IV. LOTOS.

A. *Fls. white.*

29. **Lòtus,** Linn. (*C. Lòtus,* Woodv. & Wood. *N. edùlis,* DC. *N. thermàlis,* DC., of the hot springs of Hungary). WHITE LOTUS. Fig. 2556. Lvs. orbicular, dark green above, under surface brownish, smooth or slightly pubescent; diam. 12–20 in.: fl. white, the broad outer petals suffused pink, 5–10 in. across, open 7.30 P.M. to 11 A.M.; sepals pure green; petals concave, broad, 19 or 20; stamens 96–103, yellow; anthers shorter than the filaments. Egypt. B.M. 797. F.S. 7:706, 707. G.F. 2:173. J.H. III. 67:497.—To this species may be assigned the garden forms *N. thermàlis* with broad petals and cup-shaped fls. from the hot springs of Grosswardein, Hungary; and the probable hybrids N. *dentàto-lòtus, N. eastonénsis* and Jubilee.

30. Var. **dentàta,** Schum. & Thonn. (*N. Ortgiesiàna,* Planch.). Lvs. glabrous or somewhat puberulent beneath: fls. pure white, 8–10 in. across, open until 1 P.M.; petals narrower than in the type, ovate, opening out horizontal; anthers longer than the filaments. Cent. Afr., Sierra Leone. B.M. 4257. F.S. 627, 628. A.G. 15:366.—*N. dentàta grandiflòra, N. d. magnífica,* and *N. d. supérba* are large and floriferous forms.

31. **pubéscens,** Willd. Lvs. ovate, 10–12 in. long, dark green above, dull purplish green and more or less pubescent beneath: fls. small to medium size, white; petals ovate, inner ones narrow; stamens inserted some distance above petals. India to Java and the Philippines.—Not cult.

32. **Zénkeri,** Gilg. Lvs. suborbicular, deeply triangular-excised, repand-dentate, thin and membranaceous, 5 in. across, pilose beneath: fls. 2½–3 in. across; petals 7–8, ovate-lanceolate, acute. Cameroon.—A very distinct dwarf form, cult. in Germany; probably not grown here.

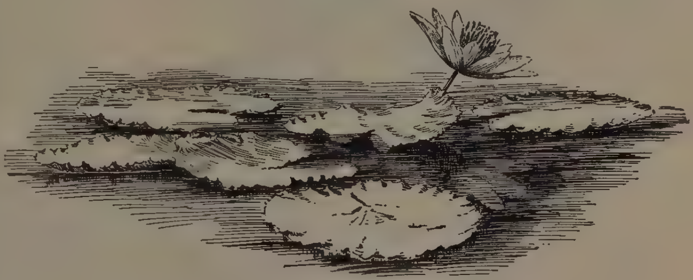
AA. *Fls. pink or red.*

33. **rùbra,** Roxbg. Lvs. orbiculate, reddish brown, bronzy, becoming greenish, pubescent beneath, 12–18 in. across: fls. deep purplish red, 6–10 in. across, open 3 or 4 nights from 8 P.M. to 11 A.M.; sepals dull purplish red, 7-nerved, never opening more than 10° above horizontal; petals 12–20, narrowly oval, rounded at apex; stamens about 55, cinnabar-red in color, becoming brownish. India. B.M. 1280. F.S. 6:629. R.H. 1879, pp. 74, 75. P.M. 11:265.—This species varies much in color, and produces fertile hybrids with *N Lotus* and *N. L. dentata.* There are, therefore, a series of garden forms of all colors from delicate pink to deep purplish crimson. In these the petals vary from broadly ovate and concave to narrowly ovate and flat, and the fls. are from tulip-shape to wide open. Some are highly floriferous, others shy bloomers. Most of these are arranged in order of color: fls. very delicate pink: *N. Smithiàna,* petals broad; *N. índica Isis, N. Laèlia, N. L. cólorans.* Fls. light pink: *N. delicatíssima, N. Deaniàna,* more pink, petals broad; *N. Boucheàna, N. índica Spìra, Reine d'Italie.* Fls. rosy pink: *N. kewénsis* (C. L. A. 25, March, p. 35), *N. Micheliàna.* Fls. red-pink: *N. Sturtevántii,* fl. tulip-shape, very massive; *N. rubicúnda,* Hofgartner Graebner. Fls. magenta: *N. Omaràna,* fl. wide open, narrow petal; *N. Ortgesiàno-rùbra, N. Màriæ-Legràngei, N. Bissétii,* Adele, Niobe, *N. tulipífera,* small, tulip-shape. Fls. rosy carmine: Diana, *N. índica Brahma, N. rùbra ròsea* (B.M. 1364), *N. devoniénsis* (B.M. 4665), Fig. 2557, *N. Arnoldiàna,* Pres. Girard. Fls. carmine: *N. Krumbiegélii, N. columbiàna, N. Diana grandiflòra.* Fls. dark red: *N. purpùrea,* Doctor Florenze, Geo. Huster. Fls. crimson to deep purplish crimson: Frank Trelease, Rufus J. Lackland, James Gurney, Jr.

SUBGENUS V. HYDROCALLIS.

34. **amazònum,** Mart. & Zucc. Lvs. ovate, entire; lobes rounded; upper and lower surfaces spotted brownish or blackish, under surface reddish brown; petiole with a ring of long hairs at the point of joining the lf.: fls. 3–6 in. across, imperfectly open 1 or 2 nights; the bud opens about half and closes again between 3 and 6 A.M. the first night; the second night the sepals and outer row of petals open about 7 P.M., the other parts remaining as a tight, white bud until 3.30 A.M., when the fl. opens fully from 4.30–5 A.M., then closes by 6.30 A.M. and draws down into the water; petals usually 20; stamens 93–297. Trop. Amer. B.M. 4823.

35. **Rudgeàna,** G. F. W. Mey. Lvs. elliptic to suborbicular, 18 in. long, margin coarsely and irregularly sinuate-dentate: fls. 3–6 in. across, imperfectly open 2 or 3 nights from twilight until dawn; usually only the sepals and 4, 8 or 12 outer petals open, the remaining parts forming a closed ovoid bud; occasionally a slight aperture is formed by drawing apart of the tip of the bud, which occurs before midnight; petals usually 16–20; stamens 43–83. Trop. Amer.



2557. **Nymphæa devoniensis.** ($\times\frac{1}{20}$). Under No. 33.

36. **blánda,** G.F.W. Mey. (Not *N. blánda,* Planch., nor of gardens). Lvs. small, membranous, entire, suborbicular; lobes slightly produced, subacuminate and subhastate: fls. 4 in. across; habits of opening unknown; petals 16; stamens about 65. Trop. Amer.

In the Hydrocallis group are the following, known only in herbaria: *N. lasiophýlla,* Mart. & Zucc. Bahia, Brazil; *N. Gardneriàna,* Planch. S. Brazil; *N. Jamesoniàna,* Planch., Porto Rico and Ecuador; *N. stenaspidòta,* Casp., Goyaz, Brazil; *N. tenerinérvia,* Casp., Bahia, Brazil; *N. oxypétala,* Planch., Ecuador; *N. Gibértii,* Morong, Paraguay.

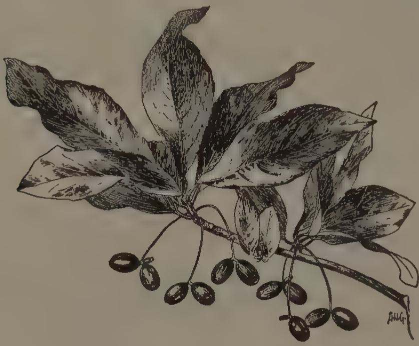
Other nympheas occasionally met with are: *N. Baùmii,* Rehn. & Henk., the smallest species known: fls. ¾–1 in. across, white, slightly fragrant. S. W. Trop. Afr.—*N. eastonénsis*=N. Smithiana × N. O'Marana.—*N. Henkeliàna,* Rehn. & Henk. Fls. strikingly flat, pale blue, having an odor of violets. Austral.—*N. Màynardii,* Hort. "Fls. fully 9 in. across, of a lovely pale shade of heliotrope."—*N. virginàlis,* Hort. Lvs. very large: fls. pure white, up to 11 in. across. Of garden origin.

HENRY S. CONARD.

NYMPHOÌDES (*Nymphæa-like*). Syn. *Limnánthemum. Gentianàceæ.* FLOATING-HEART. Ornamental aquatic herbs.

Perennial, fibrous-rooted, stoloniferous or proliferous, with floating foliage: lvs. ovate or orbiculate, heart-shaped at the base, rarely peltate, with a closed sinus, entire or slightly wavy: peduncles with 1, 2 or many fls.; fls. white or yellow, in spring and summer, borne in the axils or on filiform sts. apparently from the petioles; corolla wheel-shaped, deeply 5-cut; lobes fringed or not; stamens 5, fixed at the base of the corolla.—Species about 20 in fresh water, in tropical and subtropical regions around the world and reaching into temperate parts. The generic name is in dispute, it having been known heretofore as Limnanthemum. This genus and a very few others are sometimes separated in the family Menyanthaceæ, distinguished from Gentianaceæ in habit, in alternate or basal lvs., and different æstivation.

The floating-hearts of cultivation are most useful ornamental aquatic plants, and are represented in cultivation by but four species. *Nymphoides lacunosum* is hardiest of American species; its mottled, variegated leaves, about 2 inches broad, are very attractive, regardless of its dainty, white, miniature flowers. It is best grown under natural conditions, in pools and still water, and in water about 2 feet deep. It may also be grown in tubs, as a surface covering, with a few tall plants in the center. *N. aquaticum*, commonly known as the fairy water-lily, is a much stronger grower: leaves deep green, and, when grown in natural ponds, attain large proportions, 4 to 6 inches broad, and bears innumerable flowers, more like flakes of snow. It is also valuable for tub culture, similar to the preceding species *N. indicum*, commonly called water snowflake, is undoubtedly the most interesting and attractive of any, and deserving of most general cultivation. The leaves are of a light green color, heart-shaped, and it produces flowers in greater abundance, which are much larger and covered completely with hirsute glands. These, as in the other species, are produced in clusters on the petioles, near the surface, and, although they are of but one day's duration, they are produced in such quantities that there is never any lack of these delicate flowers all through the season. In tub culture, this species will soon crowd itself over the edge of an ordinary tub, and, although the leaves no longer float on the surface, it does not affect the growth or the proliferousness of its flowering. When grown in tubs, the receptacle should be filled two-thirds with moderately rich, loamy soil, covered with sand, and filled and kept filled with water. All three species, when strong enough to produce flowering leaves or petioles, send forth new shoots, as each cluster of flowers apparently terminates with a bud and produces leaves; these, when strong, produce flower-buds and leaf-buds again, and thus soon reproduce themselves. *N. aquaticum* produces a cluster of fleshy roots, with a bud from single leaves in fall, which are plentiful in Florida in the season. These are excellent for distribution, and can be sent safely a great distance. The petioles are very brittle and easily snap off, but the floating leaf soon emits roots at the broken end as well as where the flower-buds are located; thus it is very free and proliferous. These are very desirable aquatic plants. The fourth species, *N. peltatum*, is a rampant, weedy plant, although its mottled foliage is beautiful and the flower is much larger than those of the above plants. Its habit of growth is also different. it produces runners, and rambles over an immense space; it also produces seed in great quantity, which, when ripe, floats on the surface for a short time, then sinks to the bottom; it is best confined to the limits of a tub, where it grows freely and produces its large yellow flowers in profusion. It is hard to eradicate when once established, as it is perfectly hardy. All the floating-hearts are very pretty and useful for tub culture, but after knowing the water-lilies the general public desires more bold and striking plants. (Wm. Tricker)



2558. Nyssa sylvatica. (×⅓)

A. *Color of fls. yellow.*

B. *Fls. accompanied by clusters of tubers.*

lacunòsum, Kuntze (*Limnánthemum lacunòsum*, Griseb. *Villársia lacunòsa*, Vent.). Sts. sometimes 10 ft. long: lvs. orbicular-cordate, purplish beneath, 1–2 in. long: fls. 3–6 lines across; segms. ovate, acute: seeds smooth. July, Aug. Ponds, Nova Scotia to Fla. and La., west to Minn.

BB. *Fls. not accompanied by clusters of tubers.*

peltàtum, Brit. & Rend. (*N. nymphæòides*, Brit. *Limnánthemum nymphæòides*, Hoffm. & Link. *Menyanthes nymphæòides*, Linn.). Plant stout and branching: lvs. 2–4 in. broad: fls. 1 in. across or more; segms. obcordate, short-fringed. May–July. Eu., Asia; naturalized in District of Columbia.—Simulates *Limnocharis Humboldtii* in habit.

AA. *Color of fls. white (varying to yellow in the last).*

B. *Seeds rough.*

aquáticum, Kuntze (*L. trachyspérmum*, Gray. *Villársia aquática*, Gmel.). Stouter and larger than *N. lacunosum:* lvs. cordate orbicular, thick, entire or repand, 2–6 in. long, spongy: tubers thick: fls. 6–10 lines broad. April–July. N. J. to Fla. and Texas.

BB. *Seeds smooth.*

índicum, Kuntze (*L. índicum*, Thwaites. *Menyánthes índica*, Linn.). WATER SNOWFLAKE. Fls. white, yellow toward the base within; segms. fimbriated, densely papillose, without a longitudinal fold down the middle. Tropics. Gn.M 4:182.—There is said to be a rich yellow variety.

WILHELM MILLER.
L. H. B.†

NÝSSA (name of a water nymph; these trees grow in swamps). *Nyssàceæ*, formerly included in *Cornàceæ*. TUPELO. PEPPERIDGE. SOUR GUM. Ornamental trees planted chiefly for their handsome foliage and brilliant autumnal tints.

Deciduous. lvs. alternate, petioled, entire or rarely remotely toothed, stipulate: fls. polygamo-diœcious, minute, greenish white, in slender peduncled clusters; the staminate fls. slender-pedicelled in many-fld. clusters; calyx cup-shaped, 5-toothed; petals 5, imbricate, inserted on the margin of the conspicuous disk; stamens 5, exserted; ovary 0; pistillate fls. sessile, 1 or 2, or in few-fld. clusters; calyx-tube campanulate, 5-toothed, petals small; stamens 5–10, short, anthers often sterile; ovary 1-2-celled; style slender, recurved: fr. an oblong drupe, usually 1-seeded, with a bony, ridged or winged stone.—Five species in N. Amer. and 2 in Asia.

The tupelos are bold and picturesque trees with medium-sized or rather large, generally obovate or oblong lustrous leaves, insignificant greenish white flowers in slender-stalked clusters or solitary, and conspicuous, blue, red or purple oblong solitary or paired fruits. They are chiefly valued for the flaming scarlet of their autumn foliage and for the distinctness of their winter aspect. *N. sylvatica* is hardy North, while the other species are tenderer. They grow in swamps and are usually 40 to 60 feet high, attaining a maximum of 100 feet. Old specimens often have a melancholy appearance by reason of the drooping habit of the lower limbs. The upper branches of a tupelo are often twiggy, crooked or "kinky." Tupelos are hard to transplant from the wild, even when heavily pruned, because they have remarkably long roots with few rootlets. Nursery-grown trees that have been frequently transplanted are preferable. Propagation is by seeds sown at once or stratified; if allowed to become dry, they do not germinate until the second year; sometimes increased by layers which, however, root slowly.

sylvática, Marsh. (*N. multiflòra,* Wang.). TUPELO. PEPPERIDGE. BLACK GUM. SOUR GUM. Figs. 2558,

2559. Tree, to 100 ft., with slender pendulous branches forming a flat-topped usually cylindrical head, sometimes low and broad, or in crowded trees pyramidal: lvs. usually entire, obovate or oval, mostly acute or acuminate, lustrous above, pubescent on the veins or glabrous at maturity beneath, 2–4 in. long: staminate fls. in compound heads; pistillates larger, 2 or several: fr. ⅓–⅔in. long, nearly black, acid, with an ovoid stone, little flattened. Maine and Ont. to Mich., to Fla. and Texas. G.F. 3:491; 7:275. F.E. 14, pl. 32. S.S. 5:217.

aquática, Marsh. (*N. uniflòra*, Wang. *N. denticulàta*, Ait.). Cotton Gum. Tree, occasionally to 100 ft., with small spreading branches forming a pyramidal head: lvs. slender-stalked, ovate to oblong, acute or acuminate, entire or remotely toothed, at maturity lustrous above, pubescent beneath, 5–7 in. long: pistillate fls. solitary, surrounded by 2–4 strap-shaped bractlets to ½in. long: fr. oblong, 1 in. long, dark purple. Va. to Ill. and Texas. S. S. 5:220.

N. sinénsis, Oliver. Tree, to 40 ft.: branchlets pubescent: lvs. elliptic, dull dark green above, light green and pubescent on the veins beneath, 4–6 in. long: pistillate fls. few, on slender stalk: fr oblong, bluish, ½in. long. Cent. China. H.I. 20:1964.—Has proved hardy in S. England.

Wilhelm Miller.
Alfred Rehder.†

2559. Pepperidge.—Nyssa sylvatica.

O

OAK. Plants of the genus Quercus (which see). The word is also applied to other plants to some extent, from resemblances in form of tree, in leaf, or in hardness of wood. In Australia, where there are no species of Quercus, the word oak is applied to the species of Casuarina, "from a fancied resemblance," as Maiden says, "of the wood of casuarinas to that of oak." Other plants in Australia are sometimes known as oaks. The silk oak of florists is *Grevillea robusta*. The Jerusalem oak is *Chenopodium Botrys*, probably from the shape of the leaves. Poison oak is *Rhus Toxicodendron*, and related species.

2560. The white oak.—Quercus alba.

OAKÈSIA (Wm. Oakes, New England botanist, 1799–1848). *Liliàceæ*. Three species of native perennial woods herbs, having the graceful habit of such choice wild flowers as the Solomon's seal and more particularly the common bell-wort, *Uvularia perfoliata*. *O. sessilifolia* has been offered by a few dealers in hardy plants. It prefers a rich light soil in a rather moist, partially shaded position, and improves under cultivation.

Oakesia can be easily distinguished from Uvularia by the lvs., which are merely sessile instead of perfoliate, by the angled rather than terete sts., and fls. opposite the lvs. rather than terminal. Oakesia was separated from Uvularia in 1879 by Watson. Lately the name Oakesiella has been applied to the genus because there is an earlier Oakesia (which, however, is an untenable name for Corema). By some botanists, the species are still retained in Uvularia. Other generic characters are: fls. few, solitary on short pedicels opposite the lvs.; segms. without callosities: caps. membranous, elliptical, winged, acutish at each end, very tardily dehiscent: lvs. more or less rough on the margins: seeds globose, with a tumid raphe but no aril.

sessilifòlia, Wats. (*Uvulària sessilifòlia*, Linn. *Oakesiélla sessilifòlia*, Small). St. once forked: lvs. oblong-lanceolate, acute at each end; margins minutely scabrous: caps. borne on a distinct stipe. Canada to Fla. and Ark. B.M. 1402. L.B.C. 13:1262. L. H. B.†

OAT: *Avena sativa.*

OBELISCÀRIA: *Lepachys.*

OBERÒNIA (Oberon, king of the fairies, because of the quaint flower forms). *Orchidàceæ*. Perhaps 100 tufted epiphytic orchids in Trop. Asia and Austral. and Pacific islands, little known in cult., but of much botanical interest. Lvs. distichous, ensiform or terete: fls. very small, in dense spikes or racemes, in the cult. species yellow, orange or buff; sepals free, equal or nearly so, oblong or broadly ovate, larger than the petals; lip sessile, usually concave, entire or toothed. They probably require warmhouse treatment; some of them will grow on blocks. None of the species seems to be regularly in the trade here, but odd or particular plants are sometimes offered, as *O. tahiténsis*, Lindl. (*O. iridifòlia*. B.M. 4517, not Lindl.), *O. Myosùrus*, Lindl., *O. ensifórmis*, Lindl. (*O. acaùlis*, Hook. B.M. 5056).

ÓCHNA (old Greek name for a wild pear, which some of these plants were thought to resemble in foliage). *Ochnàceæ*. Glasshouse woody plants, little grown for the odd showy bloom and fruit.

Ochna is a genus of about 25–30 species of trees and shrubs of Trop. Asia and Afr., and a few in S. Afr.: lvs. deciduous, alternate, minutely serrate, leathery, shining: fls. yellow, rarely greenish, jointed to the pedicels; sepals 5, colored, imbricate, persistent; petals 5–10; stamens indefinite; anthers opening longitudinally or by pore-like slits; ovary deeply 3–10-lobed, the lobes 1-celled, 1-ovuled, and seated around a central disk or receptacle and becoming sessile drupes, styles connate.

multiflòra, DC. Glabrous shrub, 4–5 ft. or more high: lvs. oblong-elliptical to oblanceolate-oblong: petals sessile; anthers as long as the filaments, opening longitudinally, sepals in fr. about 4 lines long. Upper

Guinea. G.C. III. 40:212. J.H. III. 44:209. G.W. 2, p. 328.—*O. multiflora* is a greenhouse shrub cult. by a few fanciers for its remarkable appearance when in fr. The fls. are yellow, appear in spring, and are borne to the number of 10–15 in racemes terminating short lateral branches. The blossoms are short-lived, but the calyx is persistent. Its 5 sepals are greenish in fl., but become a bright red in fr. The receptacle increases until it becomes an inch or so thick, globular and bright red. Upon it are borne black seedlike bodies, which are the carpels. The red and black make a fine contrast. This plant is best prop. by half-ripened cuttings struck in summer or autumn. It requires in England a winter temperature of 48–60°, and summer temperature of 60–85°; soil, fibrous loam with plenty of drainage.

O. atropurpùrea, DC., of the Cape, may occur now and then: shrub, 4–5 ft., with ovate denticulate lvs.: calyx dark purple, petals yellow; fls. on 1-fld. stalks. J.F. 1:29.

WILHELM MILLER.
L. H. B.†

OCHROCÁRPOS (Greek, *yellow fruit*). Incl. *Calysáccion*. *Guttíferæ*. Trees, of about 20 species, widespread in the tropics, little known horticulturally. Lvs. opposite or in 3's, coriaceous: fls. axillary, polygamous, the petals 4–7 or more; stamens indefinite, free or somewhat connate, the filaments slender and anthers erect; ovary 2-celled: fr. berry-like, with a few large seeds. *O. africànus*, Oliver, is a tree 40–50 ft. high: lvs. large, oblong-elliptical, with the midrib very prominent beneath: fls. from the nodes of the fallen lvs., 1½ in. diam., the petals half as long again as sepals; stamens very many: fr. very large, several inches diam., with yellow pulp. Upper Guinea. *O. obovàlis*, Safford, is the "chopag" of Guam, the wood of which is used in house-construction (p. 1699, Vol. III). It is a medium-sized tree, with opposite short-petioled obovate or oblong-obovate entire lvs. rounded at the apex, and fragrant white polygamous fls. borne laterally, single or clustered. L. H. B.

OCHRÒMA (named for the *paleness* of the fls.). *Bombacàceæ*. One tree of Trop. Amer., allied to Ceiba: lvs. simple, angled or lobed: fls. large, terminal. **O. Lagòpus**, Swartz, is listed abroad but hardly a horticultural subject: it is the corkwood or balsa of the W. Indies, from which canoes and other things are made, the wood being very light, the bark yielding fiber: tree to 40 ft. high: lvs. 5–7-lobed or only angular, nearly entire or dentate, puberulous beneath: petals 5–6 in. long, yellowish white or brownish, somewhat surpassing the column of stamens, obovate and wavy, clawed; calyx 5-lobed, subtended by a caducous involucre of 3 parts; stamens comprising a column which is topped by 1-celled anthers; stigma 5, exserted, spiral: caps. 1 in. long, 5-celled, with reddish brown wool inside. L. H. B.

OCHRÒSIA (name records the pale yellow color of the fls.). *Apocynàceæ*. Fifteen or more trees, extending from the Mascarene Isls. eastward to Hawaii, little known to cult.: lvs. scattered, whorled or opposite, with numerous nerves, coriaceous, entire, often large: fls. in peduncled cymes, of medium size, often very fragrant, mostly white, yellowish or cream-colored; calyx small, glandless, deeply 5-cleft; corolla salverform, the tube cylindrical and dilated at point of insertion of stamens, the throat constricted and glabrous; disk small or wanting: carpels 2, distinct or connate at base, ripening into spreading few-seeded or 1-seeded drupes.—The species are grown somewhat in tropical countries for the ornamental foliage and frs.

O. borbónica, Gmel., is an evergreen tree 20–30 ft., with stout branches, glabrous: lvs. large, whorled, obovate, narrowed to a petiole, rounded at apex, shining above: fls. white; corolla-limb ⅓in. diam.: drupes about 2 in. long, bright red, considered to be poisonous. Mascarene Isls. eastward.—*O. ellíptica*, Labill.=O. parviflora.—*O. parviflòra*, Hemsl. (Cerbera parviflora, Forst.), is a Pacific species, somewhat planted in Hawaii: 30–40 ft., evergreen, with rough bark and cylindrical twigs: lvs. ternate quarternate, crowded at ends of branches, oblong-lanceolate, acuminate, shining: fls. small, white: fr. 1 or 2 scarlet drupes, not edible.—*O. sandwicénsis*, Gray, of Hawaii, is a small tree or large shrub, 10–25 ft., with long drooping branches: lvs. in 3's or 4's, long-oblong, short-acuminate, shining above: fls. yellowish to cream-colored: drupes dry, yellowish at maturity, not edible.

L. H. B.

ÒCIMUM (an old Greek name). Sometimes spelled *Ocymum*. *Labiàtæ*. Sweet herbs. See *Basil*.

Annual and perennial, sometimes shrubby, with opposite lvs.: fls. mostly small and white or whitish, or yellow, usually 6 in each verticil and the verticils in terminal or paniculate racemes; calyx deflexed in fr., unequal-toothed; corolla-tube usually not exceeding the calyx, 2-lipped, the upper lip 4-lobed; stamens 4, didynamous and declined; style shortly 2-cut: nutlets ovoid or subglobose, smooth or punctate.—Species about 60, in the warmer parts of the world. Little known in cult. except in the basil, which is used as seasoning and also grown for its very pleasing fragrance. This is **O. Basílicum,** Linn., of Trop. Asia and Afr. and Pacific islands: annual, glabrous or slightly pubescent, much branched, 1–2 ft. high: lvs. petioled, ovate, entire or toothed: fls. in moderately dense racemes, white or more or less tinged purple; calyx becoming ¼in. long, and corolla ⅓–½in. long; stamens slightly exserted. **O. mínimum,** Linn., the bush basil, is probably a small cult. form of the foregoing. **O. suàve,** Willd. (*O. gratissimum* var. *suàve*, Hook.), the tree basil of India, Afr., and the E., is a shrub 4–8 ft. high, woody below and much branched, the lvs. densely soft-tomentose on both surfaces and in this differing from *O. gratissimum:* lvs. ovate, acute, crenate or coarse-toothed: corolla whitish or purple-tinged, little exceeding the calyx, the latter becoming ¼in. long: racemes dense and much panicled, becoming 6–9 in. long.

Of the common basil (*O. Basilicum*) are forms of compact habit, and others with purplish foliage; also with crimped or wavy lvs. The basils are tender and should not be trusted in the open ground until unsettled weather is passed. The plants may be started indoors, and transplanted to 6–10 in. apart in warm ground. The herbage is cut when the plant is growing, and dried in bundles; the plant, when cut off, gives a new crop if it is not exhausted and if the soil is good. Roots may be lifted for a winter supply of foliage. The very aromatic herbage is used for seasoning, and the plant was once esteemed for medicinal properties. The oil is used in the preparation of certain liquors. L. H. B.

OCTOMÈRIA (from the Greek for *eight* and *part*, referring to the pollinia). *Orchidàceæ*. Epiphytic herbs: sts. cespitose: lf. solitary, sessile or subsessile, borne at the tips of the sts.: fls. small, clustered at the base of the lvs.; sepals and petals similar, spreading; labellum shorter than the sepals, strongly 3-lobed or pandurate; column short; pollinia 8.—The following species are natives of Brazil.

arcuàta, Rolfe. Sts. somewhat slender, clothed with membranaceous sheaths: lvs. subsessile, brown-purple on both sides when mature, lanceolate, sub-recurved, fleshy: fls. bright yellow, solitary, sub-pendulous; sepals and petals oblong, obtuse; labellum recurved, lateral lobes erect, obtuse, middle lobe broadly triangular-ovate, disk bicarinate, keels and side lobes dark purple.

decípiens, Dammer. Sts. 2–3-jointed, terete, clothed with membranaceous sheaths: lf. semi-terete; fls. fasciculate, shortly pedicellate; sepals and petals ovate, the lateral sepals slightly connate at base, yellow; labellum triangular-ovate, elongated, 3-lobed; lateral lobes rounded, erect; middle lobe yellow, disk bilamellate.

Óppenheimii, Dammer. Sts. about 2 in. long: lf. ovate-lanceolate: fls. white; lateral sepals connate at base, lanceolate, acute; upper sepal lanceolate, acuminate; petals lanceolate, labellum lyrate, 3-lobed, fleshy at base, otherwise hyaline, margin irregularly denticulate, disk bicarinate. Oakes Ames.

ODONTADÈNIA (Greek, *toothed glands*). *Apocynàceæ.* Here belongs the tropical yellow-flowered climber sold as *Dipladenia Harrisii*, which rivals in beauty the well-known greenhouse allamandas.

Tall shrubby climbers or lianas: lvs. opposite: cymes loose, usually ample, rarely few-fld. and scarcely branched; calyx 5-parted, the lobes remarkably blunt or rounded; corolla-lobes twisted in the pointed bud, overlapping to the right and twisted to the left; stamens fixed at the top of the narrow part of the tube; fls. yellow, whereas those of Dipladenia are yellow only in throat if at all. The genus is further distinguished from Dipladenia by the shape of the calyx-lobes and by the cup-shaped group of toothed glands below the pistil.—Species 20–25, Trop. S. Amer. and Cent. Amer.

grandiflòra, Schum. (*O. speciòsa*, Benth. *Dipladènia Hárrisii*, Hook.). Shrubby branched climber: largest lvs. 10–15 x 4–5 in., oblong, tapering, scarcely leathery, feather-veined, often purplish beneath; petioles stout, scarcely 1 in. long: racemes axillary and terminal; pedicels red, often 1 in. long, curved downward; corolla-tube with a roundish base about ½in. long and thick, then suddenly constricted, then gradually widening into a funnel-shaped fl. Brazil, Guiana, Trinidad. B.M. 4825.—The fls. are fragrant, about 3 in. across, funnel-shaped, with 5 rounded, spreading lobes, and are more or less streaked with red in the throat, at the base of the lobes, and on the back of the tube. The treatment for dipladenias (see *Dipladenia*, Vol. II) should be attempted for Odontadenia, but *O. grandiflora* perhaps grows at lower altitudes, and may require the treatment usually given to hothouse vines.

O. nítida, Muell. Arg. (O. cordata, A. DC.) from Trop. S. Amer., is a twining glabrous shrub with yellow corolla bearing a band of vermilion below the middle of the narrow tube: lvs. oblong or elliptic, 4–6 in. long: fls. nodding on axillary pedicels, the tube narrow and constricted at the colored part, the 5 lobes broad-ovate and acute. It is referred to the genus Angadenia in B.M. 8233 (*A. nítida*, Miers), and is probably best understood when thus separated.

Wilhelm Miller.
L. H. B.†

ODONTIÒDA (compounded from *Odontoglossum* and *Cochlioda*) *Orchidàceæ.* A genus established to contain the hybrids between Odontoglossum and Cochlioda.

The following are some of these hybrids: *O. beechénse* =O. Rolfeæ × C. Noetzliana.—*O. Bóhnhóffiæ* (O. cirrhosum × C. vulcanica). Fls. blood-red, the sepals and petals narrow, marked somewhat with white, tinged slightly purple at base; lip with a yellow crest with a few red spots.—*O. Bòltonii*=O. Vuylstekeæ × C. Noetzliana.—*O. Brádshawiæ* (O. crispum × C. Noetzliana). Fls. resembling in shape those of the first parent, but smaller; sepals and petals cinnabar-scarlet; lip 3-lobed, whitish, the lobes scarlet-tipped, and a spot of the same color in front of the yellow crest. Gn. 71, p. 55. G.M. 56:337.—*O. Brèwii*=O. Harryanum × C. Charlesworthii.—*O. Chárlesworthii* (O. Harryanum × C. Noetzliana). Fls. resembling in shape those of the cochlioda, ruby-crimson, except the spiny yellow crest. Gn. 72, p. 301. J.H. III. 56:583.—*O. chelseiénsis* (O. crispum × C. vulcanica). Fls. intermediate in shape between those of the parents, compactly arranged, carmine-rose, lightly marbled with yellow on the sepals; lip light yellow, 3-lobed, the lobes tipped with carmine-rose, and a darker blotch in front of the crest. O.R. 17:48. G.M. 52:70. Gn. 73, p. 112.—*O. chessingtonénsis*=O. Rolfeæ × C. Noetzliana.—*O. Coòksoniæ*=O. ardentissimum × C. Noetzliana. O. 1913, p. 103.—*O. Corneyàna*=O. Lambeauianum × C. Noetzliana.—*O. Craveniàna* (O. cordatum × C. Noetzliana). Fls. more nearly resembling in shape those of the cochlioda; sepals and petals red; lip broad, salmon-red, white in front, and with a yellow crest. G.M. 51:25.—*O. cùprea*=O. cristatum × C. Noetzliana.—*O. daltonénsis*=O. Phœbe × C. Noetzliana.—*O. Devossiàna* (O. Edwardii × C. Noetzliana). Panicle compact; fls. crimson, the 3-lobed lip lighter at the apex, and with a yellow crest. O.R. 16:41.—*O*, *eborìacum* (origin doubtful). Fls. medium-sized. scarlet; lip with pale yellow markings.—*O. Flòryi*=O. Andersonianum × C. Noetzliana.—*O. gattonénsis*=O. Kegeljanii × C. Noetzliana.—*O. Goòdsoniæ* (origin doubtful). Fls. large, rosy red, irregularly marked with cream-color; crest of lip yellow, somewhat red-marked in front. G.C. III. 45:195. G.M. 53:302.—*O. Graireàna*=O. Rossii majus × C. Noetzliana.—*O. gràta*=O. tripudians × C. Noetzliana.—*O. heatonénsis* (O. cirrhosum × C. sanguinea). Fls. white, the sepals and petals oblong-lanceolate, suffused at the apex and spotted below with rosy purple; lip ovate, spreading, acuminate and recurved at the rosy purple apex. B.M. 8133.—*O. Hemptinneàna*=O. eximium × C. Noetzliana.—*O. Hyeànæ*=O. ardentissimum × C. Noetzliana.—*O. ígnea*=O. Lindenii × C. Noetzliana.—*O. Jéssopiæ*=O. "Queen Alexandra" × C. Noetzliana.—*O. keighleyénsis*=O. cirrhosum × C. Noetzliana.—*O. Lambeauiàna*=O. Lambeauianum × C. Noetzliana.—*O. Leeàna*=O. spectabile × C. Noetzliana.—*O. Lutètia*=O. luteo-purpureum × C. Noetzliana.—*O. maculatíssima*=O. amœnum × C. sanguinea.—*O. Móssiæ*=O. maculatum × C. Noetzliana.—*O. nevénse*=O. nevadense × C. Noetzliana.—*O. oakwoodiénsis*=Odontioda Bradshawiæ × O. percultum.—*O. rawdonénsis*=O. ardentissimum × Odontioda Charlesworthii.—*O. Rólfei*=O. Hunnewellianum × C. vulcanica.—*O. rosefieldiénsis* (O. triumphans Mr. de B. Crawshay × C. Noetzliana). Fls. scarlet, slightly shaded yellow; lip yellow, red-tinged, the basal ridges bright yellow. G.C. III. 49:308.—*O. Sánderæ*=O. percultum × C. Noetzliana.—*O. Schrœderi*=O. crispum × Odontioda Bradshawiæ.—*O. Sèymouræ*=Odiontioda Charlesworthii × Odiontioda Bradshawiæ.—*O. Sèymourii*=O. Uroskinneri × C. vulcanica.—*O. speciòsa*=(?).—*O. Thwàitesii* (O. Harryanum × C. vulcanica). Sepals and petals bronzy claret; lip lilac-purple with a yellow crest. J.H. III. 57:147.—*O. Vuylstékeæ* (O. nobile × C. Noetzliana). Fls. about 2½ in. across; sepals and petals ovate-lanceolate, with a crimson base, the upper portion white with red spots, the margin pink; lip fiddle-shaped, yellow at base, the rounded lateral lobes crimson, the rounded middle lobe white, crimson-spotted. B.M. 7990. R.B. 33:169. Gn. 65, p. 433.—*O. wickhaménsis*=O. crispum × C. sanguinea.—*O. Wílsonii*=O. Pescatorei × C. vulcanica.—*O. Zenòbia.* G.C. III. 55:226.

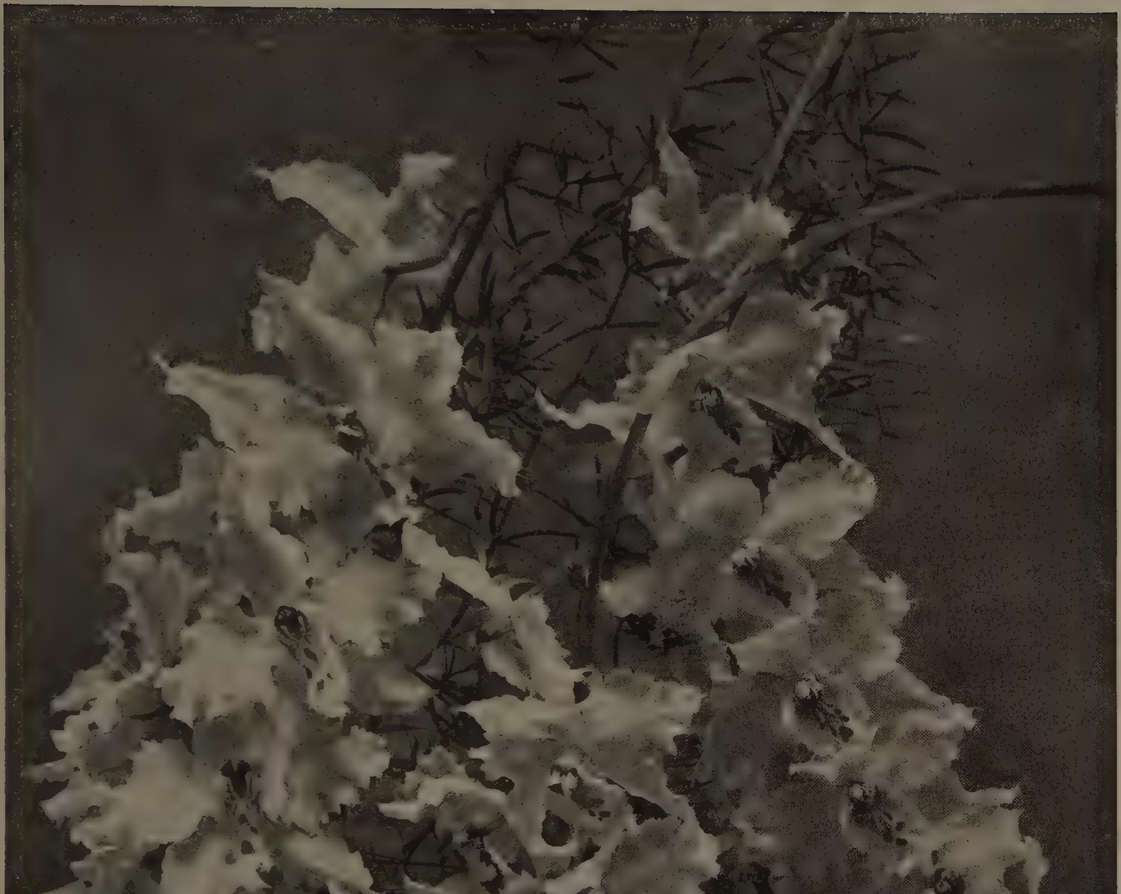
George V. Nash.

ODONTOCÍDIUM (compounded from *Odontoglossum* and *Oncidium*). *Orchidàceæ.* A genus established to contain the hybrids between Odontoglossum and Oncidium.

O. Edwardàtum=Odontoglossum Edwardii × Oncidium serratum.—*O. Fowleriànum*=Odontoglossum cirrhosum × Oncidium Forbesii. G.M. 54:878.

ODONTOGLÓSSUM (Greek, *tooth-tongue;* in allusion to the crest on the labellum). *Orchidàceæ.* Orchids which on account of their handsome flowers are great favorites of cultivators. *O. crispum* is one of the finest of all orchids.

Plants epiphytic, with short rhizomes and 2-lvd. pseudobulbs, often with sheathing lvs. at the base: fls. in few- to many-fld. racemes or panicles arising from the base of the pseudobulb; sepals and petals spreading, free, or the lateral sepals rarely somewhat united at the base; base of the labellum ascending parallel to the column and sometimes adnate to the latter; lateral lobes small, often erect; middle lobe large, spreading, variously shaped; column clavate, narrowed at the base, longer than in Oncidium.—About 100 species,



LXXVI. Odontoglossum crispum, with Asparagus Sprengeri decoration.

natives of the higher regions of the Andes from Mex. and Guatemala to Colombia, Bolivia and Peru.

This genus is closely related to Oncidium and Miltonia, some of the species of the latter being generally cultivated as odontoglossums. These two genera are easily distinguished from Odontoglossum by the labellum, which expands directly from the base of the column. There is perhaps no genus of orchids in which the species are more variable and more closely related than in Odontoglossum. Numerous varieties connect the species by intermediate links, and the occurrence of many natural hybrids makes the limitation of species in this genus almost impossible. However much this may add to the perplexity of the botanist, it gives the genus an additional horticultural value and interest resulting in the production of numerous garden hybrids and in the selection of many varieties, one species, *O. crispum*. having over a hundred named kinds.

Cultivation of odontoglossums.

Odontoglossums follow the high western mountain ranges from southern Mexico to southern Peru, and usually grow at great altitudes. With few exceptions, they are found in extremely moist situations where the annual rainfall is excessive and the temperature more or less even and cool throughout the year.

The extreme heat of our summer interferes somewhat with the culture of odontoglossums in America, especially those of the *O. crispum* section, and it is necessary to use every precaution during that season to insure success.

A lean-to or half-span roof structure of northern exposure, protected by a brick or stone wall on the south side, and with ample means of ventilation, is best suited to odontoglossum culture. Moreover, it should be provided with rolling shades elevated on framework 18 or 20 inches above the glass, to afford abundance of light, free access of air and requisite shade, with the additional assistance of keeping down the temperature in summer. The interior is best fitted with solid beds, if possible, but benches of stone flags or wood covered with ashes or gravel an inch or two deep will answer very well. These, with the floors, should be hosed down two or three times daily, to keep the house as cool and as moist as possible.

Ventilation is highly essential at all times, especially in dull or wet weather. When the atmosphere is overcharged with moisture, the quantity must be governed by outside conditions. Top ventilation is most satisfactory, because it allows the heated air to escape, gives less direct draft on the plants, and does not have the drying effect produced by side currents.

The temperature during winter should never rise above 65° F., even with mild sun heat, and may fall to 48° or 50° at night, or even lower, without injury; during summer it must be kept as low as the outside temperature will admit. Fire heat should be dispensed with as early as possible in spring.

Odontoglossums do well under pot culture, excepting a few, such as *O. Londesboroughianum* and *O. brevifolium*, with long creeping rhizomes; *O. citrosmum*, which has pendulous flower-scapes, and some of the smaller-growing species, such as the *O. Rossii* section, which are more easily cared for under basket culture.

Repotting should be attended to in October and November, never during the summer months. Chopped fibrous peat, live sphagnum and clean decayed leaves in equal quantity, well mixed together, afford a very satisfactory compost. About one-half of the pot space should be devoted to drainage of charcoal or broken potsherds. The plants should be firmly potted, leaving the surface slightly convex, thus elevating the base of the plant a little above the rim of the pot when finished.

The *O. crispum* section, which includes *O. Coradinei*, *O. gloriosum*, *O. cirrhosum*, *O. luteo-purpureum*, *O. nobile*, and kindred species, requires an abundance of water at all seasons; in fact, the compost should never dry out, and judicious light overhead syringing once a day is beneficial in bright weather, but on very warm days it should be applied in the evening, at the same time allowing free ventilation to ensure good atmospheric action. Weak liquid cow-manure during the flowering period is also of assistance.

Species of the *O. grande* section do not require so much water at the roots as the *O. crispum* type; the compost should be allowed to dry out frequently. They are also benefited by a little sun during winter. *O. citrosmum* is an exception to the genus as regards temperature, and should be grown 10° warmer. It does very well in the cattleya department, enjoys a good supply of water at the roots at all seasons, and may be easily induced to flower freely by giving it a sunny location during winter.

Very few of the species can be satisfactorily propagated by division; the trade depends principally on fresh importation, and they come readily from seeds. (See the article on *Orchids*, beginning page 2380, for discussing of seed-growing methods of orchids in general.)

Among the worst enemies of odontoglossums are slugs and the small shell snails. They destroy the tender flower-scapes, often attacking them even in the leaf-sheath. A piece of cotton wrapped about the base of the pseudobulb will afford a means of protection, and many may be caught by distributing bits of apple, potato, or saucers containing dry bran freely among the plants. Look them over in the morning or evening with a lantern.

Robert M. Grey.

Cool odontoglossums.

There has been a large measure of success attained in the culture of these Andean plants in several instances and near the seashore, or during a cool summer season. The plants do well under special conditions, such as a structure facing north, with ample shade by using roller-blinds a foot or more above the glass roof, and by using a spray of water on very hot days either under the benches or in the path, ejected with force to create a spray and cause rapid evaporation. Perforated pipes have been used, but these soon clog up and are ineffectual. It is best to turn off the spray at night as the outside air will be cooler. It is best in winter to bring the plants to a lighter house where they can get all the sun in the dull months, as most of the growth is made during the winter and needs to be well matured and strong to carry the plants through the flowering period of early summer months. In March, there are very bright days when a little shade is necessary, and early in April removal should be made to summer quarters in the coolhouse proper. One very hot summer has been known to undo the upbuilding of several preceding cool ones. Odontoglossums are freely raised from seeds by the hybridist in Europe, but have never been raised in the American collections. Their seeds germinate the readiest of any orchids, coming up like grass in a few weeks after sowing, but invariably go down again during the heat of "dog days" in summer. The hybrids imported seem to have more vigor, especially those that have *O. nobile* as a parent. One of the most wonderful phases of the hybridists' work is seen in the great variety produced, the proving up of the origin of many supposed species of Reichenbach and others, the reproduction of fine types from seeds true to themselves in a measure, but usually with an admixture of the poorest present, showing the very complex origin of our most beautiful garden orchids as they were found first. The partial extinction of these odontoglossums by the march of cultivation of coffee and other valuable crops in the Andes has no longer any terror to the cultivator, equally good forms now being raised in gardens, and sometimes flowered in months rather than years. There is still the element of uncertainty as to what will appear, as with the native imported pieces. Even the once rare native natural hybrids are now produced, but from the finest types as parents, and sold now at modest prices. It is too much to expect that the cultivation of *O. crispum* and other coolhouse species will become general until there is certainty of control of temperatures in summer as in winter. Good results have been gained by giving a weak solution of ammonium phosphate, two ounces potassium nitrate, three ounces to three gallons of water, using one ounce of this stock solution to each gallon used for the plants. This is known as the "Cookson formula," advocated by a cultivator who noticed that odontoglossums flourished in the vicinity of smoky cities, and it was traced to the deposit of soot on the glass roofs carried by rain-water into the cisterns to be used for the plants. Rain-water is seldom conserved here for watering orchids, but the addition of this slight quantity of fertilizer seems to be beneficial and to take the place of the rain-water.

E. O. Orpet.

INDEX.

album, 27, 40.
Alexandræ, 34.
Andersonianum, 34.
Andersonii, 39.
apiatum, 34.
Ashworthianum, 34.
aspersum, 10, 24.
bellulum, 18.
bictoniense, 27.
Bluntii, 34.
brevifolium, 2.
candidulum, 36.
castaneum, 15.
Cervantesii, 39.
cirrhosum, 31.
citrosmum, 40.
Cooksoniæ, 34.
constrictum, 15.
Coradinei, 6.
cordatum, 26.
coronarium, 2.
crispatum, 8.
crispum, 34.
cristatum, 25.
Dawsonianum, 44.
Dayanum, 25.
decorum, 39.
Edwardi, 45.
Egertonii, 42.
Ehrenberghii, 43, 44.
facetum, 9.
Fowlerianum, 34.
gloriosum, 13.
Gouvilleanum, 34.
Grairianum, 34.
grande, 3.
grandiflorum, 6, 41.
guttatum, 34, 36.
Hallii, 16.
Harryanum, 19, 20.
hastilabium, 28.
hebraicum, 10.
hystrix, 8.
Insleayi, 4, 5.
Karthausii, 34.
Krameri, 37.
læve, 17.
latemaculatum, 14.
Lehmannii, 34.
leopardinum, 5.
Lindleyanum, 7.
Londesboroughianum, 1.
Luciani, 34.
luteo-purpureum, 8.
macranthum, 4.
maculatum, 11, 34.
madrense, 35.
majus, 39, 41, 43.
Mariæ, 34.
maxillare, 35, 36.
maximum, 40.
membranaceum, 39.
mirandum, 12.
Mundyanum, 34.
nævium, 30.
nebulosum, 36.
nevadense, 21.
nobile, 33.
odoratum, 14.
Oerstedii, 38.
pardinum, 1.
Pescatorei, 33.
Pittianum, 34.
pulchellum, 41.
punctatum, 40.
purpurascens, 34.
radiatum, 8.
ramosissimum, 29.
Reichenheimii, 17.
rosellum, 40.
roseum, 40.
Rossii, 43.
rubescens, 43.
Ruckerianum, 32.
Sanderæ, 34.
Sanderianum, 22.
sceptrum, 8.
Schlieperianum, 4.
Schrœderi, 34.
splendens, 5, 11, 27.
superbum, 6, 11.
Thompsonianum, 11.
Trianæ, 34.
tripudians, 19.
triumphans, 23.
Veitchianum, 33, 34.
Wallisii, 18.

SYNOPSIS OF SECTIONS.

A. *Fls. yellow, variously spotted with brown, crimson, etc.*

Section I. Ground-color of the labellum yellow... Species 1–14

Section II. Ground-color of the labellum white, rarely pale yellow or changing to yellow. Species 15–28

AA. *Fls. white, sometimes shaded with rose or cream, never with a bright yellow or greenish yellow ground-color.*

Section III. Plants not dwarf: fls. numerous, in branched panicles much exceeding the lvs..... Species 29–34

Section IV. Plants manifestly of dwarf habit: fls. few, in slender racemes, with the scape (and often the whole infl.) shorter than the lvs., rarely exceeding them .... Species 35–44

AAA. *Fls. dark purple.*

Section V. Fls. numerous, small, in large, branched panicles .... Species 45

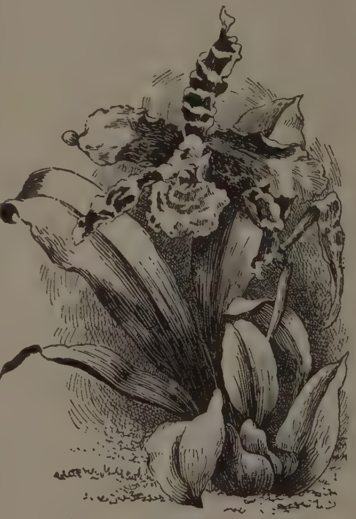
Section I.

A. *Labellum reniform, larger than the rest of the fl.* .... 1. **Londesboroughianum**
AA. *Labellum oblong or fan-shaped, shorter than the sepals; apex rounded, emarginate, or acute; margin entire.*
B. *Apex rounded or emarginate.*
C. *Sepals sub-rotund* .... 2. **brevifolium**
CC. *Sepals oblong to lanceolate.*
D. *Column with 2 blunt auricles.*
E. *Fls. marked with red-brown* .... 3. **grande**
EE. *Fls. marked with darker yellow* .... 4. **Schlieperianum**
DD. *Column with 2 cirrhous teeth* .... 5. **Insleayi**
6. **Coradinei**
BB. *Apex acute* .... 7. **Lindleyanum**
AAA. *Labellum variously shaped, fimbriately toothed, and having a pectinate crest* .... 8. **luteo-purpureum**
9. **facetum**
AAAA. *Labellum triangular or triangular-oblong, long-acuminate* ....10. **hebraicum**
11. **maculatum**
AAAAA. *Labellum lanceolate, cordate or hastate at base.*
B. *Column with rhomboid wings*...12. **mirandum**
BB. *Column with 2 subulate awns at apex* ....13. **gloriosum**
14. **odoratum**

1. **Londesboroughiànum,** Reichb. f. Pseudobulbs roundish ovate, 1–2-lvd.: raceme 3–6 ft. long, bearing as many as 30 fls.; sepals oblong, undulate, apiculate; petals obtuse, apiculate, wider; both light yellow, with many abrupt, narrow, concentric brown markings; blade of the labellum extending beyond the sepals, over 1 in. across, light yellow, with few brown blotches at base. Autumn. Mex. I.H. 30:497. Gn. 16, p. 502. F.M. 1877:246.—A distinct plant resembling an oncidium. Var. **pardinum,** Hort. Lip profusely dotted with brownish crimson. Gn. 16, p. 503.

2. **brevifòlium,** Lindl. (*O. coronàrium,* Hort.). Plants with leathery, ovate-oblong, spreading lvs. and erect racemes, about 1 ft. high, bearing 10–20 fls. 2–2½ in. diam.; sepals subrotund-unguiculate, undulate; petals similar, smaller; labellum smaller than the sepals, cuneate-emarginate, yellow in front, marked about the column with yellow and purple, with a 3-toothed tubercle on the base. Colombia. I.H. 21:170. G.C. II. 24:177; III. 18:489; 19:79. G.M. 34:819; 38:127.

3. **grânde,** Lindl. Baby Orchid. Fig. 2561 (redrawn from "The Garden"). Pseudobulbs 2-lvd.: lvs. broadly lanceolate: scape few-fld., twice as long as the lvs.; sepals lanceolate, the lateral ones keeled, yellow, banded with rich reddish brown spots; petals oblong, broader, obtuse, subundulate, apex yellow; labellum almost rotund, apex slightly emarginate, yellow, banded and spotted with rusty blotches, and with a large-lobed tubercle on the claw. Autumn. Guatemala. B.M. 3955. F.S. 1:24, 25. P.M. 8:49. Gn. 48, p. 219; 51:118. G.C. III. 17:41 (abnormal fls.); 42:387.—A magnificent species with half-drooping racemes a foot long, bearing few large, brilliantly colored fls. 5–6 in. diam.


2561. Odontoglossum grande.

4. **Schlieperiànum,** Reichb. f. (*O. Ínsleayi* var. *macrànthum,* Lindl.). Fls. on erect racemes, pale yellow, blotched and barred with deeper yellow mostly on the

lower half of the segms. Autumn. Costa Rica. G.C. 1865:1082; II. 25:269. F.S. 17, p. 78.—Resembles a small pale *O. grande*, but fine for summer flowering.

5. **Ínsleayi,** Lindl. (*Oncídium Ínsleayi*, Barker). Lvs. leathery, oblong, shorter than the raceme: fls. 3½–4 in. across, yellow, spotted with brown, borne in a stiff, erect raceme; sepals and petals oblong, undulate, nearly equal; labellum shorter, ovate, retuse, sagittate and tuberculate at base, orange-yellow, spotted with reddish brown. Oct.–Dec. Mex. F.S. 1:49. Gt. 39, p. 474.—Free-flowering. Resembles *O. grande*. Var. **spléndens,** Reichb. f. Fls. larger, labellum and segms. clouded with brown, yellow only at the tip. Gn. 25:148. G.C. II. 25:305. Var. **leopardìnum,** Hort. A highly colored form: segms. pale yellow, heavily barred with chestnut-brown. R.B. 14:61.

6. **Coradínei,** Reichb. f. (*O. Lindleyànum*, Reichb. f. & Warscz. × *O. críspum*, Lindl.). A supposed natural hybrid with the habit of *O. crispum*. Raceme arching, few-fld.; fls. stellate, 3 in. across, dark sulfur-color, with few chestnut-brown spots; sepals and petals oblong, acuminate, undulate; labellum shorter, oblong-acute, whitish, with a large oblong red-brown blotch near the center and several smaller ones on the disk; crest 3-toothed on each side. Winter. Colombia. G.C. 1872:1068; II. 24:200; 25:269; III. 25:315.—Resembles *O. triumphans*, but of more slender growth. Var. **supérbum,** Hort. A more robust variety with richly colored fls.: panicle much branched, 2 ft. long. Mex. Var. **grandiflòrum,** Reichb. f. Fls. yellow, blotched and spotted with dark brown, large and handsome. Colombia.

7. **Lindleyànum,** Reichb. f. & Warscz. Lvs. linear: raceme lax; fls. 2–3 in. across, thin; sepals and petals yellow, blotched and striped with brown; lateral lobes of the labellum small, white, with purple spots; middle lobe red-brown, tipped with yellow. Spring. Colombia. —A variable species, supposed to be the parent of many hybrids.

8. **lùteo-purpùreum,** Lindl. Lvs. ensiform, narrowed at base: fls. showy, 2–3 in. across, in a robust horizontal raceme; sepals ovate-oblong, undulate, brownish purple, with a yellow margin; petals similar, toothed and spotted with purple-brown; labellum quadrifid, cordate or oblong, fimbriate, yellow, spotted with purple and rose; crest on the claw pectinate. Winter and spring. Colombia. G.C. II. 21:585. G.W. 2, p. 611. —Owing to its wide geographical scope, this species is extremely variable. A very mixed progeny has resulted from the crossing of this with other species, and the intermixture of the descendants. Var. **radiàtum,** Hort. (*O. radiàtum*, Reichb. f.). Sepals and petals narrow, yellow, heavily spotted with dark brown; labellum expanded in front, white, shading into a brownish blotch at base. G.C. II. 25:76, 140. Var. **crispàtum,** Reichb. f. Front half of the labellum convolute into deep folds, fimbriate. G.C. III. 5:233. Not advertised. Var. **scéptrum,** Reichb. f. Sepals creamy yellow, barred and washed with brown; petals broader-toothed, densely spotted with brown; labellum whitish. I.H. 18:73; 37:99. Not advertised. Var. **hýstrix,** Hort. (*O. hýstrix*, Hort.). Labellum much fringed, and crests very spiny.

9. **facètum,** Reichb. f. (*O. Hállii*, Lindl. × *O. lùteo-purpùreum*, Lindl.). Natural hybrid: sepals lanceolate, straight, light yellow, with very large cinnamon-colored blotches; petals lanceolate, straight, finely toothed, with numerous small spots; labellum almost circular, short, finely fringed, convolute, undulate, light yellow, with a semicircle of radiating keels, some of which are fringed and in front of which is a horseshoe-shaped spot.

10. **hebràicum,** Reichb. f. (*O. cristàtum*, Lindl. × *O. cirrhòsum*, Lindl.). Natural hybrid: fls. 2½ in. across, borne in a panicle; sepals lanceolate; petals wider, undulate, all prettily marked, lemon-yellow, whitish in the center and spotted with red-brown markings suggesting Hebrew characters; labellum triangular or oblong, acuminate, erose-dentate, darker yellow toward the base, with a large maroon blotch and several smaller ones. Winter. Colombia. Gn. 21:. 386. G.C. II. 16: 173. Var. **aspérsum,** Rolfe. Differs slightly from the type in its lax racemes of golden yellow fls., blotched with purple-brown.

11. **maculàtum,** La Llave & Lex. Pseudobulbs ovate, 1-lvd.: lvs. lanceolate, acute, 6–8 in. long: raceme pendulous, loosely many-fld., longer than the lvs.; sepals narrowly linear or lance-oblong, acuminate, brown; petals ovate-lanceolate, acuminate, undulate, yellow, spotted with brown; labellum wide triangular, acuminate, crisp, yellow, brown-spotted, claw short, 2-crested; column white. Mex. B.M. 6455 (not 4878, which is *O. cordatum*, Lindl.). B.R. 26:30.—Fls. freely in June. Racemes a foot long, with stellate fls. 3 in. diam. Var. **Thompsoniànum,** Hort. Infl. vigorous, the fls. 3–3½ in. across; sepals salmon-brown, yellow-margined; petals and lip pale yellow, brown-blotched. G.C. III. 30:77. G.M. 44:547. Var. **spléndens** and var. **supérbum** are recommended.

12. **mirándum,** Reichb. f. Lvs. lanceolate: raceme stiff, 1-sided; sepals and petals lanceolate-acuminate, almost wholly red-brown, with yellow margins; labellum linear-lanceolate, similarly marked, and having a few purple lines at base, callus horned; wings of the column rhomboid-serrate. Colombia.

13. **gloriòsum,** Lind. & Reichb. f. Fls. pallid ochre, spotted with brown, paniculate; sepals and petals oblong-ligulate, acuminate; labellum lanceolate-acuminate, cordate at base, denticulate, about as long as the petals; claw with a 4-lobed, 4-toothed callus; column toothed below the middle. Colombia. G.C. 1865:578; II. 24:680.

14. **odoràtum,** Lindl. Pseudobulbs 2–3 in. long, narrowly ovoid, compressed: lvs. 1 ft. long, narrowly ensiform: panicle sometimes 2–3 ft. long, copiously branched and many-fld.; fls. 1½–2 in. across, dull golden yellow, blotched with brownish red; sepals and petals similar, narrowly lanceolate, acuminate, waved; labellum hastate, lateral lobes short, rounded; terminal lobe broadly subulate, narrowed, pubescent, waved; disk with 2 pairs of longitudinal, obtuse, erect teeth. Winter and spring. Mex. B.M. 6502. G.C. II. 15:337. Var. **latemaculàtum,** André. Fls. larger; spots purple-brown, larger and more intense. July, Aug. I.H. 17:39. Gt. 37, p. 492. Free-flowering.

SECTION II.

A. *Labellum more or less constricted in the middle, fiddle-shaped.*
  B. *Column not winged, but having 2 projecting horns at the apex*...... 15. **constrictum**
  BB. *Column winged; wings pectinate or consisting of few decurved spines*. 16. **Hallii**
  BBB. *Column winged; wings toothed or entire.*
    C. *Crest obsolete, 5-ridged*......... 17. **læve**
    CC. *Crest falcate-pectinate*.......... 18. **Wallisii**
    CCC. *Crest of radiating keels toothed or entire*....................... 19. **tripudians**
      20. **Harryanum**
    CCCC. *Crest a bifid callosity*........... 21. **nevadense**
      22. **Sanderianum**
AA. *Labellum with an ovate or oblong blade, often cordate at the base.*
  B. *Lateral lobes not upright; labellum with a toothed crest*............. 23. **triumphans**
      24. **aspersum**
      25. **cristatum**
  BB. *Lateral lobes on the claw fleshy, upright; labellum with obtuse crest or none*.................. 26. **cordatum**
      27. **bictoniense**
AAA. *Labellum hastate*.................... 28. **hastilabium**

15. **constríctum,** Lindl. Lvs. linear-lanceolate, elongate: panicle long, slender, loosely branched; fls. 1–1¼ in.; sepals and petals nearly similar, oblong-lanceolate, acuminate, bright yellow, blotched with orange-brown; labellum fiddle-shaped, with rounded or truncate, apiculate blade, white, with a rose-colored blotch on each side, toothed. Venezuela. B.M. 5736.—Small-fld., but a profuse bloomer, often bearing 4–5 many-fld. panicles 1–1½ ft. in length. Var. **castàneum,** Hort. Spots on sepals and petals covering nearly the entire surface. I.H. 35:66.

16. **Hállii,** Lindl. Lvs. a foot long, ensiform, narrowed at the base: scape 1–2 ft. long, with a many-fld. raceme of equal length; fls. 3 in. across; sepals and petals spreading, subsimilar, oblong-lanceolate, long-acuminate with recurved points, golden yellow, with transverse bands and spots of yellowish brown; labellum white, with a blood-red spot on the middle lobe and few spots on the lateral ones, erose-dentate, midlobe emarginate, with a short awn in the sinus, with 2 spinous crests on the claw. July. Ecuador. B.M. 6237. I.H. 18:58. F.S. 17, p. 81. G.C. 1865:962; II. 25:140.—The spots on the labellum are sometimes scattered.

2562. Odontoglossum crispum. (×⅓). No. 34.

17. **læ̀ve,** Lindl. (*O. Rèichenheimii*, Lind. & Reichb. f.). Lvs. 6–10 in. long, oblong-lanceolate: sepals and petals oblong-linear, acute, plane, yellow, blotched with cinnamon; labellum smaller, white in front, violet on the upper half. Spring. Guatemala. B.M. 6265. I.H. 6:213. B.R. 30:39.—Plants bear 4–6 strict, stout panicles, 3 ft. long, with numerous fls. 2 in. diam. Not much esteemed.

18. **Wállisii,** Lind. & Reichb. f. (*O. béllulum*, Hort.). Lvs. linear-lanceolate: sepals and petals ligulate, honey-colored, marked with brown streaks; labellum white, with a violaceous anterior part and marked with similar streaks at the base, with 3-falcate calli on the base. Dec. Colombia. I.H. 18:56; 38:127.—Elegant, with slender, drooping, mostly unbranched racemes, bearing few large fls.

19. **tripùdians,** Reichb. f. & Warscz. Lvs. 7–9 in. long, linear-lanceolate: raceme stiff, erect, longer than the lvs., 8–10-fld.; fls. 2 in. across, dull yellow-green on the back; sepals oblong-acute or subacuminate, dark brown, with yellowish green tips and bases; petals similar, with yellowish bands; labellum short, panduriform, as long as the segms., white, with rose-colored blotches, with about 10 keels radiating from the disk; lateral lobes rounded, crenulate; central lobe subreniform, erose-dentate. Peru. B.M. 6029. F.M. 1876:208; 1880:407. O. 1909, p. 28.

Var. **Harryànum,** Reichb. f. Sepals and petals almost blackish inside, tipped with light yellow, with a few similar marks at the base of the petal; labellum light yellow, with the base covered with rich mauve purple.

20. **Harryànum,** Reichb. f. Lvs. about 2, oblong-ligulate, obtuse, 6–12 in. long: raceme up to 3 ft. long, bearing 6–12 large fls.; sepals and petals ligulate-oblong, acute, wavy, brown with irregular, transverse, greenish yellow markings; the petals project forward; labellum large, flat, undulate, somewhat panduriform, lower half white, changing to yellow; upper half brownish marked with mauve lines and having about 7 serrated crests; column with 2 very small toothed wings. Colombia. Gn. 33:76. G.C. III. 2:169. Same as var. of No. 19(?).

21. **nevadénse,** Reichb. f. Pseudobulbs ovate, acuminate: lvs. linear-lanceolate, base narrow, keeled: sepals and petals similar, lanceolate, long-acuminate, dark brown with a golden margin, outside dark green; limb of the labellum wide, hastate, deflexed, fimbriate, white-spotted; apex acute, subincurved, appendage on the claw bifid. Spring. Colombia. I.H. 17:45. Gn. 19, p. 425; 32, p. 589; 39, p. 250. G.C. II. 16:461; 24:201. G. 16:415.—A showy plant, with slender, arching, 6–10-fld. panicles, and fls. 3–4½ in. across.

22. **Sanderiànum,** Reichb. f. Resembling *O. nevadense.* Fls. stellate; sepals and petals lanceolate, acuminate, yellow, with numerous chocolate-brown markings; labellum cuneate, panduriform, apiculate, toothed, white or pale yellow, with a purple blotch in front; lateral lobes erect. Early spring. Trop. Amer.—Free-flowering.

23. **triúmphans,** Reichb. f. Pseudobulbs 3–4 in. long: lvs. oblong-lanceolate, 1–1¼ ft. long: scape arching, branched and many-fld., 2–3 ft. long: fls. 3–4 in. across; sepals and petals lance-oblong, subacuminate, undulate, yellow, blotched with deep crimson-brown; labellum ovate, cordate, acute, toothed and undulate, white with a roseate tip; crest of yellow or white teeth. March, April. Colombia. I.H. 16:609. G.C. 1867:516; II. 24:205; 25:141; III. 27:213 (var.) R.B. 18:121. G.M. 34:89. F. 1877:217. G. 28:185.

24. **aspérsum,** Reichb. f. (*O. maculàtum*, La Llave & Lex. × *O. Róssii*, Lindl.). Natural hybrid: lvs. oblong, acute: raceme few-fld.; sepals ligulate, acute, keeled, pale yellow, mottled with numerous brown blotches; petals oblong, acute, much broader, similar in color; labellum with a cordate, acute blade wholly whitish, callus toothed, yellow, with brown lines, pubescent. Feb., March.—Free-flowering.

25. **cristàtum,** Lindl. (*Oncídium cristàtum*, Beer). Lvs. linear-lanceolate, a little shorter than the many-fld. scape: sepals and petals lanceolate-acuminate, yellow, spotted with brown; labellum oblong-lanceolate, white; apex and margin brown, with purple striæ, with a digitate crest on the disk; wings of the column semi-ovate or subquadrate. Peru. I.H. 17:21. Var. **Dayànum,** Reichb. This is colored like the type, but the lip is rhomboid, apiculate, serrate, and the teeth of the crests on the labellum cross each other like the bristles on the nearly closed leaf of *Dionæa muscipula.*

26. **cordàtum,** Lindl. Pseudobulbs oblong, 1-lvd.: lvs. oblong, acute, 6–8 in. long: fls. large and handsome, with the sepals and petals yellowish green, richly blotched with brown; labellum cordate, acuminate, subcrenate, white, with a purplish crest at base and spotted with brown on the limb; sepals lance-linear, acuminate; petals broader and longer, undulate. Mex. B.M. 4878 (as *O. maculatum*). I.H. 26:355. P.M. 13: 147. Gn. 27:46. F.C. 3:100.—St. 2–3 ft. high: few or many-fld.

27. **bictoniénse,** Lindl. Pseudobulbs oblong, 2–3 in. long, 2–3-lvd.: lvs. 1 ft. long, ensiform, undulate, spreading: raceme 3 ft. long; fls. 1½ in. across; sepals and petals subequal, linear-lanceolate, greenish yellow, blotched with brown; claw of the labellum bilamellate, blade cordate, acuminate, undulate, white or roseate. Autumn. Guatemala. B.M. 3812 (as *Zygopetalum africanum*).—This was the first odontoglossum to reach England in a living state. It is free-flowering, but not so good as plants subsequently intro. Var. **álbum,** Hort. Like the type, but labellum pure white instead of wine-red; sepals and petals brown. I.H. 19:91.

Var. **spléndens,** Ch. Lem. Labellum rose-lilac; other segms. spotted. Seems to be like the type, with more pronounced color. I.H. 12:449.

28. **hastilàbium,** Lindl. Lvs. linear-oblong: scape 1½–2 ft.; bracts long, deciduous; fls. numerous, large, handsome, varied with pale green, purple and white, fragrant; sepals and petals spreading, lanceolate, very acuminate, pale green, with transverse purple dots and lines; labellum large, the lateral lobes forming 2 horns at base, the central one with a purple, crested claw, and orbicular-ovate, white, acute blade; column slender, winged, purple. Summer. Colombia. B.M. 4272. G.W. 13, p. 620.

SECTION III.

A. *Column without wings*............29. **ramosissi-** **[mum**
AA. *Column with 2 spreading awns*......30. **nævium**
31. **cirrhosum**
AAA. *Column pluricirrhose; segms. lanceolate*..........................32. **Ruckerianum**
AAAA. *Column with fimbriate or toothed wings; segms. ovate or rhomboid*...33. **nobile**
34. **crispum**

29. **ramosíssimum,** Lindl. Lvs. linear-oblong, acute, 1 ft. long: panicle much branched and many-fld., 2 ft. long; fls. 2 in. across, white, spotted with pale purple or violet; sepals and petals very undulate, narrowly ligulate, the latter wider; labellum rhomboid, acuminate, cordate at base, crested, tomentose. March, April. Colombia. J.H. III. 29:77. I.H. 40:170 (var. *cœleste*, Lind. & Rod.).—A distinct and beautiful plant whose fls. have been likened to large spiders.

30. **næ̀vium,** Lindl. & Paxt. Pseudobulbs oblong: lvs. thin, lanceolate: panicle erect, arching, much branched, bearing numerous star-shaped fls.; sepals and petals 2 in. long, narrowly lanceolate, beautifully crenate-undulate, white, profusely spotted with rose-purple; labellum shaped nearly like the petals, shorter and broader, with 2 large crests on the yellow base. May, June. Colombia. F.S. 6:594. G.M. 31:559. B.M. 8097.—Closely allied to *O. cirrhosum.*

31. **cirrhòsum,** Lindl. Pseudobulbs lanceolate, compressed, 2–3 in. long: lvs. 4–6 in. long, linear-ensiform, leathery: panicle often over 2 ft. long, drooping, or inclined; fls. 3 in. across, snow-white, blotched with crimson or brown, base of the labellum yellow, with brown lines at the sides; sepals narrowly lanceolate, ending in long, curved points; petals wider; labellum two-thirds the length of the petals, with 2 ciliate lateral lobes and a narrow acuminate middle lobe. April, May. Ecuador, Peru. B.M. 6317. I.H. 25:301. Gt. 41:1383. Gn. 9, p. 401; 16, p. 19. G.C. II. 5:501, 503; 9:181; 25:12. F.M.1876:222.—This species sometimes produces stout few-fld. sts., which should be cut to save the vigor of the plant.

32. **Ruckeriànum,** Reichb. f. Related to *O. crispum:* sepals and petals lanceolate, acute, creamy white, bordered with violet and spotted with brown, waved; labellum rather narrow, oblong, angular-lobed on each side of the base, yellow at base, with few chestnut-brown blotches; callus rhomboid serrate. Colombia. G.C. 1873:105; II. 24:204, 748 (var. *insigne*). J.H. III. 30:455 (var. *splendens*).

33. **nóbile,** Reichb. f. (*O. Pescatòrei*, Lind.). Pseudobulbs ovate, bearing 2 strap-shaped lvs.: panicle 2–3 ft. long, diffuse, bearing numerous white, membranaceous fls. slightly tinged with rose; sepals ovate-oblong, slightly undulate; petals similar but much wider; labellum cordate-oblong, pandurate, with a yellow fimbriate crest and a few rose-colored spots. Spring. Colombia. F.S. 16:1624. I.H. 28:407. Gn. 21:216 (as *O. excellens*). G.C. II. 24:212; III. 3:245; 7:200; 25:69.; 35: 131. A.F. 5:183. J.F. 4:331. J.H. III. 60:389. G. 31: 285; 36:307.—A fine species producing numerous large, erect panicles. Var. **Veitchiànum,** Reichb. f. Like the type, but the parts of the fl. have large, crimson-purple spots. Gn. 26:112.

34. **críspum,** Lindl. (*O. Blúntii*, Reichb. f. *O. Alexándræ*, Batem.). Figs. 2562 and 2563. Pseudobulbs ovate, compressed, about 3 in. long: lvs. linear, 1 ft. long: panicles rather short, but attaining a length of 2½ ft., with few short branches and crowded fls.; fls. white, variously spotted with crimson, brown, etc., or tinged with rose, 2–3 in. across; sepals ovate to ovate-lanceolate, often undulate; petals ovate to rhomboid, toothed and undulate-crisp; labellum oblong-ovate, fringed with teeth, wavy and crisp. Fls. are produced at any season of the year. Colombia. F.S. 16: 1652. Gn. 4, p. 241; 20:12; 21, p. 95; 23, p. 210; 40, p. 596; 46, p. 149; 53, p. 297. R.B. 21:3. Gng. 6:24; 16:133. J.H. III. 34:499; 49:329; 62:449. G.C. III. 21:379; 23:165, 390; 25:67, 179, 187; 43:4. A.F. 13: 34. F.E. 9:327. G. 4:619; 9:223; 24:662; 26:198. 35: 333. G.M. 50:527. G.Z. 21, p. 145. O. 1910, p. 24. C.L.A. 10:413; 20, Aug., p. 44.—As was stated in the introduction, this species has probably more than 100 named varieties. Many besides those cited have been figured in horticultural and botanical works. Very few varieties are found in American trade lists, but some of the most distinct are given below:

2563. Habit sketch of Odontoglossum crispum.

Var. **Andersoniànum,** Hort. (*O. Andersoniànum*, Reichb. f.). Fls. creamy white, with broad, longitudinal bands of cinnamon. F.M. 1872:45. G.C. II. 24:680, 681; III. 17:739. G.W. 13, p. 619.—Listed in Amer.

Var. **apiàtum,** Ballantyne. Fls. very large; sepals and petals laciniate on the edges, white, with rich chocolate-brown blotches. G.C. III. 15:375.

Var. **Ashworthiànum,** O'Brien. Fls. almost entirely rose-purple, with white margins and a few white marks on the sepals and petals. G.C. III. 19:197.

Var. **Coòksoniæ,** Hort. Fls. 4 in. across, the segms. fringed and heavily tinged with purple on back, the face pure white around the column, the margins white, tinged purple in places, the segms. with a large central purple-red blotch, surrounded with smaller blotches. G.C. III. 33:109.

Var. **Fowleriànum,** Hort. Fls. white, the sepals with 2 large irregular ruby-crimson blotches and smaller purple ones, the petals with large ruby-crimson blotches separated by narrow white lines; lip crimped, purple-marked, the crest yellow. G.C. III. 41:278; 45:211.

Var. **Gouvilleànum,** André. Fls. large, white; petals irregularly toothed, with few small crimson blotches; sepals heavily blotched. R.H. 1888:132.

Var. **Grairiànum,** Hort. Sepals and petals for most part a glowing yellowish rose, the margins white with a few white inward-running lines; crest yellow. G.C. III. 33:407.

Var **guttàtum,** Hort. (*O. Alexándræ* var. *guttàtum,* Hook.). Sepals linear-oblong, with several pale purple blotches; petals broader, similarly spotted; labellum oblong-quadrate, contracted in the middle, spotted with rose and having a large rose patch on the disk. B.M. 5697.

Var. **Kárthausii,** Hort. Sepals and petals strongly toothed, pure white or tinted in places on the margins, with several large irregular, more or less confluent bright purple central blotches; lip marked with red-brown. C.O. 1 *s.*

Var. **Léhmanni,** Hort. Labellum broadly ovate, bright ruby-red, broadly edged with white; crest yellow; sepals and petals tinged with rose, with few red spots. G.C. III. 24:147.—In American trade.

Var. **Lùciani,** Hort. Sepals and petals violet on back, marked on face with large irregular purple-brown blotches. C.O. 1*s.*

Var. **maculàtum,** Hort. Fls. white, spotted with purplish brown; petals suborbicular, laciniate-toothed. G.C. III. 16:248.

Var. **Marìæ,** André. Fls. pure white, except a few red spots on the base of the sepals. I.H. 25:325.

2564. Odontoglossum Cervantesii var. decorum. (×⅓)

Var. **Mundyànum,** Hort. Fls. white, rose-purple tinged, heavily blotched with chestnut or red-brown, the center of lip bright yellow. G.C. III. 27:117.

Var. **Pittiànum,** Hort. Fls. white, slightly rose-tinged, the acuminate sepals and petals heavily blotched with red-brown, the back heavily tinged with purple; lip with a yellow crest marked with reddish lines and brown-spotted. G.C. III. 30:154. G.M. 49:212.

Var. **purpuràscens,** Hort. Fls. heavily tinged with rose-purple, the dorsal sepal and petals with numerous small well-defined reddish purple spots, the spots on the lateral sepals obscured by the coloring; lip white with reddish blotches in front, the crest yellow, with a few reddish lines. G.C. III. 29:233. G.M. 46:391. J.H. III. 42:275.

Var. **Sánderæ,** Hort. Fls. purple-tinted, heavily blotched with reddish orange-brown. G.C. III. 33:416. J.H. III. 43:3.

Var. **Schroèderi,** Hort. Fls. with 1 or 2 large and several small, brownish red spots on the white segms. Advertised in Amer.

Var. **Triànæ,** Hort. (*O. Alexándræ* var. *Triànæ,* Hook.). Dorsal sepals with a single roseate spot; lateral sepals suffused and spotted with rose; petals pure white; labellum with a large 2-lobed spot. B.M. 5691.

Var. **Veitchiànum,** Hort. Sepals ovate, undulate, white, with several brownish crimson spots; petals broader, color like the sepals but mostly in one large central blotch; margins undulate and toothed. G.C. III. 1:799. F. 1884:177. G.Z. 30:217.

SECTION IV.

A. *Sepals and petals similarly colored.*
  B. *Column without wings.*
    C. *Pseudobulbs compressed and edged.*
      D. *Labellum white or colored like the petals*..................35. **madrense**
        36. **nebulosum**
      DD. *Labellum violet*..............37. **Krameri**
    CC. *Pseudobulbs smooth, terete*......38. **Oerstedii**
  BB. *Column with entire wings*.........39. **Cervantesii**
  BBB. *Column with toothed or crenate wings.*
    C. *Labellum reniform*............40. **citrosmum**
    CC. *Labellum oblong-quadrate*.......41. **pulchellum**
        42. **Egertonii**
AA. *Sepals and petals dissimilar in color*..43. **Rossii**
        44. **Dawsonianum**

35. **madrénse,** Reichb. f. (*O. maxillàre,* Hook.). Pseudobulbs long-ovoid: lvs. strap-shaped, 10 in. long: fls. 2½ in. across, 4–10 in a raceme; sepals and petals lanceolate, keeled, white, with a purple blotch at the base; labellum shorter than the sepals, the lateral lobes forming 2 acute recurved appendages on the claw, middle lobe trowel-shaped, white, with a yellow base and an orange blotch. Summer. Mex. B.M. 6144. I.H. 30:480. F.M. 1875:158. Gn. 10, p. 443. G.C. II. 25:116 (seed-pod). G.M. 39:117. G. 2:535.

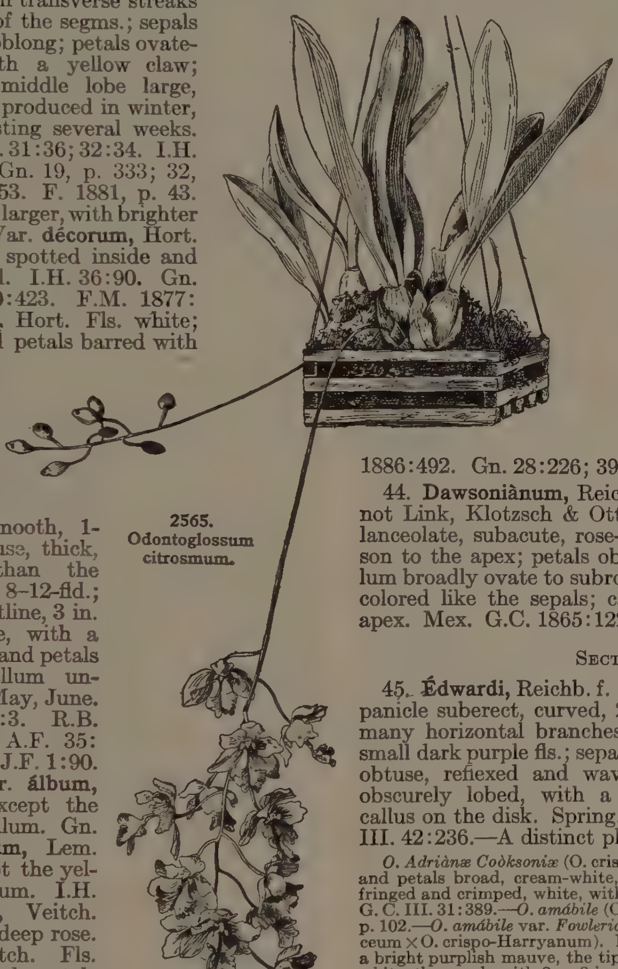
36. **nebulòsum,** Lindl. (*O. maxillàre,* Lindl.). Pseudobulbs 2–3-lvd.: lvs. oblong, acute, 9 in. long: scape about as long as the lvs., 5–6-fld.; fls. 3 in. across, pure white, with the bases of all the parts profusely spotted with brown; sepals membranaceous, oblong; petals similar but wider, all pubescent at the base; labellum with 2 large, erect lobes on the yellow claw; limb ovate, acute, dentate, pubescent. Mex., at an elevation of 10,000 ft. I.H. 6:200. G.C. 1867:572; II. 25:597. Not B.M. 6144, which is *O. madrense.* Var. **candídulum,** Reichb. f. Sepals and petals pure white, with a brown blotch and a few spots on the labellum. G.C. 1867: 710; II. 25:596. Var. **guttàtum,** Reichb. f. Sepals and petals spotted to above the middle. I.H. 31:524.

37. **Kràmeri,** Reichb. f. Pseudobulbs subrotund, compressed and sharply 2-edged, 1-lvd.: lvs. 7–9 in. long, 1½–2 in. broad, keeled: scape 4–8 in. long, inclined or pendulous, 3–5-fld.; fls. 1½ in. diam.; sepals and petals subequal, oblong-acute, pale violet-red in the center, with broad white margins; labellum with a stout yellow excavated claw bearing 2 erect calli; middle lobe subquadrate, 2-lobed, pale violet, with white and brown streaks at base. Costa Rica and Mex. B.M. 5778. I.H. 32:562. F.S. 23:2469. G.C. 1868:98; II. 25:756.

38. **Oérstedii,** Reichb. f. Plants small: lvs. linear-oblong, 4–5 in. long, narrowed to a petiole: raceme suberect, few-fld.; fls. 1½ in. across, white, with the base of the labellum golden yellow; sepals and petals broadly

oblong, the latter narrowed to a short claw; labellum sessile; lateral lobes small, auriculate; middle lobe suborbicular, plane, deeply bifid. Feb.–May. Costa Rica. B.M. 6820. Gn. 26:160. G.C. II. 7:811; 25:757; III. 19:77. G. 28:261.

39. **Cervántesii,** La Llave & Lex. (*O. membranàceum,* Lindl.). Pseudobulbs usually 4-angled, 2 in. long, bearing a single oblong lf. 4–6 in. long: scape sheathed with large bracts, bearing 2–6 membranaceous fls.; fls. 2 in. across, pure white, with transverse streaks of red near the bases of the segms.; sepals broadly lanceolate to oblong; petals ovate-rotund; labellum with a yellow claw; lateral lobes small; middle lobe large, broadly cordate. Fls. produced in winter, very fragrant and lasting several weeks. Mex. B.M. 4923. B.R. 31:36; 32:34. I.H. 1:12. P.M. 12:193. Gn. 19, p. 333; 32, p. 323. G.C. II. 15:753. F. 1881, p. 43. Var. **màjus,** Hort. Fls. larger, with brighter spots. I.H. 25:313. Var. **décorum,** Hort. Fig. 2564. Fls. large, spotted inside and outside with bright red. I.H. 36:90. Gn. 32:322. J.H. III. 30:423. F.M. 1877: 254. Var. **Ándersonii,** Hort. Fls. white; base of the sepals and petals barred with reddish brown; labellum bordered with spots of the same color. Mex.


2565. Odontoglossum citrosmum.

40. **citrósmum,** Lindl. Fig. 2565. Pseudobulbs subrotund, compressed, smooth, 1-lvd.: lvs. oblong, obtuse, thick, somewhat shorter than the raceme: scape pendent, 8–12-fld.; fls. large and full in outline, 3 in. across, white to rose, with a violet labellum; sepals and petals oblong, obtuse; labellum unguiculate, reniform. May, June. Guatemala. B.R. 29:3. R.B. 21:265. F.S. 6:633. A.F. 35: 480. Gn. W. 18:545. J.F. 1:90. J.H. III. 51:27. Var. **álbum,** Veitch. Fls. white, except the yellow claw of the labellum. Gn. 24:414. Var. **roséllum,** Lem. Fls. rose-colored, except the yellow claw of the labellum. I.H. 2:59. Var. **ròseum,** Veitch. Blade of the labellum deep rose. Var. **punctàtum,** Veitch. Fls. pale rose; sepals and petals spotted with purple. A variety called **máximum** is also advertised.

41. **pulchéllum,** Batem. Pseudobulbs oblong, compressed, 2-lvd.: lvs. grass-like, rather stiff or rigid, 9–12 in. long: scape weak, 6–7-fld.; fls. white, except the yellow crest of the labellum; sepals ovate, acute; petals obovate, acute, somewhat undulate; lateral lobes of the labellum triangular, middle lobe oblong, subquadrate, apex recurved; column very short, with 3 fimbriate wings. Spring. Guatemala. B.M. 4104. B.R. 27:48. O. 1912, p. 150. G. 33:153.—Easily grown, and never fails to blossom. The fl.-spikes suggest the lily-of-the-valley. Fragrant. Var. **màjus,** Hort. More robust than the type, with larger fls. Var. **grandiflòrum** is listed.

42. **Égertonii,** Lindl. Like *O. pulchellum,* but with the fls. only half as large: labellum acute, not almost truncate, excavated at the base and with 2 teeth inflexed over the excavation. Guatemala.—This is probably only a form of *O. pulchellum.*

43. **Róssii,** Lindl. Pseudobulbs small, much compressed, 1-lvd.: lvs. about 6 in. long: raceme about as long as the lvs., 2–5-fld.; fls. 2–3 in. diam.; sepals lanceolate, acuminate, cream-colored to greenish yellow, with short bars of dark brown; petals white, with a few brown spots at base, oblong, obtuse, revolute; labellum round-ovate, emarginate, undulate, pure white, except the yellow claw. Winter. Mex. F.C. 3:129. B.R. 25:48. Gn. 19, p. 306; 28: 226. F.S. 20:2110.—This is an extremely variable species, and probably includes the forms cult. as *O. Ehrenbergii* and *O. Dawsonianum,* which are united with this species by some authors. The name *majus* has been applied to several varieties. Probably I.H. 1: 30 (as *O. Ehrenbergii*) and F.S. 8:846 (as *O. Ehrenbergii* =*O. apterum,* ex-Index Kewensis) also belong here. Var. **rubéscens,** Carr. (*O. Róssii màjus rubéscens* Hort.). Fls. large; petals clear rose, with dark brown spots at the base. R.H. 1886:492. Gn. 28:226; 39, p. 345. G.C. II. 21:345.

44. **Dawsoniànum,** Reichb. f. (*O. Éhrenbergii,* Hort., not Link, Klotzsch & Otto). Raceme few-fld.; sepals lanceolate, subacute, rose-colored, blotched with crimson to the apex; petals oblong, acute, pure rose; labellum broadly ovate to subrotund, crenulate; apex retuse, colored like the sepals; callosity with 2 teeth at the apex. Mex. G.C. 1865:1226; II. 25:469. F.S. 17, p. 76.

SECTION V.

45. **Édwardi,** Reichb. f. Lvs. 2 ft. long, strap-shaped: panicle suberect, curved, 2 ft. long, the rachis bearing many horizontal branches covered with many rather small dark purple fls.; sepals and petals oblong to ovate-obtuse, reflexed and wavy; labellum tongue-shaped, obscurely lobed, with a prominent yellow lobulate callus on the disk. Spring. Ecuador. B.M. 6771. J.H. III. 42:236.—A distinct plant, easily cult.

O. Adriànæ Coòksoniæ (O. crispum × O. Hunnewellianum). Sepals and petals broad, cream-white, evenly brown-blotched; lip finely fringed and crimped, white, with fine brown spots and yellow crest. G.C. III. 31:389.—*O. amábile* (O. crispum × O. spectabile). O. 1913, p. 102.—*O. amábile* var. *Fowleriànum* (*O.* crispum punctatum violaceum × O. crispo-Harryanum). Fls. 4 in. across, the sepals and petals a bright purplish mauve, the tips pale violet, the margins silvery white, the sepals with 2 or 3 irregular white lines, the petals with a few white spots; lip white in front, and red around the yellow crest, marked with rose. G.C. III. 44:4.—*O. ardentíssimum* (O. crispum × O. nobile). Fls. most like those of O. crispum in size and form, white, blotched claret-purple, the crest yellow with reddish markings. G.C. III. 32:50.—*O. aspidorhìnum,* Lehm. Fls. 9–15, the sepals and petals oblong, contracted into long points, yellow, blotched with red-brown; lip subpanduriform, clawed, white, spotted with lilac-crimson. Colombia. G. 31:643.—*O. Bingeliànum* (O. crispum × O. Harryanum). G.M. 51:69.—*O. blándum,* Reichb. f. Sepals and petals pale yellowish white, spotted with crimson-brown, cuneate-lanceolate, acuminate; lip ovate, acuminate, crisped. Colombia.—*O. Brádshawiæ* (O. Andersonianum × O. Harryanum). Fls. 4½ in. across, resembling more those of O. Harryanum, yellow, tinged with rose on back of sepals, marked on the face below with numerous red-brown blotches, more or less confluent in groups. G.C. III. 33:82. G.M. 46:87. Gn. 63, p. 184.—*O. cærùleum* (O. armainvillurense × O. crispum). Fls. resembling in shape those of O. ardentissimum, the greater part of the segms. marked with confluent blotches of violet-purple. G.M. 50:413.—*O. Clàytii*=(?).—*O. Crawshayànum* (O. Hallii × O. Harryanum). Fls. intermediate in shape between the parents, but more like O. Hallii in color. G.C. III. 30:77.—*O. críspo-Harryànum* (O. crispum × O. Harryanum). More like the second parent in shape, the sepals and petals light yellow, smaller basal markings of red-brown. G.C. III. 45:133. G.M. 52:144.—*O. Edgertoniànum*=perhaps O. Egertonii.—*O. Fowleriànum* (O. cirrhosum × O. Rossii). Sepals and petals narrow, thickly spotted deep purple, bright rose-purple on margins and tips. the lip rose-purple, the callus yellow. G.M. 49:181. Gn. 69, p. 173.—*O. Gròganiæ* (O. Edwardi × O. Uroskinneri). Fls. rose-purple, with the crest yellow. G.C. III. 49:72.—*O. harvengténse* (O. crispum × O. triumphans). Sepals and petals pale yellow, spotted with red-brown, the latter with a paler central strip, the lip brown-spotted, the center yellow, the margins white. C.O. 4.—*O. Hárwoodii* (O. Wiganianum × O. maculatum auriferum). Fls. yellow, spotted dark purple. G.C. III. 49:98. G.M. 54:93.—*O. Lambeauiànum exquísitum* (O. crispum Madame Folcke × O. Rolfeæ ardentissimum). Segms. white, rose-suffused on petals, blotched red-brown. G.C. III. 38:434. C.O. 12. O.R. 14:57.—*O. Lawrenceànum* (O. Rolfeæ × O. triumphans). Fls. bright yellow, heavily brown-barred, the white lip purple-blotched. Gn. 67, p. 207.—*O. Leeànum*, Reichb. f. Fls. yellow, brown-blotched. Colombia. B.M. 8142. J.H. III. 43:193.—*O. Lucasiànum* (O. cristatellum × O. Hallii). Sepals and petals chocolate, margined and tipped yellow, lip cream-white, brown-spotted.—*O. Ossuttònii* (O. nobile × O. spectabile). Sepals and petals cream-yellow, spotted and blotched brown, the sepals flushed rose. G.W. 13, p. 212. G.M. 49:419.—*O. Phalænópsis*=Miltonia Phalænopsis.—*O. ramulòsum*, Lindl. Fls. bright yellow, with a large basal blotch of brown on dorsal sepal and petals, the lateral sepals brown-spotted, the lip with a brown band in front of the orange crest. Colombia. B.M. 8031.—*O. Roèzlii álbum*=Miltonia Roezlii alba.—*O. Rólfeæ* (O. Harryanum × O. nobile). Fls. ivory-white, with numerous small purple spots, those of the lip basal, those on the petals in a central zone, the sepals slightly purple-stained at tip. Gt. 58:1580.—*O. rosefieldiénse* (O. Harryanum × O. Lambeauianum). Fls. white, slightly tinged pink, blotched with various shades of reddish claret. G.C. III. 49:163.—*O. Smíthii* (O. Rossii × O. spectabile). Sepals and petals light green, margined with violet-purple, in upper half blotched black-brown, the front lobe of lip violet-purple, the disk and crest yellow. G.C. III. 38:427; 45:212. G.M. 48:805.—*O. Thompsoniànum* (O. crispum × O. Edwardi). Fls. rich claret-purple, the margins and tips rosy, the crest deep yellow.—*O. venùstulum* (O. armainvillurense × O. spectabile). Fls. white tinged lilac and heavily purple-blotched. G.C. III. 38:2.—*O. vexillàrium* =Miltonia vexillaria.—*O. Vuylstékeæ* (O. spectabile × O. Vuylstekei). Fls. rosy claret, with slight silvery white lines between the confluent blotches. G.C. III. 38:379. G.M. 48:743.—*O. Vuylstékei* (O. Durisonæ × O. triumphans). Sepals and petals deep red-brown, the apex and margins light yellow, a narrow irregular transverse line about the middle, the lip whitish with few irregular brown spots. G.M. 47:59.—*O. waltonénse* (O. crispum × O. Kegeljani). Fls. resemble in shape more those of O. crispum, soft canary-yellow, the lip pandurate with a bright red-brown blotch in front of crest. G.C. III. 33:51. G.M. 46:73. O.R. 11:49.—*O. Wárneri*=Oncidium Warneri.—*O. Wattiànum Crawshayànum* (O. Harryanum × O. Lindleyanum). Sepals and petals yellow, closely marked with brown, the lip white with a large violet-purple blotch and some smaller ones. G.C. III. 28:286.—*O. Wattiànum príncеps* (O. Harryanum × O. Lindleyanum). Sepals and petals pale yellow, heavily blotched with chocolate-purple, the white lip with violet basal markings. G.C. III. 41:135.—*O. Wéltonii*=Miltonia Warscewiczii.—*O. Wendlandiànum Crawshayànum* (supposedly a natural hybrid). Sepals purple, yellow-margined, with a few basal chocolate blotches, the petals tinged claret, profusely spotted with brownish purple. G.C. III. 27:275. G.M. 43:521.—*O. Wiganiànum* (O. harvengtense × O. Rolfeæ). Sepals and petals bright canary-yellow, the sepals bearing few large, the petals numerous small red-brown spots, the lip white at base, primrose in front, with a few purple spots at the middle. G.C. III. 37:274.—*O. Wilckeànum Rothschildiànum* (O. crispum × O. luteo-purpureum). Sepals yellow, blotched and barred with brown, the petals light yellow, marked with brown in center, the lip fringed, orange-yellow at base, the front lobe yellow with a large purple blotch. G.C. III. 32: suppl. Dec. 6.—*O. Wyoniànum* (hybrid). Fls. white, the middle area of segms. blotched with red-purple. G. C. III. 45:211.

Heinrich Hasselbring.
George V. Nash.†

ODONTÒNIA (compounded of *Odontoglossum* and *Miltonia*). *Orchidàceæ.* A genus established to include hybrids of the genera Odontoglossum and Miltonia.

Odontònia brugénsis=O. Edwardi × M. vexillaria.—*O. Chólletii*=O. Harryanum × M. vexillaria.—*O. Cleverlyàna*=O. Rolfeæ × M. vexillaria Leopoldii.—*O. décora* =O. Adrianæ × M. Warscewiczii.—*O. Élwoodii*=O. cirrhosum × M. Roezlii.—*O. Fanyanàna*=O. Adrianæ × M. vexillaria Empress Augusta.—*O. Farnesiàna*=O. Edwardi × M. Warscewiczii.—*O. Fírminii*=O. crispum × M. vexillaria or M. Phalænopsis.—*O. Lairésseæ*=O. crispum × M. Warscewiczii. O.R. 13:217. G.C. III. 38:2.—*O. Lambeauiàna*=O. Lambeauianum × M. Warscewiczii.—*O. Lángowoyi*=O. Uroskinneri × M. Schroederiana.—*O. MacNabiàna*=O. Edwardi × M. Bleuana. —*O. ornàta*=O. Wilckeanum × M. Warscewiczii.—*O. Vuylstékei*=O. amabile × M. vexillaria gigantea.

George V. Nash.

ODONTOSÒRIA (Greek, *toothed leaf*, alluding to the fact that the sori are on slender segms. of the leaf). *Polypodiàceæ.* A group of tropical ferns formerly included with Davallia; characterized by the decompound lvs. with cuneate ultimate segms. and the compressed suborbicular or cup-shaped indusium which is attached at its sides and open only at the top. For cult., see *Fern.*

chinénsis, J. Smith (*Davállia chinénsis*, Smith. *Stenolòma tenuifòlia*, Fée). Lf.-blades 12–18 in. long, 6–9 in. wide, quadripinnatifid, on polished dark brown stalks which rise from stout creeping fibrillose rootstocks; ultimate divisions with toothed cuneate lobes; sori terminal, usually solitary. Trop. Asia and Aus-Polynesia. Var. **stricta,** Hort., has a more upright habit and narrower lvs.

L. M. Underwood.
R. C. Benedict.†

ŒCEÓCLADES: *Saccolabium.*

ŒNÁNTHE (name refers to the vinous scent of the flowers). *Umbellíferæ.* About 30 species of glabrous often aquatic perennial herbs, rarely transferred to grounds; some kinds are poisonous. They are widely distributed about the world in temperate regions: roots fibrous or tuberous: lvs. 1–3-pinnate, much dissected, sometimes reduced to a hollow or fistular petiole: fls. white, small, in compound umbels, often polygamous and the outer ones usually sterile and rayed; calyx-teeth minute; petals 2-lobed or notched with an inflexed point. **Œ. fistulòsa,** Linn. Water Dropwort, native in Eu., W. Asia and N. Afr., is listed abroad: roots of many fleshy fibers, running deep: st. 2–3 ft. high, stoloniferous, very hollow and thick, little branched: radical lvs. 2-pinnate, the lobed segms. cuneate; st.-lvs. reduced mostly to hollow stalks, bearing at the apex only a few linear-lobed segms.: umbels terminal, each with 3–5 rays. Adapted to wet places, for its ornamental and interesting character.

L. H. B.

ŒNOCÁRPUS (*wine fruit*, as some of the species yield a beverage). *Palmàceæ.* A few species of S. American tall pinnatisect-lvd. palms differing from Euterpe in character of calyx and infl.; little grown, but numerous in the Amazon and Oronoco countries. The lvs. are borne in a large crown, and the fls. are in spikes arising beneath the lvs. Some of the species yield useful oil: fr. a medium-sized usually purple or black berry. *Œ. Bacàba*, Mart., and *Œ. Bataùa*, Mart., are the species most likely to be mentioned.

ŒNOTHÈRA (said to be Greek for *wine-scenting;* in allusion to an ancient use of the roots). *Onagràceæ.* Evening Primrose. Flower-garden and border plants, prized for their showy bright yellow, rose or white flowers.

Herbs, or sometimes shrubby at the base, annual, biennial and perennial, with alternate simple or pinnatisect lvs. and mostly showy fls., which are yellow, white or rose-color: calyx with a tube prolonged beyond the angled or cylindrical ovary, with 4 usually strongly reflexed lobes; petals 4, mostly obovate or spatulate; stamens 8, with narrow mostly versatile anthers: fr. a 4-valved loculicidal caps.—The œnotheras are mostly dry-soil plants and are chiefly N. American, the known species being perhaps 90–100. Some of them are S. American, and Bentham & Hooker admit 1 plant which grows in Tasmania. The genus is polymorphous, and there is consequently great difference of opinion as to generic bounds. The marked differences reside in form of caps., character of calyx-tube or hypanthium, and in the habit of the plant. What is by some botanists regarded as 1 genus is broken up into 10 or a dozen genera by others. These genera are here treated mostly as subgenera, for the group is fairly homogeneous from the horticultural point of view, and an entirely new set of names in several strange genera could scarcely be forced on the trade, particularly since the botanists are themselves not in agreement. Godetia is kept separate (Vol. III). Some of the true œnotheras make glowing displays of yellow in the border; but the greater number of the species are of only secondary importance to the cultivator. Amongst the best of the border-plant species are *Œ. fruticosa* var. *Youngii*, *Œ. linearis*, *Œ. pratensis*, *Œ. glauca* var. *Fraseri*, *Œ. cæspitosa*, *Œ. missouriensis*, *Œ. speciosa*. There are numbers of showy species in the genus, and others than those here accounted for may be expected to appear in cult. In recent years, the genus has assumed unusual interest because of the de Vriesian studies of evolution, founded on the mutations or elementary species in the Onagra group.

The œnotheras are of wide distribution in North America. They are open-ground sun-loving plants. Many of them are prominent plants of the prairies and plains. Some of them grow on the seacoasts and others in moist ground, but they are not marsh plants. The several widespread field species, the dead stalks of which, with the split upright pods (Fig. 2566), are conspicuous in pastures and on roadsides, are grouped together in current floras under the name *Œ. biennis*, but show great diversity among themselves. They are not ornamental plants, although the flowers that open first are usually rather large and attractive. The plants of the subgenus Kneiffia afford the sundrops of gardens, these cultivated plants are not well understood botanically, and it is not unlikely that some of them are hybrids or mutants.

There is nothing special to say about the culture of œnotheras except to note the tender kinds and the biennials. All do well in ordinary garden soil, enjoying sunshine. They are easily raised from seeds and cuttings. *Œ. acaulis*, *Œ. cæspitosa* are low-growing biennials which do well treated as annuals. They will not endure the winter. *Œ. missouriensis* is an excellent trailer, with enormous yellow flowers and seed vessels. It is quite hardy, and a fine rock-garden plant. *Œ. biennis*, the common evening primrose, is rather weedy, and fit only for the wilder parts of the garden. *Œ. Lamarckiana* is a better form. *Œ. fruticosa* and *Œ. Fraseri* are two of our best border kinds, with stiff branching stems. *Œ. linearis* is a pretty little species, often naturalized but well worth growing. Child's Mexican primrose is tender, but makes a pretty plant for hanging-pots. *Œ. speciosa* is a fine species, but spreads so quickly by underground stems as to become a weed in favorable situations: it is good for naturalizing in wild grounds. (T. D. Hatfield.)

INDEX

acaulis, 20.
albicaulis, 8, 9.
Allenii, 15.
biennis, 5.
bistorta, 2.
brachycarpa, 22.
brevistylis, 6.
cæspitosa, 21.
californica, 9.
cheiranthifolia, 3.
Childsii, 18.
Drummondii, 7.
francascana, 5.
Fraseri, 12.
fruticosa, 13, 15.
gigas, 6.
glauca, 12.
grandiflora, 5.
Havardii, 11.
hirsutissima, 5.
Lamarckiana, 5.
lata, 6.
linearis, 15.
macrocarpa, 10.
major, 13.
mexicana, 18.
missouriensis, 10.
nanella, 6.
oblonga, 6.
ovata, 1.
pallida, 15.
Pilgrimii, 14.
pinnatifida, 8.
pratensis, 16.
pumila, 14.
rosea, 18, 19.
rubricalyx, 6.
rubrinervis, 6.
serrulata, 4.
speciosa, 17.
taraxacifolia, 20.
tetraptera, 18.
Veitchiana, 2.
Youngii, 13.

KEY TO THE GROUPS OR SUBGENERA.

A. *Stigma capitate or disk-like, entire.*
B. *Calyx-tube filiform*..............I. Taraxia, No. 1
BB. *Calyx-tube short, obconic or funnelform*.........
II. Sphærostigma, Nos. 2, 3.
AA. *Stigma deeply 4-cleft or at least 4-toothed.*
B. *Stamens of equal length.*
C. *Calyx-tube shorter than the ovary*...........
III. Meriolix, No. 4.
CC. *Calyx-tube usually much exceeding the ovary.*
D. *Seeds angled, horizontal in the pod*.......
IV. Onagra, Nos. 5, 6.
DD. *Seeds not angled, ascending.*
E. *Fls. yellow, erect in bud: seeds in 2 rows in each locule*.......V. Raimannia, No. 7.
EE. *Fls. white or pink, drooping in bud: seeds in 1 row*......VI. Anogra, Nos. 8, 9.
BB. *Stamens of unequal length.*
C. *Plant caulescent (with st.).*
D. *Fls. yellow.*
E. *Seeds crested.* VII. Megapterium, Nos. 10, 11.
EE. *Seeds not crested*....................
VIII. Kneiffia, Nos. 12–16.
DD. *Fls. white, pink or reddish*.............
IX. Hartmannia, Nos. 17–20.
CC. *Plant stemless.*
D. *Caps. with wrinkled wing-angles*.........
X. Pachylophus, No. 21.
DD. *Caps. with plane or entire wing-angles*....
XI. Lavauxia, No. 22.

I. SUBGENUS TARAXIA.

Stemless, usually perennial: stigma capitate; calyx-tube filiform: caps. sessile, narrow to ovate, usually not winged: fls. yellow.

1. **ovàta**, Nutt. Golden Eggs. Perennial: lvs. slightly pubescent, ovate to lance-oblong, 8 in. or less long, acute, serrulate or entire: fls. yellow; petals about ½in. long, orbicular; calyx-tube filiform, 3–4 in. long; fl.-bud erect: caps. to 1 in. long, more or less subterranean. Calif.

II. SUBGENUS SPHÆROSTIGMA.

St.-bearing: stigma capitate; calyx-tube short, inversely conic or funnelform: caps. sessile, linear, not winged: fls. various.

2. **bistórta**, Nutt. One to 2 ft., the base decumbent, hairy and pubescent: radical lvs. spatulate to lanceolate and petiolate, dentate; st.-lvs. mostly sessile-ovate to narrow-lanceolate and about 1 in. long, dentate: fls. yellow, turning green, the petals (about ½in. long) usually with a brown spot at the base; calyx-tube 1–3 in. long: caps. ¾in. or less long, 4-angled, contorted. S. Calif.

Var. **Veitchiàna**, Hook. More slender: radical lvs. narrow-oblanceolate and long-petioled: caps. longer and narrower (1–1½ in. long) and little contorted. S. Calif. B.M. 5078.

3. **cheiranthifòlia**, Hornem. Sts. decumbent or ascending, 2 ft. or more tall, canescent: lvs. thick, about 1–2 in. long, broad-ovate to oblanceolate or the lower ones spatulate, the upper ones becoming sessile, most of them entire: petals yellow, ¼–⅓in. long: caps. ¾in. or less long, curved or spiral, somewhat hairy. Calif. B.R. 1040.

III. SUBGENUS MERIOLIX.

St.-bearing: stigma disk-like but 4-toothed; calyx-tube shorter than the ovary, enlarging upward: caps. linear or nearly cylindrical, sessile: fls. yellow, axillary.

4. **serrulàta**, Nutt. (*Meriolix serrulàta*, Walp.). Biennial or perennial: slender, simple or branched, about 1 ft. high but variable in stature, nearly glabrous to canescent: lvs. linear to lanceolate, 1–3 in. long, usually acute, attenuate to the base, sharply dentate: petals broad-obovate, ¼in. long, wavy-margined. Minn., west and south. Mn. 7:41.

IV. SUBGENUS ONAGRA.

St.-bearing: stigma 4-cleft; calyx-tube elongated and cylindrical, enlarging at the throat: caps. linear-oblong to long-conic, 4-angled: fls. yellow, opening in evening.—True Evening Primroses, comprising a mutating group.

5. **biénnis**, Linn. (*Ónagra biénnis*, Scop.). European Evening Primrose. Fig. 2566. Usually biennial, but often flowering the first year: mature rosettes of plants grown in rich soil 2 ft. diam.: roots large and fleshy, often 2 in. diam. at the crown: st. about 3–4 ft. tall, copiously branched, green: lvs. varying from narrowly oblanceolate below to ovate above: calyx-tube

nearly 1½ in. long; unopened bud an inch long or less; petals obcordate, broader than long, 1 in. wide; stigmas surrounded by the anthers and self-pollinated in the bud: caps. 1 in. long, loosely aggregated in the lower part of the spike, more densely above, shorter than the subpersistent leafy bracts.—Intro. into Eu. from Amer., and now a common weed in the Old World. Gn. 26, p. 480.—It is somewhat coarse and has little to recommend it to cult., although it is larger-fld. and more beautiful than the common American plants, which, although they are different from the species here described, pass under the name *Œ. biennis*. In France and other European countries, the roots of *Œ. biennis* are said to be used as a vegetable, after the manner of salsify or oyster plant. The root should be eaten, according to Vilmorin, "at the end of the first year of its growth." *Œ. biennis* is now unknown as a wild plant in Amer., although it will probably be found among the numerous locally distributed forms which have not yet been adequately studied. A number of obscure kinds pass in Amer. under the name *Œ. biennis*. Most of them are more weedy than the European species and the roots are generally woody and tough. A var. *hirsutissima* (*Œ. franciscàna*, Bartlett) is offered in Calif., described as having sts. stout and reddish: lvs. hairy, light green, lanceolate: fls. large, bright yellow.

2566. Capsules of evening primrose — Œnothera biennis, as known in North America. (×½)

Var. **grandiflòra**, Lindl. (*Œ. grandiflòra*, Ait.). Plant large and strong: lower lvs. often pinnatifid: fls. much larger, the petals 1–2½ in. long; buds glabrous and usually red-spotted. B.M. 2068. B.R. 1604. Gn. 26, p. 482; 46, p. 64.—Very showy when the fls. open. Commoner southward. Seeds sold under this name are usually the next species.

6. **Lamarckiàna**, Hort. Differs from the above in its densely red-tuberculate sts., broad crinkled lvs. and much larger fls.: the stigmas are longer than the stamens and are pollinated by insects after the buds open: the buds are densely pilose and viscid: the fls. open suddenly about dusk and are immediately visited by the sphinx moths.—This species is unknown in the wild state. It is suspected by some of having had a horticultural origin, but by others considered more probable that it is a wild species which will yet be rediscovered in its native region. It has become the subject of an enormous literature, due to de Vries' discovery that it gives rise to distinct true-breeding derivatives (mutations) in every generation. These mutations are considered to throw light on the vexed question of the origin of species and horticultural varieties. The most interesting of them are a giant form, *Œ. gigas*, and a dwarf, *Œ. nanella*. Others are *Œ. rubrinervis*, *Œ. lata*, *Œ. brevistylis*, and *Œ. oblonga*, whose names suggest the characters in which they differ from the parent species. They are cult. in most botanic gardens, but are not offered by the trade. *Œ. Lamarckiana* closely resembles several beautiful species of the W. which have not been intro. into cult. *Œ. rubricalyx*, Gates, is a derivative of *Œ. Lamarckiana*, from which it differs in having the calyx-tube and segms. a fine rich red. G.C. III. 53:165. It is the only one of the mutations referred to above which has been intro. into general cult. It is known to the trade as "Sutton's Afterglow."

V. SUBGENUS RAIMANNIA.

St.-bearing: stigma deeply 4-cleft; calyx-tube very long and filiform or linear: caps. narrow-cylindric, obtusely 4-angled, with numerous seeds in 2 rows in each locule: fls. yellow, mostly showy.

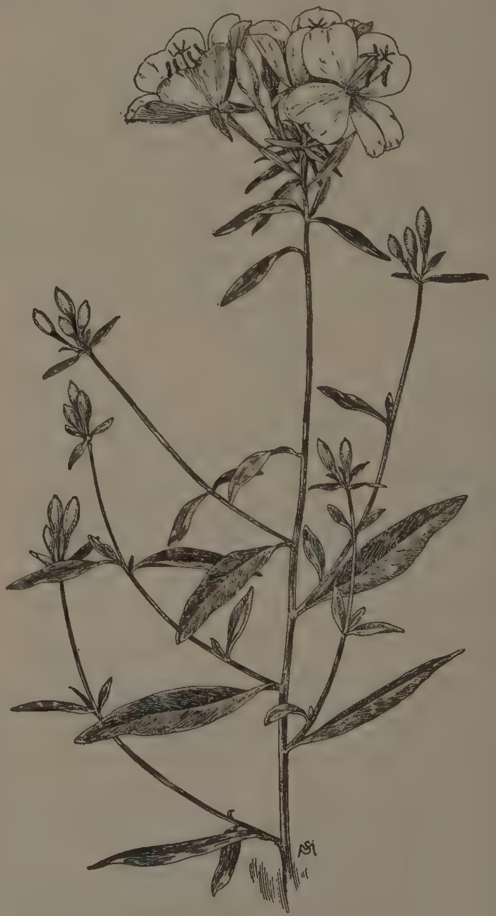
7. **Drúmmondii**, Hook. One to 2 ft., from an oblique or decumbent base, densely soft-pubescent: lvs. lance-oblong or oblanceolate, acute or obtuse, either gradually or abruptly tapering into a short petiole, entire or slightly toothed: calyx-tube usually 2 in. long and very narrow: fls. 2–3 in. across, nocturnal, bright yellow, showy: caps. 1–2 in. long. Texas coast. B.M. 3361.—Perhaps biennial, but grown as an annual.

VI. SUBGENUS ANOGRA.

St.-bearing: stigma deeply 4-cleft; calyx-tube elongated and enlarging upward: caps. oblong or linear: fls. white or pink, opening by day.

8. **albicaùlis**, Pursh (*Œ. pinnatífida*, Nutt. *Ánogra albicaùlis*, Brit.). Annual or biennial, low (1 ft. or less tall), sts. white and shreddy, the branches ascending, slightly pubescent or sparsely hairy: lvs. lanceolate, oblanceolate or lance-oblong, deeply pinnatifid or some of the larger ones only strongly toothed, 4 in. or less long, sessile or nearly so: fls. large (3 in. or less across), diurnal, white and fading to rose, the petals obcordate. Prairies, west.

9. **califórnica**, Wats. (*Œ. albicaùlis* var. *califórnica*, Wats.). Smaller and hoary-pubescent or villous, the sts. only 3 or 4 in. long, ascending from a rootstock:



2567. One of the sundrops—Œnothera linearis. (×½) lvs. narrow-oblanceolate and acuminate, usually stalked, toothed or pinnatifid: fls. often larger, fragrant, the petals lobed. Cent. and S. Calif.

VII. SUBGENUS MEGAPTERIUM.

St.-bearing: stigma 4-cleft; calyx-tube very long and slender, enlarging at the top: caps. very broad and strongly 4-winged: fls. yellow, showy.

10. **missouriénsis,** Sims (*Œ. macrocárpa,* Pursh. *Megaptèrium missouriénsis,* Spach). Low perennial with a hard base, the ascending sts. mostly not over 1 ft. long, usually pubescent: lvs. thick, varying from oval to linear to narrow-lanceolate, 5 in. or less long, acuminate, narrowed to a petiole, entire or remotely denticulate: petals 1–2½ in. long, very broad, yellow: caps. 2–3 in. long and nearly as wide, broad-winged. Mo. and Neb., west and south. B.M. 1592. Gn. 26, p. 480. R.H. 1857, p. 598.

11. **Hávardii,** Wats. Sts. numerous, short, slender and simple or branching, rising from a branching caudex, the plant canescent: lvs. linear-lanceolate in a rosette, narrowed toward either end, sinuate-pinnatifid: fls. sessile, the buds erect, the calyx-tube with coherent tips; petals ½–1 in. long, yellow turning red: caps. oblong-ovate, 4-angled and ribbed. Texas.

VIII. SUBGENUS KNEIFFIA.

St.-bearing: stigma deeply 4-lobed; calyx-tube very slender, somewhat dilated at the top: caps. rather small, club-shaped, 4-angled or narrowly 4-winged: fls. yellow, diurnal.

A. *Plant more or less glaucous, glabrous.*

12. **glaùca,** Michx. (*Kneìffia glaùca,* Spach). Erect perennial, 2–3 ft.: lvs. ovate to ovate-oblong, 4 in. or less long, acute or somewhat obtuse, sessile, remotely denticulate: fls. large, in short leafy clusters, the calyx-tube about ¾in. long; petals an inch long, more or less emarginate: caps. oblong, broad-winged, short-stalked, Va., Ky., and south. B.M. 1606. Var. **Fràseri,** Torr. & Gray (*Œ. Fràseri,* Pursh), is a form with ovate-lanceolate often slightly petioled lvs. Southern states. B.M. 1674.

AA. *Plant not glaucous, usually hairy or pubescent.*

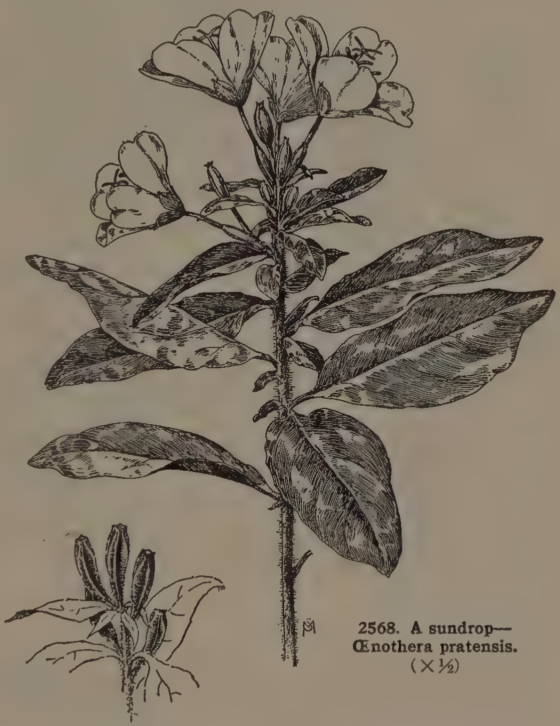
B. *Caps. smooth, or bearing slight gland-tipped hairs.*

13. **fruticòsa,** Linn. (*Kneìffia fruticòsa,* Raim.). Sundrops. Perennial (or sometimes biennial), erect and more or less branchy, rather stout, 1–3 ft. high, the terete usually reddish sts. somewhat villous: lvs. ovate to narrow-lanceolate, 3 in. or less long, firm, usually acute, remotely denticulate or entire, mostly sessile: fls. 1½–2 in. across and showy, in an elongating cluster, with linear bracts: caps. oblong to obovate, short-stalked or sessile, strongly winged. Dry soil, Nova Scotia, south and west. B.M. 332.—Very variable. Var. **Yoùngii,** Bailey (*Œ. Yoùngii,* Hort.), is common in cult., and is prized for its stocky growth and profusion of bloom. It is a strong larger-lvd. plant, with firm shiny slightly glaucous foliage, and bearing many bright lemon-yellow fls.: 2 ft., much branched and somewhat decumbent at base. Excellent. Var. **màjor,** Hort., is a strong-growing floriferous form, forming a dense bush-like specimen.

14. **pùmila,** Linn. (*Kneìffia pùmila,* Spach). Sundrops. Slender erect biennial or perennial, 1–2 ft. high, simple or branched: lvs. oblanceolate or oblong, usually glabrous, entire, the radical spatulate: fls. an inch or less across in a loose, leafy spike or raceme, the calyx-tube shorter than the ovary, the petals obcordate: caps. mostly clavate, short-stalked or sessile. Newfoundland, south and west. **Œ. Pìlgrimii,** Hort., appears to belong with this species. It is very like *Œ. fruticosa* var. *Youngii* horticulturally, but in established plants it is apparently somewhat taller and more branching, and the fls. not so large and color not so deep; it may be an offshoot of *Œ. fruticosa.*

BB. *Caps. grayish pubescent, the hairs glandless.*

15. **lineàris,** Michx. (*Œ. fruticòsa* var. *lineàris,* Wats. *Kneìffia lineàris,* Spach). Sundrops. Fig. 2567. Slender, 12–20 in. high, biennial or perennial, pilose, puberulent or nearly glabrous: basal lvs. spatulate to broad-oblanceolate; st.-lvs. linear to narrow-lanceolate: fls. bright clear yellow, 1½ in. or more across, standing well above the foliage lvs.; petals obovate and notched or emarginate at apex: caps. mostly less broadly winged, clavate. Conn., south. Gn. 26, p. 481.—In cult., this is a neat and bright little plant, blooming in July. The plant known in gardens as *Œ. fruticosa* var. *pallida* probably belongs with this species or with the form of it sometimes separated as *Kneìffia Állenii,* Small.



2568. A sundrop—Œnothera pratensis. (×½)

16. **praténsis,** Rob. (*Kneìffia praténsis,* Small). Fig. 2568. Sundrops. A day-blooming perennial, 1–3 ft. high, making a good clump and frequently planted in yards: sts. sometimes branched above, with soft-spreading hairs: lvs. oblong-lanceolate to elliptic-lanceolate, hairy, entire or sinuate, acute or obtuse: fls. bright yellow, leafy-bracted, mostly clustered at top of st.; tips of calyx hirsute; petals ½–1 in. long, obcordate: caps. club-shaped, hispid, sessile or nearly so. Maine to Iowa and Ark.—A good hardy plant for early summer to midsummer bloom.

IX. SUBGENUS HARTMANNIA.

St.-bearing: stigma 4-lobed; calyx-tube funnelform, often very long: caps. club-shaped or obovate, broad-winged: fls. white, pink or red, diurnal. (Including Xylopleurum, etc.).

A. *Plant canescent or villous, usually erect, or at least prominently ascending.*

17. **speciòsa,** Nutt. (*Hartmánnia speciòsa,* Small). Perennial, with a rootstock, erect or ascending branches, 2 ft. or less high, canescent: lvs. linear to lance-oblong, 4 in. or less long, remotely or sinuately dentate, or the

lower ones pinnatifid, attenuate at base: calyx-tube as long as the ovary; petals large, obcordate, white: caps. ½–¾in. long, 8-winged, acute at top. Mo., west and south. B.M. 3189. Gn. 26, p. 482.

18. **tetráptera,** Cav. (*Hartmánnia tetráptera*, Small). Villous: caps. larger and more broadly winged, very abruptly contracted at top: calyx-tube shorter than the ovary: fls. white, becoming rose. Texas and Ariz., south. B.M. 468. Var. **Childsii,** Bailey (*Œ. ròsea mexicàna*, Hort.), is a handsome form intro. from Texas by John Lewis Childs in 1892. It was found in the wild. "We first secured the pink," Childs writes, "and afterwards someone else sent us the white, blush and the other shades, all from Texas." In some respects it differs markedly from *Œ. tetraptera*, and it is not impossible that it is a distinct species. In cult. it is a trailing plant. The lvs. tend to be broader and less pointed than in *Œ. tetraptera*. It does not produce seed in the N., but is readily prop. by cuttings. It is an excellent plant either for the flower-garden or for pots in the conservatory. It is popularly known as the "Mexican evening primrose."

2569. Okra. The pods of okra vary greatly in length, depending on the variety, up to 10 and 12 inches; they are usually 4 to 6 inches long. (×½)

19. **ròsea,** Ait. (*Hartmánnia ròsea*, Don). Root biennial or perennial: st. erect or ascending, 1–2 ft., branching from the base: lvs. lanceolate to narrow ovate-lanceolate, mostly acuminate, rather abruptly narrowed to a petiole, entire or remotely denticulate or the larger ones small-lobed at the base: calyx-tube shorter than the ovary: fls. small, fuchsia-like, purple or rose, the petals rounded and entire: caps. much like that of *Œ. speciosa*. Texas and New Mex., south. B.M. 347.

AA. *Plant glabrous or essentially so, nearly stemless or else prostrate.*

20. **acaùlis,** Cav. (*Œ. taraxacifòlia*, Hort.). Tufted perennial or biennial plant, at first stemless, but producing prostrate, somewhat zigzag sts.: lvs. oblong in outline, 5–8 in. long, petioled, divided into many unequal narrow divisions (like a dandelion lf.): fls. usually opening white, but changing to rose, large (2–3 in. across), the very slender tube 3–5 in. long: caps. short-obovate, broadly triangular-winged above. Chile. B.R. 763. Gn. 26, p. 480.—A very interesting and attractive plant.

X. SUBGENUS PACHYLOPHUS.

Stemless or essentially so: stigma 4-cleft; calyx-tube very slender but enlarging upward, longer than the ovary: caps. with wrinkled or contorted wings: fls. white or pink.

21. **cæspitòsa,** Nutt. (*Pachýlophus cæspitòsus*, Spach). Crown 2–4 in. high, perennial or biennial: lvs. clustered, oblong to narrow-lanceolate or spatulate, sometimes 1 ft. long, attenuate, repand-toothed, pubescent: fls. white or pink, 1⅓–3 in. across, the petals obcordate; calyx-tube 2–6 in. long: caps. oblong-pointed, 1–2 in. long. S. Dak., Neb., west and south. B.M. 1593, 5828 as (*O. marginata*). Gn. 26:480; 47, p. 46 (both as *O. marginata*).

XI. SUBGENUS LAVAUXIA.

Stemless or essentially so: calyx-tube very slender, enlarging upward, longer than the ovary: caps. with plane or entire wings: fls. white, pink, or even pale yellow.

22. **brachycárpa,** Gray (*Lavaùxia brachycárpa*, Brit.). Perennial, densely pubescent: lvs. thickish, ovate to very narrow-lanceolate, about 6 in. long, long-stalked, entire or notched or lyrately pinnatifid; calyx-tube 2–3 in. long; petals about 1½in. long, purplish: caps. ovate, often 1 in. long, the wings not wrinkled. Mont. to Kans., west and south.

Œ. Árendsii, Bowles. Said to be a hybrid of Œ. speciosa and Œ. rosea, ("Œ. speciosa var. rosea") hardier than the former: spreads freely from the base, blooming on the young shoots: fls. large, delicate shade of pink with white eye. Gn. 76, p. 638.

L. H. B.

OKRA, or GUMBO (*Hibiscus esculentus*) is a half-hardy plant introduced into United States and West Indies from Africa, and cultivated for its fruit-pods, which are used in soups, stews, catsups, and the like (Fig. 2569). In soups and catsup, it gives body to the dish; stewed, it is mucilaginous, and while at first not agreeable to many persons, a taste for it is easily acquired. It is also dried and canned for winter use. When ripe, the black or brown white-eyed globular seeds are sometimes roasted and used as a coffee substitute.

Okra should be sown in a dry warm soil, of medium fertility and texture, after danger of frost has passed. It is important to select the correct type of land for growing okra. It should be a well-drained sandy loam, or if clay only is available it should be a loamy clay, and a soil that is not likely to become water-logged during the rainy weather. The soil should be prepared deeply and thoroughly, the deeper the better, if the soil is good. The rows should be made 3 to 5 feet apart, according to variety, and seeds dropped about 2 inches apart in the row; cover 1 or 2 inches deep. After plants are 6 inches high, thin to 1 foot apart for dwarf varieties and to about 3 feet for the largest varieties. After the plants have been cut out to a proper stand in the row, frequent cultivation should be given. This is best performed with implements that cut rather deeply. The okra plants do not throw out many lateral roots in the early stages of growth if planted on the proper kind of soil. The seedlings transplant with considerable difficulty, so they need to be started in flower-pots if an extra-early crop is desired. The pods must be gathered before the fiber develops in them: the size will vary with the variety, but if it is too "stringy" to cut with a dull case-knife it is too old. Keep all old pods cut off. The dwarf varieties are in greater favor in the South because of their habit of bearing early. A plant, constantly cropped, remains in bearing condition until frost kills it, but allowed to retain pods it suspends growth until the seeds have matured, when a second growth may take place. Okra will grow for years if not killed by frost or other adverse conditions, i. e., it makes an indeterminate growth like cotton, malva, hibiscus, and the like. For shipping, cut the stems (peduncles) an inch or so long so as to prevent wilting in transit. Pack firmly in vegetable crates. The demand for this vegetable is increasing, especially in New York City. Seed is easily grown and saved. The plant is subject to several diseases to such an extent that it is impracticable to raise a crop on certain pieces of land. Rotation is the best remedy. P. H. Rolfs.

ÒLAX (probably from the odor or smell). *Olacàceæ.* Thirty and more species of trees, sometimes scandent, shrubs and subshrubs in the tropical parts of the Old World, little known in cult.: lvs. alternate, simple: fls. white or whitish, sometimes colored, small, mostly in short axillary simple or branched racemes; calyx cup-shaped, minute; petals 3–6, some of them in some species coherent; fertile stamens usually 3, sometimes 4 or 5, mostly standing opposite the edges of the petals; staminodia 5 or 6, notched, mostly standing opposite the petals; ovary free, in a cup-shaped disk, the stigma 3-lobed: fr. somewhat immersed in fleshy calyx, containing a 1-seeded stone. None of the species seems to be listed; probably some of them would be interesting far S. L. H. B.

OLDENBÚRGIA (S. Oldenburg, a collector for Kew in 1772–3). *Compósitæ.* Three species of remarkable S. African stocky shrubs or subshrubs, with woolly rootstocks, and large solitary heads of purple corollas. They are not in general cult., but may be expected in some of the botanical collections: lvs in a rosette, coriaceous and 1-nerved, very hairy underneath: fls. all perfect in the head, the outer ones radiate; scales of involucre linear, acuminate, not spiny: achene beakless, with a pappus of many plumose bristles. *O. Árbuscula,* DC., has flowered in recent years in England (at Kew the plant was 3 ft. high and unbranched at 16 years): lvs. crowded at ends of branches, obovate or oblong, to 18 in. long, at first white-woolly: fl.-heads often 1 ft. across, purple and white. B.M. 7942. G.C. III. 35:9. L. H. B.

OLDENLÁNDIA (H. B. Oldenland, Danish botanist, of the 17th century). *Rubiàceæ.* More than 200 species of shrubs, subshrubs and herbs in many parts of the world, mostly tropical, of little value horticulturally. Fls. small, most inconspicuous, white or rose-colored, rarely solitary but mostly in dichotomous panicles; calyx mostly 4-toothed; corolla usually 4-toothed, rotate, funnel-shaped or salver-shaped; stamens mostly 4, inserted in the throat of the corolla: fr. a small caps. adnate to calyx-tube, dehiscent at top: lvs. opposite, mostly small and narrow. A few annual or perennial species are native in N. Amer., being small plants of no prominence. L. H. B.

OLDFIÈLDIA (from R. A. Oldfield, a merchant at Sierra Leone). *Euphorbiàceæ.* Evergreen tropical tree rarely cult. in greenhouses: lvs. opposite, digitately compound; lfts. 5–7, entire, coriaceous, pinnately veined: fls. diœcious, apetalous, in short axillary clusters; stamens 4–10; ovules 2 in each cell. Related to Bischofia. One species in Trop. Afr., *O. africàna,* Hook., is said to yield the African oak, or African teakwood, sometimes exported. It may be grown from cuttings in loam, leaf-mold and sand and should be well watered when growing rapidly. J. B. S. Norton.

OLD MAN. Another name for the southernwood, *Artemisia Abrotanum;* also for the rosemary, *Rosmarinus officinalis;* and probably for various hoary plants. *Artemisia Stelleriana* is said to be known sometimes as Old Woman.

OLD-MAN-AND-WOMAN, or common houseleek: *Sempervivum tectorum.*

OLD MAN CACTUS: *Pilocereus senilis.*

OLD MAN'S BEARD. In Europe, *Clematis Vitalba;* in America the common wild clematis, *C. virginiana;* also *Saxifraga sarmentosa;* rarely the fringe tree, Chionanthus.

ÒLEA (classical name for olive). *Oleàceæ.* Olive. The olive tree and fruit; and other small trees or shrubs of little importance in cultivation. (The *Olea fragrans* of greenhouses is Osmanthus; also *O. Aquifolium.*)

Spiny or unarmed: lvs. evergreen and thick, opposite, usually entire, and often rusty-tomentose beneath: fls. small, usually imperfect, white or whitish, in forking panicles or fascicles, the short calyx 4-toothed (corolla sometimes none), the short-tubed corolla with 4 valvate lobes, the stamens 2; ovary 2-loculed, bearing a short style and capitate stigma: fr. an oblong or ovoid drupe.—Between 30 and 40 trees or shrubs of the tropical and warm-temperate parts of the Old World to New Zeal.

europæ̀a, Linn. Small tree, rarely exceeding 20 or 25 ft. in height, and bearing small oblong or lanceolate lvs. and axillary forking racemes of yellowish white fragrant fls. It is probably native to the E. Medit. region or W. Asia, but has been in cult. from the earliest times and is spontaneous in parts of S. Eu.

Var. **Oleáster,** DC. (*O. Oleáster,* Hoffm. & Link. *O. sylvéstris,* Mill. *O. europæa* var. *sylvéstris,* Rouy). The wild form: thorny, the branches 4-angled or -cornered: lvs. elliptic or oblong: fr. small, roundish, inedible.

Var. **commùnis,** Ait. (*O. gállica,* Mill. *O. officinàrum,* Crantz. *O. lancifòlia,* Moench. *O. sativa,* Hoffm. & Link. *O. europæa* var. *sativa,* DC.). The cult. olive, a handsome gray-green tree, with thornless terete or only obtuse-angled branches: lvs. lanceolate, willow-like in shape: fr. size of a damson or larger, nearly globular to oblong. See *Olive.*

chrysophýlla, Lam. Small tree, noteworthy because of the drab or golden color of the under surface of the lvs.: branchlets slender, lepidote or scurfy upward: lvs. lanceolate, 2–4 in. long, the petiole very short: fls. small (corolla ⅛in. long), in axillary panicles: drupe rather large and blackish, globose or somewhat long. Trop. Afr.—It has been intro. to cult. in S. Calif. L. H. B.

OLEANDER: *Nerium Oleander.*

OLEÀRIA (J. G. Olearius, who published a flora of Halle, 1668). *Compósitæ.* Tree-Aster. Shrubs and trees of Australia and New Zealand, allied to Aster, somewhat planted abroad, but apparently not tested in this country.

The tree-asters are of more than 100 species, evergreen, with white, blue or purple rays, many of which are worthy of cult.: lvs. alternate, or sometimes opposite or fascicled, mostly tomentose beneath: heads various in size, solitary or clustered, sometimes rayless, the involucre with several rows of bracts that have scarious or dry margins; ray-florets female, in a single row; disk-florets perfect: achene terete or somewhat compressed, bearing one or more rows of pappus bristles. Some of the New Zealand species have large usually solitary fl.-heads and stiff lanceolate toothed lvs., which should be tested in Amer.; Cockayne writes that they require a moist equable climate with low summer temperature, and are not suited to ordinary garden conditions. Speaking of the New Zealand olearias in general, of which there are more than 40 species, Cockayne says that all are well worthy of cult.; some are alpine and subalpine; some are both trees and shrubs, others shrubs alone.

Haàstii, Hook., long known in south of England as a good late summer- and autumn-blooming shrub and apparently the only one that has been regularly offered in this country: in New Zeal., where it is native (in the south island), a shrub 4–8 ft. high, with hoary branches:

lvs. alternate, oblong, elliptic or oblong-ovate, 1¼ in. or less long, shining above and tomentose beneath: heads small and numerous, containing 8–10 florets, and 3–5 short broad white rays. B.M. 6592. G.C. III. 20:533. Gn. 38, p. 149; 78, p. 473. J.H. III. 68:265. F. 1874, p. 198. R.H. 1913, pp. 495, 497.

Other recent accessible portraits of olearias as cult. plants are: *O. chathamica*, Kirk, G.C. III. 53:363; *O. Forsteri*, Hook. f., G. 35:515; *O. insignis*, Hook. f., G.C. III. 57:333. Gn. 79, p. 301. G. 37:283. *O. macrodonta*, Baker, G. 35:443, 445; O. *myrsinoides*, Muell., Gn. 77, p. 58, the Australian daisy-bush blooming in England in June; *O. nitida*, Hook. f., G.M. 56:692. G. 35:757; *O. semidentata*, Decne., B.M. 8550; *O. stellulata*, DC. (*O. Gunniàna*, Hook. f.), B.M. 4638. Gn. 78, p. 350. R.H. 1913, p. 547.

L. H. B.

OLEASTER: *Elæagnus angustifolia;* also *Olea.*

OLFÉRSIA (after Ignaz Olfers, a German consul at Rio Janiero). *Polypodiàceæ.* A genus of one species related to Polybotrya, formerly classified with Acrostichum. Fertile and sterile lvs. dissimilar, the sterile 2-pinnate, the fertile 3-pinnate, with the sporangia in masses completely covering the backs.

cervìna, Kunze. A showy large fern adapted for cult. on palm trunks, and the like: rootstock creeping, densely clothed with long narrow scales, the lvs. 3–6 ft. long, 10–20 in. broad, coriaceous, with prominent veins which unite at the margins. R. C. Benedict.

OLIGOBÒTRYA (*few clusters*). *Liliàceæ.* One species, in China, intermediate between Smilacina and Polygonatum. It is an erect herb, 3 ft. and more tall, adapted (in England) to a shady moist border such as is suited to hardy cypripediums. *O. Hénryi*, Baker, is the species: lvs. ovate-oblong or ovate, alternate, sessile or short-stalked, many-nerved, pubescent, about 4 in. long: fls. white or pale yellow, in terminal simple or branching racemes; perianth-tube cylindric, ⅓in. long, the 6 broad lobes shorter and spreading; stamens joined to throat of corolla, the filaments very short; ovary ovoid, the stigma 3-lobed. B.M. 8238. Var. *violàcea*, C. H. Wright, has a violet perianth-tube and paler lobes. B.M. 8238.

OLIVE. A small evergreen tree grown for its drupes which yield oil and are also prepared as a food and condiment.

The cultivated olive (*Olea europæa*) is the typical species of the genus Olea (Fig. 2570). It is found growing wild in various countries from the Punjab to Morocco and the Canary Islands and on both sides of the Mediterranean from the slopes of the Atlas to southern France and Macedonia where moisture and temperature conditions are favorable. It is particularly abundant in Syria and Algeria. The wild form has small rigid leaves and a fruit with little flesh and is sometimes considered as a distinct botanical variety under the name of oleaster or *Olea sylvestris* (see *Olea*). It is used as a stock on which to graft the cultivated forms and in Algeria the government encourages the utilization of wild trees by grafting in place (Fig. 2571).

2570. Olive in flower and fruit.

The cultivated olive is grown throughout the same region and, with the aid of irrigation, in localities too dry for its naturalization. It has been grown from prehistoric times in Asia Minor where it seems to have originated. Its culture was introduced into all Mediterranean countries by the Phœnicians, Greeks, and Romans. In modern times it has been widely dispersed by colonists in America, Australia, and South Africa.

In the United States the olive succeeds only in California and in parts of Florida, Arizona, and New Mexico. It was planted at the missions by the Franciscan padres and from the trees grown there came the variety now known as the Mission, which is still preferred to all other varieties by most growers. The original trees were grown at the San Diego Mission from seeds brought from Mexico. Like the Mission grape, the Mission olive has not been identified with any Old World variety and is probably a seedling. Some growers distinguish several forms or variations of the Mission, differing in size and form of leaf, fruit, and tree. The correctness of this view seems probable from the mode of its origin, but others consider these differences to be due simply to variations of soil and climate.

The olive thrives in all soils providing they are deep and well drained, but the crops are in proportion to the fertility of the soil. The olive will often make a handsome vigorous tree in dry situations unsuited to most fruits, provided the subsoil will allow of deep penetration of the roots. Paying crops are obtained, however, only on fairly fertile soil and with intelligent and thorough cultivation. It requires a slightly greater annual sum of heat than the vine and is more sensitive to winter cold, which should never fall below 14° F., nor frequently below 19° F. A clear dry atmosphere is favorable. Summer rains or fogs render the tree subject to the attack of the black scale, which is very harmful and difficult to control on the olive.

Suitable situations and paying orchards are found in California from the upper end of the Sacramento Valley to the borders of Mexico in Imperial County. Most of the paying orchards are on the slopes of the Sierras at moderate elevations, in southern California, and widely scattered through both the Sacramento and the San Joaquin valleys. There are a few good orchards in favored locations in the inner coast valleys from Sonoma southward. Olive-growing promises to be very successful in the Imperial Valley.

The suitability of California for olive-growing began to be generally recognized between 1880 and 1890 and many orchards were planted during this period. The expectations of large profits were not as a rule realized when the trees came into bearing. Several causes contributed to this. The oil could not compete with the cheap cottonseed oil which was often sold as "pure olive oil;" the ripe pickled olives were a novelty and their merits not understood in the East and the first attempts to manufacture green pickled olives were unsuccessful. Many orchards were accordingly uprooted and few trees were planted during the next fifteen years. Recently effective pure-food laws have removed much of the competition of imported and domestic cottonseed oil, the taste for ripe pickled olives has been acquired by a large body of consumers and the methods of producing green pickles have been perfected. Few of the last, however, are made, as the demand for good ripe pickles exceeds the supply. Olive-growing has therefore been on a profitable basis for some years and large new plantations have been made during the last five years.

No reliable statistics of the olive industry are available but the statistician of the California State Board of Agriculture places the number of trees in California at 1,530,000 which corresponds to something under 30,000 acres. The same authority credits Florida with 8,000 trees, Arizona with 1,600 and all other states with 200. The State Board of Equalization, however, placed the number of trees in California in 1912 at only 700,000, or about 14,000 acres.

It is estimated that California produced in 1910 about 800,000 gallons of olive oil and 1,000,000 of pickled olives. For 1911, the oil output is placed at 920,000 gallons and the pickles at 1,150,000 gallons. If one ton of olives is reckoned to yield thirty-five gallons of oil and that it requires six pounds of olives to make one gallon of pickles, the crop of 1911 represents about 31,000 tons of fruit, of which 85 per cent were used for oil and only 15 per cent for pickles. If the average of the estimates of total acreage given above is taken, the crop is equivalent to 1.4 tons to the acre. When it is considered that many orchards are planted with poor bearing varieties and in unfavorable situations, this average is satisfactory.

2571. Arab family gathering fruit of grafted wild olive in Algeria.

According to the state statistician, six counties of the San Joaquin and Sacramento valleys produced in 1900 nearly 75 per cent of the crop of the whole state, though having but 25 per cent of the trees. This indicates a variation of crop of less than half a ton to over four tons to the acre, according to locality. In the south of France 2.7 tons to the acre is considered a maximum yield and good well-cultivated orchards are not expected to average more than 1.3 tons.

Using the estimates given above, it will be seen that pickles were made from only about 15 per cent of the crop, the remainder being used for oil. The reason for this is that while pickled olives of suitable quality are more profitable than oil, only the large olives are acceptable to the market. During the first period of heavy planting, a large number of the trees used were of varieties suitable for oil, which are all of small or medium size. Even when large-fruited varieties are planted, there will always be a large proportion of the fruit undersized, especially in poor soil and in unfavorable localities. At present the tendency is to plant only those varieties which are capable of producing large fruit but which at the same time are rich in oil of good quality. The pickled olive is thus considered the main crop and the oil a kind of supplementary or by-product. From this point of view, the Mission olive, when propagated from selected trees in favorable localities, is perhaps the best variety. Pickling and oil-making tend to concentrate in large central establishments in each olive-growing center. This makes it possible to employ the best methods and machinery in the hands of trained men. The results are great improvement in quality of the product and economy of operation.

The price paid for olives fell at one time to $15 a ton which, with the average crop, represents gross returns of $25 or $30 an acre, which in most cases would not pay the cost of cultivation and harvesting. It has risen gradually until during the last few years $100 a ton has been paid for olives suitable for pickling and even $150 to $200 a ton for very large fruit. This represents average gross returns of about $150 or more to the acre and is very profitable, as the large olives are gathered much more cheaply than the small. When turned into pickles, a ton of olives represents $250 at the low retail price of 75 cents a gallon, but a ton of olives will yield oil of a value of only about $87.50 at the ordinary price of $2.50 a gallon. As olives are usually bought ungraded, the buyer of pickling olives at present prices incurs a loss on all the small olives he uses for oil. The price paid for oil olives too small for pickling is less than half that paid for the large fruit.

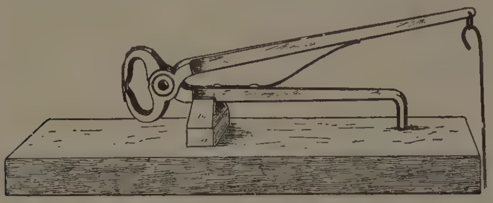
Propagation.

Olives in California are usually grown from cuttings taken from the tree when it is most dormant, that is, in January and February. These cuttings may be of any size and taken from any part of the tree. Most nurserymen prefer to use "tips." These are the mature ends of shoots 4 to 5 inches long. Two or three of the upper leaves are left or trimmed back a little and the remainder removed entirely. They are then planted in boxes of sand under glass with artificial heat and, after rooting, transplanted to the nursery where they remain for one, two or three years before being planted in place. When a greenhouse is not available, larger cuttings of older wood are preferable. These cuttings are usually made about 14 inches long and may be from ¾ to 1½ inches in diameter. Their rooting may be facilitated by splitting or scratching the bottom 2 or 3 inches with a knife. In Spain, large branches of old trees are used to produce young plants. These branches (truncheons) are cut into convenient lengths and incisions reaching half way to the center made every 3 or 4 inches. The sections are then placed horizontally in trenches about 10 inches deep, where they are covered with soil, and watered. Shoots arise near the saw-cuts and when sufficiently developed they are removed with the roots which have formed, and planted in the nursery. This method, formerly employed in California, is now little used there. Suckers taken from the base of the trunk with a plate of the old wood attached to the base are sometimes used and root more easily than ordinary cuttings.

Olives may also be propagated by seeds, which are supposed to give a stronger root-system and more fruitful trees. The seedlings, however, must be grafted and it takes a little longer to obtain a tree by this means.

The Mission and many other cultivated varieties have large seeds which are hard to germinate. Small-fruited varieties, such as the Redding and Chemlali, which resemble the wild olive, are the best. The completely ripe olives are placed in a heap until the pulp becomes soft enough to be removed easily. Usually the stones are then treated for twelve to twenty-four hours in a 10 per cent solution of caustic soda. The process must be carefully watched by breaking a stone occasionally and the lye removed before it penetrates to the kernel. The treated pits are kept in moist sand until March or April, when they are planted thickly in close rows. Many will not germinate the first year and many not at all.

Much time may be saved by clipping off the apex of the olive pit. Seeds treated in this way will germinate readily in a few weeks. By means of a simple device originated by the California Experiment Station, this clipping can be done very rapidly (Fig. 2572).



2572. Device for clipping olive seeds.

The second or third year, the young seedlings are transplanted to nursery rows in good rich soil, where they are budded or grafted the following spring. One or two years later, they are ready to be planted in the orchard.

The planting distances vary with the nature of the soil and of the variety. The trees in some orchards are planted as near as 20 feet, but more at 24 to 30. The olive is very long in reaching its full size, and some growers plant at 20 or 24 feet with the intention of taking out three-quarters of the trees when they begin to crowd, leaving them 40 to 48 feet apart. It is not, however, until the trees are twenty-five or thirty years old that they reach full size, and most growers prefer to plant at intermediate distances of about 30 to 36 feet. In France, the distances adopted vary from 15 feet in the most northerly districts to 24 feet in the more southerly. In Algeria, from 30 to 36 feet are the usual distances, while in Tunisia 45 feet and even 60 to 72 feet are adopted, usually with intercalary annual crops. Most of the olives in California are planted in solid orchards, but many are used as avenue and border trees.

Seedling olives are grafted in the nursery. This may be done when the seedlings are one year old, by means of a side- or whip-graft in early spring, or of a twig-bud after the sap is flowing freely. The graft is made at or near the surface of the ground. Older seedlings may be crown-grafted or twig-budded higher up in late spring. Old trees may be grafted to change to a more desirable variety. Much grafting of this kind has been done in California, the large pickling varieties being grafted on small oil olives or on the strong-growing Redding, which bears a worthless fruit and was at one time planted largely in the mistaken belief that it was the large-fruited Picholine. The trees may be cut back to the main branches and crown-grafted immediately or allowed to form a growth of new shoots, which are budded the following year. Much care and work are necessary for several years to prevent the growth of suckers from the old stocks.

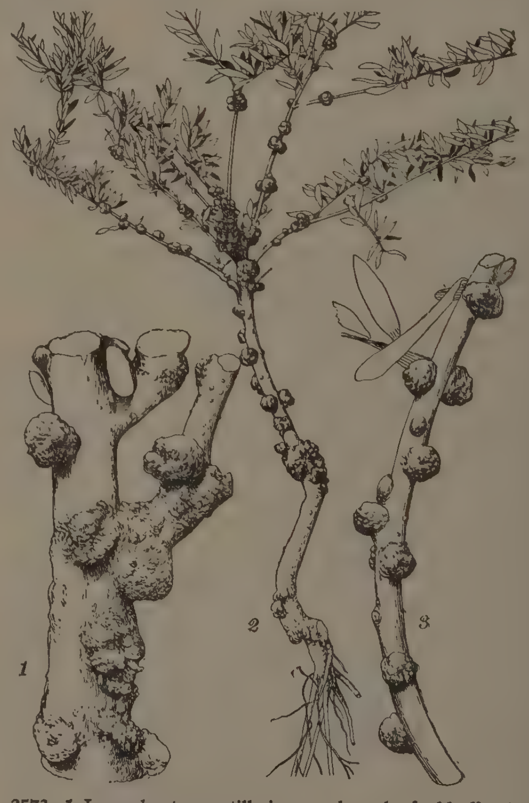
Cultivation and pruning.

The planting and cultivation of the olive require the same care as in the case of other fruits. Where the rainfall is ample, thorough cultivation may insure sufficient soil-moisture, but in most cases irrigation is necessary. Cutting back and the removal of ill-placed branches is advisable during the first and second years, and the tree should be allowed to make only one trunk. After the second year, the lower branches should be gradually removed until a clean trunk of 2 or 3 feet is formed. Cutting back and thinning out of the branches should be practised at every winter pruning in order to give the tree the required symmetrical arrangement of branches. For trees which tend to become close and compact, thinning out of branches is chiefly needed; for those which tend to become weak and elongated, more cutting back is necessary.

By the fifth or sixth year, the framework of the tree should be formed and paying crops produced. The methods of pruning bearing trees vary greatly in various countries. In many, a very severe cutting-back is practised every other year and, as a consequence, the olive bears only on alternate years. The origin of this custom seems to have been due to the olive-fly and scale, which can be fairly well controlled by this means. Trees which are not pruned at all also tend to bear only every other year and to have small inferior fruit. As the olive bears only on the two-year-old wood, like the peach, annual pruning is necessary for annual crops.

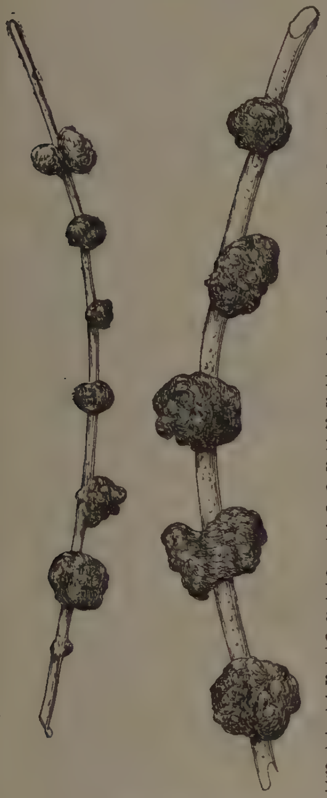
The most approved method in California is an annual pruning which consists principally of thinning out from one-third to one-half of the small branches. As much as possible of the removals should be of branches which have borne the preceding year, especially those which have made little new growth. Injured or ill-placed branches are removed and the fruiting surface spread as uniformly over the tree as possible. Vigorous trees should be pruned less than those which are weak and removals made in such a way that light and air reach every part of the bearing wood.

Thorough clean cultivation is needed by the olive and is practised as with other orchard-trees in California. The olive will live with less water than most orchard-trees, but for the production of good crops of large fruit an abundant water-supply is necessary. When the moisture is inadequate, the blossoms do not set well and the fruit is small. Most of the paying orchards are irrigated. Frequent and shallow irrigations are unfavorable to the health and bearing of the



2573. *1*, Large knots on still vigorous branch of old olive tree. *2*, Young tree planted to replace one destroyed by knot. *3*, Small knots on much weakened branch.

tree. Heavy winter and spring irrigations followed by thorough summer cultivation are usually sufficient, though a supplementary watering just before blossoming time (March to May) and one when the fruit is almost of full size are useful in many soils and locations.



2574. Tuberculosis of olive.

Diseases and insects.

The only serious disease which attacks the olive in California is the "olive-knot." This disease is characterized by numerous knots or tumors on the leaves, twigs, branches and trunk, varying in size from ⅛ inch to 1 or occasionally 2 inches (Figs. 2573, 2574). When badly attacked, the tree is much weakened and, in extreme cases, killed or rendered unprofitable. The disease is infectious and caused by specific bacteria (*Bacterium savastanoi*). Though found in several widely scattered districts, few orchards have been seriously injured and it seems probable that its spread can be controlled by quarantine. It is most harmful to young trees and in rich moist soils of the warmer districts. Eradication by means similar to those used for pear blight seems possible.

A fungous disease of the leaves (*Cycloconium oleaginum*) occurs, but is not important. Rarely, susceptible varieties are slightly weakened by an unusually heavy attack. Fungous decays of roots and stem have been noted, but do little damage as a rule. Old olive trees in Europe often bear satisfactory crops even after a great part of the interior of the trunk has decayed (Fig. 2575).

The black scale (*Saissetia oleæ*) is very injurious to the olive in the moister regions of the coast ranges, in some parts being so prevalent as to prevent the profitable growing of the tree. In the dry summer air of the interior the scale is absent or not injurious. The noxious olive-fly and olive-moth of Europe do not exist in California.

Harvesting.

The stage of maturity at which the olives are harvested depends upon the use that is to be made of them. For green pickles, they should be gathered as soon as or just before they have reached full size and before they show the slightest change of color. Only at this stage is it possible to preserve the clear yellowish green which the consumer demands and which insures the best price. In ripe pickles, the consumer demands a deep uniform shade as nearly black as possible. Different varieties of olives vary considerably in the amount of coloring matter they contain, but in all varieties it develops its full intensity only at full maturity. As the olives on a tree do not all ripen together, it is customary to wait until nearly all have developed a good black color. If gathered too soon, many will bleach to yellow or red in the pickling process; if left too long many will become too soft. Both these difficulties can be overcome to a large extent by modifications in the methods of pickling.

When used for oil-making, the quality and quantity of the oil will vary according to the degrees of ripeness of the fruit, when gathered. The maximum quantity is obtained by harvesting the olives when they are completely mature and soft. There is an increase in the percentage of oil afterward, due to a partial drying of the fruit, but no increase in the total quantity of oil. The finest and most highly prized oil is made from olives gathered just before they begin to soften.

In gathering olives for any purpose, they must be picked from the tree by hand and all bruising of the fruit avoided. Cloth bags or lined buckets hung over the shoulders of the pickers are used. Knocking the olives off the trees with rods and gathering from the ground is never practised for pickling olives; nor is it advisable for oil olives, as the mechanical injuries to the fruit promote rotting and molding which much depreciate the quality of the oil. Beating the trees also destroys much of the best fruit wood and tends to promote the spread of the olive-knot disease. Where oil olives can be marketed immediately, they may be gathered by means of special rakes with wooden teeth.

Pickling olives.

When pickles are made, the olives should be cleaned and sized as soon as possible after gathering. The sizing is done by mechanical graders which sort the olives into three or more sizes. The larger sizes are each pickled separately and the smallest used for oil. The grader should be such that the fruit is bruised as little as possible. The cleaning is accomplished by a blower which removes leaves and similar light materials and by running the olives into water which removes the dust.

The pickling process consists in removing the bitterness by means of soda or potash lye and water, then hardening and preserving the olives with a solution of common salt.

The nature of the lye treatment will depend on the variety, size and degree of ripeness of the fruit. For this reason, each variety and grade should be treated separately. The effect of the lye is partially to destroy the bitterness and to make the skin more pervious to the pickling solutions. Some varieties of olives are extremely bitter or thick-skinned and require two or three times as much lye as other varieties. If too little lye is used, the extraction of the bitterness will be very slow and often incomplete; if too much is used, the olives will become soft, the flavor will be injured and the nutritive value impaired by saponification of some of the oil.

2575. Ancient olive tree in orchard in south of France.

Average olives are placed in a solution composed of two ounces of potash lye to one gallon of water. They are left in this solution from four to not more than twelve hours. When the lye has penetrated nearly to the pit as shown by a darkening of the flesh, the olives should be removed to a bath of pure water. With very bitter olives, a second treatment with lye is often necessary. Stronger lye is likely to soften the fruit too much. With very ripe or soft olives, it is necessary to use salt from the beginning in the lye solution. Equal quantities of salt and lye may be used and more time is needed for neutralization owing to the hardening effect of the salt. Some picklers prefer to use a 1 per cent lye for all olives and to repeat the treatment two or three times. The next step is to remove the excess of lye from the olives. If the olives are firm, this is most economically and rapidly accomplished by soaking in pure water which is changed twice a day. If the olives are soft, the water should contain 2 per cent of salt. As soon as no taste of lye remains in the olives, they are placed in a brine composed of four ounces of salt to one gallon of water. This brine is replaced in about two, seven and twenty-one days with brines of six, ten and fourteen ounces to the gallon. This gradual increase of the strength is necessary to prevent shrinkage and shriveling of the olives.

Great care should be taken not to allow the olives to come in contact with anything that will injure their flavor. The vats or other receptacles used for pickling should be perfectly clean, odorless, and tasteless. Concrete is the best material, but wooden receptacles thoroughly treated with boiling water and soda until they are sterilized and all taste of the wood removed, may be used. The vats should be provided with a removable wooden grating, fastened 1 or 2 inches from the bottom, and a close-fitting, floating wooden cover to keep all olives submerged. Each vat should be provided at the bottom with a wooden spigot for drawing off the solutions. The thickness of the layer of olives should not be more than 2 feet. or less with soft varieties.

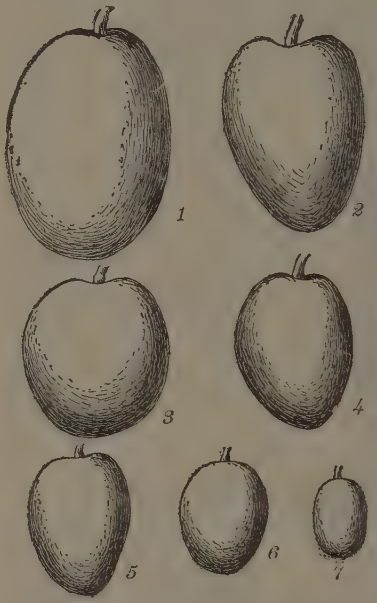
In pickling green olives, when a light color is desirable, the fruit should be exposed as little as possible to the air, especially during the extraction of the bitterness. In pickling ripe olives, on the contrary, when a uniform dark color is desired, the action of the air is beneficial. A great improvement in this respect can be obtained by leaving the olives exposed to the air for twenty-four hours when making the various changes of lye and salt solutions.

However carefully the processes of pickling are carried out, the olives will keep only for a limited time. They usually remain in good condition for about six months when kept in a strong brine, and the best may last in fair condition for a few months longer. Few olives are good when kept in the ordinary way for twelve months, but by heating them in sealed cans or bottles, they can be kept indefinitely with as great facility as any other food-product. The heating does not injure the flavor and the texture, but, on the contrary, improves them. Olives preserved by heating do not require such strong brine, and it is only necessary to add as much salt as the palate requires.

Olive oil.

The best oil is made by working the olives as soon as they are gathered, but it is usual to dry them partially first to facilitate crushing and pressing. The drying is accomplished by spreading the fruit in layers not over 3 inches deep on wooden trays which are spread out in a well-aërated shed or loft. The olives must be turned daily and prevented from molding. In cool, moist weather this is very difficult, and artificial driers constructed on the same principles as those for fruit and hops are sometimes used. The heat of these driers should be between 120° and 130° F. Higher temperatures produce rancidity of the oil. Artificial drying requires about forty-eight hours; natural drying one to two weeks. The dried olives may be stored in a cool, dark, dry place for some time before crushing, but the sooner they are used the better the oil, especially when dried by artificial heat.

The olives are first passed through a crusher consisting usually of corrugated rollers which disintegrate the flesh without breaking the pits. The crushed mass is then put under a press of moderate power. To facilitate the escape of the oil and water, the crushed olives are placed in layers of 3 to 4 inches, inclosed in strong cloth and separated by gratings. After this pressing, the pulp is thoroughly ground, usually with the pits, in an "edge-runner" mill. The ground pulp is then pressed a second time. The second pressing requires a very powerful press and very strong cloth to contain the pulp. The first pressing may be omitted when the olives are dried.



2576. Varieties of olive. ***1*, Ascolano; *2*, Sevillano; *3*, Manzanillo; *4*, Mission; *5*, Nevadillo; *6*, Frantoio; *7*, Redding.** (× about $\frac{5}{8}$).

The liquid which comes from the press contains oil, water and various impurities both solid and dissolved in the water. If allowed to stand, the oil, owing to its light specific gravity, will come to the top and may be skimmed off and freed from floating solid matters by screening. The separation, however, is very slow and imperfect and is facilitated by the process known as "washing." There are various devices for this purpose but they all consist in mixing the press liquids with a stream of pure water with continued gentle agitation. Some of the devices are continuous and the oil rising to the top flows off into the oil vats and the water and impurities escape at the bottom.

The oil thus obtained is more or less cloudy owing to the presence of minute particles of solid matter and must be made perfectly bright before it is merchantable. Perfect clarification of the oil may be accomplished by several successive settlings and decantations. The settling vats may be of tin or concrete. Drawing off after a settling of twenty-four to forty-eight hours removes most of the solid matter. The remainder is removed by two or three drawings-off, each after a settling of about a month. Filtration is usually used to hasten clarification. The most commonly used filtering materials are cotton, pure sand and filter paper. Filtering must be practised with moderation as it tends to diminish the flavor.

Only 50 per cent to 65 per cent of the oil is recovered by the methods now in use in California. The pulp with the retained oil is wasted or used as pig feed. A somewhat large percentage of the oil can be recovered by means of a centrifugal machine and the troublesome pressing and press cloths done away with. This method, however, has never been adapted to an industrial scale. Pressing is also done away with in the "Acapulco" method by which the oil is extracted by a partial vacuum. This method is said to be used successfully in several mills in Spain and Italy.

Varieties.

A very large number of olive varieties have been introduced into California, including the principal varieties of Spain, France and northern Italy. Many of these, especially the Italian varieties, are too small to make acceptable pickles and have been in great part abandoned or grafted over with larger varieties. Most of the recent plantings have consisted of Mission, Ascolano, Manzanillo and Sevillano, though about ten or twelve varieties are still found in commercial quantities. Short descriptions of the chief of these are given.

Mission (Fig. 2576).—The fruit of the common or broad-leaved Mission is typically olive-shaped, slightly oblique and pointed. Its deep color when ripe makes it suitable for ripe pickles. It ripens rather late and does not fruit nor mature well in the cooler sections. It varies in size from small to large according to soil, climate and cultural conditions. The ripe fruit is very bitter but it is firm and easy to pickle. It is one of the best oil olives among the large varieties, both as regards quantity and quality. More than half of the olives of California are of this variety.

Ascolano (Fig. 2576).—This variety, the largest of all the olives grown in California, comes from Italy, where it is grown in the province of Umbria. It is regularly ellipsoidal in shape and has a very small pit. It is sometimes called the "white olive of Ascoli" because it has very little color even when perfectly ripe. This is considered a defect for ripe pickles but by proper aëration during pickling, it can be made sufficiently dark and the color has the advantage of being very uniform. It maintains its size under most conditions and bears good crops in all the sections where it has been tried. It contains very little bitterness and requires very moderate lye treatment. Its flesh is somewhat tender and this and its large size make special care and skill necessary in preparing the ripe pickles. Many picklers have failed in this respect, but by the proper use of salt from the beginning and careful use of lye, success is not difficult and the pickles when well made command the highest price. Plantings of this variety have been heavy for several years and limited only by the scarcity of nursery trees.

Manzanillo, Number 1 (Fig. 2576).—This olive is of Spanish origin and, as its name indicates, it is apple-shaped. It is deeply colored and bitter when ripe and requires treatment with strong lye, but as it softens easily in pickling great care is needed. It ripens several weeks earlier than the Mission. It is on the average a little larger than the Mission though the largest samples of both varieties do not differ much. Its oil is somewhat inferior to that of Mission both in quantity and quality. *Manzanillo, Number 2* is the variety usually pickled in Spain. It is of excellent quality but too small for the Californian market.

Sevillano (Fig. 2576).—This is the variety from which the largest "Queen" olives of Spain are made. The largest specimens excel the Ascolano in size but it is less uniform. It is of typical olive-shape. It has a large pit and is deeply colored like the Mission. It is particularly suited for making both green and ripe pickles, but its large size makes special care necessary in the process. It is a good bearer in good, rich soil in warm localities but its range of adaptation seems more limited than that of the Ascolano.

Macrocarpa and *Polymorpha*, which seem to be synonyms, are very large and suitable for ripe pickles but are liable to a disease causing a spotting or softening of the flesh which much decreases their value.

Among other large-fruited varieties which have been tried and which have given good results in some sections are Obliza, Salonica, Regalis, Empeltre, and Columbella. These are not being largely planted now, as they are excelled in most respects by the four preferred varieties.

Among smaller varieties which under favorable conditions produce fruit large enough for pickling are the Nevadillo blanco, Oblonga, Pendulina and Uvaria. The Nevadillo (Fig. 2576) especially was planted largely at one time and under suitable conditions is one of the best oil olives. It is, however, sensitive to cold, subject to dry-rot of the fruit and in many sections an unreliable bearer. The Picholine, a variety used in France for "olives farcies" gives excellent fruit in California but has been little planted. The so-called Redding Picholine (Fig. 2576), which was largely planted some years ago under the impression that it was the true French Picholine, is a seedling whose fruit is very small and useless. Frantoio (Fig. 2576) is a type of Italian oil olive which does well in California, but is not profitable, as the fruit is too small for pickling.

Literature.

See publications of the Agricultural Experiment Station, Berkeley, California, especially Report for 1896, Bulletin Nos. 120, 123, 129, 137, and 158; also Reports of the Horticultural Commission, Sacramento, California, especially the Proceedings of the Olive-Growers' Conventions. Also Bleasdale, "The Olive Tree and Its Products," 1881; Calkins, "Gleanings in Olive-Culture," 1892; Cooper, "A Treatise on Olive-Culture," 1882; Flamant, "A Practical Treatise on Olive-Culture, Oil-making and Olive-pickling," 1887; Lelong, "The Olive in California," 1888; Marvin, "The Olive," 1888.

FREDERIC T. BIOLETTI.

OLIVE-BARK TREE: *Terminalia Catappa.*

OLIVERÁNTHUS (*Oliver's flower;* named in compliment to G. W. Oliver, U. S. Dept. Agric.). *Crassulàceæ.* A genus of 1 species, Mexican, separated from Cotyledon (or Echeveria), the fls. not strongly 5-angled, very large and solitary, at the ends of slender branches. **O. élegans,** Rose (*Cotylèdon élegans,* N. E. Br. *Oliverélla élegans,* Rose), is a caulescent and much-branched perennial, 12–20 in. high, with flat fleshy oblanceolate to spatulate lvs. closely placed near the ends of the branches: corolla about 1 in. long, bright red with yellow tips, elongated and the lobes nearly free to the base: carpels 5, free. B.M. 7993. G.C. III. 44:275.—An attractive summer-blooming plant, with large fls. of good substance borne on rather slender branches. It does very well out-of-doors at Washington, in sandy soil.

L. H. B.

OLNÈYA (Stephen T. Olney, American botanist and specialist in Carex). *Leguminòsæ.* One species, *O. Tesòta,* Gray, a small tree (15–20 ft. and more) in S. Calif., Ariz., and Mex., known locally as ironwood: often spiny: lvs. equally or unequally pinnate, the lfts. thick and entire, the stipules none: fls. white or purplish, in short axillary racemes; petals free and equal; stamens 10, diadelphous: pod 1–2-seeded, thick, with coriaceous valves, linear-oblong, 1–2 in. long, hairy. Probably not regularly in cult.

OMALÁNTHUS: *Homalanthus.*

OMPHÀLEA (Greek for *naval* or *center,* from the form of the disk or anthers). *Euphorbiàceæ.* Mostly climbing or twining shrubs of the tropics. Juice milky: lvs. alternate, entire, pinnately veined: fls. in terminal panicles, small, apetalous, monœcious; staminate calyx with 4–5 broad, free, imbricate sepals; stamens 2–3, filaments connate; ovary 3-celled, 1 ovule in each cell: fr. large, fleshy outside.—Twelve species in Trop. Amer. and 3 in the Old World tropics. Related to Sapium and Stillingia. Cult. in rich light soil; prop. by cuttings rooted with heat. *O. triándra*, Linn., Cob-Nut, Pop-Nut, Pig-Nut, with oblong obtuse lvs. and yellow fr. 1½ in. thick, has been cult. in Eu. The blackening juice of the fr. has been used in ink and the nuts eaten after removal of the poisonous embryo. W. Indies. L.B.C. 6:519. *O. megacárpa*, Hemsl., with lanceolate, acute lvs., is native and cult. in the W. Indies, the large seeds, Hunter's-Nut, being eaten as a nutrient and stimulant. H.I. 2537. *O. diándra*, Linn., with broad ovate or oblong lvs., or a related species, has been intro. from the mountains of Colombia, where the oily seed is eaten and fed to hogs. J. B. S. Norton.

OMPHALÒDES (Greek, *navel-shaped;* referring to the seeds). *Boraginàceæ.* Navelwort. Flower-garden and border plants, something like forget-me-not, not often seen in American gardens.

Annual or perennial herbs of low growth, glabrous or sparsely and minutely villous: root-lvs. long-stalked, lanceolate, ovate or cordate; st.-lvs. few, alternate: racemes lax, with or without a leafy bract at the base; calyx 5-parted; corolla-tube very short; lobes 5, imbricated, broad, obtuse; stamens 5, affixed to the tube, included; ovary 4-lobed. From Myosotis it differs in having depressed nutlets and nearly horizontal seeds, while in the forget-me-not genus the nutlets are ovoid, and the seeds erect. Since the cult. material is doubtful, the descriptions given below are adapted mostly from DeCandolle's Prodromus, vol. 10 (1846), with which the pictures cited agree rather poorly. The genus here characterized has the limits understood by Bentham & Hooker, and by Gray.—About two dozen species, native to the Medit. region, Cent. Asia, and Japan; also in Mex. and sparingly in W. U. S. (the latter by some referred to Eritrichium). For *O. longiflora*, see *Lindelophia.* The group to which Omphalodes belongs is variously understood by botanists.

Of this genus a few low-growing hardy herbs are cultivated, with flowers much like those of forget-me-not, but larger and usually with a white five-pointed star dividing the corolla-lobes. The flowers are often more or less pinkish, particularly toward the center. They like moist situations, but in deep shade grow too luxuriantly; also the flowers are fewer and of a weaker blue. Partial shade or full sunlight is preferable. The commonest kind is the "creeping forget-me-not," *O. verna,* which is a spring-blooming perennial of easy culture, producing runners freely and easily propagated by division. It can be grown by the yard in a rockery and can be easily naturalized in wild moist half-shaded spots. It is also good for fringing walks. It is said to like best a cool, moist loam, with a few bits of sandstone among which the roots may ramble and from which they may derive coolness and moisture. Perhaps the choicest kind is *O. Luciliæ,* also a spring-blooming perennial, but of tufted habit and impatient of division. It is a native of Asia Minor at a height of 8,000 feet, and grows in fissures of vertical cliffs. It is said to like a loose limestone soil, deep and well drained. When once established it self-sows. *O. linifolia* is a summer-blooming annual of easy culture. *O. verna* has a white-flowered kind, which is pretty but to most persons lacks the interest of a blue-flowered forget-me-not.

A. *Plant a summer-blooming annual.*

linifòlia, Mœnch. Erect, slightly glaucous, 1 ft. high: radical lvs. wedge-shaped; st.-lvs. linear-lanceolate, margin remotely ciliate: corolla twice as long as the calyx: nutlets dentate, inflexed at the margin. Dry, stony hills of Spain and Portugal. June–Sept. According to DeCandolle, the fls. are normally white, and it is var. **cærulèscens,** DC., which has bluish fls., sometimes tinged with rose. This interesting species belongs to a group of Omphalodes in which the nutlets are affixed laterally and lengthwise to the style which is pyramidal and has a square base.

AA. *Plants perennials, mostly spring-blooming.*

vérna, Moench. Creeping Forget-Me-Not. Stoloniferous perennial: flowering-st. erect: lvs. sparsely puberulous; radical ones long-petioled, ovate or subcordate; st.-lvs. short-petioled, sublanceolate; all lvs. acuminate, callous at the apex: fls. borne in pairs in a raceme. April, May. Eu. B.M. 7 (as *Cynoglossum Omphalodes*). Gn. 26, p. 315; 40:150; 72, p. 240.—Fls. light blue, according to DeCandolle. Var. **álba,** Hort., is also offered.

Lucíliæ, Boiss. Glabrous, tufted perennial: lvs. oblong, obtuse, the radical lvs. narrowed into a long petiole, the st.-lvs. sessile, upper ones ovate: pedicels longer than the nearest floral lf., erect, then arcuate-recurved: fls. blue; calyx-lobes ovate-oblong, somewhat obtuse, about one-fourth as long as the pedicels; corolla broadly funnel-shaped, about four times as long as the calyx: nutlets with an entire membranaceous margin. Mt. Sypilus near Manesis, and in Cilicia near Gulf of Scanderoon, at 8,000 ft. B.M. 6047 (some fls. light blue, others pinkish purple, all with a white eye). Gn. 27: 194; 69 p. 283. G.C. III. 40:53. G. 28:413.—Fls. about ½in. across, twice as large as those of *O. verna.*

cornifòlia, Lehm. (*O. cappadòcica,* DC.). Perennial herb, 6–8 in. high, sometimes grown as an alpine, with variable but usually cordate-lanceolate lvs. which are silky-hairy and with prominent arching veins: fls. about ½in. across, clear rich blue with small white eye, in loose erect cymes. Asia Minor. G.C. III. 53:380.

nítida, Hoffm. & Link. Perennial, with erect branching glabrous sts.: lvs. oblong-lanceolate, glabrous and shining above, pubescent beneath, the lower ones long-petioled and the upper ones sessile: fls. sky-blue with white center, in very long bractless racemes, the pedicels and calyx pilose. Portugal.—Said to be a plant of neat habit for half-shady moist places.

O. florariénsis, Corr., is a garden hybrid between O. Luciliæ and O. nitida (H. Correvon, Floraire, Geneva, Switzerland).

Wilhelm Miller.
L. H. B.†

ONCIDIÒDA (compounded from *Oncidium* and *Cochlioda*). *Orchidàceæ.* A genus established to contain the hybrids between Oncidium and Cochlioda.

O. Chárlesworthii (O. incurvum × C. Noetzliana) has the infl. of the former, the fls. scarlet and lavender. F.E. 33:499.—*O. cinnabarìna*=O. monachicum × C. Noetzliana.—*O. Coòksoniæ*=O. macranthum × C. Noetzliana.—*O. Mauricii*=O. tigrinum × C. vulcanica. G.C. III. 55:326. George V. Nash.

ONCÍDIUM (Greek, *a tubercle;* alluding to the crest on the labellum). *Orchidàceæ.* Epiphytal orchids for greenhouse growing.

Pseudobulbs usually present, wanting in a few species, 1–2-lvd., with sheathing lvs. at the base: lvs. plane, terete or triangular: petals like the dorsal sepal but often much larger; lateral sepals either free or partially united; labellum variable, but never with its base parallel to the column (Odontoglossum), spreading nearly at right angles to the column; column short, winged.—A broad genus with over 300 species distributed in Mex., Cent. and Trop. Amer., and in the W. Indies. In range of altitude the genus extends from the hot coast regions to elevations of 12,000 ft. in the Andes. The fls. of this genus show a remarkable diversity of form. In *O. varicosum, O. tigrinum* and related species, the labellum is greatly developed, forming the most conspicuous part of the fl., while in *O. serratum* and *O. macranthum* it is inconspicuous. The sepals and petals vary in size in relation to each other and to the rest of the fl. A remarkable example is *O. Papilio,* in which the petals and dorsal sepal have been transformed into linear-erect segms., recalling, on a large scale, the antennæ of some insect. The general habit of the plants is no less variable than the fls. They range in size from small erect forms, scarcely 6 in. in height (*O. pumilum*), to those resembling *O. altissimum*, with immense climbing panicles 9–12 ft. high and covered with numerous medium-sized fls. The prevailing color of the fls. is yellow, spotted and barred with brown. White or rose-colored fls. occur in a few rare examples (*O. incurvum, O. ornithorhynchum*).

As a class, oncidiums are short-lived under cultivation. Few growers succeed in maintaining them in good condition for any great length of time. The stock is constantly renewed from the tropics.

Cultivation of oncidiums.

The genus Oncidium embraces a great number of species which are found growing under such peculiar and varied conditions in their native homes that imitation of the same is usually impracticable and often quite impossible. A fair degree of success, however, may be obtained by careful observation and distribution of the exceptionally difficult species among the several orchid departments.

The Sarcoptera section, which embraces such species as *O. Cavendishianum, O. Lanceanum, O. luridum, O. pulvinatum* and others of similar structure, and the *O. Papilio* section, with *O. ampliatum*, may be successfully grown in a bright warm portion of the cattleya department in small baskets suspended from the roof, using for a compost a mixture of clean chopped peat and sphagnum moss, freely interspersed with lumps of broken charcoal. *O. cucullatum, O. incurvum, O. macranthum, O. ornithorhynchum, O. Phalænopsis, O. varicosum*, with a few others of like nature, do well under treatment similar to that given for odontoglossums, which see.

When a good collection of species is cultivated, a large number, including many of the above, can be readily grown in one house if it be especially adapted to them. Such a house should be a span-roof structure of east and west exposure, at an angle of about 40°, which will admit the longest possible light. The early morning and late afternoon sun striking the glass at right angles produces and prolongs the natural sun heat for a greater part of the day, while at midday, when the outside temperature is highest, the sun's rays strike the glass obliquely, giving less heat, with little danger of the plants becoming sunburned from lenses in the glass. Oncidiums require more sun and air than most orchids.

The benches may be of either wood or stone, and should be covered an inch or two in depth with sand, ashes or gravel. The benches and paths should be wet down once or twice daily to insure a moist atmosphere. Ventilators should be arranged on both sides of the roof: air may then be freely admitted without causing direct drafts on the plants by using the ventilators on the sheltered side. In winter the temperature should range from 50° to 55° F. at night and 60° to 65° by day, or a few degrees more with sun heat and ventilation. In summer it must be kept as low as outside conditions will permit. From March until October, shading must be applied to the glass sufficiently heavy to keep down the temperature without excluding indirect solar influence. A good shading is made of turpentine and white lead; it stands well and is easily removed. It can be applied rapidly with a whitewash brush on a long pole, and removed with a hard brush in the fall.

Oncidiums may be grown in either pots or baskets, but as many species are of rambling habit, the latter are preferable. The tiny species, such as *O. Limminghii*, do best on blocks with little compost beneath them. Clean chopped peat fiber and live sphagnum moss, equal parts, make the best general growing material, and this should be liberally interspersed with broken pieces of charcoal. The plants in all cases must be securely fastened, and the compost must be pressed in moderately firm, but should be used sparingly. Overhead syringing should be given frequently, about once or twice a day in bright weather, but care must be taken not to keep the compost too wet, for the roots are liable to decay: it is advisable to let them dry out occasionally.

Stock is increased by division or notching the rhizome between the pseudobulbs just before the growing season, allowing about three or four pseudobulbs to each piece and separating the parts after the first growth is matured.

For other cultural notes on the genus, see the various manuals on orchid-growing.

Robert M. Grey.

INDEX.

albiflorum, 31.
album, 31.
altissimum, 24, 25.
ampliatum, 19.
atratum, 7.
aurosum, 20.
Barkeri, 21.
Batemannianum, 28.
Baueri, 24.
bicallosum, 40.
bicolor, 12.
Bradshawæ, 7.
carthaginense, 43.
Cavendishianum, 41.
Cebolleta, 48.
Charlesworthii, 14.
cheirophorum, 37.
concolor, 18.
cornigerum, 10.
crispum, 9.
Crista-galli, 39.
Crookii, 21.
cucullatum, 11.
curtum, 8.
dasystyle, 17.
divaricatum, 32.
Eckhardtii, 45.
excavatum, 20.
flexuosum, 13.
Forbesii, 7.
grandiflorum, 9, 21, 26.
guttatum, 44.
Harrisianum, 29.
Harrisonianum, 29.
hastiferum, 5.
Henchmannii, 43.
incurvum, 23.
iridifolium, 39.
janeirense, 16.
Jonesianum, 47.
juncifolium, 48.
Kramerianum, 46.
Lanceanum, 42.
leucochilum, 30.
Limminghii, 36.
longipes, 16.
Louvrexianum, 42.
luridum, 44.
macranthum, 5.
maculatum, 35.
majus, 19, 31, 33.
Marshallianum, 6.
Martianum, 12.
micropogon, 1.
moortebeekiense, 14.
nubigenum, 11.
ornithorhynchum, 31.
Papilio, 45.
Phalænopsis, 15.
phymatochilum, 2.
pulvinatum, 33.
pumilum, 38.
reflexum, 27.
rhodoptera, 18.
Rogersii, 14.
roseum, 43, 44.
sanguineum, 43.
serratum, 3.
sphacelatum, 26.
splendens, 30.
splendidum, 22.
sulphureum, 6.
superbiens, 4.
superbum, 1, 42.
tigrinum, 21.
triquetrum, 49.
undulatum, 43.
unguiculatum, 18, 21.
unicolor, 13.
varicosum, 14.
Warneri, 34.

SYNOPSIS OF SECTIONS.

A. *Lvs. plane, not terete.*
  B. *Labellum smaller than the sepals and petals*... Species 1–5
  BB. *Labellum at least as large as the other segms., often greatly exceeding them.*
    C. *Lateral sepals more or less united at base.* Species 6–18
    CC. *Lateral sepals free.*
      D. *All the segms. having a distinct blade, none of them linear-subterete.*
        E. *Pseudobulbs present*.........Species 19–37
        EE. *Pseudobulbs wanting or obsolete* Species 38–44
      DD. *Only lateral sepals with distinct blade; dorsal sepal and petals elongate, linear, erect, with an obsolete blade*.....Species 45–46
AA. *Lvs. terete or subterete*...............Species 47–48
AAA. *Lvs. subtriangular in section*..........Species 49

DESCRIPTION OF SPECIES.

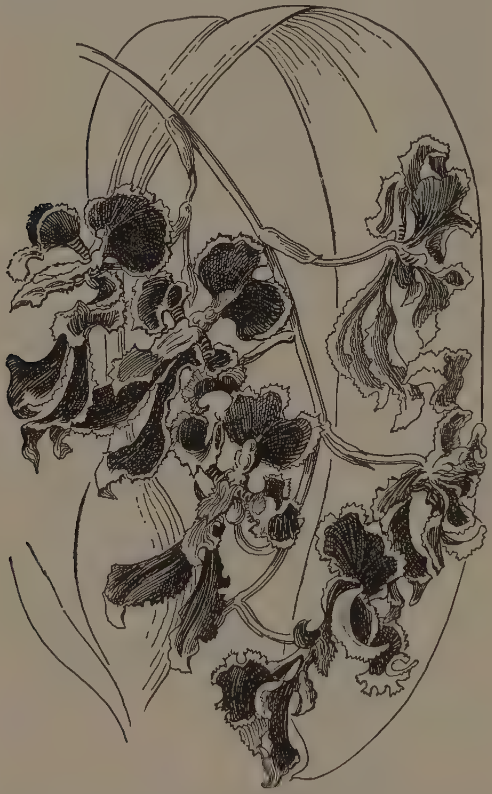
A. *Lateral sepals united at base*......... 1. **micropogon**
AA. *Lateral sepals free.*
  B. *Sepals and petals linear, flaccid*.... 2. **phymatochilum**
  BB. *Sepals and petals broad, serrate*.... 3. **serratum**
  BBB. *Sepals and petals broad, entire or subentire.*
    C. *Fls. brown*.................... 4. **superbiens**
    CC. *Fls. yellow*.................... 5. **macranthum**

1. **micropògon**, Reichb. f. Pseudobulbs almost in 2 rows on the rhizome, broadly ovoid: lvs. 4–6 in. long, linear-oblong, rounded at the top, leathery: raceme 8–10 in. long, on a long stalk, flexuous, pendulous; fls. 1½ in. across; sepals linear-oblong, undulate, yellow, barred with brown; petals clawed, orbicular, yellow, with a deep red-brown claw; labellum yellow, smaller than the petals, having 3 almost equal, rounded, clawed lobes. Aug. Trop. Amer. B.M. 6971. Gt. 4:308. Var. **supérbum**, Hort., is advertised.

2. **phymatochilum**, Lindl. Pseudobulbs broadly fusiform, 4–5 in. long, purplish brown, with several large

scales at the base: lvs. membranous, oblanceolate, 12–14 in. long: scape rather slender, over 1 ft. long, with a pendent panicle more than a foot long: sepals and petals linear-subulate, flaccid and somewhat twisted, greenish yellow, with deep orange blotches; labellum shorter than the sepals, white, with a yellow and orange crest; the middle lobe triangular-ovate, acuminate. Brazil. B.M. 5214. F.S. 23:2465. G.C. 1848:139.

3. **serràtum,** Lindl. Fig. 2577. Pseudobulbs 4–6 in. long, partly inclosed by sheathing lvs., 1–2-lvd.: lvs. about 1 ft. long and 2 in. broad: infl. a long, twining, loosely-branched panicle, 6–10 ft. long; fls. numerous, 3 in. across; upper sepals broad, reniform, the lateral ones very much longer, obovate, all chocolate-brown, with yellow tips and margins, strongly undulate, serrate; petals shorter, oblong, wavy and curled so that they almost meet over the column, yellow with brown spots, margins serrate; labellum small, hastate, fleshy, with a crest of 5 ridges. Winter. Peru. B.M. 5632. F.S. 6, p. 167.



2577. **Oncidium serratum.** (×½)

4. **supérbiens,** Reichb. f. Pseudobulbs 3–4 in. long, ovate to ovate-lanceolate, much flattened: lvs. linear, 14 in. long and 1¼–1½ in. broad, some sheathing the pseudobulb: panicle 2–3 ft. long, loosely branched and flexuous, bearing 20–30 fls. each 2½ in. diam.; sepals long-clawed, undulate, chocolate-brown with yellow tips; the upper one trowel-shaped, with a cordate base, the lower pair more ovate; petals rather smaller, with shorter, broader claws, much recurved and wavy, yellow with brown bars; labellum less than half as large as the sepals, revolute, trowel-shaped, with auriculate side lobes, brown with a yellow crest. Spring. Venezuela, Colombia. B.M. 5980.

5. **macránthum,** Lindl. (*O. hastiferum,* Hort.). Pseudobulbs ovoid or flask-shaped, 3 in. long: lvs. narrowly lanceolate, acuminate, 1 ft. long: panicle climbing, loosely branched and many-fld.; fls. 3–4 in. across; sepals rounded-oblong, with green claws, the upper one yellowish brown, the lower pair orange-yellow; petals similar, golden yellow, streaked with blood-red at the base; labellum small, hastate, purple-brown, with a prominent white crest. Spring and summer. Cent. Amer. B.M. 5743. Gn. 24:486. F. 1871, p. 187. J.H. III. 34:337.—A magnificent orchid, of which there are several varieties, some of secondary merit.

A. *Petals clawed, with a broad, obovate or rounded blade, not much smaller than the labellum.*
B. *Fls. yellow; column-wings short, quadrate*.................... 6. **Marshallianum**
BB. *Fls. red-brown; column-wings narrow, angular*.................. 7. **Forbesii**
BBB. *Fls. dull brown, with yellow markings.*
C. *Column-wings small, truncate*.... 8. **curtum**
CC. *Column-wings large, sharply serrate*.......................... 9. **crispum**
AA. *Petals and dorsal sepals obovate, cucullate, not clawed*..............10. **cornigerum**
AAA. *Petals and dorsal sepals subsimilar, very small; labellum larger than the rest of the fl.*
B. *Labellum white, spotted with rose-purple*.........................11. **cucullatum**
BB. *Labellum yellow.*
C. *Blade bifid*....................12. **Martianum**
13. **flexuosum**
CC. *Blade quadrifid*................14. **varicosum**
AAAA. *Petals and sepals lanceolate, ovate, at least one-half as long as the labellum and of a different form.*
B. *Fls. white, spotted with purple*......15. **Phalænopsis**
BB. *Fls. yellow or greenish, spotted and barred with brown.*
C. *Crest serrate*..................16. **longipes**
CC. *Crest a smooth, heart-shaped callus*........................17. **dasystyle**
BBB. *Fls. entirely yellow*..............18. **concolor**

6. **Marshalliànum,** Reichb. f. Pseudobulbs ovoid, 2–4 in. long: lvs. narrowly oblong, 6–8 in. long: fls. numerous, 2½ in. across, borne on a stout panicle 1–2 ft. high; the upper sepals oblong-apiculate, the lateral ones united, yellow, with purplish bands; petals much larger, fiddle-shaped, wavy and 2-lobed, golden yellow, with few blotches of chocolate-brown; labellum with a very large spreading 2-lobed middle lobe and ear-like side lobes, yellow, with orange-red spots on the base. May. Brazil. B.M. 5725. F.M. 1877:285.—A very effective and showy plant related to *O. crispum.* Var. **sulphùreum,** Hort., has yellow fls. without the usual markings.

7. **Fórbesii,** Hook. Pseudobulbs rather small, oblong, compressed and sulcate: lvs. lanceolate, dark green, 9 in. long: panicle about 1 ft. high, bearing numerous handsome fls. 2 in. across; fls. rich reddish brown, margined with yellow; sepals small, obovate; petals twice as large, obovate-rotund; side lobes of the labellum small; middle lobe spreading, fan-shaped. Autumn. Brazil. B.M. 3705. G.C. II. 11:525.—A rare but very ornamental orchid. Var. **atràtum,** Hort., has large fls., purple-brown. Var. **Brádshawæ,** Hort., an alpine form with yellow markings.

8. **cúrtum,** Lindl. Lvs. and pseudobulbs like those of *O. crispum:* infl. an erect, much-branched pyramidal panicle; fls. 1–1½ in. across; lateral sepals united, rather small; dorsal sepals and petals obovate-obtuse, yellow, with reddish brown bars and blotches; labellum with small lateral lobes and a roundish, notched middle lobe, yellow bordered with brown; crest lobed and warted, yellow, with red spots. Brazil. B.R. 33:68. Gn. 10, p. 131; 31, p. 198; 34, p. 87.—Blossoms in spring, the fls. remaining fresh for several weeks.

9. **críspum,** Lodd. Pseudobulbs oblong, sulcate, rough and usually dark brown: lvs. leathery, lanceolate,

about 9 in. long: fl.-st. 1–1½ ft. high, arched, bearing 20–50 large fls. 1½–3 in. across: fls. shining brown, with few yellow and red marks at the bases of the segms.; sepals obovate, obtuse, recurved and undulate, the lateral ones united; petals twice as large, broadly obovate, obtuse, much waved and crisped; middle lobe of the labellum large, rotund-cordate, waved and crisped; lateral lobes small, horn-like. Fls. at various seasons. Brazil. B.M. 3499. B.R. 1920. L.B.C. 19:1854. F.S. 21:2147, 2148. F.C. 2:64. B. 1:26. O. 1912, p. 18; 1913, p. 74. Var. **grandiflòrum,** Hort. Fls. very large, the segms. edged with yellow.

10. **cornígerum,** Lindl. Pseudobulbs oblong, sulcate, 3 in. long, 1-lvd.: lvs. dark green, broadly ovate to oblong, fleshy, ribbed, 4 in. long: panicle about 18 in. long, drooping, branched and crowded with fls. above; fls. small but numerous, yellow, spotted with red; dorsal sepals and petals obovate, concave, undulate, the lateral sepals smaller and united; labellum with long-linear lateral lobes and 2 horn-like processes at the base; middle lobe obovate, subrepand. April, May. Brazil. B.M. 3486. B.R. 1542.—A compact free-flowering plant which is very attractive when grown in baskets so that the long racemes can hang over the sides.

11. **cucullàtum,** Lindl. Pseudobulbs oval, 1½ in. long, smooth, becoming ribbed: lvs. oblong-lanceolate, 6 in. long: raceme almost simple, 8–12 in. long, bearing 6–12 fls. 1¼ in. across; dorsal sepals and petals small, oval, greenish, shaded with rose-purple; lateral sepals almost entirely united; labellum cordate-panduriform, with the middle lobe much dilated and 2-lobed, white to rose and spotted with dark purple. Spring. Colombia. F.S. 8:835; 23:2457. J.F. 3:317. J.H. III. 49:365. I.H. 25:305. Gn. 22:166 (var. *giganteum*).—A species with many varieties, which differ in shape and coloring of the fls. It is one of the coolest of the Andean orchids. Var. **nubígenum,** Lindl. Raceme suberect; sepals and petals white or light purple, with green tips; labellum white, with a purple blotch around the crest. B.M. 5708.

12. **Martiànum,** Lindl. (*O. bícolor,* Lindl.). Pseudobulbs ovate, compressed and ribbed: lvs. oblong, striate: fls. yellow, spotted; lateral sepals united, ovate, acute; petals obovate, concave; middle lobe of the labellum larger than the rest of the fl., 2-parted by the deep sinus in front, clear yellow. Autumn. Brazil. B.R. 29:66.—A beautiful yellow species, with a panicle 2 ft. high.

13. **flexuòsum,** Sims. Pseudobulbs ovate, flattened, 2 in. long: lvs. linear-oblong, 6 in. long: fls. scarcely 1 in. across; sepals and petals small, recurved, yellow, with chestnut bars; labellum yellow, with few reddish spots; side lobes small; middle lobe reniform, notched. Brazil. B.M. 2203. L.B.C. 5:424. Gn.W. 7:53.—The plant blooms freely at various seasons. The fls. open in succession on a loose spreading panicle about 2 ft. high. Var. **unícolor,** Hort., has clear unspotted fls.

14. **varicòsum,** Lindl. Pseudobulbs ovate, angled, 2–4 in. long: lvs. rigid, linear-lanceolate, 9 in. long: fl.-spikes strong, arching, 3 ft. long, with numerous fls. 1 in. across; sepals and petals small, green, with brownish blotches; labellum very large in proportion to the fl., bright yellow, with a curiously toothed crest; lateral lobes rotund; middle lobe reniform, obscurely 4-lobed. Winter and spring. Brazil.—One of the most attractive. J.F. 2:206, 207. J.H. III. 54:497; 69:355. Var. **Rógersii,** Reichb. f. (*O. Ródgersii,* Hort.). Fig. 2578. The best variety. Specimens have borne 150 fls., with the lip over 2 in. across, rich yellow, with a few red bars at base. G.C. 1870:277. F.S. 18, p. 150. F. 1870:25. Gn. 55:408. G.M. 39:366. A.F. 17:10. Gng. 10:38. J.H. III. 49:433. O. 1912, p. 18. Var. **Chárlesworthii,** Hort.. Lip 2¾ in. across. G.M. 45:566. Var. **moortebeekiénse,** Hort. A large reddish brown blotch at base of lip. G.M. 45:177.

15. **Phalænópsis,** Lind. & Reichb. f. A small-growing plant, with pseudobulbs oblong, somewhat ribbed, 1–2 in. high: lvs. narrow at the base, broadening upward, about 6 in. long: fls. 3–6 on a slender raceme, gaily colored, creamy white, with the sepals and petals barred with reddish purple, and the base of the lip profusely spotted with the same color; sepals and petals quite similar, oblong, acute; labellum pandurate, with 2 rounded lobes in front. Blooms at various seasons, and lasts a long time. Ecuador. I.H. 17:3. Gn. 41:492. J.H. III. 28:515.—A beautiful little plant, worthy of extended cult. Much like *O. cucullatum.*

16. **lóngipes,** Lindl. (*O. janeirénse,* Reichb. f.). Pseudobulbs narrowly ovate, 2-lvd.: lvs. narrow: scape several-fld., equaling the lvs.; fls. on long pedicels; lateral sepals elongate, pendulous, united at the base; dorsal sepals shorter and wider, recurved; petals oblong, plane; all yellowish green, barred with brown; labellum yellow, spotted with brown at the base; lateral lobes small, obtuse; middle lobe transversely broadened, apiculate, the narrow part serrated. Summer. Brazil. I.H. 2:54. B.M. 5193 (called *O. longipes,* is *O. Crœsus,* Reichb. f.).—A small species.

2578. Oncidium varicosum var. Rogersii. (×⅓)

17. **dasýstyle,** Reichb. f. Pseudobulbs ovate, flattened, strongly rugose: lvs. 4–5 in. long, linear-lanceolate: scape very slender, 6–7 in. long, bearing 2–5 fls., each 1½ in. across; dorsal sepals and petals subequal, lanceolate, pale yellow, blotched with purple-brown; lateral sepals larger, united half-way; labellum large, sulfur-yellow, with a blackish purple callus; lateral lobes small, triangular; middle lobe round-fan-shaped, membranous and undulate. Jan., Feb. Organ Mts., Brazil. B.M. 6494.

18. **cóncolor,** Hook. (*O. unguiculàtum,* Klotzsch). Pseudobulbs small, oval-oblong, slightly furrowed: lvs. lanceolate: fls. 1–2 in. diam., rich yellow, borne on pendulous racemes 1–2 ft. long; lateral lobes united for half their length, smaller than the dorsal sepals and petals, which are obovate; labellum twice as long as

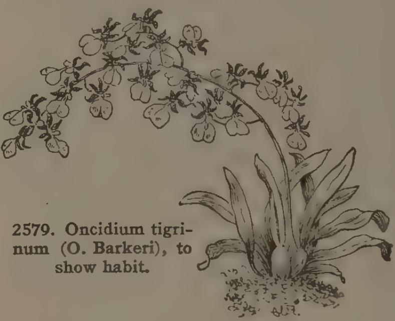
the sepals, broad, flat, bilobed, with 2 reddish ridges running down on the base. April–June. Organ Mts. B.M. 3752. I.H. 30:487. R.H. 1881:30. Gn. 13:58. G. 26:237; 27:133; 35:301.—A plant of close and compact habit, making one of the most attractive yellow coolhouse orchids. Var. **rhodóptera,** Hort. Upper part of column-wings and margin of stigma red.

A. *Labellum with a large reniform mid-lobe; lateral lobes small or none.*
  B. *Petals much broader than the sepals* 19. **ampliatum**
    20. **excavatum**
  BB. *Petals and sepals nearly of the same size.*
    C. *Fls. over 2 in. across; labellum large, forming the most conspicuous part of the fl.; panicle stout*......................21. **tigrinum**
      22. **splendidum**
    CC. *Fls. medium-sized, numerous, in long, climbing panicles.*
      D. *Sepals and petals linear-lanceolate, acute.*
        E. *Color of fls. white and purple.*23. **incurvum**
        EE. *Color of fls. yellow and brown.*
          F. *Column-wings very truncate; crest of several interrupted ridges*.......24. **Baueri**
          FF. *Column-wings rounded, slightly crenulate*......25. **altissimum**
          FFF. *Column-wings erose, sphacelate*............26. **sphacelatum**
          FFFF. *Column-wings falcate, dentate*..................27. **reflexum**
      DD. *Sepals lanceolate; petals spatulate*......................28. **Batemannianum**
      DDD. *Sepals and petals linear to oblong, obtuse.*
        E. *Color of labellum yellow*....29. **Harrisonianum**
        EE. *Color of labellum white*.....30. **leucochilum**
AA. *Labellum with the middle lobe variously shaped, rarely reniform, but more so than the lateral lobes, large.*
  B. *Fls. rose-colored*.................31. **ornithorhynchum**
  BB. *Fls. yellow, variously marked and spotted.*
    C. *Crest pulvinate, pubescent*.......32. **divaricatum**
      33. **pulvinatum**
    CC. *Crest not pulvinate.*
      D. *Apex of labellum deeply 2-lobed*.....................34. **Warneri**
      DD. *Apex of labellum apiculate, lateral lobes tooth-like*.......35. **maculatum**
      DDD. *Apex of labellum merely emarginate, lateral lobes large.*
        E. *Middle lobe broadly reniform, clawed*............36. **Limminghii**
        EE. *Middle lobe not clawed, separated from the lateral lobes merely by a sharp constriction*...................37. **cheirophorum**

19. **ampliàtum,** Lindl. Pseudobulbs subrotund, compressed, bright green with purple spots, becoming blackish purple and wrinkled with age: lvs. plane, oblong-lanceolate, 9 in. long: infl. a large panicle 1–3 ft. long, with numerous fls., which are yellow, spotted with red at the bases of the segms.; sepals and petals small, the former entirely free; labellum reniform, spreading, wavy, 1½ in. across, narrow at the base, with 2 small lateral lobes and a prominent lobed crest. March–May. Throughout the coast of Nicaragua. B.R. 1699.—The fls. are produced in magnificent panicles. In var. **màjus,** Hort., they are half again as large as in the type. F.S. 20:2140, 2141. G.C. III. 17:173. Gn. 45, p. 491. G.M. 27:475. C.L.A. 6:166. G. 17:202. J.H. III. 54:295.

20. **excavàtum,** Lindl. (*O. auròsum,* Reichb. f. & Warscz.). Pseudobulbs oblong, compressed, 3–5 in. long: lvs. 1½ ft. long, leathery, shining green: panicle 3–5 ft. long, with numerous fls. 1½ in. across, yellow, spotted with brown; sepals obovate, obtuse, free; petals oblong, retuse; labellum sessile, with several broken ridges near the base, pandurate, excavated on the under side; middle lobe rotund, emarginate. Autumn. Peru. B.M. 5293. I.H. 17:34.—Strong plants produce as many as 100 fls. on each panicle.

21. **tigrìnum,** LaLlave & Lex. (*O. Bárkeri,* Lindl. *O. unguiculàtum,* Lindl.). Fig. 2579. Pseudobulbs oval, compressed, 2-lvd.: lvs. oblong-lanceolate, thick, 1 ft. long: panicle erect, stout, 3 ft. high; fls. 2½ in. across; sepals and petals similar, lanceolate, undulate, rich reddish brown, with few bars and spots of yellow; labellum yellow, with a very large, orbicular-reniform blade supported on a long claw, lateral lobes oblong. Winter. Mex. I.H. 1:2; 22:221. P.M. 14:97. R.H. 1889, p. 176.—Very much like *O. splendidum,* from which it differs by the longer claw of the labellum having a thick keel, and the oblong lateral lobes of the labellum. Both are among the most showy oncidiums in cult. Var. **grandiflòrum,** Hort., is advertised. Var. **Crŏckii,** Hort. Sepals and petals marked with light brown bands.


2579. Oncidium tigrinum (O. Barkeri), to show habit.

22. **spléndidum,** A. Rich. Pseudobulbs small, round, compressed, 1-lvd.: lvs. leathery, oblong-ovate, 6–12 in. long: fl.-stalk erect, 2 ft. long; fls. 3 in. across; sepals and petals similar, lance-oblong, acute, recurved, yellow-green, with broad brown bands; labellum very large, yellow, the broad claw of the middle lobe expanding into a large reniform blade; lateral lobes small, rotund. Spring. Guatemala and Mex. B.M. 5878 (as *O. tigrinum* var. *splendidum*). F.S. 18:1825. Gn. 51:410. R.B. 17:108. G.C. 1871:42; III. 3:108.

23. **incúrvum,** Barker. Pseudobulbs ovate, compressed and ribbed, 2 in. long: lvs. 9 in. long, ensiform, acute: panicle 2–3 ft. long, slender, much branched and gracefully arched; fls. 1½ in. across, numerous; sepals and petals linear-lanceolate, undulate, white, banded with purple; labellum white, with a purple blotch; lateral lobes rotund, small; middle lobe subreniform, concave. Bears numerous panicles in autumn. Mex. B.M. 4824. B.R. 31:64. I.H. 2:49; 29:444 (white variety).

24. **Baùeri,** Lindl. (*O. altíssimum,* Lindl.). Pseudobulbs oblong, compressed: lvs. ensiform, rigid, keeled: panicle with numerous branches and rather dingy fls.; sepals and petals about as long as the labellum, linear-lanceolate, undulate, yellow, with red spots; labellum with 2 spreading lateral lobes and a reniform emarginate midlobe, yellow, with a reddish band. Trop. Amer. B.R. 1651 (as *O. altissimum*).—A gigantic epiphyte with fl.-sts. 6–9 ft. long and "lvs. as long." It has been confused with *O. altissimum.*

25. **altíssimum,** Swartz. Pseudobulbs nearly rotund, much compressed and edged: lvs. 1–2 at the top and several at the base of the pseudobulb, ensiform, keeled, 1½–2 ft. long: infl., an almost simple, drooping raceme, 4–6 ft. long; sepals and petals free, similar, spreading, linear-lanceolate, undulate, pale yellow, with olive-brown blotches; labellum nearly as long as the petals, fiddle-shaped, with the middle lobe reniform, spreading, yellow, with a brown band near the center, prominently crested. Aug. W. Indies. B.M. 2990. B.R. 1851.

26. **sphacelàtum,** Lindl. Pseudobulbs elongate-ovate, compressed: lvs. long, ensiform, apex recurved: scape

strict, bearing a many-fld. panicle; sepals and petals linear-lanceolate, undulate, yellow, spotted with brown; labellum about as long as the sepals; lateral lobes auriculate; middle lobe with 2 rotund lobes, yellow, with brown spots at the base. Spring. Honduras and W. Indies. B.R. 28:30. Var. **grandiflòrum,** Hort., is a better variety.

27. **refléxum,** Lindl. Pseudobulbs ovate, 1-lvd.: lvs. narrowly lanceolate, acute: panicle with its stalk 3–4 ft. long, pendulous; sepals and petals linear-lanceolate, undulate and reflexed, yellowish, shaded with pale brown; labellum with a large, reniform, emarginate middle lobe and rotund lateral lobes, yellow, with few reddish spots on the base. Mex. B. 3:116.

28. **Batemanniànum,** Parm. Pseudobulbs large, 4–5 in. long, with sheathing lvs. at the base: lvs. oblong-ensiform, 2 ft. long: scape erect, 6–8 ft. long; sepals lanceolate, undulate, reddish brown, slightly marked with yellow; petals similarly colored, spatulate and very much undulate; labellum brilliant yellow, with the crest marked with brown; lateral lobes small, rounded; middle lobe large, reniform, emarginate. Brazil. F.C. 3.137.—Related to *O. altissimum.*

29. **Harrisoniànum,** Lindl. (*O. Harrisiànum,* Hort.). Pseudobulbs subglobose, 1-lvd.: lvs. linear-oblong, acute, fleshy and recurved: panicle about a foot high, erect, with the st. and branches gracefully curved; sepals and petals linear, obtuse, yellow, spotted with purple-brown; labellum yellow, longer than the sepals, with small lateral lobes and a subreniform, emarginate middle lobe. Autumn. Brazil. B.R. 1569. L.B.C. 20:1917. R.B. 18:253. O. 1912, p. 8. G.W. 11, p. 518; 14, p. 519.

30. **leucochìlum,** Batem. Pseudobulbs sulcate, ovate, compressed, 2–4 in. long: lvs. sword-shaped, 1 ft. or more in length: scape 3–4 ft. high, with numerous branches on which the fls. are loosely scattered; sepals and petals oblong, obtuse, green, blotched with reddish brown; labellum pure white; lateral lobes small, rounded; middle lobe broadly reniform, emarginate. Autumn. Guatemala. F.S. 5:522. P.M. 7:241. G. 28:387. J.H. III. 43:215.—A noble species, with the habit of *O. Baueri.* Panicles 6–9 ft. long. Var. **spléndens** is listed.

31. **ornithorhýnchum,** HBK. Fig. 2580. Pseudobulbs oblong, compressed, 2–3 in. long, 2–3-lvd.: lvs. grass-like, 8–12 in. long: stalks 1 ft. long, slender and arched, many-fld.: fls. scarcely 1 in. across, soft rose-purple; sepals linear-oblong, wavy; petals oblong and a little broader; labellum pandurate, with small lateral lobes and a larger dilated, emarginate middle lobe. Fragrant. Autumn and winter. Mex. B.M. 3912. B.R. 26:10. F.C. 3:136. R.H. 1876:230.—This is an easily grown, free-flowering plant of dwarf, compact habit. Its soft rose-purple color is very delicate and unusual in the genus. Var. **albiflòrum,** Reichb. f. (var. *álbum,* Hort.). Fls. whitish, with only the calli yellow. F.M. 1880:398. G.C. III. 16:781. J.H. III. 29:399. G.M. 38:18. There is also a variety called **màjus.**

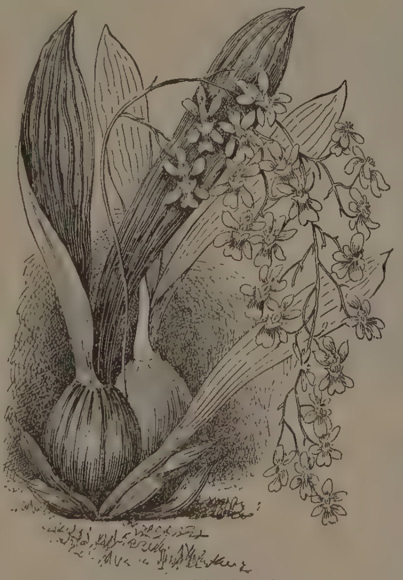
32. **divaricàtum,** Lindl. Pseudobulbs compressed, each with a fleshy, oval, apiculate lf.: scape 1½ ft. high, with the branches of the panicle extremely divaricate; sepals and petals oblong-spatulate, greenish yellow, spotted with purple toward the base; labellum yellow, spotted with red; lateral lobes large, half-rotund; middle lobe smaller, emarginate. Autumn. Brazil. B.R. 1050. L.B.C. 13:1212. P.M. 3:4.—A floriferous species easily recognized by its singular oval, fleshy lf. and the divaricate panicle.

33. **pulvinàtum,** Lindl. Panicle very much branched, in a loose, spreading manner, weak, 8–9 ft. long; fls. yellow, with the sepals and petals blotched with red; segms. obovate, acute; the 2 parts of the labellum nearly equal; lateral lobes rotund-crenate and crisp; middle lobe undulate, crest a villous cushion. Summer. Brazil. B.R. 25:42.—One of the largest of the oncidiums. The fls. last a long time. Var. **màjus,** Hort., is said to be desirable.

34. **Wárneri,** Lindl. (*Odontoglóssum Wárneri,* Lindl.). Pseudobulbs ovate, somewhat angular: lvs. linear-lanceolate: raceme short, few-fld.; sepals oblong; petals a little wider; all white or yellowish, striated with rose-purple; labellum brilliant yellow; lateral lobes subquadrate; middle lobe deeply divided into 2 rounded lobes. Autumn. Mex. B.R. 33:20 (var. *purpuratum,* Lindl.).

35. **maculàtum,** Lindl. Pseudobulbs ovate, compressed, 4-angled, 2-lvd.: lvs. broadly linear-oblong: fls. 1¼ in. across, yellow, spotted with deep purple; sepals and petals subequal, rather fleshy, ovate-subacuminate; labellum oblong-apiculate, the lateral lobes forming 2 large teeth near the middle; middle lobe ovate, sulfur-yellow, base marked with few red lines, claw with 4 horn-like plates. Winter. Mex. B.M. 3836 (var. *ecornutum*) and 3880. B.R. 24:44. F.C. 2:57 (all as *Cyrtochilum maculatum*).

36. **Límminghii,** Morr. Pseudobulbs oval, compressed: lvs. oblong, acute, mottled: raceme 1–2-fld., erect, several times longer than the small lvs.; fls. yellow, spotted and banded with brown; sepals and petals lanceolate, the lower pair larger; labellum with large, auriculate lateral lobes and a transversely broadened, subreniform, emarginate mid-lobe, spotted with red. June, July. Caracas. F.S. 18: 1827.—A pretty dwarf plant with the habit of a sophronitis.



2580. Oncidium ornithorhynchum. (×¼)

37. **cheiróphorum,** Reichb. f. Pseudobulbs 1 in. long, ellipsoid: lvs. 3–6 in. long, linear-lanceolate: scape bearing a dense panicle longer than the lvs.; fls. about ½in. across, entirely bright yellow, with greenish sepals; sepals and petals small, rounded-ovate, spreading or reflexed; labellum much larger, with three large lobes, the middle lobe notched. Colombia. B.M. 6278. G.C. 1871:168, desc. J.H. III. 65:591; 68:575.

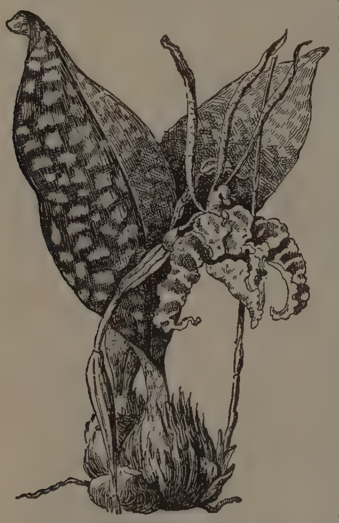
A. *Plants dwarf, scarcely over 8 in. high.*
  B. *Labellum with 3 equal lobes* ......38. **pumilum**
  BB. *Labellum with small lateral and a 4-parted middle lobe*............39. **Crista-galli**
AA. *Plants large.*
  B. *Wings of the column narrow, falcate*.........................40. **bicallosum**
  41. **Cavendishianum**
  BB. *Wings of the column fleshy, rotund, reniform, etc.*
    C. *Labellum pandurate, with triangular lateral lobes*............42. **Lanceanum**
    43. **carthaginense**
    CC. *Labellum reniform, with small blunt lateral lobes*............44. **luridum**

38. **pùmilum,** Lindl. A small plant about 6 in. high, without pseudobulbs, and with oblong, leathery lvs.: infl. a small, branched panicle, scarcely longer than the lvs.; sepals and petals obovate, yellow, spotted with brown; labellum yellow, rounded, trifid. Spring. Brazil. B.M. 3581. B.R. 920. L.B.C. 18:1732. J.H. III. 47:459.

39. **Crísta-gálli,** Reichb. f. (*O. iridifòlium*, Lindl., not HBK.). Lvs. radical, cuneiform-ligulate, 2–3 in. long: fl.-sts. several, 1–2-fld., slightly exceeding the lvs.: fls. yellow, with few red spots at the base of the segms. and labellum; sepals lanceolate, acute; petals oblong, crisp, much wider; labellum large; lateral lobes oblong-cuneate; middle lobe divided into 4 lobes, of which the inner 2 are smaller. B.R. 1911.—A very small, neat plant.

40. **bicallòsum,** Lindl. Pseudobulbs none: lvs. large, oblong-lanceolate, keeled, thick and leathery: panicle many-fld., variable in size; fls. 2 in. diam.; sepals free, obovate, concave; petals oblong-obtuse, undulate; all rich yellow or honey-colored, bordered with cinnamon-color; labellum with small, narrow lateral lobes, and a pair of tubercles for a crest; middle lobe large, transversely expanded, emarginate, subcordate. Autumn and winter. Guatemala. B.M. 4148. B.R. 29: 12. I.H. 12:458.

41. **Cavendishiànum,** Batem. Pseudobulbs none: lvs. fleshy, broadly lanceolate, 1–1½ ft. long: scape 4 ft. high, erect, with a dense panicle about 1 ft. long; sepals and petals oblong-obtuse, greenish yellow, with bright chestnut spots; labellum yellow; lateral lobes rather large, spreading, rounded, narrowed to a claw; mid-lobe broadly reniform and deeply emarginate. Guatemala. G. 27:164. G.W. 3, p. 471.—Grows very slowly.


2581. Oncidium Papilio. (×⅓)

42. **Lanceànum,** Lindl. Pseudobulbs wanting: lvs. fleshy, oblong, acute, 1 ft. long and about 3 in. broad: scape stiff, erect, branched above and 1 ft. or more in length; fls. 2–3 in. across, numerous; sepals and petals oblong, obtuse, fleshy, concave, yellow, marked and barred with chocolate-brown or crimson; labellum narrow in the middle, with the 2 lateral lobes forming a hastate base, middle lobe broadly expanded, cuneate. The color of the labellum is variable, usually rose in front, becoming violet toward the base. Summer. British Guiana. B.R. 1887. F.S. 18:1842, 1843. P.M. 4:169. F.C. 2:79. G.C. II. 21:609; III. 54; 279. G. 31:613. G.W. 10, p. 403. Var. **supérbum,** Hort., is described as a superior variety. Var. **Louvrexiànum,** Hort. (*O. Louvrexiànum*, Hort.). A variety with yellow fls., prettily spotted and marbled; labellum yellow at the base, white in front.

43. **carthaginénse,** Swartz (*O. Hénchmannii*, Lodd. *O. ròseum*, Lodd. *O. undulàtum*, Salisb. *O. sanguíneum*, Lindl.). Pseudobulbs obsolete: lvs. solitary, oblong, acutish: panicle 3 ft. long and loose; fls. small, whitish, marked and blotched with red and bordered with yellow; sepals and petals oblong-ovate, free, waved; labellum with horizontal, triangular lateral lobes and a fan-shaped middle lobe, crimson, with a yellow border. Summer. Trop. Amer. B.M. 3806 (as *O. Hunteanum*). F.C. 3:97 (as *O. luridum* var. *Henchmannii*).

44. **lùridum,** Lindl. Lvs. elliptical, thick, rigid, dull green, 15 in. long: scape slender, 3 ft. high, much branched and many-fld.; fls. nearly 1½ in. diam., dark green or olive-green, with indistinct darker spots; sepals clawed, undulate, crenate, obtuse, warted on the back, the upper one rotund, the others spatulate-oblong; petals larger and without warts; labellum reniform, almost plane. S. Amer. B.M. 3603. B.R. 727.—The panicle is said to grow to a height of 9 ft. A var. **ròseum,** Hort., is said to have rose-colored fls., spotted with white and bordered with yellow. Var. **guttàtum,** Lindl., has yellow fls. spotted with orange. B.R. 25:16.

45. **Papílio,** Lindl. Butterfly Orchid. Fig. 2581. Lvs. oblong, very leathery, olive-green, mottled with purplish brown, 6–8 in. long: peduncle 2–3 ft. long, flattened and jointed, producing fls. several years in succession; fls. 4–5 in. long and 2½ in. across; dorsal sepals and petals erect-linear, with a small lanceolate expanded portion, brown, with bands of yellow; lower sepals lanceolate-falcate, curved downward, yellow, with heavy bands of brown, labellum pandurate, usually plane, with the middle lobe rounded, transversely broadened, emarginate, yellow, with a broad band of brown around the margin; wings of the column toothed. Fls. at any season. W. Indies. B.M. 2795; 3733 (var. *limbatum*). B.R. 910. L.B.C. 11:1086. F.S. 9:920–2. P.M. 5:175. F.C. 1:12. F. 1842:49.—Variable in color of fls. and lvs. Lvs. sometimes green on the upper surface. Var. **Éckhardtii,** Lind. All parts of the fl. very large; sepals and petals golden yellow, barred with red; labellum yellow, with a broad margin of brown. I.H. 30:500.

46. **Krameriànum,** Reichb. f. This species is much like *O. Papilio*. Pseudobulbs rounded, 4–7-angled: st. terete: petals and dorsal sepals shorter than in *O. Papilio*, apex more distinctly dilated; lateral sepals golden yellow, spotted (not banded) with cinnamon-brown, crisp, undulate, finely toothed; labellum very crisp and undulate, finely toothed, pale yellow, with a narrow band of cinnamon-brown spots around the margin; column-wings entire. Cent. Amer. F.S. 19:1956. I.H. 41, p. 206. Gn. W. 20:738.

47. **Jonesiànum,** Reichb. Plants with fleshy, rush-like lvs. 3–12 in. long and usually hanging downward: fl.-sts. 6 in. to 2 ft. long, the largest bearing about a dozen fls. 2 in. across; sepals and petals oblong, wavy, cream-colored, with sepia-brown spots; labellum white, yellow at the base, with a few crimson spots near the isthmus; middle lobe large, subreniform, 2-lobed, wavy; lateral lobes toothed. Fls. at various seasons. Paraguay. B.M. 6982. R.B. 15:7. Gn. 31:148.—The handsomest of the round-lvd. species.

48. **Cebollèta,** Swartz (*O. juncifòlium*, Lindl.). Pseudobulbs very small, each with a single, terete, obscurely furrowed lf.: lvs. 1 ft. long, spreading, harsh in texture: panicle rigid, erect, about 2 ft. high; sepals and petals nearly equal, obovate, greenish yellow, spotted with red; labellum large, bright yellow; lateral lobes broadly obovate; middle lobe broadly obovate or subreniform, undulate, notched in front. Spring and summer. Brazil. B.M. 3568. B.R. 1994; 28:4 (as *O. longifolium*).

49. **triquètrum,** R. Br. (*Cymbídium triquètrum*, Swartz. *Epidéndrum triquètrum*, Swartz). Pseudobulbs none: lvs. few, 4–6 in. long, triquetrous and grooved: scape about as long as the lvs., purplish, bearing a raceme of 10–12 medium-sized fls.; sepals broadly lanceolate, the lower pair united, purplish green; petals ovate, white, tinged with green and spotted with purple; labellum cordate-ovate, constricted near the middle, white spotted with purple; crest orange. Autumn. Jamaica. B.M. 3393.

LXXVII. Onion.—The Prizetaker, a handsome pale yellow popular variety.

O. abortìvum, Reichb. f. Greater number of fls. abortive; perfect fls. pale yellow with chestnut-brown markings. Venezuela. G.C. III. 46:322.—*O. anfráctum,* Rolfe. Scapes rather slender, about 3 ft. long; fls. bright yellow, with dark brown bars on sepals and petals. Venezuela.—*O. ansíferum,* Reichb. f. Sepals and petals oblong-obovate, free, crisp; labellum with ligulate lateral lobes and a reniform, emarginate middle lobe, golden yellow, with 2 dark brown bars at the base, flaccid. The sepals and petals are greenish, with yellow tips. Colombia.—*O. anthocrène,* Reichb. f. Fls. yellow, brown-barred, fragrant; sepals cuneate-oblong, undulate-crisped, acute, about equaling the petals; lip with lateral lobes deflexed, the isthmus narrow, the front lobe broad, reniform, 2-lobed. Colombia.—*O. armillàre,* Lindl. Sepals and petals lanceolate, acuminate; crest of 3 flexuous keels. Peru. Gt. 7:296.—*O. Baldeviàmæ,* Reichb. f. (O. Balderramæ, Reichb. f.). Panicle ample; dorsal sepals rounded, clawed, crisp, yellowish olive-brown with a yellow border; lower sepals longer clawed, cuneate-oblong, unicolored; petals oblong, short-clawed, crisp, nearly complicate, smaller than the sepals, yellow, with brown blotches; labellum hastate, ligulate, obtuse. Summer. Colombia.—*O. Bállii,* Rolfe. Scape about 12 in. long; panicle about 7 in. long, many-fld.; fls. small, bright yellow with brown markings on lower half of sepals and petals; base of lip dark shining brown. Habitat (?).—*O. Beyrodtiànum,* Schlecht. Allied to O. varicosum and O. flexuosum but distinguished by the crest of the lip, which is simple, quadrate-rounded, and scarcely warty above the base.—*O. bicotiénse,* Hort. ex-Lindl.=Odontoglossum sp.—*O. bidentàtum,* Rolfe. Scapes slender, about 6 ft. long; fls. medium-sized, yellow marked with brown. Ecuador.—*O. bifòlium,* Sims. Fls. yellow, the dorsal sepal and petals brown-barred, undulate, the lateral sepals united below; lip broad, reniform, 2-lobed. Argentina. G.W. 10, p. 80.—*O. cæsium,* Reichb. f.=O. Geertianum.—*O. caloglóssum.* Reichb. f. A supposed natural hybrid between O. Marshallianum and O. Forbesii. Sepals and petals yellow, with dark brown stripes nearly confluent on the petals. Brazil. Var. *cóncolor* is a yellow-fld. form.—*O. cardiochìlum,* Lindl. Panicle large, lax-branching; fls. numerous, about 1½ in. across; sepals and petals brown; lip yellow. Colombia.—*O. Chárlesworthii,* Hort. (supposed to be natural hybrid). Fls. racemose, chestnut-red, lip yellow at base. G.C. III. 45:377.—*O. Clæsii,* Rolfe. Sepals bright chocolate-red; petals and lip deep carmine, shaded with violet. Colombia.—*O. corynephòrum,* Lindl. Sepals and petals rounded, undulate, light rosy purple, broadly white-margined; lip orbicular, deep violet-purple with a yellow base. Peru. G.C. III. 38:340.—*O. cristàtum,* Beer=Odont., cristatum.—*O. Fóstermannii,* Hort.=(?).—*O. fuscàtum* Reichb. f.=Miltonia Warszewiczii.—*O. Gárdneri,* Lindl. (O. Gardnerianum, Hort.). Resembles O. crispum and O. Forbesii. Fls. lemon-yellow, spotted and barred with chestnut-brown on the sepals and petals; labellum broad, yellow, margined with the same color; all segms. undulate, crisp. Brazil. G.C. II. 16:86. F.M. 1880:401. J.H. III. 47:415; 56:489. This is probably O. curtum, Lindl., which should be referred to this species.—*O. Geertiànum,* Morr. (O. cæsium, Reichb. f.). Species probably based on a variety of O. reflexum.—*O. graminifòlium,* Lindl. (O. Wrayæ, Hook.). Fls. panicled, yellow; sepals and petals blotched with deep brown, oblong-elliptic, acute; lip large, broadly obovate, lobed. Mex. B.M. 3854.—*O. Gravesiànum,* Rolfe. Pseudobulbs broadly oblong-compressed, 3 in. long: lvs. elliptic-oblong, 4 in. long: panicle large, branching; fls. 2 in. across, yellow, spotted with brown; dorsal sepals spatulate; lateral sepals lanceolate-oblong, united at base; petals obovate, wider than the sepals; labellum pandurate, with small spatulate lateral lobes and a broadly orbicular-ovate, undulate middle lobe. Brazil. R.B. 21:73. G.C. III. 11:651. Near. O. crispum.—*O. hastàtum,* Lindl. Sepals and petals yellow, spotted with brown; labellum pale yellow. Mex.—*O. hýbridum*=O. tigrinum × O. lamelligerum.—*O. illústre* is a supposed natural hybrid between O. leucochilum and O. maculatum.—*O. Jánssenii*=O. tigrinum × O. Forbesi.—*O. Johniànum,* Schlecht. Lip 3-lobed, shorter than sepals, lateral lobes very obtuse, about ¼in. long. Brazil.—*O. lamellígerum,* Reichb. f. Fls. large; sepals light brown, margined with yellow; petals very crisped, light yellow; lip narrow, light yellow, stained with purple. Ecuador.—*O. lancifòlium,* Lindl. (O. sessile, Lindl. & Paxt.). Pseudobulbs oblong: lvs. short, pale green: panicle much branched and bearing a large number of fls.; sepals and petals large, obtuse, yellow, spotted with cinnamon-brown at the base; labellum large, of the same color. Ecuador.—*O. Lávenderi.*—*O. Lawrenciànum,* Reichb. f.=Brassia Lawrenciana.—*O. Leopoldiànum,* Rolfe. Fls. panicled, numerous; sepals and petals white, with a large purple spot; lip violet-purple, the disk yellow. Andes. G.M. 48:711.—*O. Lòwii* is a supposed natural hybrid. Infl. over 6 ft. in length; fls. numerous, yellow spotted with brown.—*O. Mántinii* is a supposed natural hybrid between O. Marshallianum and O. Forbesii. Sepals and petals yellow, centers covered with rich chestnut-brown; lip clear yellow, with few purplish brown spots. Var. *Lòwii,* Hort., has the fls. unusually large.—*O. McBeaniànum*=O. superbiens × O. macranthum.—*O. microchìlum,* Batem. Fls. colored like O. crispum, panicled; sepals free, and, like the petals, oblong, undulate, and retuse; lip nearly round, cordate, barely half as long as the sepals. Guatemala.—*O. Mùlleri,* allied to O. corynephorum and perhaps a form of it. Sepals and petals white, tinged with rose; lip rose-purple, with a cream-yellow crest. Peru.—*O. murìnum,* Reichb. f. A species with numerous small yellow fls. borne in panicles.—*O. oblongàtum,* Lindl. Fls. yellow; petals flat, undulate, with a few reddish brown basal bars. Mex.—*O. obryzàtum,* Reichb. f. & Warsc. Fls. golden yellow, spotted with brown, borne in a much-branched panicle. Peru. Said to be an elegant winter-flowering orchid.—*O. platybúlbon,* Regel. Panicle about 4 in. long; fls. rather crowded; sepals and petals obovate-oblong, olive-yellow; lip yellow. Brazil. Gt. 52:1518.—*O. pulchéllum,* Hook. Fls. racemose; sepals and petals whitish, the lateral sepals united; lip large, quadrate, 4-lobed, flushed with rose and with a few yellow spots. Jamaica. B.M. 2773.—*O. punctàtum* is a supposed natural hybrid between O. Forbesii and O. Gardneri.—*O. Reichenbachii,* Lindl. Colombia.—*O. Rivieriànum,* Hort. Peduncle about 2½ ft. long, bearing 15–20 fls.; sepals lanceolate, white, spotted with brick-red and black; lip golden-yellow, spotted. Brazil.—*O. robustíssimum,* Reichb. f. Fls. panicled; sepals and petals yellow at top, brown at base; lateral lobes of lip serrate, the front lobe emarginate, marked with cinnamon bars. Brazil. G.C. III. 38:45.—*O. ròseum,* Beer=Colchioda rosea.—*O. rupéstre,* Lindl. Fls. numerous, in a branched panicle 2 ft. high, brilliant yellow, spotted with brown. Peru. Said to be desirable.—*O. Russelliànum,* Lindl.=Miltonia Russelliana.—*O. Sánderæ,* Rolfe. Lvs. brown-marbled: fls. on a long scape; dorsal sepal linear-lanceolate, acute, reddish brown, about 3 in. long, the lateral sepals oblong, crisped, yellow, brown-spotted, a little shorter, nearly 2 in. wide; petals linear-lanceolate, similar to dorsal sepal; lip 3-lobed, the lateral lobes rounded, crisped, yellow, brown-spotted, the middle lobe orbicular, clawed, crisped, about 1½ in. across. Peru. B.M. 8374.—*O. sarcòdes,* Lindl. Pseudobulbs sub-cylindrical, 3 in. long, 2–3-lvd.: lvs. lanceolate: panicle branched, many-fld., slender; fls. large, yellow, spotted with brown; sepals free, obovate; petals larger, clawed, obovate-spatulate, repand; labellum with small serrate lateral lobes; middle lobe large, emarginate, undulate. Brazil. I.H. 21:165. J.H. III. 58:92. Near O. ampliatum. Var. *ornàtum,* Hort., differs in the color of its fls.—*O. Schilleriànum,* Reichb. f. Trop. Amer.—*O. Schlímii,* Lind. A large, rampant species, with yellow fls. marked with brown, about 1 in. diam. Nov. Cent. Amer.—*O. Stánleyi,* Hort., is a natural hybrid supposedly between O. Marshallianum and O. curtum. J.H. III. 53:267.—*O. stellígerum,* Reichb. f. Sepals and petals oblong-ligulate, stellate, yellowish, with many brown dots; labellum with short, obtuse-angled lateral lobes, a narrow isthmus, and a cordate, rotund, cuspidate middle lobe, pale yellow, with a darker callus. Mex. Near O. hastatum.—*O. Vólvox,* Reichb. f. Venezuela.—*O. Warszewíczii,* Reichb. f. Pseudobulbs rounded, compressed: lvs. 1 ft. long, thin: scape stout, with an 8–13-fld. panicle; fls. yellow, with purple spots and the middle of the labellum blood-red; upper sepals lanceolate, acute, crisp; lower pair oblong, shorter than the labellum, united; petals oblong, much wider than the dorsal sepals; labellum with auriculate lateral lobes, and a reniform bifid middle lobe. Colombia.—*O. Wéltonii,* Hort.=Miltonia Warszewiczii.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

ONCÒBA (Arabian, *onkob;* name of a North African species). *Flacourtiàceæ.* Glasshouse woody plants, grown sometimes for the bloom.

Tropical and subtropical shrubs or small trees, sometimes spiny: lvs. alternate, without stipules: fls. terminal, solitary or clustered, white, reddish or yellow, large for this family, polygamous; sepals 3–5 and petals 5–10; stamens very numerous, inserted in many rows beneath the ovary; filaments filiform; anthers linear, 2-celled, attached to the base, erect, opening at the sides; stigma dilated, notched; ovary free, 1-celled; style cylindrical: berry leathery, pulpy within; seeds 1, few, or many, sometimes used as ornaments by the natives.—Species 25 or more, Trop. Amer. and Trop. Afr., also S. Afr.

Kraussiàna, Planch. A branching shrub without thorns, young lvs. and shoots slightly pubescent, the older branches having a rough ash-colored bark: lvs. elliptic-oblong to oblanceolate, obtuse or subacute, entire, 2 in. long, with midrib, pinnate and netted veins, somewhat pale on under side: peduncles terminal or opposite the lvs., 2–3 in. long; fls. erect, solitary, about 2 in. across, white; sepals roundish and very concave; petals twice as long, spreading, with narrow claws, cuneate at base, broadly obovate, with scattered, woolly hairs; anthers pointless; stigma 5–6-rayed; ovary hairy. Procurable in S. Calif.—This makes a very fine pot-plant in greenhouse temperature, flowering in spring. It is also useful for subtropical bedding. Prop. from ripewood cuttings, also from seeds. Give the plant a sunny position, and plenty of water while new growth is making.

Roùtledgei, Sprague (*O. spinòsa* var. *Roùtledgei,* Hort.). Shrub, to 20 ft., with strong axillary spines: lvs. alternate, short-petioled, oblong or elliptic-oblong, crenate-serrate, nearly glabrous: fls. white, fragrant, about 2 in. across, one or two together on the old wood; sepals 4, reflexed under the fr.; petals about 8; stamens very many. Trop. Afr. G.C. III. 49:322, 330. G.M. 54:277 (as *O. speciosa* var. *Routledgei*). L. H. B.†

ONCOSPÉRMA (Greek, *tumor-shaped seed*). *Palmàceæ,* tribe *Arèceæ.* A group of little-known palms not in cultivation in America outside of botanic gardens.

Trunk low, very spiny: lvs. equally pinnate; lfts. ensiform-acuminate, entire, equidistant or somewhat clustered in 2 or more series, the veins scaly beneath; rachis convex on the back, with a blunt keel above: spadix from between the lvs., monœcious, crowded with sessile, spirally arranged fls.: fr. small. Oncosperma differs from Euterpe in the small, acute sepals: stamens 6–12, the anthers erect: albumen ruminate.—Species 6. Trop. Asia. Cult. as in Areca.

fasciculàta, Thwaites. Caudex at length 30–40 ft. high, 5–6 in. diam.: lvs. 18 ft. long; pinnæ fascicled, 12–18 in. long, 1–2 in. wide, lanceolate, long-acuminate, the tips drooping; sheath 2½ ft., armed and scurfy: fr. globose, black-purple, ½in. diam., much like a black currant. Ceylon.

filamentòsa, Blume (*Arèca Nìbung*, Griff. *A. tigillària*, Jack). Trunk 30–40 ft., armed with long black spines: lvs. 10–12 ft. long, drooping; lfts. 2 ft. long, narrow, acuminate, scurfy beneath: fr. spherical, ⅗in. diam. Malaya. N. Taylor.†

ONION. All the onions of common or general cultivation are forms of one variable species, *Allium Cepa* (see *Allium*, Volume I). It is probably native to southwestern Asia, but it has been long domesticated and has varied much. Other cultivated species are *A. fistulosum* (Fig. 2583), *A. Porrum* (Fig. 2484), and *A. Schœnoprasum* (Fig. 2585).

The onion is grown primarily for its bulbs, but the leaves are sometimes used as seasoning and in stews. Under long-continued cultivation and selection, the bulbs have developed into large and shapely organs. Now and then the bulb does not develop and the neck (or stalk just above the bulb) remains relatively thick: such onions are "scullions." Seeds from poorly selected or deteriorated stock may be the cause of scullions: they are to be considered as reverted or run-down forms. Sometimes scullions result from very wet soil, whereby the plants grow too much to top. Seeds grown in the South or in a long-season climate tend to produce plants in short-season regions that do not "bottom" before caught by frost.

2582. Onion in flower.

The onion is one of the hardiest of vegetable-garden plants. In the southern climates it is grown largely as a winter crop. In the northern states and Canada the seeds are sown or the bulbs planted as soon as the ground can be fitted in the spring. It is always best, if possible, to prepare the ground in autumn in order that the seeds may be sown on the first approach of warm weather. When onions are grown from seeds, it is essential that the ground be fine and loose, and all surface stones and litter removed. The seeds are small and do not germinate quickly. The young plants are surface feeders. If the seed is sown late or if the ground is droughty, the plants will either perish or make no headway. Land that is foul with weeds should not be planted to onions, for the young onion plants cannot withstand such competition. In the old-fashioned gardens, it was the custom to plant onions in short rows crosswise of raised beds. This entailed an endless amount of small hand labor and usually resulted in the expenditure of more time and effort than the onions were worth. The better method is to grow the plants in long rows which are far enough apart to admit of the use of a wheel-hoe. Even when a small quantity of onions is desired, it is better to place them all in one row than to have many short rows. With the best of land and management, and with the use of wheel-hoes, more or less finger work will be necessary in order to bring the crop to full perfection. The seed may be sown thick in the home garden, and as the young plants begin to crowd, they should be thinned. The plants taken out in the second and third thinnings may be used on the table (Fig. 2586). It is very important that the best grade of seed be used, for the onion deteriorates rapidly from seed which is not well grown nor carefully selected. There are great numbers of varieties. For early use and for variety, great numbers of kinds may be selected from reliable seed catalogues. Some of the quick-growing southern onions are excellent for early use. Forms of onions are shown in Fig. 2587.

2583. Welsh onion—Allium fistulosum.

2484. Leek—Allium Porrum.

There are two general methods of propagating the onion—by seeds and by bulbs. Onions grown from seeds are ordinarily called "black seed onions," although there is no onion seed that is not black. The main field crop is grown from seeds, as explained in the articles which follow. The onion seed of the market is produced from full-grown and typical bulbs of the desired variety. These bulbs are grown from seed and are kept over winter as other onions are. In the spring they are planted in rows 2 feet apart and as near together in the row as they will stand. They send up a flower-stalk which blooms in early summer (Fig. 2582), and the seed is harvested.

Propagation by bulbs is employed for the purpose of securing early onions for home use or for the special early-season trade. Until within recent years, all the very early or bunch onions were raised from bulbs, but recently a so-called "new onion-culture" has come into vogue, which consists in sowing seeds in hotbeds or coldframes and transplanting the young plants. Bulb-propagation is of three general categories: (1) The use of bulbets or "top onions" which appear on the top of the flower-stalk in the place of flowers; (2) the use of bulbels or separable parts of an onion bulb, known as "multipliers," or "potato onions;" (3) the use of ordinary bulbs which are arrested in their growth, known as "sets."

2585. Chive.—Allium Schœnoprasum.

Bulblets, or top onions, are shown in Fig. 2588. If one of these bulblets is planted in the spring, it quickly produces a young bulb, and the growing bulb may be pulled at any time and eaten. If allowed to remain in the ground, however, it sends up a stalk (either the first or second year) which bears a cluster of bulblets, sometimes mixed with flowers, on its top. There are two or three strains of top onion on the market, although the leading ones are the white and the red, these names applying to the color of the bulblets. The so-called "Egyptian onion" is a top onion; also the "tree onion."

Multipliers are shown in Figs. 2589, 2590. Instead of containing a single "heart" or core, as in most onions, it contains two or more. When the onion is planted, each of these cores or bulbels sends out leaves and grows rapidly for a time; that is, the old or compound bulb separates into its component parts. The growing bulbels may be pulled and eaten at any time. If allowed to remain in the ground, each of these bulbels will make a compound bulb like that from which it came. Sometimes flower-stalks are produced from multiplier or potato onions. The best results with multipliers are secured when the bulbels are separated on being planted, for each one has room in which to grow. Two or three kinds of multiplier onions are known, the variation being chiefly in the color of the bulb.

Onion sets are merely ordinary onions which are arrested in their growth, and when planted will resume growth. They are grown from seed. The seed is sown very thick on rather poor land, so that the young bulbs soon reach the possibilities of their growth; they mature when still very small. These small bulbs or sets are then harvested and kept over winter, and used for planting the following spring. When planted, they grow rapidly and may be pulled and used for the table. If allowed to remain in the ground, they send up flower-stalks and produce seeds as do common onions. Sets are not allowed to seed, however, since the seeds from sets would probably produce an inferior race of onions. Any variety of seed-bearing onion may be grown and propagated as sets, although there are relatively few that give uniformly good results. In the trade, onion sets are usually designated as yellow, red, or white. In order to secure good results from onion sets, it is essential that the sets be small and firm. They should not be over ½ inch in diameter, if they are of the best. If they are much larger than this, they tend to run to seed rather than to produce bulbs. Sometimes the very small and inferior onions are saved from the regular crop and are used as sets the following spring. Such sets are generally known as "rareripes." Usually they do not give the best results.

The varieties of onions are numerous. Some of the forms of bulbs are shown in Fig. 2587. In 1889 ("Annals of Horticulture") seventy-eight varieties of "seed" onions were offered by American dealers, and also about twenty kinds of multipliers, potato onions, and sets. For purposes of careful scientific study, the varieties may be classified into geographical races, but for purposes of description they may be assembled into groups characterized by such arbitrary features as form and color of bulb. Goff (Sixth Report of New York State Experiment Station, for the year 1887) classifies first by shape of bulb and then by color. He makes four primary groups: bulb oblate, spherical, top-shape, oval or pear-shape. Each of these groups is divided in three sections: color white, yellow or brownish, red or reddish. Another classification (Bailey, Bull. No. 31, Mich. Agric. College, 1887) makes three primary sections on methods of propagation: propagated by division (multipliers), by bulblets or "tops," by seeds (or sets). The last section (seed onions) is divided into bulbs silvery white and bulbs colored, and these groups are again divided on shape of bulb.

When onions are grown continuously on the same land they are likely to become seriously affected with smut. Rotation of crops is the fundamental remedy. Sulfur and lime drilled into the soil with the seed at the rate of one hundred pounds sulfur and fifty pounds air-slaked lime to the acre, is also helpful. The smut may kill the young onion plants outright. The onion mildew causes wilting or blighting of the leaves, without the black pustules caused by the smut. Bordeaux mixture is the standard remedy; a "sticker" should be added to the mixture.

Aside from the chapters on onions in the vegetable-gardening manuals, there are special treatises, as Greiner's "Onions for Profit," and "The New Onion Culture;" Greiner and Arlie's "How to Grow Onions," the Orange Judd Company's "Onion Book," Gregory's "Onion Raising;" J. P. Underwood's "Onion Culture."

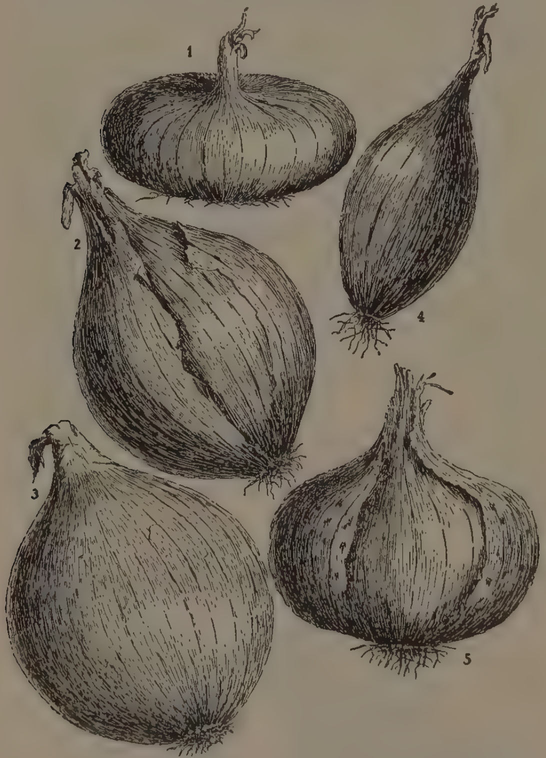
L. H. B.

The new onion-culture (transplanting process).

The idea of raising onions by growing seedlings in beds and transplanting to the open, which are the essential features of what has been termed "the new onion-culture," is not new. It has long been put in practice in the Bermudas, among the Portuguese growers in California, and in various places in Europe. This, however, does not detract from the fact that the writer, as well as W. J. Green, of Ohio, rediscovered (about 1889) this old plan or method of onion-growing, which was then unknown in their localities and also in most parts of the United States. There are only few, if any, modern innovations which have left an equally deep impression on our garden practices. The transplanting method is admirably adapted

2586. Bunch onions from the early spring sowing.

to the character of the large foreign onions, especially those of the Spanish type, and by it the American grower is enabled to produce bulbs in every way the equal of those large sweet onions which are imported from Spain and other foreign countries, and sold in our groceries at 5 to 10 cents a pound. Some of the onions now sold to the unsuspecting buyer in various places as "imported Spanish" may be really nothing more than these home-grown bulbs of the Prizetaker variety, and the buyer is not the loser by any means. This Prizetaker is perhaps the best of this class of onions to be grown by the transplanting process at the time of writing—large, of good shape, perhaps a little darker in color than the imported Spanish, and its equal in mildness of flavor. The newer Gibraltar is still larger, milder, a little later, not so good a keeper, but altogether one of the best onions which the home-grower, as well as the market-gardener who can sell his crop before late fall and at good prices, could produce.



2587. Forms of onions. *1*, flat; *2*, long globe; *3*, globe onion; *4*, oblong; *5*, oblate.

The plants should be started under glass (preferably in greenhouse) during January or February, sowing seed rather thickly in drills ½ or 2 inches apart, and using about an ounce of seed to 10 square feet of bed-surface. The soil should be sandy and very rich. Keep the plants in good growth, and as soon as the patch outdoors can be properly prepared in spring, set the seedlings in rows about 14 inches apart, and from 3 to 4 inches apart in the rows. Little hand-weeding will be necessary, but the wheel-hoe should be used freely. Green or bunching onions are also often grown in this way. For that purpose the plants are set more closely in the rows, not over 2 inches apart. Seed of the Prizetaker is mostly grown in the United States, while that of others is as yet all imported.

T. Greiner.

Commercial onion-culture in the North.

The soil for onion-culture should be a rich, moist, but not wet, loam with a subsoil of clay, or close compact sandy loam, not coarse gravel, as that lets the water leach out too quickly. Onions will stand a large amount of fertilizing, and there is little danger of getting the soil too rich. Soil that has been under cultivation for three or four years at least is much better than new land. The tendency of the latter is to produce too much top-growth and improperly ripened bulbs.

To prepare the soil, plow 10 or 12 inches deep, if the soil is of sufficient depth, or down to the subsoil. Care should be taken not to turn up much subsoil, or the crop will not mature evenly.

If the soil is poor, plow in 5 to 10 cords of stable manure to the acre, and spread on an equal amount of well-rotted manure after plowing, to be harrowed in. Unleached hardwood ashes is also a good fertilizer, especially on rather dry land, as it aids in the conservation of moisture. The action is quick, which makes it valuable where a little of the subsoil has been turned up in plowing, giving the young plants a good start, when, without it, they would be too light-colored and weak in growth. Ashes should be spread as evenly as possible, seventy-five to one hundred bushels to the acre on the ground after plowing, and harrowed in.

The harrowing should be thorough, using some kind of a disc or spring-tooth, for the first time over, with a Meeker or some other smoothing-harrow for the finish. It is impossible to get a good even stand of plants if the ground is rough or lumpy, while those that do grow are weak and puny on rough ground. Hand-raking is sometimes necessary to insure germination of seed in a satisfactory manner.

The drainage must be nearly perfect, to get best results. There should be no hollow places in the beds. Even on a sloping piece of land, the dead-furrows or alleys should be kept open to a depth of 8 or 10 inches, and evenly graded so the surplus water will all drain off. If there is a natural sag in the land which cannot be surface-drained, it is often practicable to underdrain so as to get satisfactory results; for there is no crop grown in the ordinary market-garden which will pay a larger percentage of return for underdraining, in nearly all locations. If the foliage is of a light color, and the crop does not ripen evenly, an underdrain will usually correct the trouble. The time to drain is when the ground is being prepared for planting, not after a heavy rain, when water is standing in pools over the field.

The time to plant is as early in the spring as the soil becomes in good working condition. The common spring frosts and snow flurries will do no harm if other conditions are right.

There are a few growers who can profitably grow their own seed, but the masses should buy. This should be done early, so that there may be no delay at planting time, and also that one may get the best stock obtainable. If one wants ten pounds or more, it is sometimes advisable to order from some one of the large seed houses of the country, but if there is a reliable local dealer who buys seed in bulk, one can often do better than to send direct to the large seed house, even on quantities of fifty to one hundred pounds. Be sure to know where the seed comes from, and if possible test it before planting. In any case, always buy the best seed obtainable, no matter if it costs double the price of other stock.

The sowing of the seed should be done with one of the standard garden seed drills, the first essentials of which are that the machine can be regulated to sow evenly and in the quantity desired without clogging. The machine should open a row, sow, cover, roll, and mark the next row, all at one operation. The machines which have a sliding piece at the bottom of the hopper, which opens and closes a diamond-shaped opening, are the best, as the operator can regulate exactly the amount of seed sown.

The seed should be sown in rows 12 to 14 inches apart, and at the rate of three and one-half to four and one-half pounds to the acre, according to soil and seed. A soil which produces heavy tops requires less seed than the drier, sandy soil which grows small tops. The plants should stand from 1 to 3 inches apart in the row. The seed should be sown from ½ to 1 inch deep, according to soil.

2588. Top onions. (×⅓)

Cultivation should begin as soon as the plants are up enough for the rows to be seen. Begin with a double-wheel straddle cultivator if one is at hand, setting the knives as closely as can be worked without covering the young plants, and continue as often as necessary to keep weeds destroyed and the ground loose on top until the plants are too large to get through. The last time through may be done with a single-wheel machine, which will throw a little earth up to the plants. A single-wheel machine may be used throughout the season, but the double-wheel is preferable for the first part of the work.

On light soil, a hand-weeder may be used with profit after the young plants have reached 3 to 5 inches in height. This works two rows at one passage, stirring the soil in the rows where the wheel-hoes do not work, and greatly reduces the amount of hand-weeding to be done. Of course, hand-weeding must be done as often as necessary to keep the beds clean.

Harvesting may be done in the following manner: If the crop ripens evenly, so that there are no green tops standing, the topping can be done most rapidly before the onions are pulled. By using a thin, sharp knife, taking the dry tops in one hand and cutting from the person, the work can be done quickly and well. Be careful not to tear the skin down the side. The length to cut the tops is a point of importance and must not be overlooked. If the tops are left too long they have a ragged appearance, and if too short, there is danger of causing the onions to rot in the tops, because of bruising or because of water having gone to the inside of the onions. The proper length is about ½ inch from the bulb; or, take an onion by the top, with the thumb and forefinger close to the bulb, and cut the top close to the fingers The pulling may be done by hand, but a puller made to fit a hand-cultivator is much more rapid and does not injure the bulbs. The puller is simply a curved knife with one or more fingers to move the bulbs slightly after the roots are cut. In light dry soil it works very well without any fingers.

Many growers prefer to pull the onions first, allowing them to dry a few days before topping. This is what should be done if the tops do not dry evenly, or if the crop is late and needs to be hurried; and is all right in any case, though not quite so rapid as the other way.

After the onions are topped, they should be gotten under cover as soon as possible. Let them dry a day or two if the weather is favorable and then pick them up and store in the curing-shed. If allowed to lie too long on the ground the skin peels off too much. The shed should have doors or ventilators at each end from top to bottom, so that the air can pass through freely and be free under the floor. If the floor is tight, with no circulation under it, lay some 2 by 4 scantling on the floor and lay a loose board floor over them without nailing; then take some pieces of 2 by 4 sawed just 1 foot long and nail them to the floor at even distances for posts to carry stringers for the next floor. Use 2 by 4 for the stringers; set them on edge, nail them to the posts and all is ready for the onions. This gives a space of 16 inches. Fill 12 inches (the length of the posts) and leave the 4 inches for air-space. Lay another floor and proceed as before, being careful to get the upper posts directly over the lower ones, or the stringers will break after two or three floors are in.

In handling the onions, bushel boxes are the most convenient. Pick them up in common baskets, leaving all small, defective, or odd-colored bulbs on the ground, to be picked up separately and sorted as occasion may require. Dump in the boxes, then drive along the side of the bed with a platform wagon, and load. Have a screen about 4 feet long by 2 feet wide made of narrow strips ½ to 1 inch wide and about 1 inch apart and the sides 10 inches high. Put legs on one end about 14 or 15 inches long and on the other end long enough to give it a sufficient incline to make the onions roll down freely. With an old coffee sack, make a bag like a sheet hung by the corners with hooks, to hang under the screen, in order to catch the dirt and leaves. Carry the boxes of onions directly from the wagon to the screen and pour them over it, moving the screen back as the floor is filled to the proper depth. This will take out all the dirt and most of the loose leaves, and make the onions come out of the shed in much better shape. They should lie in the shed until they are dry enough to peel off another skin, and rattle and crackle when the arm is run in among them.

If all has gone well, the crop should average 500 bushels to the acre on good land, or 600 bushels on very rich land, and 700 or 800 bushels on a single acre selected from the best part of a 10-acre field.

2589. A multiplier onion.

2590. Section of a multiplier onion.

There is an old saying, "the time to sell is when someone wants to buy." This is a very good rule to apply, unless one is prepared for cold weather or is reasonably sure of an advance in price. In a general way, it is best to ship in sacks of even size and not too large, one and three-fourths to two and one-fourth bushels. These points must be governed by the market. In sacking to ship, always throw out all defective bulbs and all of another color. In size, down to about 1½ to 1¼ inches in diameter is a good scale to use in a general way, but this point must also be governed by the market. Sell by sample so far as possible.

There are three varieties of onions which take the lead clearly above all others in the big markets of the country,—the White Globe, Yellow Globe, and Red Globe. These come under different names, as Southport Yellow Globe and Michigan Yellow Globe, but the object in view among seed-growers is to get bulbs as nearly globe-shaped as possible. The skin should be thick and two or three layers deep, to prevent bruising.

Irving C. Smith.

Onion-culture in the South.

Twenty years ago onion-growing from seed was not considered practicable, and by many it was considered impossible south of the Potomac. The introduction of varieties from southern Europe and more careful attention to details of the work have made onion-growing not only possible but often exceedingly profitable.

The eastern South consumes large quantities of the mild forms, such as the Bermudas. In the markets at Jacksonville, Florida, these are sold by the piece, frequently retailing at 5 cents and 10 cents each. The southern onion-grower must keep in close touch with the northern and foreign onion markets. In the humid regions of the South, there is a considerable risk from unseasonable rains. In the drier regions, such as a part of Texas, it becomes a very important and remunerative form of vegetable-growing. They have developed onion-growing most extensively and have organized the marketing arrangements most perfectly there.

2591. Red Bermuda.

The soil should be alluvial, sandy, and of a fine texture. A level tract, freed of all debris, and one that can be plowed deeply, is desirable. In the coast regions such land may be obtained in great abundance. It is frequently used for vegetable-growing, but large areas are still uncleared or are used for farm crops. In the hilly regions of the interior, onion lands must be sought mainly along rivers or old river-beds.

Undecomposed vegetable matter should not be applied immediately preceding the crop. Even cotton-seed meal should be used three weeks or more before the seed is sown and then carefully incorporated with the soil where the rows are to be, or if the rows are to be a foot or 14 inches apart the cotton-seed meal may be sown broadcast and cultivated in.

Seed-sowing in the field occurs in the uppper districts as early as the first of April or a little earlier, in the central district about the last of February, while in the Gulf region it may occur late in fall or any time during the winter, being gauged largely by the time required for the variety to mature, and the market to be met. It is a good rule to put on an abundance of seed, about twice as much as recommended in general, especially in the Gulf region. Many fields suffer from deficient stand more than from any other cause, and in some years it is the only cause for an unprofitable crop.

Good crops may be grown from sets, but the labor involved and cost of the "seed" is usually so great as to deter many from planting them. In using sets, they should be separated into three or four grades, the largest size maturing earliest and the smallest last. In most cases the smallest sets grow such inferior onions that they had better be discarded. This takes for granted that the sets were all grown at the same time and from the same seed in one field.

Nearly all the onion sets used in the South are shipped in, while they may be grown as well here as anywhere. In the Gulf region there is time enough to grow a crop of sets after the northern crop has been harvested and marketed. Thus in case of shortage in northern-grown sets, it is entirely practicable to ship the seed South, grow sets, and ship sets back in time for spring market.

Much has been written and spoken about raising the plants in a seed-bed and then transplanting to the field. While this may be practised successfully, the greater quantity of onions is raised by the old-fashioned method, i. e., by seeding in the drills where the plants are to mature bulbs.

In certain localities it is advantageous to plant out a seed-bed before the general field will permit working, and then transplant as soon as all conditions are favorable. In the upper districts of the South, seed may be sown in hotbeds as early as the first of February, and the plants may usually be set out by the first of April. In the central South, seed may be sown in protected coldframes as early as the middle of December, or in an open bed in February. The earlier plants may be transferred to the field by the last of February, or as soon as danger from frosts is past. In the Gulf region the seed may be sown during the fall in an open bed, and transplanting to the field may occur when plants are of proper size and favorable condition of weather prevails.

Harvesting is often attended with considerable difficulty, and in some cases special drying-houses have to be constructed to secure the crop in first-class condition. The crop is a perishable one, and must be pulled, gathered and shipped in as short a time as possible, when sufficiently mature.

There seems to be no generally accepted plan for marketing, the crop being placed in boxes, barrels or bags for shipping.

The following varieties have given good crops in the hands of expert growers and may be recommended for the entire South: White Bermuda, Red Bermuda, Prizetaker, Yellow Danvers, Giant White Italian, Giant Rocco, and Large Tripoli. Other varieties than those named here have given as good or better returns, but do not seem to have been so generally successful. Additions are Red Bermuda (Fig. 2591) for Gulf region and Red Wethersfield for central and upper district.

Black mold (*Macrosporium Porri*) is a disease which spreads rapidly over the field, especially late in the season. Some good may be done by spraying with bordeaux mixture, but its application is limited almost to the diseased portion.

Another disease attacking onions is smut (*Urocystis cepulæ*). The name of this fungus describes it fairly well. About all that can be done is to subject the field to rotation, and to sow seed from smut-free districts. Some years nearly all southern-grown onions brought to market will be more or less infected.

Rotting is especially severe in wet seasons when the crop cannot be properly handled, and is caused by a number of fungi. The best preventive is to store in a dry place, and consume as soon as practicable.

Onion fly, or onion maggot, is one of the most severe pests when it enters the field. There seems to be but little encouragement in combating the pest. It often leaves the field as mysteriously as it appeared. This disappearance has been coincident with the application of some supposed remedy, and has consequently led to the recommending of unreliable remedies. A thorough application of ground tobacco stems down the row seems to act as an insecticide and a repellent, besides being of value as a fertilizer.

Thrips attack the leaves at times, and become so numerous as to cause the tips to turn brown and finally destroy the whole leaf. Besides the insect injury they open the way for such fungi as Macrosporium. This insect may be treated successfully with kerosene emulsion, tobacco decoction, resin wash and possibly with kerosene-water mixture. P. H. Rolfs.

ONION, SEA: *Urginea maritima;* also applied to *Ornithogalum caudatum.*

ONÓBRYCHIS (Greek, *asses' food*). *Leguminòsæ.* Among cultivated plants, this genus contributes the sainfoin, used for forage. The group yields little in the way of ornamentals.

Perennial, sometimes shrubby and spiny: lvs. odd-pinnate, with entire not stipellate lfts.: fls. purplish, rose-colored or whitish, in axillary peduncled spikes or racemes; calyx-lobes subulate, for the most part nearly equal; corolla papilionaceous, the standard obovate or obcordate and narrowed toward the base; wings short; keel obtuse, equaling or exceeding the standard; stamens 9 and 1; ovary 1–2-ovuled: pod sessile, flat and hard, 1-seeded and indehiscent.—Species 80 and more, Eu., N. Afr. and W. Asia. Closely related to Hedysarum, but differing in the 1-seeded or 1-jointed pod.

viciæfòlia, Scop. (*O. satìva,* Lam. *Hedýsarum Onóbrychis,* Neck.). Sainfoin or Saintfoin. Holy Clover. Esparcet. Perennial herb with ascending sts. 1–2 ft. long: lfts. many, oblong, somewhat downy or pubescent beneath and glabrous above: peduncle exceeding the lf., the spike lengthening; fls. pale pink (varying to white): pod twice exceeding the lf., strongly curved on the lower edge, with short teeth on the margin and sometimes prickly. Cent. and S. Eu., Temp. Asia.—Grown for forage. It requires a limestone soil, and in the U. S. is grown chiefly in the southern states, but it has never become agriculturally important in this country. The seeds are nutritious and are eaten by fowls. From 100–150 lbs. of seed are sown to the acre. L. H. B.†

ONOCLÈA (Greek, *closed vessel;* alluding to the closely rolled sporophylls). *Polypodiàceæ.* A small group of coarse ferns of north temperate regions, with creeping rootstocks, anastomosing veins and two sorts of lvs., the segms. of the sporophylls being closely rolled about the sporangia into bead-like bodies. For *O. Struthiopteris,* see *Matteuccia.*

Onocleas are tenacious of life, and will grow under almost any conditions, especially *O. sensibilis,* but they prefer a moist, rather heavy loam, in a cool but not necessarily shaded position. *O. Struthiopteris* (a Matteuccia) in the sunny border is likely to burn during severe drought. It is a suitable deciduous fern for the greenhouse, and may easily be had in foliage before their natural season. (F. W. Barclay.)

sensíbilis, Linn. Sensitive-Fern. Fig. 2592. A coarse, easily grown fern, a native species, with broad triangular lvs., growing in low, wet places. Sensitive only in that it does not stand frost.
L. M. Underwood.

ONÒNIS (old Greek name). *Leguminòsæ.* Rest-Harrow. Good plants for borders and rock-gardens, with clover-like leaves.

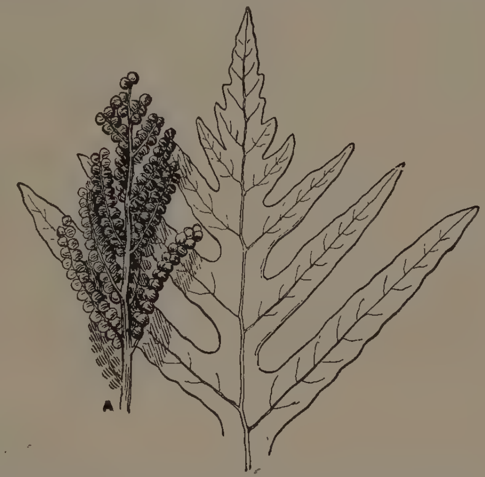
Annual, biennial or perennial, often shrubby; glabrous or villous: lvs. usually pinnately foliolate, the stipules attached to the petiole: fls. papilionaceous, yellow, purple, pink or rarely white, solitary, 2–3 in the axils or in peduncled racemes; calyx bell-shaped, 5-parted, deeply cut, narrow; standard large, striped; stamens united in a tube, the members sometimes partly free: pod usually swollen, few-seeded.—Some 70 species, Canaries, Medit. region, to Cent. and N. Eu. A few of the perennial species are more or less in cult. They thrive under usual treatment; prop. by division and by seeds. Sometimes the lvs. are 1-foliolate.

a. *Fls. solitary or in groups of 2–3, rose-colored.*

rotundifòlia, Linn. A neat, attractive, shrubby, hardy plant 1½ ft. high: lvs. trifoliolate; lfts. subrotund to ovate, serrate: peduncles axillary; racemes 2–3-fld.; fls. pea-like, bright rose, not bracted; standard striped with lines of a deeper shade. S. Eu. B.M. 335. G.L. 27:131.—Of easy cult. in border and rockery, not liking too much shade. Summer.

hircìna, Jacq. (*O. altíssima,* Lam.). Erect, spineless, more or less villous, 1–2 ft.: lfts. 3, oblong-lanceolate, acute, serrate: fls. about 2 together, rose and white, May–July or Aug. Eu.—A pretty plant for rather dryish borders and rocky places.

spinòsa, Linn. Somewhat shrubby, spinose, the sts. more or less erect: lfts. 3, oblong with cuneate base, subentire: fls. solitary, rose-colored. Eu.



2592. Sensitive fern.—Onoclea sensibilis. Fruiting frond at *A*.

fruticòsa, Linn. Sturdy compact little woody bush about 1 ft. high and becoming much broader: lfts. 3, to 1½ in. long, lanceolate and deeply serrate: peduncles about 3-fld. and collected into racemes or clusters; standard pale rose with central stripe, wings whitish suffused pink. Eu. B.M. 317. L.B.C. 16:1569. G.C. III. 47:420.—Excellent for rock-garden.

aa. *Fls. solitary, yellow.*

Nàtrix, Linn. Goat-Root. Yellow-flowered Rest-Harrow. Low, much-branched perennial: st. 1–1½ ft. high: lvs. trifoliolate; lfts. elliptical or oblong, serrated near the apex or sometimes entire; stipules large: fls. axillary, the standard finely striped with red. Midsummer to fall. B.M. 329. M. B. Coulston.
L. H. B.†

ONOPÓRDON (old Greek name). Sometimes written *Onopórdum. Compósitæ.* Coarse woolly Old World herbs.

Stems stout (sometimes acaulescent), winged by the decurrent bases of the lvs., which are large, alternate, prickly, dentate or pinnately cut: involucre globose, the bracts imbricated in many series, and in some cases spiny; receptacle flat, fleshy, honeycombed, not bristly; pappus not plumose, but with bristles in several series. —About 12 species, annual and biennial.

a. *Involucral bracts erect and appressed.*

b. *Sts. usually nearly simple, the heads often solitary.*

arábicum, Linn. St. tall, swollen and deeply winged by the decurrent lvs.: branches numerous, short, erect: lvs. ovate-lanceolate, sinuate and spiny: fls. in dense, solitary terminal heads, the infl. usually arachnose, as are the erect involucral bracts. Medit. region. B.M. 3299.—A showy biennial with purplish red fls.

BB. *Sts. mostly much branched, the heads corymbose or paniculate* (*solitary at the end of the peduncles in O. Acanthium*).

Acánthium, Linn. Scotch Thistle. Biennial, vigorous, much-branched, 3–9 ft. high: lvs. oblong, lobed and dentate, acute, the lower often 1 ft. long, cottony white, spiny: heads of pale purple fls. 1½–2 in. across, borne singly on the branches. July–Sept. B.B. 3:491. Gn. 46, p. 9; 68, p. 157. G.W. 7, p. 425. R.B. 20, p. 200.—The Scotch thistle is often called the cotton thistle; sometimes also Argentine, asses', down, oat, Queen Mary's or silver thistle. It is apparently not advertised in Amer., but is sometimes cult. for "auld lang syne," and occasionally it is used with striking effect by some lover of hardy plants. It is then placed against a background of dark shrubbery, which sets off the silvery foliage and bold habit. The plant is rarely found growing wild in the Atlantic States, having come from Eu. The Scotch thistle will probably never be a weed of the first importance in Amer., as is the Canada thistle. Nevertheless, care should be taken not to let it go to seed. A white-fld. Scotch thistle, var. **álba,** Hort., was advertised in Germany in 1894 as a horticultural novelty. Gt. 45, p. 107.

taùricum, Willd. An ornamental plant of tall stately growth and many-headed infl.: st. white-hairy: lvs. somewhat decurrent, elliptic-oblong, the margins wavy and spinose; involucral bracts ovate-lanceolate, the tips subulate. Russia and S. Eu. G.W. 7, p. 425.—Perfectly hardy and only recently intro.

polycéphalum, Boiss. A densely tomentose, tall-stemmed biennial with grooved sts. and a many-headed corymb of showy fls.: lvs. somewhat lobed, spiny-margined, diminishing in the infl.: involucral bracts pale, all erect, lanceolate.

AA. *Involucral bracts* (*outer*) *recurved.*

bracteàtum, Boiss. & Heldr. A tall tomentose much-branched biennial: lower lvs. oblong-lanceolate, the shallow lobes and often the margins tipped with yellow stout spines; cauline lvs. much smaller, decurrent, diminishing in the infl. to start short bracts: heads large, globose, the outside involucral bracts recurved. E. Medit. region.—Probably not hardy northward.

O. Sàlteri, Hort. "Plant pyramidal in habit, about 5 ft. high, silvery shining. Lowest lvs. widely spreading on the ground, incised, spiny, upper reduced." Country unknown.

N. Taylor.†

ONÓSERIS (*asses' salad;* significance not evident). Including *Isótypus. Compósitæ.* Some twenty herbs or shrubs, mostly Andean, but also in Mexico and southeastern Brazil, grown rarely indoors and out for the large purple, pinkish or white flower-heads; allied to Mutisia, but it has no close relatives of much horticultural importance.

Plants of various habit, mostly erect, sometimes annual, some species almost stemless: lvs. radical and cauline, white-tomentose beneath: heads large, heterogamous, solitary or panicled, the peduncles or scapes usually long and more or less bracted; ray-florets pistillate in one series (heads discoid in *O. Isotypus*); disk-florets usually hermaphrodite and fertile; involucre hemispherical or top-shaped, the bracts linear, imbricate and in many series, the exterior ones gradually shorter.—They appear to require no special cult. treatment; prop. by seeds.

O. adpréssa, Less. (Centroclinium adpressum, Hook.). Little shrub, blooming under cult. at 1 and 2 ft., with woolly branches: lvs. lanceolate, reflexed, 3 in. or more long, nearly entire but undulate: peduncle solitary and terminal or becoming lateral by elongation of other shoots; head solitary, large, fragrant; rays long and narrow, about 8, rose-purple. Peru. B.M. 3115.—*O. Drakeàna,* André. Woody, little branched, often weak: lvs. alternate, ovate, lanceolate or hastate, entire or shallowly dentate: peduncles scape-like, 1-headed, with few bracts; rays violet, about 20, showy. Colombia. R.H. 1883:180.—*O. Isótypus,* Benth. & Hook. (Isotypus onoseroides, HBK. Caloseris rupestris, Benth.). Showy shrub 3–5 ft. high, the branches white-lanate: lvs. long-petioled, large, broadly hastate-cordate, 5–8 in. long, acute, sinuate-lobed and dentate, 3–5-nerved, the petioles 6–10 in. long: heads about 1 in. long in a terminal panicle, the corolla red and scarcely exceeding the involucre. S. Mex. Guatemala. G.W. 12, p. 11.—*O. purpuràta,* Willd. Nearly stemless perennial: lvs. radical, lyrate, the terminal lobe large and deltoid-hastate and dentate: scape branched at middle, 3-headed, the rays purple and short. Colombia.—*O. refléxa,* Less. (Centroclinium reflexum, Hook.). Woolly branched, about 2 ft., probably annual: lvs. ovate-lanceolate, 2–3 in. long, coarsely toothed and acute: peduncle solitary, terminal or from upper axils, with many small bracts: heads large and handsome, fragrant; rays 9–12, very narrow, rose-purple. Peru. B.M. 3114.

L. H. B.

ONÓSMA (*onos,* an ass, and *osme,* smell; the odor reputed to be liked by that animal). Golden Drop. *Boraginàceæ.* Outdoor or border plants, grown for the small pretty flowers.

Bristly hardy perennial, annual and biennial herbs or undershrubs, with long narrow alternate lvs. and 1-sided simple or cymose bracted racemes: fls. yellow, purple, or white, tube-like, or urn-shaped, sessile or with short pedicel, with 5 very short corolla-lobes; calyx 5-parted or cut; corolla-throat dilated or contracted; stamens 5, inserted midway on corolla-tube, mostly included; ovary with 4 distinct lobes, the style filiform and stigma small: nutlets 4 or fewer, erect or incurved, smooth and shining or less frequently tuberculate.—Species 70, Medit. region and the Himalayas. They are adapted to borders and rock-gardens; of simple cult. requirements. The perennial kinds are increased by cuttings in summer, in a frame; the annuals and biennials by seeds. Most of the cult. species do not ordinarily much exceed 1 ft. in height and many of them are lower than that.

echioìdes, Linn. Biennial or perennial strigose herb, from a red root, blooming in spring, erect or rarely branched, 6–9 in. high or more: lvs. spatulate or linear-lanceolate, sessile, becoming cordate above; floral lvs. lanceolate to nearly ovate-lanceolate: fls. pale yellow to whitish, drooping, fragrant; corolla cylindrical or subclavate. S. Eu. G.W. 6, p. 529.

stellulàtum, Waldst. & Kit. Perennial, branched at base, ascending, hispid: lvs. linear-oblong, plane, obtuse or the upper ones acute: fls. yellow, more or less cernuus, short-pedicelled, in bifid cymes; corolla 1 in. long and about ½in. wide at apex, somewhat clavate, twice longer than calyx, the teeth very short and revolute. S. and S. E. Eu. Variable; cult. chiefly in the var. **taùricum,** Hort. (*O. taùricum,* Pall. *O. angustifòlium,* Lehm.), with narrow revolute lvs. and citron-yellow fls., the corolla often 1½ in. long. B.M. 889. J.H. III. 35:11. Gn. 50, p. 251. G.C. II. 16:21; III. 51:274. G. 4:447. Succeeds well on high ground or on sunny rockery, with light, open, deep soil. Prop. by cuttings generally, or by seed.—Var. **compáctum,** Hort., is a condensed form. M.D.G. 1912:325. *O. helvéticum,* Boiss, is a Swiss form, not so tall and with rather broad lvs. G.C. III. 52:280.

álbo-ròseum, Fisch. & Mey. (*O. álbum,* Hort.). Perennial, more or less woody, tomentose: lvs. hoary, oblong and somewhat obtuse, narrowed to petioles, the upper ones sessile and lance-oblong: fls. white changing to rose and violet, velvety; corolla nearly 1 in. long, clavate pubescent, nearly double length of calyx. Asia Minor.

Fórrestii, W. W. Smith. Perennial: basal lvs. linear-lanceolate or -oblanceolate, 6 in. or less long, the st.-lvs. linear and erect, all of them white-tomentose: infl. rather dense, thickly covered with whitish hairs, the fls. rose-color; calyx nearly ½in. long, the narrow-tubular canescent corolla scarcely exceeding it. Yunnan, China.

O. sericeum, Willd. Perennial, somewhat woody, silky-pubescent: lvs. oblong-lanceolate to obovate, the lower ones narrowed to the petiole: fls. yellow, ¾in. long, the corolla broad at apex and exceeding the calyx. Orient. G.C. III. 52:281.—*O. Thómpsonii*, Hort., is Echium rubrum, Jacq., of S. Eu. and Caucasus: lvs. white tomentose, linear-lanceolate: fls. scarlet, racemose.

L. H. B.†

ONOSMÒDIUM (like *Onosma*, a European genus of this family). *Boraginàceæ.* False Gromwell. About 10 species of N. American and Mexican branching herbs, mostly or wholly perennial, bristly, 1–4 ft. high, rarely transferred to cult. grounds: lvs. oblong, sessile, rib-veined: fls. white, greenish or yellowish, in long, erect, leafy, raceme-like clusters; corolla tubular or oblong-funnel-shaped, with throat naked, the lobes erect, acute, the sinuses more or less inflexed; style filiform or capillary, very long; stigma exserted before the corolla opens: nutlets ovoid or globular, bony, smooth and polished, white. Closely related to Lithospermum. None of the species seems now to be in the trade; the names and descriptions may be found in the manuals of native plants. They are of little value horticulturally.

ONTADÈNIA: *Odontadenia.*

ONÝCHIUM (Greek, *onyx*, a claw; referring to the shape of the lobes of the lvs.). *Polypodiàceæ.* A group of small mainly Asiatic ferns, with the sori arranged on a continuous linear receptacle as in Pteris, but with narrow segms. in which the indusia extend nearly to the midrib. For cult., see *Fern.* The orchids occasionally advertised as onychiums are dendrobiums.

auràtum, Kaulf. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with membranous indusia and abundant sporangia of a golden color; divisions of the sporophylls pod-like. India and adjacent islands.

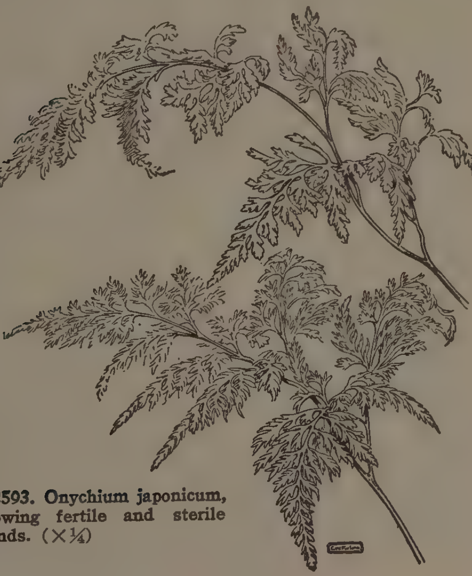
japónicum, Kunze. Fig. 2593. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with pale indusia and brown sori; divisions of the sporophylls linear-mucronate, similar to those of the sterile lf. India, China, and Japan.

L. M. Underwood.

OPHÈLIA: *Swertia.*

OPHIÁNTHE: *Gesneria.*

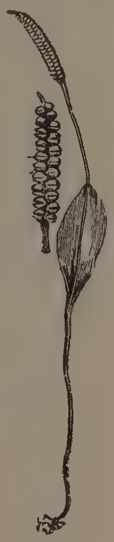
OPHIOGLÓSSUM (Greek, *serpent's tongue*). *Ophioglossàceæ.* About 40 species of small plants allied to true ferns, of wide distribution. The sts. are subterranean, small, bearing usually a single erect succulent lf. which consists of a petiole, an expanded simple blade, and a contracted fertile spike bearing 2 rows of fleshy coalescent sporangia; venation reticulate. Rather difficult of cult., and mainly of interest as curiosities.



2593. Onychium japonicum, showing fertile and sterile fronds. (×¼)

vulgàtum, Linn. Adder's Tongue Fern. Fig. 2594. Lf. 6–12 in. high, the petiole 3–6 in. high, the blade ovate, 1–2 in. long, the spike about 1 in. long, on a long stalk. Spores mature in July. In low places, Eu. and N. Amer.—May be cult. in moist peat in a partially shaded spot. Occasionally found in large numbers in peaty meadows.

R. C. Benedict.



2594. Ophioglossum vulgatum.—Adder's tongue.

OPHIOPÒGON (Greek, *snake's beard;* a translation of the Japanese name). *Liliàceæ.* Herbs, grown for the bluish or white small flowers and the grass-like foliage that may form a good ground-cover.

The genus is oriental, of about a score of species. The plants have a short thick rhizome, and the fibrous roots sometimes act like runners, and may be thickened into tubers: lvs. linear or oblong-lanceolate and narrowed into a petiole: bracts small, scarious: perianth-tube none; stamens 6, fixed at the base of the segms.; filaments erect, distinct, shorter than the linear anthers; cells of 3-celled ovary 2-ovuled: fr. indehiscent; seeds in the form of a globose berry.—The E. Indian species appear not to be cult. The genus is closely allied to Liriope. *O. spicatus*=*Liriope graminifolia.*

Of this genus, two species are well known in cultivation. They are low-growing herbaceous perennials from Japan, with linear foliage, which is often striped or spotted with white or yellow, and racemes of small six-parted pendulous flowers, varying from white through lilac to violet-purple. They are procurable from a few dealers in hardy perennials, from specialists in Japanese plants and from Dutch bulb-growers. The most popular form is *O. Jaburan* var. *aureus variegatus*, which is chiefly used as a greenhouse foliage plant. The flowers of *O. Jaburan* are followed by large showy shining dark blue berries. It is easy to manage in the window, and is almost hardy. *O. japonicus* is much used in Italy and southern France for a green turf and for border edgings, and it begins to be used for the same purpose in southern California. It needs no clipping, and will stand under the shade of trees, making a dark green lawn-cover, standing well in drought. The species of ophiopogon are propagated by division.

japónicus, Ker. Perennial stemless glabrous herb, with a stoloniferous rhizome: fibrous roots long, slender, often nodulose: root-lvs. numerous, erect, narrowly linear, ½–1 ft., and 1–1½ lines wide, 5–7-nerved: scape 2–4 in. long; raceme lax, few-fld., 2–3 in. long, the lower fls. in groups of 2–3; fls. drooping, violet-purple to lilac or more or less whitish. Japan, Korea, N. China. B.M. 1063. Var. **variegàtus,** Hort., has variegated foliage.

Jabùran, Lodd. Habit of the above, but more robust: lvs. 1½–3 ft. long, 4–6 lines wide, many-nerved: scape ½–2 ft. long; raceme 3–6 in. long, the lower fls. usually in groups of 6–9; fls. white to lilac. Japan. L.B.C. 19:1876 (a fine pure white). Var. **cærùleus,** Hort., has "blue" fls. Var. **aùreus variegàtus** has foliage striped golden yellow. Var. **argénteus variegàtus** has foliage spotted white. Var. **argénteus vittàtus** has foliage striped white.

Regnièri, Bois. Stemless: lvs. in a rosette, erect or reflexed, lanceolate, slender-petioled, to 1 ft. long, marked with pale green and yellow: scape 8 in., 2-edged, bearing a several-fld. raceme; fls. violet-white, to

¾in. across, the tips of the segms. greenish. Cochin-China. R.H. 1906, p. 371.—Recent.

Wilhelm Miller.
L. H. B.†

ÒPHRYS (Greek, *eyebrow*). *Orchidàceæ*. Terrestrial orchids.

Having the habit of Goodyera, bearing a basal rosette of lvs. with an erect fl.-st. terminating in a raceme or spike of fls.: sepals similar, spreading; petals smaller, often pubescent; labellum generally convex with incurved margins, not spurred, entire or 3-lobed; column short.—About 30 species, mostly in the North Temperate Zone in Eu., Asia and N. Afr., the greater number being found in the Medit. region. Cult. as for habenaria.

A. *Margin of the labellum brown or purple-brown.*

B. *Labellum scarcely longer than the sepal.*

C. *Sepals green.*

aranífera, Huds. Spider Orchis. Resembles *O. apifera*. Sepals green; petals very short; labellum dull brown, marked with paler spots, obscurely lobed. Spring and early summer. Eu. B.M. 5712. B.R. 1197.

fúsca, Link. Lvs. oblong-lanceolate, those on the st. narrower: sepals green, ovate-oblong, the upper one smaller, oblong; petals half as long, lanceolate-obtuse; labellum oblong, dark purple and hairy on the margin, disk light blue, polished. Medit. region. B.R. 1071.

CC. *Sepals rose-colored or white.*

arachnìtes, Lam. St. erect, leafy: lvs. ovate-lanceolate: fls. distant; sepals ovate concave, rose-colored, tinged with green; petals conical, fleshy, smaller than the sepals and colored like them; labellum round, with the sides reflexed, black-purple, with yellow marks and green appendages. Cent. Eu. B.M. 2516. G.C. III. 48:482.

apífera, Huds. (*O. arachnìtes*, Reichard). Bee Orchis. St. 9–18 in. high, with few oblong or lanceolate lvs.: fls. 3–6, rather large; sepals ovate, pale pink or white; petals smaller, erect; labellum broad, convex, lobes all turned, velvety brown, marked with paler lines or spots. Fls. early summer. Dry pastures, Cent. and S. Eu. Gn. 69, p. 257. G. 35:379.

BB. *Labellum longer than the sepals.*

Spéculum, Link. Looking-Glass Orchis. St. 4–12 in. high, 3–6-fld.: lvs. linear-oblong: fls. ½–1 in. across; sepals linear-oblong, green, with purple bands; petals very small, triangular-lanceolate, dark purple-brown; labellum quadrate, oblong, very convex; disk shining blue, with a yellow edge; margin pilose and fimbriate, maroon-purple. Medit. region. B.M. 5844. B.R. 370.

muscífera, Huds. (*O. myòdes*, Jacq.). Fly Orchis. St. very slender, 3–4-fld.: sepals oblong or narrowly ovate, greenish; petals narrowly linear; labellum long, oblong, purplish brown, with pale white or blue marks in the center; central lobe notched. Spring and early summer. Cent. and E. Eu. R.B. 21:241.

AA. *Margin of the labellum yellow or greenish yellow.*

tenthredinífera, Willd. Sawfly Orchis. St. 6 in. high: lvs. elliptic-lanceolate: spike 3–8-fld.; fls. nearly 1 in. across; sepals oblong, obtuse, concave, varying from rose to white; petals very small; labellum broadly obcordate, greenish yellow, pubescent, with a large chestnut-colored spot on the disk. Medit. region. B.R. 205; 1093. B.M. 1930. F. 1872, p. 128.

lùtea, Cav. St. 4–7 in. tall, many-fld.: lvs. linear-oblong: fls. ¾in. across; sepals oblong, obtuse, incurved, green; petals much smaller, linear-oblong; labellum quadrate, golden yellow, with a purple disk. Medit. region. B.M. 5941.

Áceras anthropóphora, Br. Advertised as Ophrys anthropophora, Linn. Man Orchis. St. about 9 in. high, the spike being 2–4 in. long: lvs. ovate to oblong or lanceolate: fls. dull yellowish green; sepals and petals converging over the column; labellum much longer than the sepals; side lobes long, narrow, and the middle lobe split into 2 narrow lobes. Early summer. Pastures, S. Eu. Ophrys differs from Aceras in having a very convex labellum. Both genera are distinguished from Orchis by the absence of a spur.—*O. etrúsca*, Hort., and *O. Grampínii*, Hort., are hybrids between O. aranifera and O. tenthredinifera.

The name Ophrys is used by some botanists to replace Listera (p. 1891); in that case, the synonymy of the listeras becomes:

O. convallarioìdes, Wight (Listera convallarioides, Torr.).—*O. cordàta*, Linn. (Listera cordata, R. Br.).—*O. Smállii*, House (Listera Smallii, Wiegand). Similar to O. convallarioides: lvs. ovate-reniform, borne at or below the middle of the st.: raceme loose, few-fld., lip ¼in. long, not ciliate, broadly ovate, cleft at the apex; ovary glabrous. Mountains of Pa. to N. C.

Heinrich Hasselbring.

OPHTHALMOBLÁPTON (Greek, *eye injuring*, from its poisonous action). *Euphorbiàceæ*. Trees with milky juice: lvs. alternate, simple, pinnately veined: infl. axillary or lateral; fls. inconspicuous, monœcious, apetalous; calyx with 1–3 short lobes, valvate in the bud; stamen 1; styles connate to the apex; ovary 3-celled, 3-ovuled.—Three Brazilian species related to Sapium and Stillingia, not cult. but noted for their poisonous action upon the skin and mucous membrane. *O. macrophýllum*, Fr. Allem., Saint Lucia, is the best known species.

J. B. S. Norton.

2595. Oplismenus hirtellus.

OPIUM is the product of *Papaver somniferum*, the common annual summer-blooming poppy of gardens with smooth, glaucous leaves and white flowers.

OPLÍSMENUS (Greek, *awned*, referring to the awns). *Gramíneæ*. Delicate creeping, branching grasses with rather broad blades and narrow panicles consisting of spreading 1-sided racemes: spikelet 1-fld.; first and second glume and often the sterile lemma awned.—A genus allied to Panicum, containing 5 or 6 species of the warmer regions, one of which is cult. in conservatories for ornament.

hirtéllus, Roem. & Schult. (*Pánicum variegàtum* of florists). Fig. 2595. A half-creeping perennial, with small, greenish panicles, the common form with neatly white- and pink-striped lvs. W. Indies. Gn. 47, p. 68. G. 37:271.—Popular for edges of beds and for hanging-baskets. Prop. by divisions of the rooting sts. This plant has usually passed as *O. Burmannii*, which, however, is an annual with silky panicles.

A. S. Hitchcock.

OPORÁNTHUS: *Sternbergia*.

OPÚNTIA (old Latin name used by Pliny, later used for the Indian fig, probably derived from Opus, a town in Greece). *Cactàceæ*. Succulent plants, a few species of which are extensively cultivated in warm regions for their large, edible fruits, while others are grown as hedges; numbers of species are grown in the collections of fanciers for their oddity.

Opuntias vary from small, prostrate plants a few inches above the ground to trees with spreading tops 20 or more ft. high: sts. flat, clavate or cylindrical, bearing more or less elevated areoles; from each of which appears a small caducous pointed lf., rarely spreading and foliar; an oval or circular area, more or less covered with soft wool, intermixed with barbed bristles and usually a variable number of spines, occurs in the axil of each lf.: fls. borne singly toward the upper part of the joints or sts., on the bristle-bearing part of the areole, and with spreading, showy corollas; the usually many-ovuled inferior ovaries are not of foliar development, and sometimes differ but slightly in appearance from normal sts., usually bristle- and spine-bearing: fr. dry or succulent, frequently edible; seeds large, flattened, discoid and often margined.—There are about 130 species and many varieties and hybrids, extending from Canada southward through the U. S., Mex., W. Indies and Cent. Amer. to the southern part of S. Amer. The species are confined mostly to arid and semi-arid regions; however, some are found in regions of heavy rainfall. They are found in greatest quantity and variety of species in S. W. U. S. and N. Mex., where they are often trees and form the most conspicuous part of the flora. Opuntia is a genus of great variation in habit and appearance, and, from the frequency of natural hybrids and ill-defined specific lines, one of the most difficult genera of flowering plants to present satisfactorily in systematic order. Some of the largest cacti are opuntias, while nearly all that are of economic value belong to this genus.

Although the opuntias are less attractive as pot-plants and, on account of their barbed spines and bristles, more difficult to handle than most other cacti, they are coming into favor on account of their unique appearance, rapidity of growth and attractive flowers. They grow best with an abundance of heat and sunlight, the character of the soil being a secondary consideration. Like all other cacti, they require perfect drainage. They are readily grown from cuttings, and also from seed under proper management.

Economically considered, the opuntias are by far the most important of the cacti. Although originally confined to the New World, the more important species are now in cultivation or have escaped from cultivation and become wild in every arid and semi-arid region of the globe where the temperature permits their being grown. Wherever grown, their tendency is to escape from cultivation and become persistent and troublesome weeds. In this respect they are much more to be dreaded in foreign countries than in America, the place of their nativity.

As ornamental plants, opuntias are unusual rather than pleasing. From their stiff, formal aspect they do not harmonize, as a rule, with other plants, and on account of their spines and bristles they are difficult to handle and are considered by most gardeners as a nuisance in decorative planting. It is as hedges and as groups of mixed species that they are most effective. Most species grow rapidly and bloom profusely. The flowers, as a rule, are large and showy and of various colors, although yellow predominates. They wither soon after opening and remain at their best only for a few days. The spines and bristles which usually cover the base of the flowers render them of no value as cut-flowers. With many species, such as *O. leptocaulis, O. tetracantha,* and some forms of *O. Tuna,* the bright-colored fruits, which remain on the plants for a long time after ripening, render them more attractive in fruit than in flower. Crested or fasciate forms (Fig. 2596) are common.

Although extensively cultivated for their fruit in many countries, where they furnish an important article of diet for four to five months each year, they do not as yet take a pomological rank with the horticulturist, although they are much more widely used and of far more economic importance than many plants which have an established place in pomological literature. From the fact that opuntias flourish best in regions where experimental horticulture receives little or no attention, the development of desirable economic varieties has not been what might be expected of plants which respond so readily to cultivation and selection, and which may be hybridized with so little difficulty. Botanically considered, the fruit is a kind of berry, varying from dry to fleshy and succulent. Morphologically, it is a modified stem with the true seed-capsule sunken into its apex; hence it bears leaves and spines, and usually, under suitable conditions, and frequently in the natural state when it becomes detached, will bud and grow like a normal stem-cutting.

Opuntias were cultivated by the aborigines of America at the time of its discovery, and were early taken by the Spanish explorers to Spain and Spanish colonies in other parts of the world. After becoming established in the Canaries, Azores, and Madeira islands, it was not long before their culture extended to Portugal, Spain, and the whole littoral region of the Mediterranean. From there they spread to Egypt, India, and other parts of southern Asia. In comparatively later times they reached South Africa, Australia, and New South Wales, where they are fast becoming a serious menace to agriculture and grazing. In all the regions above noted they have escaped from cultivation and have become pestiferous weeds.

The want of fixed characters, the great variations in most species under different soil and climatic conditions, and the readiness with which natural hybrids occur, make the identification of cultivated and introduced species so difficult that the considerable literature on this subject is extremely uncertain as to nomenclature. The common names Indian fig, barberry fig, prickly pear, and tuna, are applied indiscriminately by most persons to any flat-jointed opuntias, but more particularly to the kinds with edible fruits.

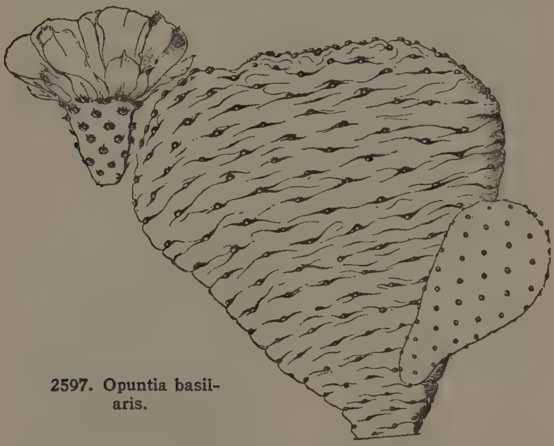
2596. Opuntia ramosissima. To illustrate fasciation, which is of frequent occurrence in nearly all species of cacti.

The two most widely distributed and extensively cultivated are *O. Ficus-indica* and *O. Tuna.* These plants have often been confused by authors. Much that has been written under the name of one species really applies to the other. They are closely linked together by hybrids, and each has been in cultivation for so long a period that numerous cultural varieties have developed, particularly in Mexico and Sicily. It is possible that the many cultivated forms of both species originated from the same source.

Although the Mexicans and Indians eat the fruit of more than a score of indigenous species, the two named above, with their many cultivated forms, are by far the most desirable and palatable. *O. Ficus-indica* is preferable in most respects to *O. Tuna* on account of its fewer and smaller spines and usually larger fruit. The latter, however, makes a more formidable hedge, and is more frequently planted in the United States. Hedges of this plant are to be seen at many of the old Spanish missions in Arizona and California, where they were probably first introduced into the United States. *O. Ficus-indica* is frequently grown by the Mexican population of New Mexico, Arizona, and California. In southern Florida it has escaped from cultivation and become naturalized. The fruits are usually larger and fewer-seeded than in *O. Tuna*, and are commonly yellow. They frequently measure 3 to 4 inches in length and 2 to 3 inches in width. Forms of this species about the old missions of southern California vary considerably. One form, known as *Tuna Colorado*, has an insipid, light crimson-colored fruit, while another, *Tuna manse*, has a yellowish fruit, irregularly mottled with crimson.

General cultivation. (D. M. Andrews.)

Hardy opuntias satisfy a rather general desire for something unique or grotesque, while at the same time they possess enough ornamental value to recommend them to everyone, and especially to those lovers of cactaceous and succulent plants whose space indoors is limited. Being natives of the western plains and foothills of the mountains, they can scarcely suffer from long-continued drought, and the sunny side of the rockery will suit them exactly, as it will allow all surplus moisture to drain off, and no artificial watering will be necessary. William Falconer, who has used large quantities at Schenley Park, Pittsburgh, Pennsylvania, writes as follows: "In certain localities, as on bleak, exposed banks and about rocky knolls, opuntias and *Yucca angustifolia* can be used unsparingly with perfect success." He also says, "All have been planted out-of-doors, remaining unprotected summer and winter, and all have been perfectly hardy." They have succeeded also at Kew Gardens, in the very humid climate of England, without protection. Their requirements seem to be as follows: a porous, well-drained soil, a sunny exposure, and a season long enough in which to ripen the fruit and annual growth; these conditions being complied with, they will endure almost any degrees of cold to be experienced even in the most northern portions of the United States. Their altitude-limit in Colorado indicates that they will succeed as far north as Indian corn can be matured. The following kinds have been used successfully, as above indicated: *O. arenaria*, with small, round to oblong, very spiny joints, the spines varying much in color from gray and straw-color to purplish brown; *O. arborescens*, the tree or candelabrum cactus, the tallest of this list, is of cylindrical branching growth, with bright purple flowers and yellow fruit; *O. Camanchica* has very large, orbicular joints, the upper half thickly beset with spines, fruit purple; *O. fragilis* resembles *O. arenaria*, but is smaller; *O. humifusa* includes a multitude of forms, all of which are very hardy; *O. phæacantha* var. *major* is one of the most striking sorts, with immense, glaucous joints, dark purple spines, yellow flowers, and purple fruit; *O. polyacantha* is one of the most variable, as well as one of the most showy. The spines vary from ivory-white to purple and brown, and from short and stout to long and slender. Nearly all the opuntias have very showy flowers, usually in various shades of yellow and orange.


2597. Opuntia basilaris.

Economic value and cultivation.

Two opuntias, *O. Ficus-indica* and *O. Tuna*, and possibly a few other closely allied ones, are extensively grown in Mexico. The fruit begins to ripen in June and July, while the later varieties last until December. The fruit is consumed by all classes and conditions of people. The fine bristles which invest the fruit are usually removed before picking by rubbing them with straw, grass or leaves. The fruit is later picked by the hand, or, in some instances, with wooden tongs. In large plantations, when the fruit is raised for commercial purposes, it is usually harvested with a heavy knife, the workman first cutting off the joint bearing the fruit, and later detaching the separate fruits.

In preparing the fruit for the table, a thin slice is cut from each end and a slit made through the paring, joining the cut surfaces. The thin paring is easily separated from the mealy but juicy pulp, and quickly removed with the fingers.

Today the finest opuntia fruits are grown in Sicily, where they are one of the most important crops that the island produces. From July to November the peasants live almost entirely on this fruit, and considerable quantities are yearly exported to other countries, some of which finds its way to New York and other American cities. It is grown extensively by the Arabs throughout northern Africa, and forms an important part of their food for a portion of each year.

The nutritive value of this fruit ranks high, as shown by the following analysis by Wolff:

	Per cent
Dry substance	21.60
Ligneous matter	3.70
Proteid substances	.59
Fatty bodies	1.80
Sugar	14.00

It has been ascertained that some of the best varieties are capable of producing on lean, sandy or rocky soil, ill-suited for growing ordinary crops, as much as 18,000 pounds of fruit to the acre. When it is considered that this is equal to 2,500 pounds of sugar, as well as other valuable food constituents, it may be readily seen that the food value from the standpoint of nutrition is considerable.

Plantations are usually made on dry slopes of hills, as the plants do not thrive where there is much moisture or on heavy clay soils. Joints, cut or broken from the plants, are used instead of seeds, and are planted at distances of 6 to 8 feet in furrows from 6 to 15 feet apart. No tillage is practised, as they grow rapidly, and in a few years shade and smother out all other growth. Before planting, the cuttings are exposed in half sunlight from seven to fifteen days, that they may partially wither, in order to facilitate rooting.

An important advantage in the culture of these plants is the regularity of the yearly crop. They begin to bear in about three years after planting, and continue in bearing for many years.

Of the opuntias indigenous to the United States, none as yet has been grown for fruit, or with an effort to improve them. *O. Engelmannii* has a large but poorly flavored fruit, rarely eaten, even by the Indians. *O. lævis* has one of the largest and most palatable fruits of any of the species found growing wild within the United States. This plant also has the advantage of having but few spines. *O. Camanchica*, *O. humifusa*, *O. chlorotica*, *O. phæacantha* and *O. macrocentra* have medium-sized fruits, insipid and unpalatable to the cultivated taste, but eaten by Indians and Mexicans.

Wherever grown extensively, the opuntia fruits are used for making a weak alcoholic drink. The juices of the highly colored sorts are sometimes used to color confectionery.

Many of the opuntias have considerable forage value, particularly during periods of long drought when other forage crops are short. The range cattle of the southwestern United States feed on either the branches or fruits, or both, of nearly all the indigenous species, the flat stems of *O. Engelmannii* and the pendulous fruit clusters of *O. fulgida* being most largely consumed. When cattle are fed largely on unsinged native opuntias, the spines and bristles do great injury. They collect mainly in the mouth, making eating very difficult if not impossible on this account. There are indications that "hairballs" composed of opuntia fibers and spicules are likely to be prevalent also under such conditions.

In northern Africa the flat joints of the forms with few spines are used as forage for cattle during the dry season, after being allowed to ferment slightly. In Tunis, plantations are sustained by dairymen for the purpose of feeding their cows upon the fleshy stems.

Species of opuntia have run wild to a remarkable extent in southern Africa. They have spread rapidly during the past century, and in many places have crowded out the grasses and become a nuisance. Two forms of the plant are recognized by the Dutch farmers; viz., a thorny variety growing on the open country and on stony hillsides known as Doornblad, and a fewer-spined larger variety with thicker stems known as Kaalblad. It is probable that these two varieties originated from the same introduction, for, according to Macdonald, the seed from the Doornblad or Kaalblad variety may give rise to plants resembling either or both of them. It is extensively used as feed for cattle, ostriches and pigs, either alone or when mixed with other forage. Here, however, much harm has come from range cattle eating it in times of little or no other forage, and ostriches become blind from the spines and bristles getting into their eyes in eating the fruits.

In New South Wales and Australia, where several species have escaped from cultivation and spread over large areas of arable land and driven out more valuable forage plants, the land has depreciated 50 per cent in value. Here, however, some of the worthless species, such as *O. vulgaris* and *O. monacantha*, are more widely spread than the more valuable varieties of *O. Ficus-indica* and *O. Tuna*.

From what has been said it may be seen, first, that varieties of *O. Ficus-indica* and *O. Tuna* produce large crops of edible and nutritious fruits; second, that plants with few or no spines are the general rule in *O. Ficus-indica* and of not infrequent occurrence in *O. Tuna;* third, that opuntias are strong, vigorous plants that will grow in situations in which few other plants will thrive; fourth, that spineless forms make valuable forage.

With these and more qualities to recommend them, it yet remains for horticultural enterprise to develop a spineless and bristleless variety that will not only be of value for forage but will produce large crops of fruits as attractive to the educated palate as to the savage. From the experience gained in establishing a garden of nearly seventy species and varieties of opuntias, comprising about 300 plants, and watching their growth and behavior for several years, it is thought that they offer great possibilities in the way of improvement in the hands of a careful plant-breeder.

In recent years, the prickly pear has attracted considerable attention as forage for cattle. Full report of yields of several species in test plantations in southern Texas is given in Bulletin No. 208 of the United States Department of Agriculture (May, 1915) by David Griffiths. See also a discussion of the forage value of prickly pears by Woodward, Turner and Griffiths, "Journal of Agricultural Research," August, 1915.

INDEX.

acanthocarpa, 46.
albispina, 14, 29.
arborescens, 54.
arbuscula, 59.
arenaria, 31.
aurantiaca, 4.
basilaris, 7.
Bernardina, 48.
Bigelovii, 52.
brachyarthra, 32.
brasiliensis, 1.
cæspitosa, 32.
Camanchica, 20.
candelabriformis, 11.
chlorotica, 16.
clavarioides, 35.
clavata, 40.
crassa, 12.
crinifera, 5.
cristata, 33, 35.
cylindrica, 33.
cymochila, 24.
Darwinii, 37.
Davisii, 45.
diademata, 38.
echinocarpa, 47.
Emoryi, 43.
Engelmannii, 18.
ferox, 29.
Ficus-indica, 13.
filipendula, 23.
fragilis, 32.
frutescens, 60.
fulgida, 51.
fulvispina, 9.
galapageia, 2.
gigantea, 20.
glauca, 12.
Grahamii, 41.
Greenii, 24.
gymnocarpa, 13.
horrida, 15.
humifusa, 24.
hystricina, 28.
imbricata, 53.
invicta, 44.
leptocaulis, 60.
leucotricha, 9.
macrocentra, 21.
macrorhiza, 24.
major, 19, 60.
mamillata, 51.
mesacantha, 24.
microdasys, 6.
microsperma, 29.
missouriensis, 29.
monacantha, 3.
nigricans, 22.
oplocarpa, 24.
papyracantha, 38.
Pes-corvi, 26.
phæacantha, 19.
platycarpa, 29.
polyacantha, 29.
polyantha, 14.
prolifera, 50.
puberula, 8.
pulchella, 39.
pycnantha, 17.
Rafinesquii, 24.
ramosa, 7.
ramosissima, 61.
rufida, 6.
rufispina, 29.
rutila, 30.
Salmiana, 36.
Schottii, 42.
senilis, 5.
serpentina, 49.
spinosior, 55.
splendens, 29.
stellata, 54.
stenochila, 24.
tessellata, 61.
tetracantha, 58.
Treleasii, 7.
triacantha, 10.
tricophora, 29.
tuberiformis, 32.
Tuna, 15.
ursina, 27.
variegata, 3.
versicolor, 57.
vestita, 34.
vulgaris, 25.
Whipplei, 56.

KEY TO THE SPECIES.

A. *Articulations or joints strikingly different, flat to cylindrical* .... 1. **brasiliensis**

AA. *Articulations or joints similar, more or less flattened (Nos. 2–32).*

B. *Species from S. Amer* .... 2. **galapageia**
3. **monacantha**
4. **aurantiaca**
5. **crinifera**

BB. *Species from N. Amer.*

C. *Joints pubescent* .... 6. **microdasys**
7. **basilaris**
8. **puberula**

CC. *Joints not pubescent (except sometimes in O. pycnantha).*

D. *Fr. fleshy or succulent.*

E. *Size of joints large: plants mostly large (O. crassa moderately small).*

F. *Color of spines white* ..... 9. **leucotricha**
10. **triacantha**
11. **candelabriformis**

FF. *Color of spines yellow (sometimes red to white in O. Engelmannii, O. polyantha, O. crassa, and O. Ficus-indica).*

G. *Spines none or few* .... 12. **crassa**
13. **Ficus-indica**

GG. *Spines always present, few to many. (One form of O. macrocentra has no spines, and occasional plants of O. chlorotica are without spines.)* ..... 14. **polyantha**
15. **Tuna**
16. **chlorotica**
17. **pycnantha**
18. **Engelmannii**

FFF. *Color of spines reddish brown to black, usually with purplish joints* .... 19. **phæacantha**
20. **Camanchica**
21. **macrocentra**
22. **nigricans**

EE. *Size of joints small: joints variable in shape: plants mostly low or prostrate. (Some forms of O. humifusa have moderately large joints.)* .... 23. **filipendula**
24. **humifusa**
25. **vulgaris**
26. **Pes-corvi**

DD. *Fr. dry, more or less spiny*.....27. **ursina**
28. **hystricina**
29. **polyacantha**
30. **rutila**
31. **arenaria**
32. **fragilis**
AAA. *Articulations or joints similar, more or less cylindrical.*
B. *Species from S. Amer.*
C. *Joints cylindrical, mostly elongated*.....................33. **cylindrica**
34. **vestita**
35. **clavarioides**
36. **Salmiana**
CC. *Joints globose to broadly obovate*...37. **Darwinii**
38. **diademata**
BB. *Species from N. Amer.*
C. *Spines without sheaths: plants mostly small, with clavate joints*......................39. **pulchella**
40. **clavata**
41. **Grahamii**
42. **Schottii**
43. **Emoryi**
44. **invicta**
CC. *Spines sheathed: joints cylindrical or nearly so, more or less elongated.*
D. *Number of spines variable, always more than one.*
E. *Fr. dry, usually spiny*.....45. **Davisii**
46. **acanthocarpa**
47. **echinocarpa**
48. **Bernardina**
49. **serpentina**
EE. *Fr. fleshy, proliferous*......50. **prolifera**
51. **fulgida**
EEE. *Fr. fleshy, rarely proliferous*.52. **Bigelovii**
53. **imbricata**
54. **arborescens**
55. **spinosior**
56. **Whipplei**
57. **versicolor**
58. **tetracantha**
DD. *Number of spines few, usually one, rarely more or wanting*..59. **arbuscula**
60. **leptocaulis**
61. **ramosissima**

1. **brasiliénsis,** Haw. A large, tree-like plant reaching a height of 15–18 ft., numerously branched, with a thick, roundish crown and an upright trunk, 4–6 in. diam., and bearing numerous spines 1 in. or less in length: joints of two kinds, cylindrical, unarticulate, elongate ones and others which are shorter and much flattened and which arise as offshoots from the former; the latter lf.-like, thin, 2–6 in. long, oblong, rarely oblong-lanceolate or orbicular, dark green, margin angular, sometimes irregular: areoles with short gray wool and numerous brown bristles; spines usually 1, sometimes 1–3 small additional ones, 1–2½ in. long, mostly from the marginal areoles, white, with brownish tips: fls. numerous, citron-yellow, 2 in. wide: fr. globose or ellipsoidal, yellow, about 1½ in. diam. Brazil and southward.—One of the species most frequent in cult.

2. **galapagèia,** Hensl. An upright, tree-like plant 6–13 ft. high, with a circular, spreading crown and a very spiny trunk, 6–8 in. diam., and light-colored bark becoming loosened and hanging in fragments from the older sts.: joints elliptical to oblong, thick, 10–14 in. long: spines at first 3–4, spreading, flexible, increasing in number and size with age, finally covering the joints with long, brush-like bundles: fls. small, less than 1 in. wide, red: fr. subglobose, red. Galapagos Isls.

2598. Fruit of Opuntia Ficus-indica. (×½)

3. **monacántha,** Haw. An upright plant branching from the ground and reaching a height of 6 or more ft.: joints oblong to elliptical, rather thick, terminal ones much thinner, 5–12 in. long, 3–6 in. wide, bright green: areoles with uniformly short wool and yellowish brown bristles; spines 1–2, seldom more, erect, ¼–1½ in. long, yellow to dark reddish brown: fls. yellow, 3 in. wide: fr. ellipsoidal to pyriform, occasionally proliferous, red, somewhat spiny. Argentina.—The horticultural variety, **variegàta,** is in the trade.

4. **aurantìaca,** Lindl. A numerously branched, rather weak, semi-prostrate plant 3–5 ft. high: joints linear-lanceolate to lanceolate, 2–10 in. long, ½–1 in. wide, elliptical in transverse section, dark green, turgid: areoles with a tuft of grayish white wool and bright yellow bristles; spines 4–6, spreading, straight, stiff, brown to yellow, the longest less than 1 in. long: fls. yellow, 1½–2 in. wide: fr. carmine-red, globose, with short spines; seed with woolly hairs. Argentina.

5. **crinífera,** Salm-Dyck (*O. senìlis,* Parm.). A much-branched, wide-spreading plant, about 3 ft. high: joints obovate to elliptical, 6 in. long and 3–4 in. wide, dark green, occasionally glossy: areoles crowded, small, with white wool, numerous golden yellow bristles, and a variable number of long silky hairs; spines 6–8, later more, white, glistening, reaching 1 in. long, the long silky hairs particularly developed on the under side of the young joints: fls. 3½–4 in. wide, golden yellow, often reddish. Brazil(?).

6. **microdàsys,** Lehm. An erect, wide-spreading plant, rarely more than 3 ft. high: joints elliptical to obovate, 3–4 in. long and nearly as wide, thick, bright green, densely pubescent: areoles with short, whitish wool and numerous golden yellow bristles of variable lengths; spines wanting: fls. greenish to lemon-yellow, about 2 in. wide: fr. comparatively small, oval, less than 1 in. diam., armed with numerous yellow bristles; flesh whitish. N. Mex., southward.

Var. **rùfida,** K. Schumann. Of more robust growth: joints rounder and larger, paler green, the bristles inclined to reddish brown. Mex.

7. **basilàris,** Engelm. & Bigel. Fig. 2597 (adapted from Pacific R. R. Report). A low, spreading plant, rarely 1 ft. high: joints thick, variable, usually broadly obovate, with more or less truncate top and branching from the base, 4–7 in. long and 2–4 in. wide, bluish green, and very minutely pubescent: areoles depressed, close together, and with brownish yellow wool and numerous short yellowish brown bristles; spines wanting, rarely present: fls. dark purple, rarely white, 3 in. or more diam.: fr. short, thick green, becoming white and dry at maturity and filled with many large white seeds. S. W. U. S. and N. Mex.

Var. **ramòsa,** Parish. A smaller plant, with joints branching from the upper end, and usually glabrous. S. Calif.

Var. **Trelèasii,** Coult. Differs from the species in having larger orbicular or obovate joints, with terete base, and larger lvs. S. Calif.

8. **pubérula,** Pfeiff. A numerously branched and upright plant, 2–3 ft. high: joints obovate or somewhat rounder, when young covered with very soft pubescence which becomes bright green with age: areoles with short brownish yellow wool and numerous short amber-colored bristles; spines 5–7, 1 in. or more in length, straight, cylindrical, white, with amber-colored base, shining, the lower ones the longer: fls. 1½–2 in. wide, greenish yellow: fr. oval, 1½ in. diam., the many areoles bearing short wool and many bright amber-colored bristles; flesh sweetish; seeds many, correspondingly small. Mex.

9. **leucótricha,** DC. (*O. fulvispìna,* Salm-Dyck). An upright, numerously branched plant, sometimes reaching the height of 10 ft.: joints elliptical or narrower, mostly rounded at the end, 8–10 in. long and half as wide, dark green: areoles small, with white or whitish gray wool and numerous short brown bristles; spines very slender, mostly 4 at first, but later as many as 10–12; some reach the length of 3–4 in., becoming bristle-like and very flexible: fls. 2–3 in. wide, yellow, with reddish center: fr. spherical, 1–1¼ in. diam., pale green to white, thickly beset with velvety wool and brownish yellow bristles; pulp sweet, edible. Mex.

2599. Opuntia Tuna.

10. **triacántha,** Sweet. An upright, tree-like plant, reaching 10–12 ft. in height: joints often very large, occasionally 18 in. long and 10 in. wide, obovate, thick, grayish green: areoles remote, from 1¼–1½ in. apart, with short grayish wool and yellow bristles; spines 3–4, white, with yellow points and bases, 1 in. or less long: fls. 2½–3 in. wide, carmine to orange-yellow: fr. elliptical, 1½–2 in. long; pulp acid. W. Indies.

11. **candelabriformis,** Mart. An upright, sparingly branched plant, 2–4 ft. high: joints elliptical to obovate, thick, dark green, 3–10 in. long and half as wide: areoles with brownish white wool, later becoming gray, and numerous white bristles; spines 4–5, of which 3 are very strong, white, 1¼ in. or less in length: fls. 2½–3 in. wide, carmine-red: fr. spiny. Mex.

12. **crássa,** Haw. (*O. glaùca,* Hort.). A sparingly branched, upright plant, 4–6 ft. high: joints oblong to ovate, 3½–5 in. long and two-thirds as wide, glaucous, greenish blue, thick: areoles with brownish wool, and few bristles of same color; spines usually wanting, sometimes ½in. or less long, straight and needle-like. Mex.

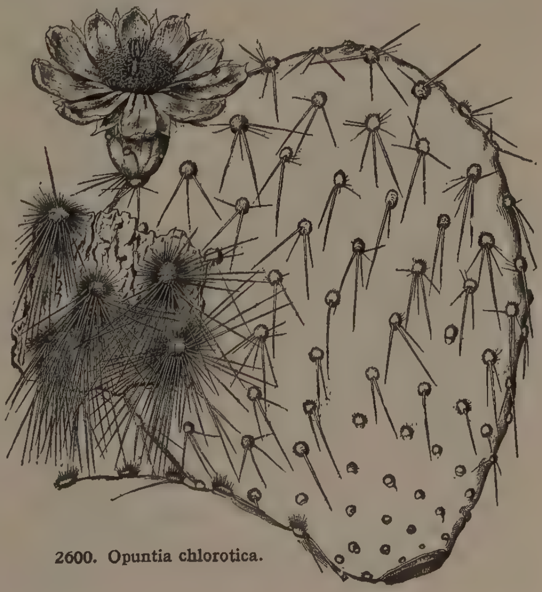
13. **Fìcus-índica,** Mill. (*O. gymnocárpa,* A. Web.). INDIAN FIG. Fig. 2598. An erect, tree-like plant, reaching the height of 10–15 ft., and with a woody cylindrical trunk: joints elliptical or oblong, often with bluish bloom, thick, often 18 in. long and one-third as wide: areoles orbicular and sparingly covered with white wool and yellow bristles; spines usually wanting, occasionally 1–2 small weak ones are present: fls. yellow, expanding to 3–4 in. diam.: fr. yellow, with reddish pulp, bristly, 2 in. diam., edible. Mex. J.H. III. 68:447.—A species widely grown throughout the warm temperate regions of the world. In some regions, escaping from cult., it has become a troublesome weed. Frequently cult. for its fr. under the name of Indian fig.

14. **polyántha,** Haw. A much-branched, spreading plant, 3 ft. or less in height: joints oblong to obovate, dark green, weak-spined, 4–6 in. long and 3–4 in. wide: areoles with white wool and brown bristles; spines 3–8, slender, golden yellow, seldom over ¾in. long: fls. 2½ in. wide: fr. broadly oval, deep red. W. Indies(?). For. var. **albispìna** consult *O. polyacantha,* No. 29, of which it is perhaps a form.

15. **Tùna,** Mill. (*O. hórrida,* Salm-Dyck). Fig. 2599. An erect, wide-spreading, tree-like plant, rapid-growing and frequently 10–12 ft. high: joints deep green, mostly elliptical, 10–14 in. long and 6–10 in. wide: areoles with whitish wool which later becomes dirty gray, and a fascicle of long brownish yellow bristles; spines 4–6, rigid, stout, yellow, frequently subulate, spreading, unequal in length, 1–2 in. long: fls. 3–4 in. wide, yellow, fading to red: fr. pear-shaped or rounder, 1–1½ in. diam., sweet, edible, dark reddish purple. W. Indies and Mex.—Probably the most extensively cult. of all the opuntias. Under the name of "tuna" it has been grown in S. W. U. S., W. Indies and Mex. since the earliest Spanish possession. It is extensively grown both for its fr. and as a hedge plant. It has escaped from cult. and become naturalized in N. and S. Afr., S. Eu., S. W. Asia and Austral., and in some places has become a troublesome weed.

16. **chlorótica,** Engelm. Fig. 2600 (adapted from Pacific R. R. Report). A compact, upright, moderately branched plant, from 3–6 ft. high, the trunk and main sts. becoming woody and terete, and densely covered with long straw-colored bristles and spines: joints orbicular, somewhat glaucous, 6–10 in. diam.: areoles crowded, with fine, gray wool and very numerous golden yellow bristles of unequal length; spines 3–6, rarely none, on old sts. occasionally 40 or more, unequal angular, golden yellow, deflexed, usually 1 in. or less long: fls. yellow, 2–3 in. diam.: fr. deep purple, moderately bristly, edible, 1½ in. diam., broadly obovate to globose; seeds comparatively small, sometimes sterile. S. W. U. S.

17. **pycnántha,** Engelm. An upright, moderately branched plant, 3–5 ft. high: joints oval to orbicular, occasionally somewhat pointed at the ends, 4–8 in. long, sometimes pubescent, armed with a densely interwoven covering of mostly deflexed spines: areoles crowded, approximately ⅓in. apart, with dark brown wool and numerous long, yellow bristles; spines 3–7, on old sts. 20 or more, straw-colored to ashy, mostly less than 1 in. long: fls. greenish yellow, 2–3 in. broad: fr. obovate, 1½ in. diam., and covered with numerous spines and bristles. Low. Calif.



2600. Opuntia chlorotica.

18. **Éngelmannii,** Salm-Dyck. Fig. 2601. An erect to semi-prostrate, profusely branching, coarse plant, 2–5 ft. high, forming large, impenetrable thickets, usually with a short, more or less terete, woody trunk, with grayish bark which becomes unarmed with age: joints broadly obovate to orbicular, pale to bluish green, very variable in size, in large specimens 12–14 in. long and nearly as wide, moderately thick: areoles remote, about 1 in. apart, with gray wool and large, rigid, gray to yellow, unequal bristles: spines mostly 2–4, sometimes 1–3 small additional ones, very variable, horny, variously colored, mostly yellow, or white with reddish base, usually compressed or angular and curved or twisted: fls. yellow, red within, fading to red, 2½–3 in. diam.: fr. broadly pyriform to globose, frequently 2 in. diam., dark purple, with insipid purple flesh. U. S. and Mex.—This species, with its numerous varieties, is the most widely distributed and abundant of the large, flat-stemmed opuntias in the U. S. It varies greatly in different localities, and its many forms have not as yet been adequately defined.

2601. Opuntia Engelmannii. (×⅙)

19. **phæacántha,** Engelm. A diffuse, semi-prostrate plant, 1–2 ft. high, and freely rooting from lower margin of joints: joints broadly obovate, moderately thick, 4–6 in. long: areoles about 1 in. apart, with short wool and reddish or brownish bristles; spines mostly toward margin or on apex of joints, 2–5, straight and stiff, reddish brown to almost black with lighter tips, 1–2½ in. long: fls. 2½ in. broad, yellow: fr. usually long-pyriform, 1 in. or less diam. and twice as long, purple, with greenish acid pulp. S. W. U. S. and Mex. Var. **màjor,** Hort., is a good form.—This species and a number of the following become deep purplish green during autumn and winter. In the spring they lose their purplish color to a large extent and take it on again in the fall. The spines are also much darker in winter than in summer.

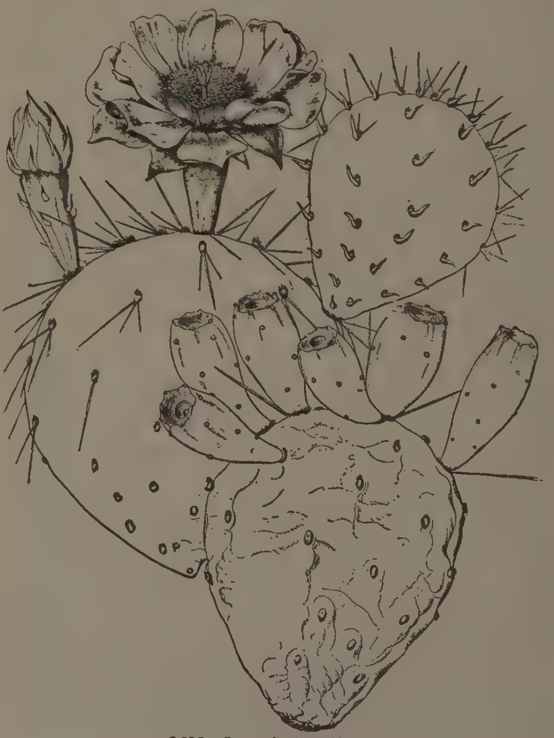
20. **Camánchica,** Engelm. & Bigel. A prostrate, widely spreading plant 1–2½ ft. high, and freely rooting at the lower margin of the joints: joints broadly obovate to orbicular, 4–6 in. long, moderately thick: areoles about 1 in. apart, with light brown short wool and yellowish brown bristles, mostly armed; spines very variable, usually 1–3, sometimes 3–6, on marginal areoles, reddish to blackish brown with lighter tips, variable in length, sometimes 2½ in. long: fls. 2½–3 in. wide, yellow, with reddish center: fr. oval to globose, sometimes pyriform, deep red, sweet, edible, 1–1½ in. diam. S. W. U. S. Var. **gigantèa,** Hort., of the trade proves to be *O. phæacantha.*

21. **macrocéntra,** Engelm. A semi-prostrate, spreading plant, 2–3 ft. high: joints strikingly purple-green, very thin, broadly obovate to nearly orbicular, 5–9 in. diam., with a few remarkably long spines on the marginal areoles: areoles about 1 in. apart, grayish wool and short grayish yellow bristles; spines rarely wanting, usually 1–2, reddish brown to almost black, annulate, 3–5 in. long, slender and straight or variously twisted, sometimes 1–3 much smaller, lighter colored, secondary spines: fls. 3 in. wide, yellow: fr. oval to globose, rarely ovate, 1 in. diam., red; pulp sweet, edible. S. W. U. S., Mex.—This species is remarkable for its exceedingly long, dark spines and purple joints.

22. **nígricans,** Haw. A large, robust, upright plant, 2–5 ft. high: joints usually obovate, dark green, rarely tinged with purple, about 10 in. long and 6 in. wide, moderately thick: areoles with short, grayish wool and yellowish brown bristles; spines 1–2, awl-shaped, 1–2 in. long, strong, dark brown, at first yellowish: fls. 1½–2 in. wide, yellow with red center. Mex.—Frequent in cult.

23. **filipéndula,** Engelm. A small, semi-prostrate plant, freely branching from the base of the joints, rarely 10 in. high and with thick, tuberous, moniliform roots: joints small and thin, bluish, glaucous, rarely 3 in. greatest diam., orbicular to broadly obovate, sometimes diamond-shaped, frequently flattened at the top and broader than long: areoles orbicular and with an abundance of whitish wool and many long, slender, yellowish green bristles, which are very conspicuous, particularly on the older joints; spines sometimes wanting, when present usually 1–3, rarely more, white, very slender and flexible, 1–2 in. long, mostly marginal: fls. yellow, 1½–2 in. diam.: fr. clavate to narrowly obovate, 1½ in. long and half as wide, greenish yellow, with few seeds. Texas to Ariz., extending into Mex.

24. **humifùsa,** Raf. (*O. Rafinésquii,* Engelm. *O. mesacántha,* Raf.). Fig. 2602 (adapted from Pacific R. R. Report). A wide-spreading, prostrate plant, freely rooting from the lower margin of the joints, roots sometimes tuberous: joints obovate to orbicular, usually 2–5 in. long and 2–4 in. wide, sometimes twice as large, dark to light green: areoles with gray wool and bright reddish brown bristles; spines sometimes wanting, when present 1–3 and mostly marginal, stout, 1 in. long, white with darker tips and bases, frequently 1–3 small secondary spines also present: fls. 3 in. or less diam., golden yellow, frequently with reddish center: fr. slender-clavate or broader, 1½–2 in. long, yellowish red



2602. Opuntia humifusa.

to purple, with insipid purplish pulp; seeds comparatively large. W. Cent. U. S.—An exceedingly variable species of wide distribution and imperfectly known. Many varieties have been described, some of which are in the trade. The extreme forms vary greatly from the type. Of these forms vars. **Greènii, oplocárpa, cymochìla, stenochìla** and **macrorhìza,** Hort., have appeared in the trade.

2603. Opuntia ursina.

25. **vulgàris,** Mill. Barberry Fig. A diffuse, prostrate plant a foot or less high: joints usually resting on the ground and rooting from the lower margin, obovate to suborbicular, thick, 2–4 in. greatest diam., pale green: areoles with grayish wool and a few short, greenish yellow bristles; spines rarely present, when present usually 1, stout, erect, less than 1 in. long, yellow, often variegated: fls. 2 in. wide, pale or chrome-yellow: fr. obovate to spherical, 1 in. diam., red, flesh insipid. E. U. S. Hardy in Mass.

26. **Pes-córvi,** LeConte. A small, diffuse, prostrate plant, rarely 1 ft. high: joints fragile, somewhat tumid, narrowly ovate to obovate or oblong, 2–4 in. long and less than half as wide, frequently much smaller, very thick, broadly oval in transverse section, bright green with a bluish tinge: areoles circular, with short, whitish wool and a few short, slender, pale bristles; spines rarely exceeding 2, frequently none, slender, white, often brownish, less than 1 in. long: fls. yellow, 1½ in. wide: fr. obovate, bristly, purplish, 1 in. or less diam.; seeds comparatively large, very few. Fla.

27. **ursìna,** Web. Grizzly-Bear Opuntia. Fig. 2603. An upright, diffuse plant, 1–2 ft. high: joints oblong to obovate, grayish green, thick, 3–6 in. long and 2–4 in. wide: areoles with white wool and numerous yellow bristles; spines 12–20, reddish white, very slender and bristle-like, sometimes 4 in. long, frequently almost completely hiding the epidermis of the plant: fls. 2½–3 in. wide, reddish yellow. Calif.

28. **hystricìna,** Engelm & Bigel. A semi-prostrate, spreading plant, ½–1½ ft. high: joints obovate to orbicular, 3–5 in. long, moderately thick and very spiny: areoles with grayish wool and yellowish red bristles; spines 10–15, 2 in. long or shorter, white or dusky, slender, flexile, angular and twisted: fls. light purple, 2–3 in. wide: fr. broadly obovate, 1 in. diam., armed with many long spines. S. W. U. S.

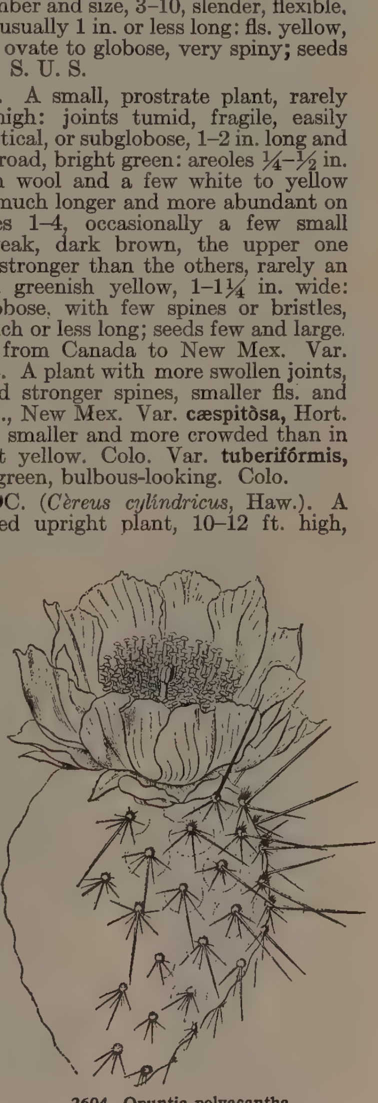
29. **polyacántha,** Haw. (*O. missouriénsis,* DC. *O. fèrox,* Haw. *O. spléndens,* Hort.). Fig. 2604 (adapted from Pacific R. R. Report). A prostrate, wide-spreading plant, rarely rising 1 ft. above the ground: joints variable, from elongate-obovate to orbicular, usually bright green, frequently wrinkled and tuberculate, 2–6 in. long: areoles about ½in. apart, with short, grayish wool and long, reddish brown bristles; spines 0–12, very variable in length, number and color on different forms and plants from different localities, mostly marginal, white or variously tinged with red or brown, slender, twisted and flattened, some reaching a length of 3 in.: fls. yellow, darker within, 2–2½ in. wide: fr. broadly ovate or subglobose, ¾–1 in. diam., armed with numerous rather short spines; seeds comparatively large. W. Cent. U. S.—A species of wide distribution and very variable, some high mountain forms entirely without spines, while other forms are armed with a close network of closely interwoven ones. A number of the forms have been segregated as varieties, of which the best known are **rufispìna, platycárpa, microspérma, albispìna** and **trichóphora,** Hort. All the forms appear to run together and the varietal distinctions are of doubtful value. Hardy in Mass.

30. **rùtila,** Nutt. A low, diffuse plant, ½–1 ft. high: joints tumid, readily becoming detached, and covered with a close network of slender, interwoven, light gray spines, thick, elongate-ovate, 2–4 in. long: areoles crowded, less than ½in. apart, with short, white wool and yellow bristles; spines 3–5, sometimes a few short accessory ones, slender, reddish gray to white, with darker tips, 1¾ in. or less in length, larger ones often flattened and twisted: fls. red, 1½–2 in. wide: fr. broadly ovate to subglobose, usually armed with very long, interwoven spines; seeds comparatively large. S. W. U. S.

31. **arenària,** Engelm. A diffuse plant with upright terminal joints, rarely 1 ft. high: joints thick, obovate, 2–5 in. long and half as wide, tumid, strongly tuberculate: areoles crowded, ¼–½in. apart, with sparse white wool and numerous yellowish brown bristles; spines very variable in number and size, 3–10, slender, flexible, white to ashy gray, usually 1 in. or less long: fls. yellow, 2–2½ in. broad: fr. ovate to globose, very spiny; seeds large and irregular. S. U. S.

32. **frágilis,** Haw. A small, prostrate plant, rarely more than 4 in. high: joints tumid, fragile, easily detached, oval, elliptical, or subglobose, 1–2 in. long and nearly as thick as broad, bright green: areoles ¼–½ in. apart, with whitish wool and a few white to yellow bristles, which are much longer and more abundant on older joints; spines 1–4, occasionally a few small additional ones, weak, dark brown, the upper one usually longer and stronger than the others, rarely an inch in length: fls. greenish yellow, 1–1¼ in. wide: fr. ovate to subglobose, with few spines or bristles, mostly sterile, an inch or less long; seeds few and large. Rocky Mt. region from Canada to New Mex. Var. **brachyárthra,** Coult. A plant with more swollen joints, more numerous and stronger spines, smaller fls. and more spiny fr. Colo., New Mex. Var. **cæspitòsa,** Hort. Joints bright green, smaller and more crowded than in the type: fls. bright yellow. Colo. Var. **tuberifórmis,** Hort. Joints olive-green, bulbous-looking. Colo.

33. **cylíndrica,** DC. (*Cèreus cylíndricus,* Haw.). A moderately branched upright plant, 10–12 ft. high, with main sts. 2–2½ in. diam., new growth dark green, the comparatively long (½in.) lvs. persisting for some time: areoles depressed, with a little white wool, a few white bristles and some long white hairs; spines at first 2–3, erect, rather stiff, ½in. or less long, at first whitish yellow, later grayish: fls. rose-red, 2–2½ in. wide from end of joints: fr. pyriform, 2–2½ in. long, yellowish green, somewhat spiny. Chile. Var. **cristàta** is offered in cult.



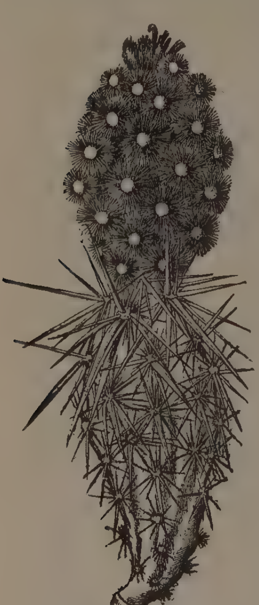
2604. Opuntia polyacantha.

34. **vestìta,** Salm-Dyck. A small, upright, numerously branched, ramifying plant a foot or more in height: joints rather short, 1–2 in. long and half as thick, usually dark green: areoles with white to grayish wool and a number of long, rather soft, grayish white hairs; spines 4–8, either short, flexible and grayish yellow or four times as long (½–¾in.), stiff and red: fls. 1–1½ in. wide, mostly lateral, dark red: fr. ellipsoidal, ¼–¾in. long, bright red and covered with grayish wool. Bolivia.

35. **clavarioìdes,** Link. & Otto. A low, numerously branched, spreading plant, 1–1½ ft. high: joints rather fragile and slender, ½in. thick, cylindrical or somewhat clavate, frequently cristate, with numerous terminal, slender branches: lvs. extremely small: areoles close together, small, with white wool: spines 4–10, sometimes fewer, very small and appressed, white,: fls. 1–1½ in. wide and twice as long, greenish red: fr. elliptical, ½–¾in. long; seeds with woolly hairs. Chile. Var. **cristàta** is offered.

36. **Salmiàna,** Parm. A numerously branched, upright plant, about 3 ft. high, with very long, proportionately slender branches: sts. about ⅗in. diam., with rough, fissured or cracked, grayish brown or lead-colored bark, the terminal joints pencil-like, 3–10 in. long and ⅓–½in. wide: areoles on young growth with sparse white wool and few bristles, on older growth the bristles are very numerous and somewhat spine-like; spines 3–5, spreading, about ⅓in. long, grayish: fls. 1 in. wide, red: fr. pyriform, 1–1¼ in. long, scarlet-proliferous, rarely fertile. Brazil.

37. **Dárwinii,** Hensl. A small, numerously jointed, prostrate, ramifying plant a few inches high: joints globose to broadly obovate, 1½ in. greatest diam., olive-green: areoles with yellowish wool and few bristles; spines rigid, 1½–2 in. long, the lower ones shorter and darker: fls. only on top of terminal joints, 1–1½ in. wide, yellow; ovaries as large as the joints. S. S. Amer.

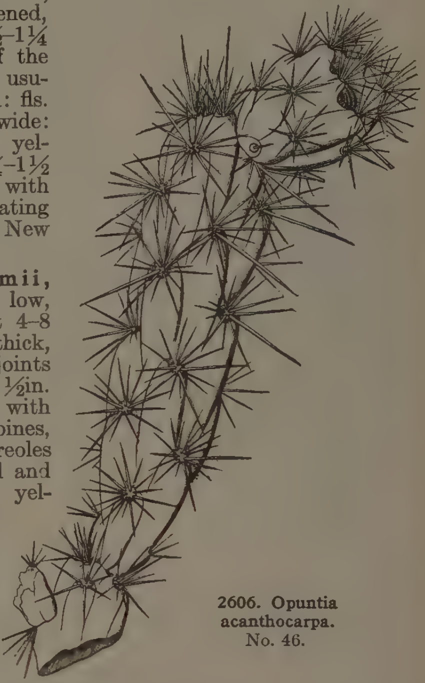

2605. Opuntia clavata.

38. **diademàta,** Lem. (*O. papyracántha,* Phil.). A low, moderately branched, spreading plant, rarely more than 4 in. high and forming dense patches several feet diam.: joints 1–1½ in. long and nearly as thick, globose to broadly clavate, usually growing several in succession, one above the other, young growth bright green, soon becoming grayish: areoles with abundant white wool and brownish black bristles; spines 1–2, papery, flexible, white or brownish with darker tips, ⅕ (?) in. long, and half as wide: fls. rather small, pale yellow. Argentina. R.B. 40, p. 186.

39. **pulchélla,** Engelm. A small, spreading, numerously branched plant, seldom more than 6 in. high: joints ascending, 2½ in. long and ½in. thick, obovate to clavate: areoles crowded, with white wool, and yellowish bristles which become more numerous and larger with age; spines 10–15, of variable length, the central one flattened, flexible, somewhat papery, 1 in. long: fls. from the top of the joints, purplish to rose-red, 1–1½ in. wide: fr. broadly clavate, 1 in. long, with long, hair-like, flexible white spines, dry. Nev., Ariz.

40. **clavàta,** Engelm. Fig. 2605 (adapted from Pacific R. R. Report). A low, spreading plant, 4–6 in. high, forming dense mats of ascending joints 4–5 ft. diam.: joints 1–3 in. long and 1 in. thick, armed with numerous short, flat spines: areoles with white wool and rigid, white bristles; exterior spines 6–14, white, ⅙–¾ in. long, interior 4–7, larger, flattened, scabrous and ½–1¼ in. long, one of the central spines usually very broad: fls. yellow, 1½ in. wide: fr. long-clavate, yellowish, dry, 1¼–1½ in. long, armed with many white radiating bristles. Nev., New Mex.

41. **Gràhamii,** Engelm. A low, spreading plant 4–8 in. high, with thick, fusiform roots: joints 2–3 in. long and ½in. thick, armed with long, dark spines, bright green: areoles with white wool and numerous long, yellowish brown, rigid bristles which become very conspicuous on old joints; exterior spines 4–8, ⅓in. long, interior 4–7, more rigid and longer (1½–2 in.), reddish to ashy brown: fls. yellow, 1½–2 in. wide: fr. ellipsoidal, 1½–1¾ in. long and half as wide, armed with many large, radiating spine-like bristles. New Mex., Texas.


2606. Opuntia acanthocarpa. No. 46.

42. **Schóttii,** Engelm. A wide-spreading, prostrate plant, 4–6 in. high, with numerous short, curved branches: joints short-calvate, rarely more than 2 in. long and armed with numerous dark-colored spines: areoles with white wool and very few bristles; exterior spines 6–10, very variable, ½in. long; interior usually 4, flattened or irregular, 1½–2 in. long, brownish red: fls. greenish yellow to reddish, 1½ in. wide: fr. short-clavate, the numerous areoles covered with white wool and many short bristles. Texas, Mex.

43. **Émoryi,** Engelm. A prostrate and spreading plant with comparatively large, long-clavate, curved joints and reaching a height of 8–12 in.: joints 4–7 in. long and 1–1½ in. thick, with large, elongated tubercles: areoles remote, with white wool and a few long (½in.) yellow bristles; spines numerous, exterior 10–20, ½in. or less long, very bulbous at base; interior 5–10, brownish to reddish black, more or less flattened and sometimes 3 in. long: fls. yellow, reddish within, 1½–2 in. wide: fr. ellipsoidal, yellow, 2–2½ in. long and 1 in. wide, armed with numerous bristles and spines. S. W. U. S., N. Mex.

44. **invícta,** Brandegee. A numerously branched, spreading plant, 10–14 in. high, bluish green and armed with many rigid, erect spines: joints 4–6 in. long and 2–2½ in. thick, nearly cylindrical: areoles with whitish wool and yellowish red bristles; spines 15–25, exterior 6–12, ½in. or less long; interior 10–15, very strong and rigid, 1–2 in. long, more or less flattened: fls. yellow, 1½–2 in. wide: fr. broadly obovate, dry, armed with numerous reddish spines and bristles. Low. Calif.

45. **Dàvisii,** Engelm. & Bigel. A procumbent, spreading shrub, with firm, woody skeleton, 1–2 ft. high:

joints 4–7 in. long and ⅓–½in. thick: areoles with short, white wool and numerous straw-colored bristles; spines usually 8–13, exterior ½in. or less long; interior 4–7, triangular, brownish, with lighter tips, ¾–1¼ in. long, very loose-sheathed: fls. greenish yellow, 2–2¼ in. wide: fr. clavate, 1 in. or more long, often sterile, spiny. Texas to Calif.

46. **acanthocárpa,** Engelm. & Bigel. Fig. 2606 (adapted from Pacific R. R. Report). An arborescent, erect plant, 4–8 ft. high, with dense reticulate-tubular skeleton and ascending, spreading branches: joints usually 4–10 in. long, sometimes 20, and ¾–1 in. diam.: areoles with short, white wool and scanty bright yellow bristles; spines very variable in length and numbers on different plants, usually 8–25, 1½ in. or less long, with loose straw-colored or brownish sheaths: fls. greenish yellow, with reddish centers, conspicuous for stamens with stout red filaments, 1¼–1½ in. wide: fr. subglobose to pyriform, 1 in. diam. and usually armed with many long, stiff spines. Ariz. and Calif.—A factory has been established at Tempe, Ariz., where the wood of this species is made into light furniture, picture-frames, and the like.

2607. Opuntia Bigelovii.

47. **echinocárpa,** Engelm. & Bigel. A low, spreading shrub, with reticulate woody skeleton, rarely more than 1¼ ft. high: joints 1½–3 in. long, rarely 4–6 in., ¾in. thick, somewhat clavate: areoles with short white wool and a few coarse, straw-colored bristles, spines very variable in length and number, exterior 8–16, 1¼ in. or less long; interior usually 4, forming a cross, 1–1½ in. long, with loose white or straw-colored sheaths: fls. greenish yellow, 1¼–1¾ in. wide: fr. depressed-globose or hemispherical and armed with many long (1–1½ in.) spines on the upper areoles. Utah, Ariz., and Calif.—The fr. of this species, like most others with dry fr., ripens in the early summer, while most species with fleshy fr. do not mature them until fall or the following spring.

48. **Bernardìna,** Engelm. A slender, branched, upright shrub, 3–5 ft. high, usually with several long, straight sts. arising from the base: joints 4–24 in. long and ¾in. thick, armed with numerous short spines: areoles with grayish white wool and numerous yellow bristles; spines yellow or brownish, 8–14, usually with inconspicuous sheaths, ¾in. or less long: fls. greenish yellow, 1–1½ in. wide: fr. obovate, 1 in. long, armed with numerous rather short spines. S. Calif.

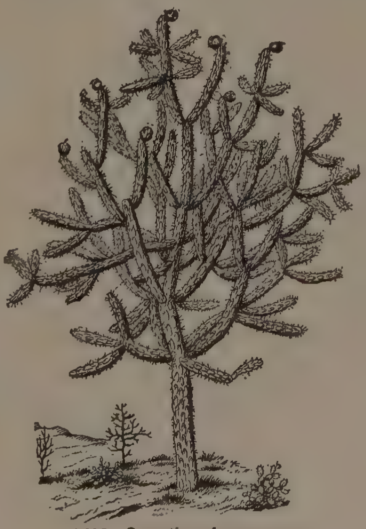
49. **serpentìna,** Engelm. A prostrate, rarely ascending, sparingly branched shrub, a few inches to 2 ft. high: joints much elongated, 6–20 in. long and ½–1 in. thick: areoles with short white wool and whitish bristles; spines comparatively short, usually 7–9, sometimes 15 or more, yellowish or rusty, ½in. or less long: fls. greenish yellow, 1–1½ in. wide: fr. hemispherical, ½–¾ in. diam., armed with numerous short spines and long woolly hairs. S. Calif., Low. Calif.

50. **prolífera,** Engelm. An arborescent, thick-stemmed plant, 3–8 ft. high, with numerous horizontal, spreading branches, the erect trunk sometimes 8 in. diam : joints short-cylindrical, rounded at the ends, very succulent, tumid and readily detached, bright green, 2–6 in. long and 1¼–2 in. thick: areoles with white wool and on older joints with numerous straw-colored bristles; spines variable, usually 6–10, with conspicuous, loose, yellowish or rusty sheaths and much-barbed, usually about 1 in. long: fls. 1¼–1½ in. wide, greenish red: fr. subglobose, ¾–1¼ in. diam., light green, with few small spines and bristles, pendulous in clusters, frequently sterile. Calif., Low. Calif.

51. **fúlgida,** Engelm. A numerously branched arborescent plant, often 10–12 ft. high, with erect trunk 8–14 in. diam., having a thick, grayish, scaly, unarmed bark: joints congested toward the ends of the larger branches, ovate to ovate-cylindrical, 2–8 in. long and often 2 in. thick, very fragile and tumid, easily becoming detached and taking root, bluish green, somewhat glaucous: areoles with white wool and bright straw-colored bristles; spines on young growth 5–8, increasing yearly until ultimately 30–50, finally deciduous, with loose, glistening, white or straw-colored sheaths 1½ in. or less long: fls. ¾–1 in. wide, pink: fr. obovate to globose, light green, pendulous, in large, proliferous clusters, sometimes 50 in a single cluster. S. W. U. S. and N. Mex.—The common "cholla" of the Ariz. plains, where it often becomes a fair-sized tree and notable for its formidable armor of barbed spines completely hiding the surface of the plant. Var. **mamillàta,** Coult. Differs in having fewer, shorter spines.

52. **Bigelòvii,** Engelm. Fig. 2607 (adapted from Pacific R. R. Report). An erect, compact plant, 4–6 ft. high, rarely higher, with fragile woody skeleton which does not appear in joints of the first year's growth, the most densely spine-covered and difficult to handle of the cylindrical opuntias: joints readily detached and forming formidable burs, ovate, short-elliptical to long and cylindrical, with rounded ends, readily breaking from the plant and taking root, pale green, fragile, tumid, terminal ones frequently 3–5 in. long and half as thick: areoles close together, with white wool and pale yellow bristles; spines 10–20, some very small, increasing in number as sts. become older, straw-colored, loose-sheathed, 1 in. or less long, completely hiding the surface of the plant: fls. greenish red, 1 in. broad: fr. very spiny, ovate, 1¼–2 in. long and one-third as wide, few-seeded, mostly sterile. Ariz., Calif.

53. **imbricàta,** DC. A wide-spreading, irregularly branching shrub, rarely more than 5 ft. high, the trunk and larger branches with dark, rough, unarmed bark: joints frequently 12–14 in. long and 1–1¼ in. thick, with very prominent long, cristate tubercles: areoles with yellowish wool and straw-colored bristles; spines 2–5, of variable length, 1 in. or less long, loosely sheathed, white to straw-colored: fls. 2–2½ in. wide, light purple: fr. unarmed, depressed-globose, with large tubercles, yellow, 1–1½ in. diam., adhering to the plant and drying on the sts. during the winter. Texas and N. Mex.—Usually confused with *O. arborescens,* from which it differs in its smaller growth, different habit, much longer joints, larger, more prominent tuber-


2608. Opuntia arborescens.

cles, and fewer spines. The fr. and fl. also show marked differences.

54. **arboréscens,** Engelm. (*O. stellàta*, Salm-Dyck). Fig. 2608 (adapted from Pacific R. R. Report). An arborescent, numerously branched plant, 4–8 ft. high, with trunk of larger plants having very rough, dark, unarmed bark: joints with moderately prominent, narrow, cristate tubercles, verticillate, horizontally spreading on mostly pendulous, moderately spiny branches, mostly 3–6 in. long and 1 in. or less thick: areoles with dirty-white wool and small yellow to light brown bristles; spines 6–20, variable in length, 1 in. or less, central ones more loosely sheathed, horny or reddish brown, white to straw-colored sheaths: fls. purple, 2–3 in. wide: fr. unarmed or with few spines, conspicuously tuberculate, subglobose, 1 in. diam., yellow to yellowish red. S. W. U. S.—Frequently confused with *O. imbricata* and *O. spinosior*, and intermediate between the two. Differs from the latter in having much larger, more cristate tubercles, fewer spines and different fr.

55. **spinòsior,** Toumey. A small tree, 6–12 ft. high, with numerous verticillate branches, forming a rounded head, the cylindrical trunk usually branching a few feet above the ground, and with rough, dark brown or grayish unarmed bark: joints verticillate and pendulous, ultimate ones usually 4–8 in. long and about 1 in. thick, dark green, frequently more or less purplish, with short, crowded rhombic tubercles: areoles with white to reddish brown wool and usually few, small, variously colored bristles; spines 10–30, increasing in number yearly as the joints become older until finally deciduous, short, and rarely conspicuously sheathed, usually ½–¾ in. long: fls. showy, bright to dark purple, 2–2½ in. wide, in whorls at the ends of the joints: fr. elliptical to oblong, rarely obovate to globose, 1½–2½ in. long, yellow, frequently remaining on the stems during the second year. Ariz., N. Mex.

56. **Whípplei,** Engelm. & Bigel. Fig. 2609 (adapted from Pacific R. R. Report). A spreading, sub-prostrate shrub, rarely more than 2 ft. high, with numerous ascending secondary branches, having short, crowded, prominent tubercles: joints variable, terminal ones clavate, 2–5 in. long and ⅔–¾in. thick, mostly armed on upper half: areoles with short white wool and a few short, light-colored bristles; spines white, very variable, on terminal joints, usually from 1–3 conspicuous loose-sheathed interior ones and several small, deflexed or radiating ones: fls. greenish yellow, crowded at the ends of the joints, 1–1¼ in. wide: fr. unarmed or with few spines, pyriform to subglobose, densely tuberculate, yellow or tinted with scarlet, ½–1 in. diam., drying and remaining attached to the plant during the winter. S. W. U. S. and N. W. Mex.—This plant is frequently confused with *O. spinosior*, probably from confusion in the original description.

2609. Opuntia Whipplei.

57. **versícolor,** Engelm. A small, numerously branched tree, 6–10 ft. high, with rounded head and a short trunk, having smooth, light brown or reddish brown, unarmed bark: joints much elongated, usually 6–12 in. long, sometimes 20, ⅔–¾in. thick, deep green, more or less colored with red and purple: areoles with short gray wool and lighter colored bristles; spines variable, on terminal joints, usually from 5–13, older joints with 10–20, rarely, however, increasing in numbers after the second year, reddish brown, with inconspicuous, close-fitting sheaths, ¾in. or less long: fls. bronze-colored, 1–1½ in. wide: fr. pyriform to clavate, of same color as joints, never yellow, sometimes tinged with red or purple, unarmed or with a few persistent short spines, 1–2 in. long. Ariz., N. Mex.

2610. Opuntia ramosissima.

58. **tetracántha,** Toumey. An irregularly branching shrub, 2–5 ft. high, primary branches from a stout, upright trunk 2–4 in. diam., and bearing numerous short lateral ones at irregular intervals: joints very variable in length, usually 4–10 in. long and ½in. thick: areoles with whitish wool and a crescent-shaped tuft of light brown bristles; spines 4, rarely more or less, ¾–1½ in. long, stout, loosely sheathed, straw-colored, flattened, strongly deflexed, not increasing in numbers on older joints: fls. greenish purple, ½–1 in. broad: fr. obovate to subglobose, ½–1 in. long, juicy, scarlet, unarmed, or with a few stiff deflexed spines. Ariz.—One of the most attractive of the cylindrical opuntias on account of its numerous bright scarlet frs.

59. **arbúscula,** Engelm. A short, numerously branched, round-headed, arborescent plant, rarely reaching the height of 5 ft., but always with an upright, well-defined trunk, having rough, brown, unarmed bark: joints usually 2–4 in. long and ⅓in. wide, easily broken from the plant: areoles comparatively large, with white wool and brush-like tufts of long, slender, yellow bristles; spines yellow, usually 1, frequently a small, slender, additional one at either side, ¾–1½ in. long, loosely sheathed. fls. bronze-colored, ¾–1 in. wide: fr. unarmed, of same color as joints, long, clavate, 1–2 in. long and one-third as wide, mostly sterile, fertile ones with a few remarkably large, irregular-spheroidal seeds. Ariz., Sonora.

60. **leptocaùlis,** DC. (*O. frutéscens*, Engelm.). An erect shrub, 2–4 ft. high, with long, slender, flexible sts. branching from near the ground, and numerous lateral secondary ones, very short, usually unarmed and easily detached: joints about ⅕–¼in. thick: areoles with short white wool and numerous reddish brown conspicuous bristles; spines usually 1, sometimes wanting, erect, stout, frequently 2 in. long, brownish or horny, with a loose yellow sheath: fls greenish yellow, ⅓–½in.

wide, with deflexed perianth: fr. scarlet, succulent, obovate to oblong, rarely globose, ⅓–⅔in. long, frequently proliferous, armed with tufts of long, reddish brown bristles. S. W. U. S. and Sonora. Var. **màjor,** Hort., is advertised.—One of the slenderest of the opuntias. It differs from other species in that the fls. do not open until late in the afternoon. Several forms of this plant occur throughout its range, some of which have been separated as varieties. One of the most frequent of the cylindrical opuntias in cult.

61. **ramosíssima,** Engelm. (*O. tessellàta,* Engelm.). Fig. 2610. A spreading bush, 2–5 ft. high, with numerous slender branches arising from a short trunk, 1–3 in. thick, and having dark, scaly bark: joints ashy to bluish gray, variable in length, ultimate ones 2–6 in., ¼–⅓in. thick: areoles with sparse white wool and a few small yellow bristles; spines sometimes wanting, usually 1, stiff, erect, 1½–2 in. long, loosely sheathed: fls. reddish purple, ½–⅔in. wide, dry, narrowly, obovate, 1 in. long, ⅓in. wide, with 1 or 2 seeds, frequently sterile, armed with numerous long, grayish bristles. Ariz., Calif., Sonora.

O. Bergeriàna, A. Web. Allied to O. nigricans. Forming a shrub 5–10 ft. high: joints obovate or oblong-ovate, 9 in. long, 4½ in. wide: spines varying in number and size, spreading: fls. red, over 1 in. long. G.C. III. 35:34.—*O. cantabrigiénsis,* Lynch. Similar to O. Engelmannii, but differs in the whitish spines and broadly obconical ovary. G.C. III. 33:98.—*O. cervicórnis.* Probably a hybrid. Joints cylindric, strongly tubercled, decumbent, about 5 in. long: spines golden brown: fls. yellow, 2½ in. wide. Colo.—*O. coccinellífera,* Mill.=Nopalea.—*O. cornigàta,* Salm-Dyck, was once advertised, but is little known.—*O. Dèamii,* Rose. About 3 ft. high: joints erect or spreading, 10–12 in. long: spines 2–6, stout, white or dull yellow: fls. 3 in. long, rose-colored. Guatemala.—*O. Dillènii,* Haw. Erect: joints glaucous, obovate-rotundate: areoles clothed with yellow, eventually white, tomentose; spines yellowish, 3–5 smaller ones and stronger: fls. yellow. W. Indies.—*O. glaucophýlla,* Wendl. Erect: joints obovate, glaucous: spines 1 or 2, less than 1 in. long. Mex.—*O. Gosseliniàna,* A. Web. 3–4 ft. high: st. with long bristles. Mex.—*O. hæmatocárpa,* Berger, is advertised abroad.—*O. haitiénsis,* Brit. Trunk 10–13 ft. high, densely armed with spines 5 in. or less long: fls. yellow to orange. 1 in. broad. Haiti.—*O. Hanburyàna,* A. Web. Distinct on account of its straggling habit, long spreading spines, small ovary and fr. G.C. III. 35:34.—*O. Kleìniæ,* DC. Shrubby, erect: joints cylindrical, slender: spines mostly solitary: fls. cinnabar-red. Texas.—*O. lævis,* Coult. Joints light green, elongate-obovate, 12 in. long: areoles small, gray tomentose, with numerous short pale bristles: fls. yellow, tinged with red, about 2 in. broad: fr. somewhat pyriform. Ariz.—*O. lùrida* is probably O. arborescens.—*O. Míllspaughii,* Brit. Trunk 2 ft. or less high, densely covered with spines sometimes 6 in. long: fls. scarcely ½in. across. Bahamas.—*O. myriacántha,* A. Web. Branches yellow-green, pendulous when old: areoles clothed with clusters of yellow bristles: petals pure yellow. Galapagos Isls. G.C. III. 27:178.—*O. sánta-rìta,* Rose. Joints reddish, usually orbicular: areoles with chestnut-brown bristles: fls. deep yellow, 2½–3 in. across. S. W. U. S.—*O. Schùmannii,* A. Web. Allied to O. nigricans. Shrub, 4–5 ft. high: joints obovate-oblong, 12 in. long, about 5 in. broad: fls. 2½ in. long. G.C. III. 35:34.—*O. Spegazzínii,* A. Web. St. and branches cylindric: spines 5 or 6, short, whitish: fls. small, numerous, white. Paraguay.—*O. Tàylori,* Brit. & Rose. Prostrate, widely branched: joints oblong to narrowly obovate, up to 5 in. long: fls. small, yellow. Haiti.—*O. tomentélla,* Berger. Very free-flowering: joints 8–12 in. long, bright green: areoles clothed with short blackish wool; spines 1 or 2, slender, whitish: fls. yellow-red. Guatemala.—*O. tomentòsa,* Salm-Dyck. Erect: joints lanceolate, 6 in. long: spines bristly, scarcely exceeding the tomentum: fls. reddish. Mex.—*O. utahénsis,* Purpus. Prostrate: joints ascending, elliptic or obovate, swollen, about 6 in. long: areoles circular, with yellowish white wool; spines 1–4, rigid: fls. carmine, up to 4 in. across. Utah.

J. W. Toumey.
J. N. Rose.†

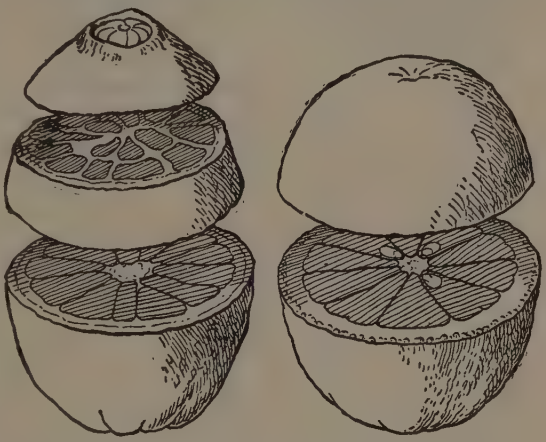
ORACH, or French spinach, is a pot-herb cultivated and used much like spinach. It is an annual, grows 5 to 6 feet high, has furrowed stems and arrow-shaped slightly crimped leaves of soft texture. The inflorescence suggests that of amarantus-like plants. The individual flowers are very small, devoid of petals, and greenish or reddish according to variety. For a technical description, see *Atriplex hortensis,* page 427.

There are three main types of orach, based on the color of the leaves. The white variety is most commonly grown; the leaves are pale green, almost yellow. The red or dark red variety has stems and foliage of dark red color, which disappears in cooking; it is occasionally cultivated as an ornamental foliage plant under the name var. *atrosanguinea.* The green variety is perhaps the most vigorous type; the leaves are rounder than those of the white variety and less toothed.

The seed is usually drilled into the open ground in early spring, and usually seedlings are not transplanted but thinned and allowed to stand in the row. The plants are used in their young state, being cooked after the manner of spinach or other "greens." They bear hot weather fairly well, but soon run to seed. Monthly successional sowings are therefore desirable. Orach is little grown in America.

Wilhelm Miller.

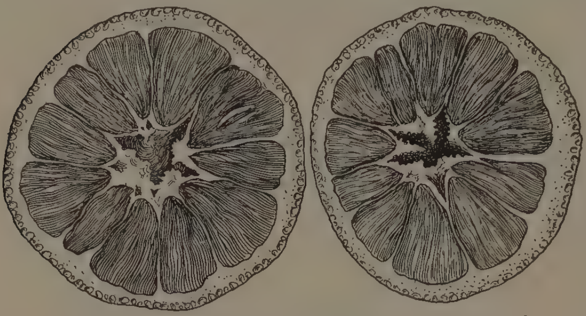
ORANGE. Plate LXXVIII. The orange is one of the oldest of cultivated fruits. Its nativity is still in doubt, but it is probable that it is indigenous to the Indo-Chinese region. It is now widely distributed in all warm-temperate and tropical countries, in many of which it has run wild and behaves like a native plant. In parts of Florida the orange was found wild when permanent settlements were made, but it had probably spread from stock that was introduced by the early Spaniards.



2611. The "navel" structure.—Normal orange on the right; abnormal or navel orange on the left, showing the adventitous cells in the center.

In stature of tree and character of fruit, the orange has varied immensely. Normally, the fruit contains ten compartments or locules; but under the influence of domestication these compartments have been increased, and in some cases a secondary axis, with its accompanying locules, has been thrust into the center of the fruit, causing the "navel" appearance of some varieties (Figs. 2611, 2612). These navel oranges, of which the Washington Navel, or Bahia, is the best known, are chance kinds or varieties, as other varieties are. The immediate cause of this particular kind of variation, as of other variations, is unknown. The Washington Navel was introduced from Brazil in 1870 by the late Wm. Saunders, and by him distributed as the Bahia (see Van Deman, Report of the Department of Agriculture, 1886, page 267). The two "original" trees in California are still standing at Riverside, carefully protected (Fig. 2613). In recent years, some of the odd and grotesque types of Japanese oranges have been introduced into this country, but they will probably always be curiosities rather than commercial pomological products. See A.G. 1890, 333–336. The sweet and sour oranges are considered to be two species (pages 782–784, Volume II), *Citrus sinensis* and *C. Aurantium* respectively. To the former belong nearly all the usual commercial oranges, although the King orange is *C. nobilis,* of which the tangerines, mandarins and satsumas are varieties (Figs. 2614, 2615). The orange belongs to a tribe of three-foliolate plants, and although its leaves appear to be simple, they are really compound. Fig. 2616 shows the articulation above *a*, at which point the blade is jointed to the rachis; this blade is a leaflet, and the side leaflets have not developed, as they do in the trifoliolate orange (*Citrus*, or *Poncirus, trifoliata*).

There are three well-developed orange regions within the confines of the United States: central and southern Florida; the delta region of the Mississippi; California. Parts of Texas and the Mexico-Arizona region will no doubt develop into commercial orange sections in the near future. Until within recent years a large part of the oranges consumed in this country had come from Mediterranean regions, but the Florida and California oranges have taken the place of the imported fruit.



2612. Orange (Satsuma). Showing the multiplication of locules or compartments.

Oranges under glass.

Years ago, oranges were commonly grown under glass in England and parts of the continent. At that time there was no rapid transportation between the orange-growing regions and northern countries, and the orange fruit was a luxury. Special houses, known as "orangeries," were devoted to the culture of the fruit. The trees were ordinarily grown in large tubs or boxes, and were kept in the open in summer and were placed in the orangery in winter. These orangeries were scarcely greenhouses in the modern understanding of the term. In many cases they had slate or shingle roofs, the sides only being provided with an extra extent of glass in the shape of windows. Some of them, however, were houses with glass roofs. As imported oranges came to be more common, these orange-houses gradually fell into disuse. It is doubtful whether there are any of these establishments now standing in this country; but one sees them sometimes in Europe. As the orange trees disappeared, other plants were grown in the house, so that an orangery came to mean a particular kind of house in which plants are grown that will thrive in conditions suited to the orange. It came to be no uncommon thing to see orangeries in which there were no oranges.

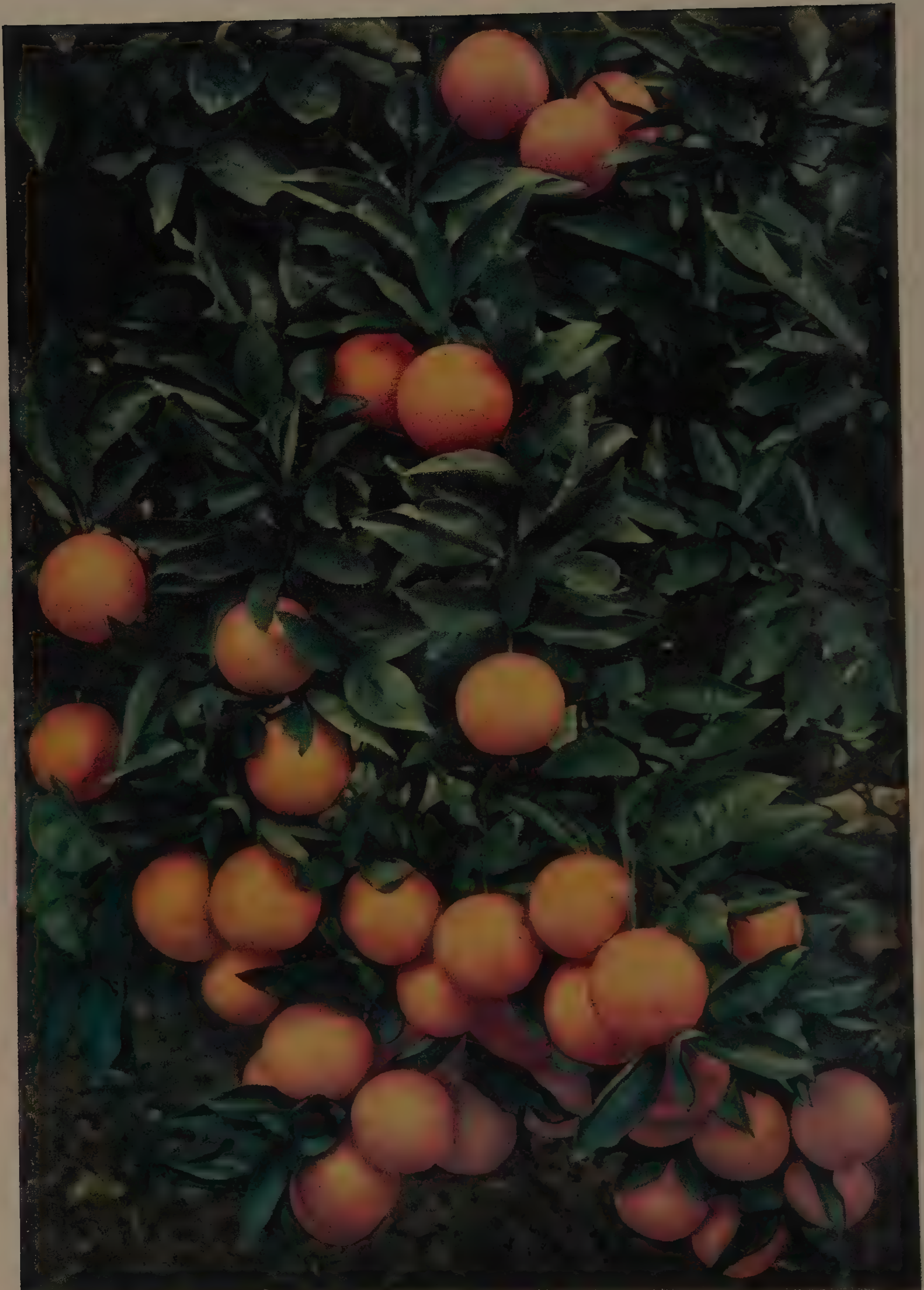
The orange tree is still a popular subject in conservatories, however, and in window-gardens. In the latter conditions it rarely produces fruit of any consequence, but the shining evergreen foliage and the very fragrant flowers make the plant interesting and desirable. The plant is subject to scale and mealy-bug, and constant attention must be given to syringing and sponging the foliage. The leading difficulty in the rearing of an orange tree in the dwelling-house is a tendency to have it growing the entire year and to keep it too wet at the roots. After the fruiting season, in late autumn or early winter, the plant should be allowed to rest for a time in order to harden its wood for the next year's bloom. It may then be kept at a temperature of 40° to 50° and fairly dry at the roots. Water should not be withheld entirely, however, because the plant should be kept in such condition that the foliage will not drop. After a period of relative inactivity of one or two months, the plant may be set in a sunny place and given a somewhat higher temperature, and water and liquid manure may be applied at the roots. It should be in bloom in the summer and early autumn. Best results are secured if the roots are somewhat confined. When the plant is small, it may be potted on from time to time; but after it has attained the height of 5 or 6 feet, it should not be given more root-room than a small tub or a half-barrel. Ordinarily, it will not need repotting for several years at a time after it has attained this size. Some of the surface soil may be removed from time to time and fresh soil added and liquid manure applied. Usually the plants are grown from seeds, and they vary as peaches or apples do. Some of the plants may give desirable fruit, but the larger part of them will give fruit of indifferent or even inferior quality. If the best kind of fruit is wanted, the young plants should be budded after they are well established in the pots. Buds may be secured from any tree that bears a desirable fruit, or they may be brought from the South.

In recent years the Otaheite orange (described in Volume II, page 785) has come into prominence as a pot-plant. It is known botanically as *Citrus taitensis* (Fig. 2617). It is undoubtedly the best form of orange for growing in the house. The fruits are small and handsome, and the flowers have a pinkish tinge and are very fragrant. These plants will bloom and bear when not more than a foot high if the roots are somewhat confined or the plants not over-potted. Usually they will bloom the greater part of the year, but, like most hard-wooded plants, the best results are secured if they have a period of rest, as indicated above. The temperature for all oranges should be relatively low; that is, it should be the temperature of the intermediate house or one that will grow carnations, chrysanthemums, geraniums, and the like.

Literature.

There is much literature on the orange, a large part of it in the form of bulletins and reports. An authoritative general work on oranges is Risso and Poiteau, "Histoire et Culture des Oranges," Paris. On the oriental forms and histories of oranges, one should consult Bonavia, "The Cultivated Oranges and Lemons of India and Ceylon," London, 1890. The American books on the orange are as follows: Hume "Citrus Fruits and Their Culture;" Coit, "Citrus Fruits;" Garey, "Orange Culture in California;" Moore, "Treatise of Orange Culture in Florida, Louisiana and California;" Manville, "Practical Orange Culture: including the Culture of the Orange, Lemon, Lime, and other citrous fruits as grown in Florida;" Spalding, "The Orange: Its Culture in California;" also small books or pamphlets or reports

2613. One of the two original Washington navel oranges still standing in California.



LXXVIII. A cluster of oranges.—the Pineapple variety.

by Canada, Davis, Fish, Fowler, Gallesio, Garcelon, Lelong, Prange.

L. H. B.

Orange-culture in Florida.

The Spanish occupation of Florida began with the landing of Ponce de Leon in 1513, and they maintained a more or less precarious hold upon the state, disputing possession with the English colonists to the northward, and with the aborigines, until the year 1821 (excepting the years 1763–1783), when it passed under the control of the United States. It was during the Spanish régime that oranges were first grown in Florida, and there is reason to believe that as early as the year 1600 the orange was fairly well established on the Florida peninsula.

As in the early days of orange-culture in Spain, the sour orange (*Citrus Aurantium*) was the fruit cultivated, so in Florida it is not unlikely that the earliest Spanish importations were of sour orange fruit from which seed was secured. At any rate, when the early English colonists made their homes in Florida, they found the sour orange much the more common, although some sweet orange groves were also found. One of the most noteworthy of these sweet orange groves was found in 1823 in Turnbull Hammock near Hawk's Park. It was from this grove that the old strains of oranges which made the Indian River famous came. The old sour orange groves were found mainly on the shores of lakes and rivers, where the fruit had been brought and consumed by the Indians and where the seeds, thrown aside by them, found a congenial soil for germination and growth. The trees were usually mixed with and protected by magnolia, live oak, and other hardwood forest growth. These natural sour orange groves were the foundation, in many instances, of important sweet orange plantings, particularly in the older orange districts in the central part of the state. In some cases, the sour orange trees were topworked where they stood; in others they were taken up, planted out in orchard form and then topworked. There is no orchard cultivation of the sour orange in the state at this time.

The earlier sweet orange groves in Florida were established near lakes and rivers because these afforded the only means of getting the fruit to market. These plantings were made almost entirely with seedling trees, and in spite of the ravages of mal-di-gomma and frost, in many regions they furnish a very large proportion of the crop at the present time. Nor is its quality open to question. In the early sixties there were many famous groves along the St. John's River, but it was not until the railroads opened up the state that the growing of citrous fruits took its place as Florida's most important horticultural industry.

Previous to the severe frost of 1894–5, much fruit was produced in northern Florida, but while some is still grown, the industry has been gradually moving southward, until now the larger part of the total crop comes from the southern part of the state.

Climate.

The Florida climate is usually marked in spring by a pronounced dry period which extends from the latter part of March or early April up to the beginning of the summer rains, which generally commence in June. During June, July, and August, the rainfall is uniform and heavy. The autumn months are fairly dry, while showers are intermittent during the winter season, with a very large proportion of days of bright sunshine. The annual average rainfall is 53 inches, most of which comes during the summer months.

Florida has been visited from time to time by severe cold waves. Among these, the most noteworthy were the ones which came in 1886 and in 1894–5. At the time of these cold waves, the orange industry was established in the more northerly counties of the state and consequently the damage was much more serious than would occur at the present time, owing to the opening up of the southern districts. The damage from cold waves in Florida has often been greatly increased because they were preceded by periods of high temperatures which caused sap movement in the trees. When entirely dormant, an orange tree is fairly hardy, while, in growth or when stirred from its dormant condition, it may be injured at comparatively high temperatures. This, however, is more or less true of other plants, though they do not respond so readily to variations in temperature. But in Florida, many fruit-trees and ornamentals entirely hardy much farther north have been injured at times because they were not completely dormant.

Soils.

Florida lands are generally grouped according to elevation and the growth of native timber or vegetation by which they are, or were, covered in a virgin state. Those commonly used for the cultivation of citrous fruits are high hammock, and low hammock, high pine and flat woods land.

High hammock lands are elevated, naturally well drained, and are covered with a native growth of evergreen hardwood and deciduous trees. Among these may be mentioned the live oak, hickory, magnolia, dogwood, and holly. They are well supplied with vegetable matter, the soil is comparatively rich, deep and well adapted for citrous fruit-culture.

2614. Mandarin, a kid-glove orange. Citrus nobilis var. deliciosa.

Low hammock lands (hammock is an Indian name for a hardwood forest) correspond in a large measure to the high hammock soils. They are not so well drained naturally. The native growth is of much the same character, but the sweet gum, live oak, and cabbage palmetto are more in evidence. Drainage requires careful attention, but the soil is rich in humus. The clearing and preparation of these low hammocks for planting is difficult and expensive, but the results in vigorous orange trees and crops of fine fruit leave little to be desired.

High pine land is well drained, elevated and often rolling. The native growth consists almost entirely of long-leaf or yellow pine with little or no undergrowth, the latter being replaced by wire-grass. Sometimes a few high-land willow oaks are found. These lands are frequently swept by fires, and consequently the humus-content is lower than would otherwise be the case. The subsoil may be sand, clay or loamy sand. They are not rich soils, but respond readily to good treatment and produce excellent oranges.

Flat woods land is also covered with long-leaf and other pines, but the elevation is much lower and the surface flat and level. Often there is a dense growth of saw palmetto. The subsoil may be clay, sand or hardpan. The better class of flat woods make good citrous soils, but those supporting a heavy growth of saw palmetto or with a hardpan subsoil are not considered good, and though sometimes used are usually avoided.

In the handling of Florida soils, the most important things to which attention should be given are drainage and the maintenance of the humus-content of the soil. The rainfall is heavy at times and provision must be made for the rapid elimination of surplus moisture, while the light character of the soil, high temperatures and moist condition assist in the rapid disintegration of the vegetable matter. A water table about 3 feet below the surface is desirable.

Stocks for citrous trees.

Intimately associated with the character of the soil is the kind of stock which should be used for the orchard. The seedling sweet orange as a foundation for a young orchard is a thing of the past and at this time only trees budded on stocks of different kinds are used.

The stocks more or less commonly used for orange trees in Florida are sour orange (*Citrus Aurantium*), rough lemon (form of *Citrus Limonia*), grapefruit (*Citrus grandis*) and trifoliata (*Poncirus trifoliata*). Each has its peculiar advantages for certain soils and climatic conditions.

No stock is more commonly used in the world's citrous regions than the sour orange. Trees propagated on it are long-lived, vigorous, and produce fruit of high quality. The stock itself is resistant to mal-di-gomma and some other similar diseases which affect other stocks. Wherever it can be used, it should be given preference. It is a congenial stock for all important varieties of oranges, the Satsuma alone excepted. This variety does not grow well upon it. The sour orange tree itself is more resistant to cold than the sweet oranges usually worked on it. It is adapted to low hammock, high hammock, flat woods and to high pine land soils where the latter are not too porous, open, and deficient in moisture. If fruit is to be held on the trees later than its season, or for late-maturing varieties, it has no superior.

2615. Satsuma orange.—Citrus nobilis var. unshiu. (×⅓)

Rough lemon stock produces more vigorous tree-growth than sour orange stock. The root-system is widespreading and rather shallow. It is much more tender than the sour orange and trees budded on it are not so cold-resistant. It is not desirable for early varieties as the fruit is not well filled and juicy, and fruit borne by trees budded on it cannot be held very much beyond its season without parting with its juice. It is adapted to conditions where a comparatively shallow root-system is advantageous and to very light sandy soils where a root-system of wide foraging range is necessary.

Grapefruit stock, used in a limited way, produces high quality fruit and is adapted to soils containing liberal amounts of moisture and with rather high water-tables. Where it can be used, it gives very satisfactory results. If the soil is underlaid with clay, close to the surface, so much the better. Grapefruit stock is entirely unsuited to dry open porous soils. In point of hardiness and resistance to cold, it ranks with rough lemon.

Poncirus (*Citrus*) *trifoliata*, commonly referred to as trifoliata stock, is the hardiest citrous stock now in general use in America. The tree itself will stand 22° F. at least and it imparts a certain measure of its own hardiness to the orange that is worked on it. This, in the main, is brought about by its very dormant character. In this combination is a noteworthy example of an evergreen tree budded on a deciduous one. Trees budded upon it do not start into growth so readily nor so early in spring. The fruit produced on this stock is smooth, thin-skinned, very juicy, and of high quality even with the very first crops. *Poncirus trifoliata* stock is adapted to clay soils, loamy or sandy soils with clay close to the surface and to alluvial soils. It requires a uniform and goodly supply of moisture. In Florida it is used for plantings of Satsuma and other oranges in the northern and western parts of the state.

Propagation and the seed-bed.

The seed-bed in which citrous seedlings are grown is carefully prepared in advance by liming and by applying commercial fertilizers. The soil is well and deeply broken, pulverized and raked free of all roots and trash. Irrigation is usually provided, though not always necessary and may be dispensed with on moister soils.

Seeds of sour orange, rough lemon, grapefruit and trifoliata are extracted by cutting through the rind of the fruit, twisting the halves apart and squeezing out the pulp and seed into a vessel. They are then washed free from pulp and dried off slightly in the sun, just enough to remove such moisture as may remain on the seed-coats. Sometimes the fruits are allowed to decay partially, when the seed is removed by macerating in water and floating off the pulp, rind, and other refuse.

Citrous seeds will not stand drying and remain viable. If they are dried, the cotyledons separate and they will not germinate. Seeds may be kept several weeks, or even months, by drying off on the outside and packing in pulverized charcoal in tight receptacles. It is best, however, to plant sour orange, rough lemon, and grapefruit seeds immediately after they are extracted in December and January. Trifoliata seed is best extracted in September and October and planted at once in soil containing considerable moisture, yet well drained. Frosts are very injurious to young citrous seedlings of all kinds except trifoliata. If frozen off when 1 or 2 inches in height, they are killed out, but trifoliata develops shoots from buds lower down on the stem and the stand is but little injured.

Seeds are planted much as garden beans are planted, in rows 2 feet apart. Frequent cultivation is given from the time the plants come through the soil, and fertilizers rich in nitrogen are applied from time to time as required by the seedlings. Damping-off sometimes causes serious losses in seed-beds, but may be prevented by spraying frequently with bordeaux mixture and by keeping the soil about the plantlets dry and well pulverized on top.

Seedlings are transplanted when one year old and 6 to 15 inches in height or when two years old and 15 to 24 inches in height. Preference is given to the larger seedlings, as they are easier to handle and care for under field conditions. The nursery rows are spaced 4 feet apart, the plants about 1 foot apart in the rows. A row is left out here and there at convenient distances apart, making an 8-foot wagon passage. About 10,000 seedlings are set on an acre of ground.

The seedlings are grown from one to two seasons in the nursery, when they are ready for budding. While citrous trees may be propagated in many different ways, budding alone is resorted to in nursery practice in

Florida. By far the greater number of trees are dormant budded, the buds being inserted by the ordinary inverted shield method, the cross cuts being made at the bottom of the downward incisions and the buds shoved up from below. Wrapping is usually done with strips of waxed cloth. These are allowed to remain on from ten days to three weeks, depending upon weather conditions. Frequently, in the colder sections, these dormant buds are banked with earth, using a plow and a celery-hiller, to protect them against possible frost-injury in winter. In spring, the seedling tops are cut off and a stake driven beside each bud, to which it is tied as it grows. These stakes (4 feet long and ¾ inch square, made of cypress) insure straight trunks on the young trees and prevent the buds from being broken off when young and succulent. Careful attention is given to keep off all sprouts which come out on the stock and on the bud growth too low down. The work of sprouting and tying requires each bud to be handled five or six times by competent workmen, during the summer growing season. This adds greatly to the expense, but is necessary in the production of quality stock. At about 30 inches, the buds are topped and allowed to branch. Good buds of one season's growth will caliper ½ to ⅞ inch, 2 inches above where the buds were inserted. Usually the buds are placed rather close to the ground.

2616. Compound leaf of orange, with only one leaflet.

One-year buds are used by many planters, but two- and three-year buds are preferred by many, particularly among the older planters. These latter trees caliper from 1 to 2 inches, depending upon the variety and the stock on which they are grown.

Planting.

Opinions vary considerably as to the best distances at which to set orange trees in Florida, but 25 by 25 feet may be taken as a reasonable distance for standard sorts, or sixty-nine trees to the acre. Some prefer to set trees farther apart one way than the other, as 20 by 30 feet. Satsuma is usually planted 20 by 20 feet. The rectangular system is used almost entirely.

Land is prepared for planting, by plowing deeply and pulverizing thoroughly. Nearly all Florida soils are greatly benefited by applications of lime, and by having a cover-crop of some kind grown on them during the summer and turned under the autumn before planting. This increases the humus-content of the soil and leaves it in the best possible condition for the trees.

Sometimes orange trees are planted out during the early summer months, just after the summer rains set in; but by far the best season for planting the trees is during the winter months of December, January, and February. Planting should not be delayed too late, as best results are secured if the trees are established in advance of the dry spring period, which usually begins in March.

In the actual setting of the trees, the chief points to be observed are (1) that the roots be not exposed, (2) that the trees be set at the same depth as they grew in the nursery row, (3) that the soil, naturally rather open, be well packed and firmed about the roots. Balled trees are not used in Florida on account of the character of the soil, nor are they considered necessary. Water at time of planting is advantageous, as it helps to settle and pack the soil about the roots, and at times there is an actual lack of moisture to be supplied. Surface soil is used in filling in about the roots and some commercial fertilizer is often thoroughly mixed with it, from a half-pound to a pound, depending upon the size of the trees. The use of stable manure is not advisable.

Cultivation.

Clean cultivation throughout the year, though at one time attempted in Florida, is a practice which has entirely disappeared. It did not take many years to demonstrate that it was a failure, because the basic necessity of maintaining and increasing the humus-content of the soil was not taken into consideration. At the present time, two systems of cultivation are in use: (1) the usual system of clean cultivation in spring and summer, followed by a cover-crop; (2) a system of non-cultivation, under which the vegetation which covers the soil is cut from time to time and allowed to mulch the surface.

By far the greater number of plantings is handled by the first system. Under the clean-culture-cover-crop or the 4-C system, cultivation begins in early spring as soon as danger of frost is past and the trees have started into growth, and is continued until about the middle of June or the beginning of the summer rainy season. During this period the grove is cultivated shallowly once every ten days or thereabouts, and a dust mulch is constantly preserved to prevent the escape of moisture from the soil. When cultivation ceases in June, a cover-crop is either planted or allowed to come on voluntarily, consisting of cowpeas, velvet beans, beggarweed or native weeds and grasses. If the growth of this crop is so rank as to make it difficult to handle in fall, it is cut with a mowing machine and allowed to remain on the ground for some time before incorporating in the soil. In autumn the cover-crop is either plowed under or cut into the soil with a disc-harrow. It is advisable to have the ground bare and free from vegetation in winter as a safeguard against fires, and when the soil is bare, the trees suffer much less from cold than when the soil surrounding them is covered by a dense mat of dead or living vegetation. On heavier soils the cover-crop may be plowed under, but on lighter soils best results are secured by disposing of it with disc-harrow, cutting it over several times if necessary. In Florida, it is not advisable to incorporate a green cover-crop with the soil. The advantage of the 4-C system is that clean culture during the spring months conserves soil-moisture when most needed, while the cover-crop during the summer helps to take care of the excess supplied by the rains. At the same time, vegetable matter is added. In handling young groves, the plan is often followed of cultivating the soil in the narrow strip along the tree rows throughout practically the whole season and growing a cover-crop on the middles. The implements com-

2617. Otaheite orange in a pot.—Citrus taitensis.

monly used for grove-cultivation in Florida are the plow, disc-harrow, and Acme harrow.

The system of non-cultivation is followed on certain lowlands, on light soils, and, in general, where the character of the soil or subsoil makes it inadvisable to follow the 4-C system. It has also given good results under conditions where the 4-C system might be used, and is followed because less expensive and the trees thrive under it. The plan is to give no cultivation at all, except when the trees are young, only to hoe the weeds and grass immediately surrounding the trees. This same end is secured in many cases by mulching heavily with weeds, grass, leaves or trash of any sort. From time to time, the mower is used to cut down the growth of vegetation. It is allowed to remain where it falls. There is no question but that fine fruit is produced under certain conditions by this system, but much depends upon the character of the soil and the moisture available.

2618. Frost protection. Movable shed with cloth sides and board top, for protecting young trees. It is not used commercially.

Cover-crops.

The plants commonly used in Florida for cover-crops are beggarweed, cowpeas, velvet bean and its relatives, and native weeds and grasses. Cowpeas and velvet beans are better adapted for new soils, those only recently brought into cultivation. These crops are also very valuable for preparing soils for planting. A good stand of cowpeas may be secured on almost any Florida citrous soil if planted at the right season. But the best cover-crop for Florida orange groves is beggarweed, either alone or combined, as it most usually is, with a number of other native plants. These latter appear without the necessity of seeding them.

Beggarweed is a strong, erect annual legume, a native of Florida, and thoroughly adapted to all parts of the state. When standing apart, with plenty of room for growth, it is a much-branched plant, but, when closely planted, it produces small straight stems. Nitrogen tubercles are produced in abundance on its deep roots. At the end of its season's growth, a good covering of partially decayed foliage covers the ground. Often it is best to cut it once during the season to prevent its getting too rank and heavy. If cut at the blossoming season, a second crop will come on from the stubble. As much as one to two tons of stems and leaves may be produced to an acre. From five to ten pounds of seed are sown to the acre in April and May, broadcasted and harrowed into the soil. After the crop has become well established, it reseeds itself from year to year and cultivation may be continued up to the rainy season without interfering with the crop. It will come on as soon as cultivation ceases. If it be deemed advisable to stop the growth of beggarweed in a grove, as is sometimes the case if there is too much nitrogen in the soil, it may be accomplished by cutting frequently to prevent seeding and by continuing cultivation later into the summer.

Pruning.

The general plan followed in Florida orange-growing is to give the trees but little pruning. Beyond shaping up the trees, mostly done while they are young, little is done except to remove dead, injured or diseased branches. The type of trees developed is low-headed, symmetrical, and spreading. The low-headed tree is almost the only form seen in the younger groves and as the advantages in shading the ground and the tree-trunks, in spraying and in harvesting, are all in its favor, it is not likely to be displaced.

Fertilizers.

In no citrous region have the problems connected with the fertilizing of orange groves received more attention nor has a greater amount of definite knowledge pertaining to this difficult problem been secured than in Florida. The kind and quantity of fertilizer used has a pronounced influence, not only upon the quantity and quality of fruit, but upon the growth, health and longevity of the trees, and it has taken many years to determine the value of different materials in the fertilizers applied. Much remains to be found out, but a good start has at least been made.

The leguminous cover-crops referred to, when rightly handled, supply a large part of the necessary nitrogen, but the fertilizers applied to orange groves in Florida are drawn almost entirely from commercial sources. Potash is used largely in the forms of high- and low-grade sulfate of potash; phosphoric acid is secured from bones and phosphate rock, while nitrogen is procured from nitrate of soda, sulfate of ammonia, and from organic sources such as blood, tankage, cottonseed-meal, castor pomace, and the like. Much care must be exercised in the use of nitrogen in organic combinations because they are prone to induce "die back," a physiological disease characterized by the exudation of gum on twigs, leaves, and fruit. The several materials entering into the composition of fertilizers, as sulfate of potash, sulfate of ammonia, and acid phosphate (for example) may be purchased separately and mixed by the grower in proper proportions, but more usually they are mixed by the fertilizer manufacturers and sold as complete fertilizers.

Fertilizers for nursery trees, and plantings which have not reached bearing age, contain about 6 per cent phosphoric acid, 4 per cent ammonia, and 6 per cent potash, while for bearing trees one containing approximately 8 per cent phosphoric acid, 4 per cent ammonia, and 10 or 12 per cent potash is commonly used. These percentages are of course not absolute, as the exact composition must be governed by the character of the soil, the condition or requirements of the trees, and crops. Growers watch the behavior of their trees carefully and are governed in the use of fertilizers by their general appearance.

2619. A slat shed formerly used to some extent for the protection of orange plantings in Florida, but now discarded.

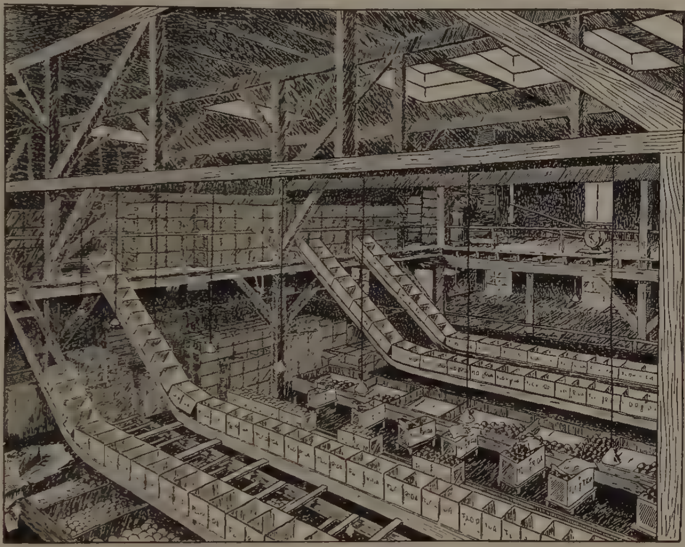
Lime is very generally deficient in Florida citrous soils and the trees and fruit are much benefited by applications of ground limestone, broadcasted over the surface at the rate of about two tons to the acre.

The general tendency in the use of commercial fertilizers is to make frequent applications of small amounts, thereby preventing loss from leaching. Applications, by many growers, are made in February, April, June, and September. The composition of these applications is often varied, giving larger amounts of nitrogen in spring and larger proportions of potash in autumn. Young orange trees are fertilized roughly on a basis of one pound to two pounds for each year of age and bearing trees according to their size and crop indications; sometimes as much as thirty or even fifty pounds a tree in the year is applied in the several applications to the latter. These amounts may even be exceeded if the crop in sight justifies.

In fertilizing young trees, the fertilizer is scattered in a band 2 or 3 feet wide, beginning back 6 to 12 inches from the trunk. As they become older, the fertilizer is spread out toward the ends of the branches and in old orchards or groves it is broadcasted over the whole surface, as the roots have made their way into all parts of the soil. After each application of fertilizer the ground is usually cultivated.

Insects and diseases.

The insects which cause most damage in Florida orange groves are the white-fly (*Aleyrodes citri*), scale insects of different kinds, and the rust mite. In insect-control, fumigation has been carefully tried out but has not met with general favor, and by most growers spraying is considered more satisfactory and practicable. Against the white-fly and scale insects, miscible oil and whale-oil soap sprays are generally used; and against the rust mite, sulfur in some form is effective. For the control of white-fly and scales, most of the spraying is done in the winter dormant season, one thorough application usually giving satisfactory results. Spraying for rust mite is done during the summer months as it injures the skin of the growing fruits, and three or more sprayings are generally necessary. In Florida, beneficial entomogenous fungi are very effective in holding scale insects and white-fly in control.



2620. A Florida orange packing-house.

Among the fungous diseases the most injurious are melanose with which is associated the stem-end-rot, and anthracnose or wither-tip. These may be handled by careful attention to grove sanitation, removing diseased fruit, pruning out dead and injured wood, and by spraying with bordeaux mixture. "Die-back," a physiological trouble to which reference has already been made, may be corrected by changing the method of cultivation and the fertilizer used. The common method is to discontinue cultivation entirely, and use no fertilizers or those drawn only from inorganic sources and rich in potash.

Citrus Canker, a bacterial disease caused by *Pseudomonas citri* (see also page 2375) has gained a foothold in Florida and threatens serious injury to the citrus industry. The authorities are meeting with success in their determined efforts to stamp it out. No attempts have been made at control, the method of handling it being to burn the affected trees where they stand.

Frost protection.

Within recent years much attention has been given to the protection of orange groves against cold. Many different methods have been tried, but protection by means of sheds, tents and the like has been abandoned except for strictly amateur purposes (Figs. 2618, 2619). The trees were not fruitful under the artificial conditions created, or the methods were too costly. In the more exposed sections, the trees are still banked with clean earth, sufficiently high to afford protection to the bud unions. But the chief method of protection is by firing with small wood-fires or with oil-heaters.

Harvesting and marketing.

The season for Florida oranges extends from the latter part of October until June. This is divided into two parts by the Christmas holidays. At that time but little is shipped. Unfortunately, it has been the custom to ship fruit that is green and unfit for consumption. Attempts have been made to correct this mistake by laws and these have helped greatly.

Perhaps the greatest change in harvesting and marketing in the last two decades has been in the disappearance of the small individual packing-house. Most orange groves in Florida are small, 10 to 25 acres, and formerly nearly every owner had his own packing-house and picked, packed, and shipped his own fruit under his own brand. Now the marketing of the crop is in the hands of the Florida Citrus Exchange, or of individuals or companies operating on a large scale, and the fruit, in large quantities, is handled through centrally located packing-houses equipped with every convenience for the rapid and economical preparation of the fruit for market (Fig. 2620). This noteworthy change has brought about a great improvement in the methods of handling and the uniformity of the pack. Every detail of picking, hauling, handling, packing, and shipping has been carefully investigated and many improvements have been introduced. As a result, the value of the Florida orange in the markets has been greatly increased by the care taken in handling it.

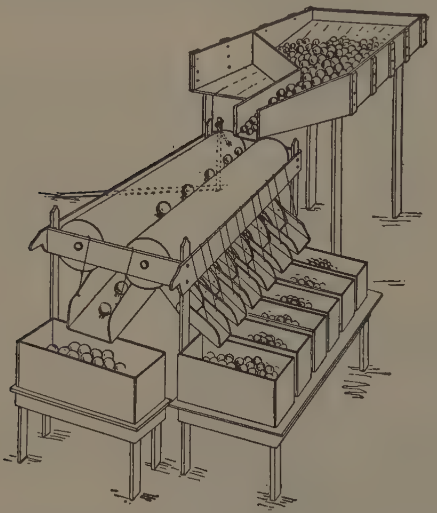
The standard Florida orange box, the size of which is fixed by state law, contains two compartments, each 12 by 12 by 12 inches, or 2 cubic feet of fruit. Oranges of the mandarin group are put up in half-boxes, two of which are fastened together for shipment, known as a "strap." The fruit is arranged in the box according to definite diagrams for each size.

The Florida orange crop has been gradually increasing. In the season of 1914–1915, approximately 7,000,000 boxes were produced.

Varieties.

Of the mandarin group, the varieties planted are Satsuma (in the northern part of the state), Dancy, Tangerine, and King. The Dancy originated in Florida; the other two are introductions.

A great many varieties of sweet oranges have originated in Florida as noteworthy seedlings in different groves. Perhaps in no fruit-growing region of America was the amateur spirit more strongly developed or was more interest taken in the merits of different varieties. Formerly a great many different sorts were planted, but gradually the most of these have been eliminated until only a few remain. Of these the most important, arranged according to season of ripening, are, Parson Brown, Homosassa, Pineapple, Ruby, Valencia Late (Hart's Tardiff, Hart's Late), and a recent introduction, Lue Gim-Gong, remarkable because of its late-keeping qualities. Of this list, all originated in Florida except Ruby and Valencia. These are introductions from Europe.



2621. A sizer or grader for oranges. (Wester.)

H. Harold Hume.

Orange-culture in Louisiana.

From the early settlement of Louisiana to the present day, orange-culture has received most attention in the lower Mississippi delta, but for several years past, the other coastal lands have produced fruit in some quantity, and more recently, plantings of the hardy Satsuma variety in particular have been made in the interior sections of the southern half of the state. Originally, the seeds of sweet oranges were planted and the young trees transplanted in and around the home yards and gardens; and, to a slight extent, this method of growing trees is practised yet by individuals. No extensive groves were grown until after the close of the Civil War. At first, groves of these seedling trees only were planted and they proved exceedingly profitable up to the very cold spell of 1895, which destroyed nearly every one in the state. Another freezing calamity, occurring in February, 1899, utterly killed every tree to the ground.

In the meantime, extensive experiments had been made in budding the choice varieties of sweet oranges on various kinds of stocks, and many of the trials demonstrated the power of resisting moderate freezes by certain kinds of root-growth, notably the *Poncirus trifoliata*. Accordingly, many of the old groves and numbers of new ones were planted in budded stocks, using the buds of selected trees of sweet oranges and establishing them upon the *Poncirus trifoliata*. The success of this method also led to the growing of grapefruit or pomelo, mandarin or tangerine, and Satsuma and kumquat upon the trifoliata stock.

Budded stock has thus almost entirely superseded sweet seedlings. The sour orange, the bitter-sweet orange, the rough lemons, the grapefruit or pomelo, and the *Poncirus trifoliata* have all been used successfully as stock for the sweet orange. Meanwhile, with the introduction of the hardy Japanese varieties, including the Satsuma, mandarin or tangerine, these were also budded upon various kinds of stock. In 1895, when the temperature fell to 15° F. in New Orleans, the only trees able to survive this cold were found to consist of the combination of the hardy Japanese varieties budded upon the *Poncirus trifoliata*. This experience caused the adoption of the trifoliata as the chief stock for future groves. Therefore, nearly all of the groves planted since that time have been made with this stock.

Account must be taken of a frost limit beyond which this combination succumbs to the effects. Such results were evidenced by the unprecedented freeze of February, 1899, which practically wiped out every kind of citrous growth. Since that time, orange-growing made very slow progress for a long time, but gradually the ground was replanted and the industry expanded until plantings are now scattered over most of the southern half of the state, and, at present, many large groves are to be found. Under suitable attention, the industry has brought profitable returns, and the fame of the Louisiana Sweet, also called "creole orange," is widely known for its excellence. These names apply to a great variety of strains, but all are of a type originally introduced from southern Europe and developed by select cultivation. The budded trees bear early and yield in three to five years after being transplanted in the grove. The city of New Orleans furnishes a home market for most of the crop that is raised in the delta, although large shipments are made to northern points. Local consumption generally absorbs the supply grown in other sections.

The Louisiana orange matures ahead of the Florida fruit and is also ready before the California crop ripens, and, therefore, reaches the market when, on account of scarcity, good prices prevail. These facts, coupled with the readily productive soil, seldom requiring any fertilizer, and the abundant rainfall, dispensing with irrigation, make orange-culture attractive in Louisiana.

Frost protection.

The most serious drawback is an occasional cold blast from the North in winter or early spring, which drives Gulfward, overcoming the usually balmy weather and temporarily chilling the growth. At rare intervals, such as have been mentioned, a blizzard occurs so intense as to kill the trees outright. How to protect groves against these destructive frosts is an important matter with the orange-growers. Flooding the orchard with water drawn from the adjacent river or bayou, upon the approach of a freeze, has been practised upon a large scale without complete success. The use of oil-burning orchard-heaters, or smudge-pots, comes nearest to solving the problem, and some enterprising growers are equipped with outfits. Other producers sometimes resort to building smudge-fires on the ground. The practice of banking the trees by piling the soil around the trunk to a height of a few feet more or less (Fig. 2622), on the approach of a freezing spell whose intensity and time of coming are usually predicted by the government weather service, is very largely adopted as the next best economical protection against excessive cold. This banking retains vitality in the main trunk, and while the outer limbs may be killed, young shoots will start from the tree when the soil is removed and spring advances. This practice, therefore, gives only partial protection. Should the tree be frozen so as virtually to cause the death of the growth, new shoots from the protected trunk will soon appear, and in a year or two the tree resumes shape and becomes ready to bear a crop. Although the yield is lost for the ensuing interval, yet, by skilful care, the grower is enabled to secure a renewed orchard quickly. A trial with shelters built to cover the trees has shown them to be very expensive and, further, caused shortage of yield by shading the growth in summer.

Insects and diseases.

Unfortunately, not enough attention has been given toward preventing the introduction of pests, both insects and diseases, nor to accomplish their control after becoming established. Consequently, through carelessness and neglect principally, the pests have spread nearly everywhere and made many trees unproductive. The leading growers have been compelled to fight these enemies in order to produce clean fruit in sufficient quantity to make commercial growing pay. Added to the cost of spraying groves regularly, some packers clean and polish their fruit, which process involves an investment in a properly equipped plant and further labor for the purpose. The chief insect foes are the citrus white-fly (*Aleyrodes citri*), the purple scale (*Lepidosaphes beckii*), Glover's or long scale (*Lepidosaphes gloverii*), and the chaff scale (*Parlatoria pergandii*). Recently, the cottony cushion or fluted scale (*Icerya purchasi*) has appeared to a limited extent in one locality. With the advent of the Argentine ant (*Iridomyrmex humilis*), the attendance of this pest upon scale insects has greatly increased the abundance of the latter and complicated the problem of their control. Russeting of fruit, due to infestation by mites, occurs in some places.

Following the discovery of the canker disease in 1914, many thousands of nursery stock plants and numbers of older trees were entirely destroyed by cutting and burning in efforts to eradicate this incurable evil. The danger of this menace has brought the growers to a realization of the need of having adequate state protective measures provided for the industry. Awakening to the necessity of aiding in the development of citrous culture, the General Assembly in special session during 1915 appropriated $5,000 for eradication of canker, other diseases, and pests. This recognition, however, gives some hope that sufficient provision will be made by the state in the near future to bring it to the fore rank in horticultural prosperity through the suppression of enemies and the promotion of all fitting lines of fruit-growing. The leading orange culturists have effected an organization called the Louisiana Citrus Growers' Association, whose object is to protect their interests against natural foes.

Propagation.

The propagation of oranges is effected directly from seed and from buds. Budding is done at any time of the year from early spring to late fall. When performed in the fall, the buds remain dormant through the winter. The various stocks have particular merits for special soils and other conditions, and several kinds are used, as already said; but when the chief obstacle to successful orange-culture is cold, all other considerations must be dispensed with and only the most resistant stocks used. These stocks, are, first, *Poncirus trifoliata*, and, second, sour orange. The latter, however, is not very well adapted to the climate much north of the latitude of New Orleans. Hence, nearly all Louisiana groves have been propagated on these two stocks, a large part being on the former.

Planting a grove is always preceded by a nursery, and though home-grown stock is being produced in extensive quantities, most trees for planting are yet brought from outside of the state. The nursery is started by planting the seed of the *Poncirus trifoliata* or sour orange. When the shoots are one to two years old, they are shield-budded with buds from selected varieties, or rarely grafted to obtain the desired kind of top-growth. One year later, as a rule, the combined growth is large enough to be planted out in groves.

Soil and fertilizer.

The soil selected for groves is first thoroughly prepared and pulverized, and needs to be well drained. The trees are planted at intervals of 12 to 20 feet (sometime more or less) apart both ways, and the grove is cultivated until the trees become large enough to shade the ground. After that period, only the weeds and bushes are kept down. Very early or late cultivation of trees is usually discouraged, as having a tendency to induce a too luxuriant, sappy growth, which may be injured by subsequent frosts. The cultivation is usually performed with light plows or suitable cultivators.

A fertilizer containing fifty pounds of nitrogen, fifty pounds potash, and twenty-five pounds phosphoric acid to an acre is the one usually recommended in this state. Of course, special requirements should be considered, depending on the age of trees. Sometimes on rich soils, only a dressing of lime or bone-meal is needed. Truck or leguminous crops may be advantageously grown between the rows of young trees.

Yield.

In three years after a grove is planted, the trees should begin to bear, increasing their products every year thereafter, and becoming profitable at five to six years of growth. When ripe, the fruit is carefully gathered by hand with clippers, using ladders to reach the high limbs, then assorted and packed in boxes, and shipped to market, generally in New Orleans.

Some idea of the status of production may be obtained from figures secured in 1915 by the entomologist in charge of Tropical and Subtropical Fruit Insect Investigations of the United States Department of Agriculture, having a station in New Orleans. According to the data applying to 361 groves, the yield is classified proportionately as follows: sweet, 63 per cent; mandarin, 20 per cent; tangerine, 5 per cent; navel, 7 per cent; pomelo, 3 per cent; Satsuma, 1 per cent; and Valencia, kumquat and miscellaneous, 1 per cent. On an average, 108 trees are planted to the acre. In Plaquemines, St. Bernard and Cameron parishes, the number of bearing trees amounted to 270,505, while 73,285 trees were found that had not yet borne any fruit. A large part of a tract of 7,000 acres, located near the city of New Orleans, has been planted in groves, and the company is proceeding in preparations to cover the whole area with one vast orchard.

The marketable crop for 1914 was placed at 275,000 boxes by a well-posted commission merchant of New Orleans. To quote his experience during the past twenty years in marketing the fruit, he says: "When my first visits were made to groves, the growers were not disposed to deal with commission merchants, owing to previous unfair treatment, and the industry was entirely without organization. The growers then had no knowledge of the value of their oranges, or of how to market them. They sold their fruit to speculators, who bought it on the trees, for any price that they chose to give for the crop. These speculators' manner of handling the fruit was very crude. They pulled the oranges from the trees without the use of clippers, threw them into buckets, dumped them into boxes, hauled them to the

2622. The banking of orange trees on the Mississippi delta.

boats which sailed for New Orleans, and, in this unattractive fashion, offered the fruit for market in a bruised and decaying state. After educating the growers, they began picking carefully, but without any method of grading or sizing. The first packing efforts were made without using wrapping-paper, though later they were taught how to wrap the fruit. Many years passed, however, before our leading growers were induced to install modern graders, cleaners and polishers. The growers are now using labeled paper and printed boxes, and compete in the principal markets, and have been doing so for the past several seasons, with the best oranges grown elsewhere.

"Louisiana oranges are of the highest quality, being thin-skinned, sweet, juicy, and have a delicious flavor that is not found in any other orange. A number of markets take them at higher net prices to the growers than are obtained for either Florida or California oranges. A vastly greater quantity than we now raise could be handled to equally good advantage. The opportunity to market so many more than are now grown should be an inducement to an enormously increased acreage.

"Any number of growers who have shipped from 1,000 to 10,000 boxes of oranges are willing to testify that results during the past five years have been from $1.25 to $1.75 per box net on the trees. These prices included culls and all varieties of oranges which they grew. The production per tree compares favorably with other citrous fruit-growing sections. Our real industry, however, lies in our commercial varieties known as the Louisiana Sweet orange. This fruit comes on the market about the first of October, and shipments continue until the first of January. The season could be extended, but, on account of our limited crops, we find no necessity to hold the fruit any longer. We grow successfully the Satsuma, which begins to move in the latter part of September, and shipments are madeuntil the end of October. Then follows our sweet high-grade mandarin; these first appear in October and last until the middle of November, sometimes extending a month longer. The tangerine starts to move about the middle of November and continues until the latter part of December. The navel orange is also grown very successfully, the only drawback being that they grow too large, as the market is limited for extra-large sizes. Valencias are ready for market in February and the season extends until March; they usually command $1 per box more than Louisiana Sweets for the reason that the bulk of the sweet crop is then sold out, thus leaving a bare market. Grapefruit is perfectly adapted to our soil and climate. It is a large producer and of a quality equal, if not superior, to that grown elsewhere. Our prices have been very high, on account of which our growers are generally increasing their acreage of this fruit tree."

E. S. Tucker.†

Orange-culture in California.

Orange seeds were brought into California by the Jesuit missionaries who planted the first orchard at San Gabriel Mission in 1804. The success of these trees so impressed William Wolfskill, a Kentucky trapper of German blood, that he planted the first commercial orange orchard in 1841 on the ground now occupied by the Arcade Passenger Station of the Southern Pacific Railway in the city of Los Angeles. Wolfskill was highly successful and gradually enlarged his orchard of seedling trees from 2 to 70 acres. It was he who, in 1877, shipped the first full carload of oranges across the Rocky Mountains to eastern markets.

Thomas A. Garey, of Los Angeles, established the first citrous nursery in 1865 and by propagating trees and introducing new varieties, played a prominent part in establishing the industry.

Extensive commercial development of orange-culture may be said to have begun with the completion of the Southern Pacific Railroad's connections with the East in 1876. Three years later, the exhibition of the first fruits of the Washington Navel orange at Riverside gave another impetus to citrous planting, but the greatest development came with the completion of the Santa Fe's competing line of railroad which was opened about 1885.

The strong demand for California oranges in the eastern markets and the high prices received by some, brought on a period of frenzied planting and speculation which culminated in 1882–1883, when drought, frost, scale insects, and the lack of a coherent marketing organization, conspired rudely to awaken from their golden dreams many who had rushed into the business with insufficient knowledge and capital to weather a period of depression. Since 1890, expansion has been rapid but conservative; better distribution and increased consumption have taken care of the increased production. At present (1915) production is increasing much more rapidly than consumption. The growth in production may best be shown by the shipments for the past twenty-four years:

California Citrous Shipments.
(Including all citrous fruits.)

Season	Carloads	Season	Carloads
1890–91	4,016	1902–03	23,871
1891–92	4,400	1903–04	29,399
1892–93	5,871	1904–05	31,422
1893–94	5,022	1905–06	27,610
1894–95	7,575	1906–07	29,820
1895–96	6,915	1907–08	32,729
1896–97	7,350	1908–09	40,592
1897–98	15,400	1909–10	32,648
1898–99	10,875	1910–11	46,394
1899–00	18,400	1911–12	40,673
1900–01	24,900	1912–13	18,960
1901–02	19,180	1913–14	48,548

The chief factors which have influenced the growth of the industry are: (1) The very favorable climatic and soil conditions. (2) The building of the railroads. (3) The great success of the Washington Navel variety as a regular and heavy bearer, a good shipper, and a splendid seller. (4) The protective duties imposed upon imported citrous fruits by the United States Congress. These duties have been continuously in force since July 4, 1789, although they have been changed in amount nineteen times during that period. (5) The marked enterprise of the persons engaged in the business. The California citrous business is peculiar in that the persons who have made it are, in so many cases, retired business or professional men from the East and North who, having lost their health in the acquisition of wealth, have bought and developed citrous properties, thus bringing into the industry much-needed capital, commercial ability, and business habits. (6) Coöperative packing and marketing. By this means a uniform standard pack has been established, better distribution secured, and, by uniting their strength, the growers have been able to secure from the railroads many valuable concessions. (7) The introduction of the Australian lady-bird beetle, *Novius cardinalis*, and its control of the cottony cushion scale. (8) The development of the method of refrigeration in transit. (9) Rigid inspection and quarantine methods against injurious insect pests and diseases. By this means the state has so far been kept free from the Mexican orange maggot, the Mediterranean fruit-fly, and many other damaging pests, such as the citrus canker. (10) Scientific investigations and research by the United States Department of Agriculture, the State University Agricultural Experiment Station, and the State Commission of Horticulture. (11) The great advertising activities by the Chambers of Commerce of the various cities and towns.

It is estimated that in 1915 the California citrous industry represents an investment of $200,000,000 and gives continuous employment to the equivalent of 40,000 persons. Not less than 200,000 acres were devoted to citrous fruits at the end of 1914.

The orange-producing lands of California are scattered from San Diego to Shasta County, a north-and-south distance of 450 miles. It is a peculiar fact that there are orange orchards in California in the same latitude with New York City; Peoria, Illinois; Lincoln, Nebraska; and Salt Lake City, Utah. This is made possible by the peculiar topography of the state whereby the mountain ranges are so arranged that the cold winds of the North are shut out, and the warm southwesterly breezes from the Pacific are admitted. The great interior valleys, such as the Sacramento, San Joaquin and Imperial, are very hot and dry. The chief citrous areas of these valleys are situated on the foothills about their rims. West and south of the Coast Range, the fogs and moist ocean breezes protect, to an extent, from sudden fluctuations in temperature, and orange orchards extend from the foothills well out upon the valley floor. The factors which determine orange areas are: frequency of frosts, water-supply, transportation, and soil conditions. The greatest and most productive area embraces the country around Los Angeles, Riverside, Redlands, Corona, Orange and Santa Ana. The second area in importance is the Porterville section in Tulare County. Other important areas are in San Diego, Santa Barbara, Ventura, Kern, Fresno, Sacramento, Yuba, and Butte counties. Large extensions are now under way in Ventura, Los Angeles, Tulare, Fresno, Glenn, Sacramento and Tehama counties. On account of the higher temperatures, the interior valley oranges ripen much earlier than those grown near the coast. As some of these valley orchards lie far to the north of the coast country orchards, the unusual procedure of shipping early ripening fruits southward to market is accounted for.

Cultivation.

Almost all the old seedling orchards of early days have given place to budded trees. Several kinds of stocks are used. The most popular root at present is the Florida sour orange, because it is better suited to heavy lands and is markedly resistant to gum disease and foot-rot. Sweet orange root is desirable on light well-aërated soils. Grapefruit root is being increasingly used and is especially satisfactory on desert soils of a granitic nature. The use of China lemon root has been discontinued entirely. The rough lemon and trifoliata roots are little used, as they very rarely show any advantage over the sour or pomelo, and in many cases suffer in comparison with them.

Seeds are usually planted under the partial shade of a lath-house. They are covered with an inch of sterile sand and watered with great care in order to prevent serious loss from damping-off fungi. After a year in the lath-house, the seedlings are transplanted into the field 12 inches apart in rows 4 feet apart. After a year's growth, they are budded from 2 to 6 inches from the ground. After the bud has set, the top is cut away and the young shoot trained to a lath stake and headed at about 33 inches. Budding is done both in the fall and in the spring and early summer. Some of the more rapid-growing trees will be large enough to set in orchard form at one year from the bud, but some will require two years. Often the slower-growing trees are the more desirable, having been budded from wood with heavy fruiting tendencies. In fact, a pair of calipers is a poor gauge of the value of an orange tree. Many fine large nursery trees produce but little fruit in after years. The selection of buds is a very important matter. Oranges vary and sport much more commonly than apples or pears and the greatest care and eternal vigilance is necessary in order to keep the nurseries free from undesirable sports. The worthless "Australian" or "hobo" trees which make up such a shockingly large proportion of many orchards are the result of ignorance or carelessness in selecting buds on the part of nurserymen whose only concern is to sell nursery stock.

Citrous nursery trees are usually dug and transported with a twenty- to forty-pound ball of earth about the roots inclosed in burlap. When set out, the cords are cut and the corners turned down but the sack is not removed, inasmuch as it quickly decays in the soil. Orange trees will grow just as well when dug with bare roots as when balled, provided the sun and dry desert air are not allowed to touch the moist roots even for a few minutes. There is the greatest difficulty in impressing laborers with the importance of this danger, which has led to the custom of balling trees and paying transportation charges on the extra soil as a precautionary measure. Balled trees retain their leaves, while bare-root trees have the leaves removed when they are dug.

2623. A California orange grove.

The prevailing custom in California is to plant the trees in orchard form in squares 22 by 22 feet or 22 by 24 feet, the former requiring ninety trees to the acre. Great care is used to keep the bud-union above the ground and free from the soil. Yucca or paraffined pasteboard trunk-protectors are almost universally used to prevent sunburn. Often the trees are planted out ahead of canal-construction and watered for a year or two from a tank wagon.

Soils and fertilizers.

The character of soil for orange-culture is not so important as its physical arrangement. If the soil is deep, fertile, well drained, and free from layers or strata of a different physical make-up from the main body of the soil, for 5 or 6 feet in depth, it does not matter so much whether the soil is light sand, heavy adobe, loam, or disintegrated desert granite. Excellent orange orchards exist in all these types of soil. It is more pleasant and convenient to cultivate a loam than an adobe, and it is easier to irrigate a loam than a light sand. These things should always be taken into account, but the successful growth of the trees depends more on the uniformity than upon the character of the soil. Upon shallow soils, trees will succeed for a while, but artificial feeding must be resorted to earlier. No soil less than 2 feet deep should be considered safe for oranges. Soils underlaid by hardpan, or layers of open gravel are apt to cause functional derangements of the nutrition of the trees. The ideal soil is a friable easily worked loam, 8 or more feet deep, growing gradually lighter in color and texture as the depth increases. This not only provides a large storehouse of plant-food but a great reservoir to hold water. Of the two most common conditions, it is much better to have a light topsoil over heavy clay subsoil than a heavy clay topsoil over sand or gravel.

It is the custom to plow the orchards once a year, usually in the spring at the time of turning under the green-manure crop. Throughout the spring and summer, the soil is clean cultivated to a depth of 4 to 8 inches. Thorough cultivation and the reëstablishment of the dust mulch follows each irrigation during summer. For this work, either disc, spike-tooth cultivators, or spading harrows drawn by three or four horses are used. Orchard tractors are beginning to take the place of horses in the interior valleys. In some soils, the oft-repeated tramping of the horses causes the formation of a "plow-sole" which interferes with the downward course of the irrigating water. This may be broken up every second or third year by running a subsoil plow through the middles in such a way as to cut as few of the large roots as possible. Some growers have abandoned all tillage and cover the ground 8 or 10 inches deep with mulch. The trees do well under this system but the mulching material is expensive and the danger from fire during the dry season is very great.

California soils are, as a rule, noted for their low content of humus. It is imperative that the humus-content be increased and maintained by generous additions of organic matter. The chief source of humus is the vetch green-manure crop, but where the trees are large and shade the ground, the growth of vetch amounts to little, and other means must be resorted to. Large quantities of stable manure, grain, hay, lima-bean straw, and even alfalfa hay, have been used for this purpose, and of late attention has been called to the possibility of using kelp, which is plentiful along the Pacific coast. How to maintain a high humus-content in the soil is today one of the chief problems before the industry.

Commercial fertilizers are commonly used and in increasing amounts from the time the trees are five or six years old. There is probably more difference of opinion and diversity in practice in connection with the use of commercial fertilizers than with any other phase of the business. The amount of application runs from two to forty pounds to each tree, annually, depending upon its size and age. Some apply the fertilizer all at one time, just before the spring plowing, while some make two or three applications a year. California soils are usually high in potassium, and wherever the humus is high, this element is hardly needed. In many cases in which the soil is deep, rich and high in humus, an annual application of ten to fifteen pounds of ground phosphate rock to a tree, together with the vetch crop and five tons of alfalfa or bean straw to the acre every alternate year will be a satisfactory program. Orange trees are very susceptible to alkali. Where the soil contains .2 of 1 per cent of total salts, the trees begin to decline. A total salt-content of less than .1 of 1 per cent is usually considered safe. These figures will vary somewhat, however, according to the proportion of the different salts, which, taken together, are known as "alkali," some of which (such as sodium carbonate) are very injurious.

Irrigation.

On none of the citrous areas of California is the rainfall sufficient. Irrigation is practised in every orchard. For the most part, water is taken out of streams near the upper headwaters and conveyed by gravity through cement canals sometimes for hundreds of miles to the citrous orchards. Often the descending water generates electrical energy to be used in pumping additional supplies from wells. The water is distributed through steel or concrete pipe-lines and delivered at the upper end of the furrows. Usually the grower buys the water-right with the land and is assessed annually for the upkeep of the system serving him. The keys to the water gates are kept by a water-boss or "zanjero" who measures out to each grower his proper allotment. The amount of water required varies with the character of the soil and the age of the trees. Full-grown bearing trees require from 1 ordinary miner's inch continuous flow to 10 acres up to as much as an inch to 3 acres, depending on the rainfall and whether the soil is a heavy clay or an open sand or gravel. An irrigation is given every month or six weeks during the summer and less often in winter, according to the rains. In heavy soils, the water is run for three or four days at each irrigation in very small streams through four deep furrows to each tree row. The water is cut off when tests with a soil-tube show the soil to be soaked 5 feet deep. In very light porous soils, it is necessary to throw up ridges each way, leaving each tree in the center of a large basin. These basins are filled quickly with a large stream. It is only by the use of large, rapid streams that water may be conveyed across and distributed over such open and porous soils.

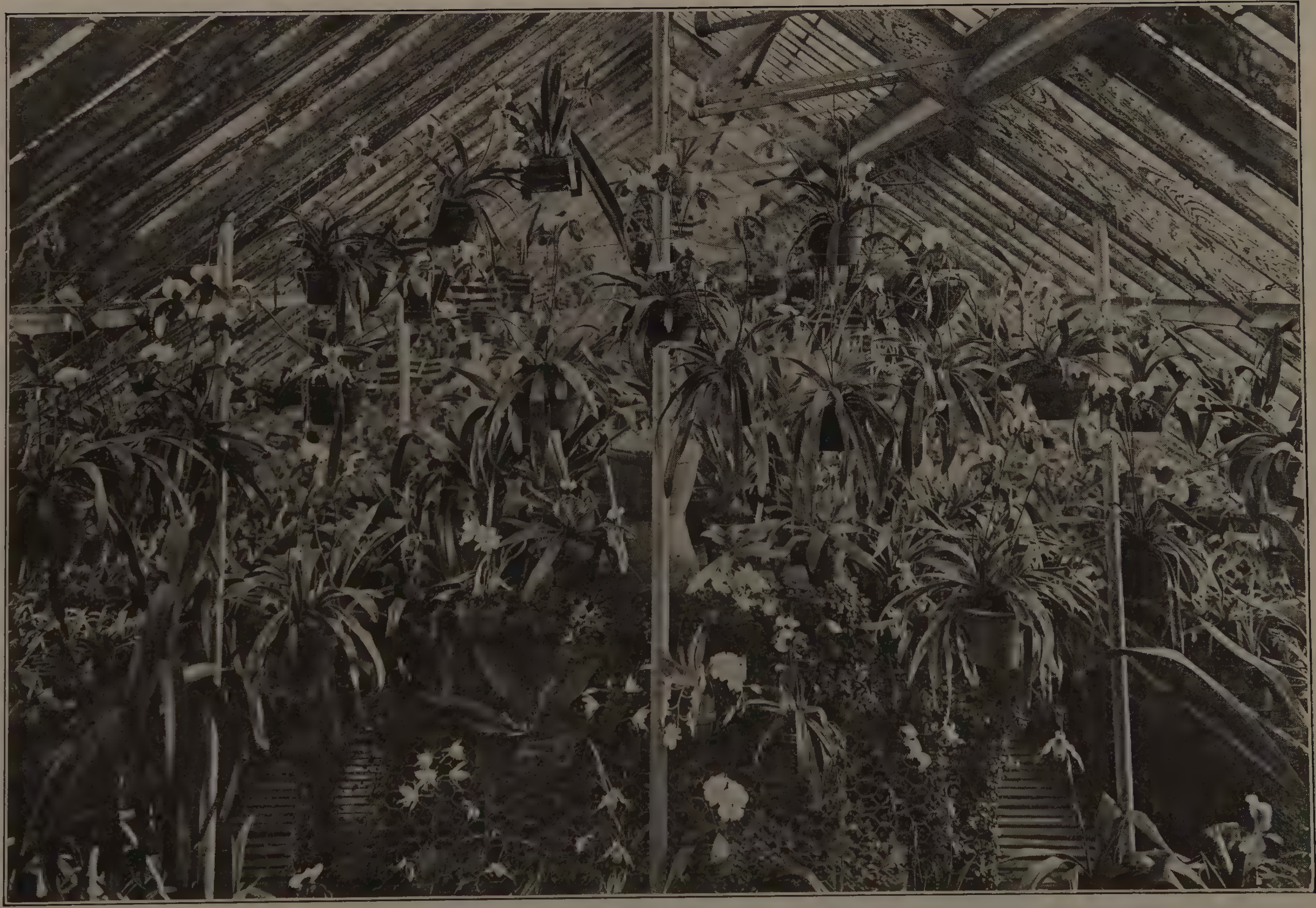
The common or spring vetch (*Vicia sativa*) is very commonly grown as a green-manure crop in southern California. It is planted in September and turned under in February before the trees start the spring growth. The seeds are large and germinate well and the vines suffer less from the trampling incident to harvest than some other green-manure plants. Canada field peas, Tangier peas, bur clover, fenugreek, and sour clover (*Melilotus indica*) are occasionally used in place of the vetch. In northern California, bur clover volunteers satisfactorily and is commonly used. Summer green-manure crops, such as cowpeas, are coming into use wherever there is sufficient cheap water available to supply both the trees and the peas during the dry hot months.

Pruning.

Orange trees are pruned somewhat differently according to the variety. The young Washington Navel tree should not be pruned for the first two or three years after being headed and set in the orchard. Especially if budded from the best type of wood, it may be depended upon to form a good head by itself. Suckers should of course be removed whenever they appear. The Valencia is a more rampant grower, and the young upright shoots are apt to grow too long before branching. They should be pinched back. In pruning old trees, the following rules are thought to embody the best practice: Remove suckers whenever and wherever they appear. Remove the too vigorous vertical shoots which tend to produce coarse fruit. Remove old brush of waning vitality. Thin the tops and, to some extent, the sides so as to allow proper airing and lighting of the interior foliage, thus encouraging the production of high quality, inside fruit. Remove all dead twigs from the fruiting brush. Navel trees rarely need propping, while Valencia trees, unless the limbs are kept short and stout by pinching, are apt to require a great deal of propping.

Harvesting.

California oranges are harvested the year round, the Navels, from November 1 to May 1; seedlings and miscellaneous varieties during May; and the Valencias, from June 1 to November 1, thus overlapping the next Navel crop. A ripe Navel will remain in prime con-



LXXIX. An orchid fancier's house.—Cypripediums, Selenipediums, Miltonias, Lælias, Oncidiums.

dition on the tree for two months, a Valencia for six months or longer.

Oranges are picked with extraordinary care to prevent injury. They are never pulled, but are clipped flush with the "button" with round-pointed clippers. The fruit is collected in canvas bags carried by the picker, which open at the bottom and allow the fruit to slide gently into wooden lug-boxes. The unbroken skin of an orange is very resistant to decay, but the least abrasion, no matter how slight, whether caused by withdrawing the orange carelessly from the branches, or by the finger-nails, or by placing the fruit in boxes in the bottom of which a few grains of sand or dirt have fallen, is almost sure to become inoculated with spores of decay fungi, such as the blue-mold or the soft-rot. Many growers do not take all the fruit from the trees at one picking, but pick the lower fruit first, thus getting it out of the way of frosts which are most severe near the ground; and brown-rot, which is splashed up from the soil by winter rains; and also to relieve the strain on the branches. The standard car is made up of a certain proportion of the different sizes, hence it is customary to go over those remaining on the trees, selecting certain sizes to meet the daily demands at the packing-house. Formerly, picking was paid for by the box, but the tremendous losses from the decay resulting from rapid work has brought about a complete change to day labor.

The lug-boxes of fruit are hauled to the packing-house on spring wagons or auto trucks and weighed in. The fruit is then stored in the same boxes from one to five days, in order that the rind may shrink and the surface cells become less turgid and subject to abrasion. In this condition, oranges will stand a large amount of handling and tumbling about in the padded machines without injury. The fruit is first run through a brusher which removes dust and dirt. In case there is smut from scale insects or soot from oil-pots, they are put through a washing machine containing a $\frac{1}{50}$ of 1 per cent solution of copper sulfate in water. The fruit next travels on belts before the graders who, considering color, shape, smoothness and blemishes, sort the salable fruit into three grades, standard, choice, and fancy. Each one of these grades, after being weighed on automatic scales, passes through a separate sizing machine which delivers each of the eight or ten sizes into a separate, heavily-padded canvas bin. The packers, mostly women, wrap each fruit in printed absorbent tissue paper and place it in the box with great dexterity and skill, averaging sixty boxes a day. A very high pack is customary, and after the covers are forced on and nailed, the boxes are delivered by automatic carriers to the car or the pre-cooling room. One hundred lug-boxes will usually pack out about sixty packed boxes. The cars vary in capacity, depending on whether they are provided with collapsible ice-bunkers. The standard car contains 384 boxes loaded two tiers on end and six rows wide and including not more than 10 per cent of the following sizes, 96, 112, 250, and not over 20 per cent of the 126 size. The remainder of the car may be divided among the 150, 176, 200 and 216 sizes. Cars other than standard are discounted on the market according to the number of the off sizes they contain. The freight is figured on an estimated weight of seventy-two pounds to the box. In summer about five tons of ice are placed in the bunkers after loading and the cars are re-iced in transit as needed, unless they have been pre-cooled, in which case the initial icing suffices. The average time between San Bernardino where the Santa Fe trains are made up, or Colton where the Southern Pacific trains are made up, and New York is about fourteen days. The packing-houses vary in capacity up to twenty carloads a day. In no other fruit industry have the appliances for handling the fruit in the packing-house been so highly developed.

While a few of the larger growers still look after the sales of their own fruit, and a few sell the fruit on the trees to various fruit companies and commission men, the larger part turn their fruit over to a large and very strong coöperative organization of growers known as the California Fruit-Growers' Exchange. This organization began business in 1895 but was reorganized in 1905. In 1915, the Exchange handled about 62 per cent of all the citrous fruits shipped out of the state. The Exchange has greatly increased the consumption of citrous fruits by advertising and better distribution. The business of the Exchange is to "provide for the marketing of all the citrous fruit of members at the lowest possible cost under uniform methods, and in a manner to secure to each grower the certain marketing of his fruit and the full average price to be obtained in the market for the entire season." Much of the fertilizer and other supplies used in the industry are secured through a coöperative store known as the Growers' Supply Company. In 1914 this store did a business of $3,319,062.04 at an operating expense to the members of ¾ of 1 per cent on each dollar of business transacted.

Varieties.

A large list of varieties of oranges has been tested out under California conditions, but the law of "the survival of the fittest" has worked rapidly and today two varieties dominate the field, viz., the Washington Navel and the Valencia Late. While old orchards of other varieties are still producing considerable quantities of fruit, new plantings are now practically limited to these two varieties. The Washington Navel originated at Bahia, Brazil, in the early part of the nineteenth century and was introduced into California by William Saunders, of the Department of Agriculture, in 1870, through Mrs. L. C. Tibbet, of Riverside. This variety now known as the "king of oranges" rapidly gained in popularity until at the present time nearly 80,000 acres of it are planted. It owes it success to the following characteristics: fruit large, smooth, with fine color and flavor, seedless, a splendid shipper, and having a navel mark which serves on the market as a trade-mark. The tree is semi-dwarf, precocious, prolific, and a regular bearer. The Navel is prone to sport and much care should be used in cutting budwood. The Thomson Improved is the best example of a desirable sport from the Navel. The Navel reaches its highest development in the interior valleys.

The Valencia Late originated in the Azores and was introduced into the United States in 1870 by S. B. Parsons, of Long Island, through Thomas Rivers, of England. The Valencia reaches its highest development along the coast. It is a poorer orange than the Navel, but it is the only variety which remains on the trees in good condition until late fall or early winter. Other varieties still marketed to some extent from old groves are Mediterranean Sweet, Paper Rind, Jaffa, Ruby Blood, and Seedlings.

Insects and diseases.

The following insect pests occur in the California citrous orchards: the black scale, red scale, yellow scale, purple scale, cottony cushion scale, soft brown scale, citricola scale, hemispherical scale, greedy scale, oleander scale, citrus mealy-bug, red-spiders, silver mite, thrips, aphis, orange tortrix, Fuller's rose beetle, and a few others. More than $500,000 are expended in southern California each year combating the scale insects. The cottony cushion is controlled by a predaceous beetle, but the other scales are controlled by fumigation with hydrocyanic acid gas under movable tents made especially for the purpose. The cost of fumigating a medium-sized tree averages about 35 cents and the work must usually be repeated every second year. Spraying citrous trees for scale insects is almost obsolete in California. The black and purple scales are most damaging along the coast, while the red and yellow are severe in the interior valleys as well as the coast country. In Tulare County, a species of thrips has done much damage by scarring the fruit and distorting the leaves. The Tortrix worm is the only insect which burrows into the orange.

Gum disease is the most serious fungous disease of the tree in California, while armillaria root-rot, mal-di-gomma, trunk-rot (Schizophyllum), twig-blight (Sclerotinia), wither-tip (Colletotrichum), and damp-off fungi are minor troubles. Physiological diseases of the tree include squamosis or scaly bark, exanthema, chlorosis, mottled-leaf, die-back, and leaf-gumming. Fungous diseases of the fruit are: brown-rot (*Pythiacystis citrophthora*), blue-mold (*Penicillium italicum*), green-mold (*Penicillium digitatum*), gray-mold (*Botrytis vulgaris*), sooty-mold (*Melilola Camelliæ*), cottony-mold (Sclerotinia sp.), gray scurf and navel end-rot (*Alternaria citri*).

Physiological defects of the fruit are: sunburn, frost, off-bloom, exanthema, corrugations, bottle-neck, fingers, yellow-spot, double navel, brown-spot, stem-end spot, cracks, puffs, splits, peteca, red-blotch, and others.

Control measures, more or less satisfactory, have been worked out for the larger number of insects and diseases prevalent in the state.

Protection against frost.

The different kinds of citrous fruits vary in the amount of cold they will endure without injury. The amount of injury done by a given degree of cold upon a given variety will vary, also depending upon the degree of dormancy, the state of the weather just preceding and just after the freeze and the length of time the cold lasts. Many thousand acres of land in California are well suited for growing citrous fruits except for the fact that they are subject to occasional frosts which destroy the crop and sometimes injure the trees. It is natural, therefore, that under such conditions, the citrous growers of California should be pioneers in the work of frost-protection. A great deal of experimenting has been done along the line of diminishing the radiation of heat and by raising the dew-point. It has been demonstrated, however, that the most practicable and satisfactory method of fighting frost is by adding heat directly to the trees through the agency of fires distributed throughout the orchard. Some ten or more types of patent orchard-heaters are now on the market, but the kind the citrous growers find most satisfactory is a round sheet-iron pot of three or five gallons capacity fitted for burning low-grade distillate or crude-oil. The pot should be provided with a suitable cover to keep out the rain and a draught by which the size of the flame may be regulated to suit the degree of cold to be overcome. The less smoke is produced, the better. The smudge commonly used by deciduous fruit-growers is objected to on the ground that the fruit is covered with soot and it is both expensive and damaging to the keeping quality of the fruit to clean it properly. Citrous growers prefer to generate the additional amount of heat necessary to compensate for the lack of smoke.

Many small fires are better than a few large ones. The heaters are usually placed one to each tree or about ninety to the acre throughout the orchard with an extra row along the windward sides. Each ranch should be provided with an oil-reservoir which will hold enough oil to fill all the heaters on the ranch five or six times. When properly equipped with heaters, the temperature of an orchard can be maintained during the night at 10° F. above that of the surrounding country.

The effects of frost on oranges appear as a spotting of the skin and a softening of the outward side of exposed fruits. The juice disappears, leaving the interior dry and pithy. Slightly frosted oranges occasionally develop a very bitter taste. Fruit from the same trees will often grade all the way from sound to badly frosted, depending on the position the fruit occupied on the tree. The method of separating sound from frozen fruit is based on specific gravity.

The machine consists of an oblong tank through which water may be made to circulate at definite speeds by a small propeller. The oranges roll down an incline and drop into the moving water from a height of a foot or more. The light frosted oranges bob up to the surface quickly, while the sound, heavy fruit is slower to rise. Meanwhile the oranges have been carried along by the current, the sound fruit passing under, and being caught by a horizontal wire screen, while the light fruit is carried along above it. At the farther end of the tank the two grades are lifted by conveyors and delivered to separate bins. By adjusting the position of the screen and the rate of flow of the water, any degree of separation desired may be secured.

By-products.

The manufacture of citrous oils, perfumes, citrate of lime, and other by-products has never been developed commercially in California, although at present much experimenting is being done in an effort to encourage such an industry, which is badly needed. At present, the culls mostly go to waste or are applied to the land as fertilizer. The manufacture of marmalade and citrate of lime has been attempted but has not as yet assumed importance.

J. Eliot Coit.

ORANGE, OSAGE: *Maclura.*

ORANGE ROOT: same as goldenseal, *Hydrastis canadensis.*

ORCHARD. In North America, the word orchard is applied to a plantation of fruit-trees. The orchard is one part of the typical American farmstead, comprising either a few trees for domestic supply in a regularly laid-out plantation or a larger area planted as a source of revenue. Commercial plantings of large extent are also made without particular reference to a homestead. Except in the warmer parts, the apple tree comprises the usual orchard planting. Plantations of bush-fruits are not known as orchards in this country. By custom, orchards of citrous fruits are usually called groves.

ORCHARD-GRASS: *Dactylis glomerata.*

ORCHARD HOUSE, a name frequently used in England for glasshouses devoted to fruit-trees. Consult the article on *Forcing of Fruits,* volume III, page 1260.

ORCHARD PROTECTION: See article on *Frost.*

ORCHIDS. A vast assemblage of herbaceous plants, mostly with unusual and interesting flowers, of which about 15,000 species are at present known. This number is being augmented yearly as the regions which they inhabit become more accessible to collectors. A single collection in New Guinea in 1907 to 1909 brought to light 1,102 new species,—an indication of the number of new forms still to be expected from little-explored regions. Since the first edition of the "Cyclopedia of American Horticulture" was published, the number of known species has been increased by about 5,000. Probably the species now outnumber those of the great family Compositæ.

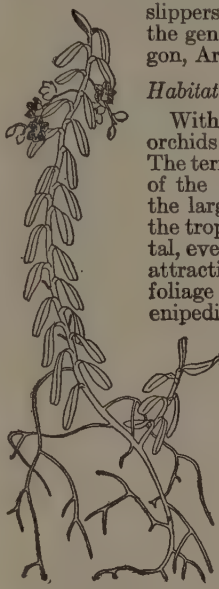
Although widely distributed, the orchids are seldom abundant in any place as to individual plants. They are mostly inhabitants of special or particular places. Orchids are also highly specialized in structure, particularly in character of flowers, in this differing widely from the broadly generalized structure of the Compositæ.

These very special plants, with marvelous range of form and color, have naturally excited the greatest interest on the part of cultivators, and great collections have grown up. To a large extent, these collections have been renewed from fresh importations from the wild, but the recent discoveries of symbiotic relations in germination, as well as better understanding of cultural requirements, will constantly increase the domestic supply. In the culture of a wide range of orchids the gardener exhibits his mastery of the arts of cultivation. The recent studies in this field afford very definite practical applications of scientific methods.

Distribution.

The orchids are distributed over all parts of the world with the exception of the polar regions and the great deserts. About 85 per cent of the species occur in the tropical and subtropical regions. Here they are found to a great extent in the mountainous districts. In some parts of the Himalayan region, the orchids constitute the most abundantly represented family of plants in point of number of species. Most of the tropical species are endemic. The widely distributed species are found in the North Temperate and the Subarctic zones. They include such forms as *Calypso bulbosa* (formerly known as *C. borealis*), *Microstylis monophyllos*, *Liparis Lœselii*, and species of Orchis (or Galeorchis). These are found throughout the northern regions of both hemispheres. The greater number of the orchids are distributed in three regions of the earth: (1) The tropical African region, including the islands to the east, furnishes comparatively few species to cultivation. These mostly belong to the genera Angræcum, Bulbophyllum, and Disa. This region also contains a number of endemic genera not of great interest to cultivators, and representatives of such widely distributed genera as Habenaria, Liparis, Microstylis, Epipactis, and others. (2) Unusually rich in genera is the region of tropical Asia, including the neighboring groups of islands. Typical of this region are the large genera Dendrobium, Eria, and Bulbophyllum, and many smaller genera, including Paphiopedilum, Cœlogyne, Cymbidium, Sarcanthus, Saccolabium, and Vanda. Among the genera common to this region and the African region are Bulbophyllum, Phaius, Calanthe, Liparis, and Microstylis. (3) The tropical American region, embracing Mexico, Central America, tropical South America, and the neighboring islands, occupies an isolated position and consequently contains an unusually large number of endemic genera, many of which are represented by hundreds of species. Besides the large endemic genera Epidendrum, Pleurothallis, Oncidium, and Odontoglossum, this region contains many of the commonly cultivated genera, among which may be mentioned Cattleya, Lælia, Masdevallia, Schomburgkia, Brassavola, Lycaste, Peristeria, Stanhopea, Gongora, Zygopetalum, Miltonia, Phragmipedilum, and many others. Some genera, among them Vanilla, Bulbophyllum, Calanthe, Liparis, and Microstylis, are common to both this region and the Old World. Compared with these great floristic regions, the temperate lands of the southern hemisphere are of less importance. Of the south African genera, Disa and Calanthe furnish a few species valuable to cultivation. Australia contains many genera in common with the tropical Asiatic region, but few of the cultivated species are derived from there. In temperate South America the orchids are sparsely represented by a few species of Epidendrum, Oncidium, Spiranthes, Habenaria, and a few other genera. From a horticultural standpoint, the species of this region are of little importance. About twenty genera are found in the northeastern United States and Canada, mostly in swamps and moist grounds; among them are the Cypripediums or lady's slippers, and many beautiful plants in the genera Habenaria, Pogonia, Calopogon, Arethusa, and Calypso.

2624. Monopodial growth in a vanda.



2625. Monopodial growth in Renanthera Cathcartii.

Habitat.

With regard to their habitat, the orchids are either terrestrial or epiphytic. The terrestrial orchids include the species of the temperate regions and many of the largest and most stately orchids of the tropics. Many of these are ornamental, even when not in flower. A few are attractive on account of their variegated foliage and some, like Sobralia and Selenipedilum, are admired on account of their tall graceful stems.

Most of the terrestrial orchids are green plants which obtain their carbon supply from the carbon dioxide of the air, but a few forms either lack chlorophyl entirely or possess it only in traces too small for normal photosynthesis. These forms are saprophytic in their mode of life and depend for their carbon food upon the organic matter of the humus. The appellation of parasites, which is sometimes given to these forms, is erroneous. True parasites are not known among the orchids.

In the saprophytic orchids, the subterranean part is either a much-knotted coral-like rhizome devoid of true roots (Corallorhiza, Epipogon), or a subterranean rootstock producing numerous crowded fleshy roots (Neottia, Galeola). The annual shoots are yellowish, brownish, or reddish, without true leaves, but bearing scales and a terminal inflorescence which may be reduced to a solitary flower. Very curious are the members of the Javan genus Galeola, whose leafless climbing stems attain a height of 100 feet, ascending trees by means of roots that arise opposite the scale-leaves, and producing a terminal and many lateral racemes in the upper part of the stem. The saprophytic orchids are not cultivated except occasionally in botanic gardens, as the conditions necessary for their existence are not readily imitated.

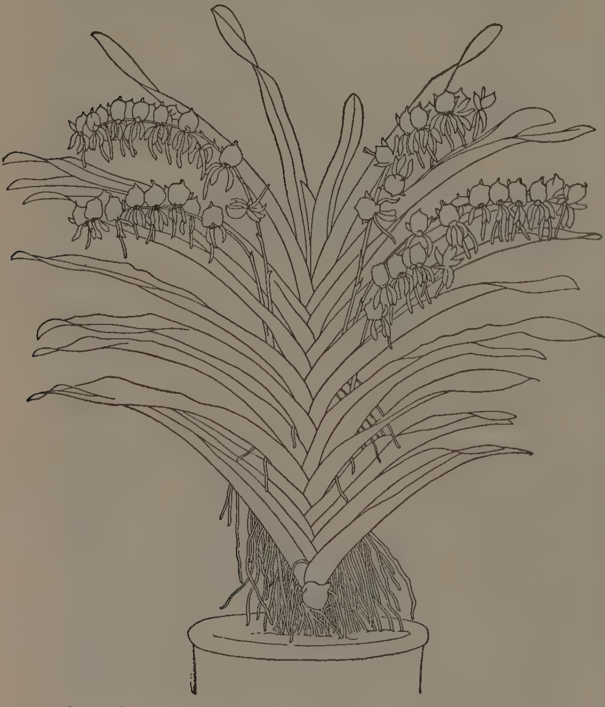
The epiphytic orchids exhibit the most varied forms. They are confined to the tropics and subtropics, where they inhabit branches of trees, dead trunks, and often barren rocks in exposed places. They grow mostly in regions where a part of the year is unfavorable to vegetation. As an adaptation to these conditions, they have developed special food reservoirs (pseudobulbs) terminating each season's growth. In this group there are comparatively few plants of attractive habit. They are usually devoid of graceful foliage, each pseudobulb bearing a few stiff leathery leaves. The older pseudobulbs become shriveled and leafless, detracting from the appearance of the plants, and in Pleione the plants are entirely leafless at the flowering time. In some of these, however, the pseudobulbs are numerous and closely crowded, and retain their foliage, making plants of neat compact habit (Cœlogyne, Miltonia). In their mode of life, the epiphytic orchids resemble the green terrestrial orchids. For their mineral nutrients they are dependent upon the material which is mostly the residue of decayed organic matter which accumulates among their roots. They are not saprophytic or parasitic.

Morphology of the vegetative parts.

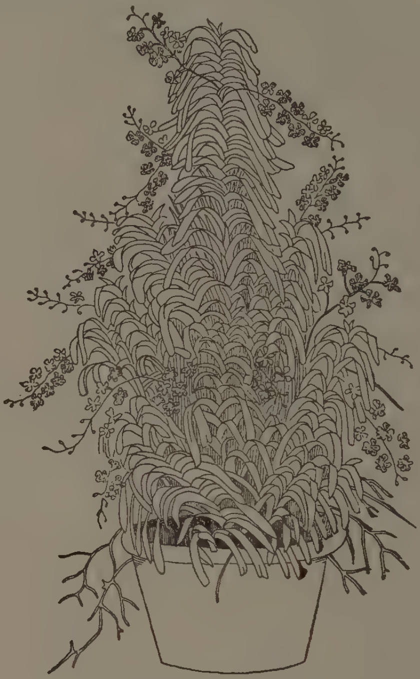
All orchids are perennial herbs which, according to their mode of growth, fall into two groups—the monopodial and the sympodial.

In the monopodial orchids, the growth of the main stem is continued indefinitely by the terminal bud. (Figs. 2624–2627.) Lateral branches are frequently produced, but they do not regularly assume the part of the main axis and do not under ordinary conditions exceed it in length. The growth of the main stem and its branches may be interrupted for a time by a period of rest, but such interruption is not manifested on the stem by the formation of scales and juvenile leaves when growth is resumed. All leaves are similar. The habit of the monopodial orchids is various. In spite of their indeterminate growth, they do not usually attain great size. This fact is explained by the slow growth of the plants, which often require several months to develop a single leaf. Nevertheless, some of the species attain stately proportions. The climbing species of Renanthera sometimes reach a length of 12 feet or more in greenhouses. Some of the vandas, aërides, and angræcums form handsome plants 1 to 2 feet high and well clothed with long distichous leaves. (Figs. 2626, 2627.) While these forms grow into tall leafy plants, others, like Phalænopsis, remain almost stemless and possess only a few large fleshy leaves. The extreme reduction is represented by such forms as *Polyrrhiza funalis*, in which the stem is reduced to a mere scaly bud seated on a mass of tangled green roots which perform the function of photosynthesis.

In the sympodial orchids, the growth of each shoot is definitely terminated usually after one, rarely after two or more seasons. The development of the plant is continued by buds originating in the axils of the scale-leaves at the base of the parent shoot. (Figs. 2628, 2629.) The lower part of each new axis is prostrate at first and often subterranean and bears only scales. It is known as the rhizome. In many terrestrial orchids of the temperate regions, the lower terminal part of the rhizome forms a tuberous root from whose apex the shoot of the next season arises. (Fig. 2630.) In a few sympodial orchids with perennial stems and climbing habits, branches originate in the axils of the stem-leaves (Vanilla). These bear a strong resemblance to the monopodial orchids, but all the branches as well as the main stem are finally terminated by inflorescences.



2626. Angræcum superbum, to show a monopodial growth.



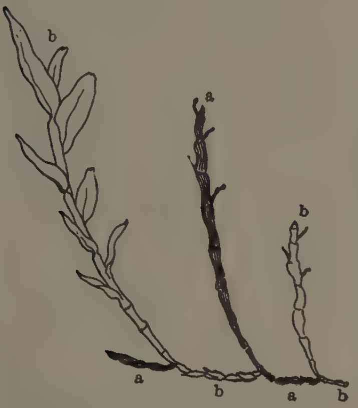
2627. Vanda tricolor, a branching monopodial orchid.

The general habit and appearance of orchid plants depends to a great extent on the nature of the rhizome. When this is long, the plants have a loose straggling habit (Epidendrum). When it is short, the plants are compact (Masdevallia, Cattleya, Cœlogyne). The rhizome may be much branched and give rise to numerous upright shoots (Sobralia, Cœlogyne, Disa), or it may be simple and give rise to only one shoot annually as in many of our native orchids. In some species, the rhizome assumes suberect or climbing habits (Lycaste).

The upright part of the axis presents a great diversity of forms which may be grouped in two classes according to the position of the inflorescence. This may be either terminal or lateral.

In the forms with a terminal inflorescence, the leafy part of the stem may be very short so that the leaves appear as a rosette on the ground while the upper part of the stem bears bracts from whose axils the flowers appear (Goodyera, *Orchis rotundifolia*, *Cypripedium acaule*), but generally it is more developed and bears a succession of leaves which are gradually reduced to bracts in the upper part (Habenaria, Cypripedium, Disa, Thunia). In Selenipedilum and Sobralia, the tall reed-like stems reach a height of 6 to 15 feet and often form dense thickets. In Vanilla the stems are long, branched, and climbing. In many of the epiphytic forms the stem is thickened into a pseudobulb. This may consist of a single internode which bears one or two leaves at its summit (Cœlogyne), but more frequently several internodes are enlarged to form the pseudobulb, which is then clothed with leaves at least when young, and later bears the scars of fallen leaves (Lælia, Cattleya, Epidendrum). Figs. 2631 and 2632 show the two forms of pseudobulb. Sometimes the whole stem is more or less fleshy without being enlarged into a distinct pseudobulb (Epidendrum spp.).

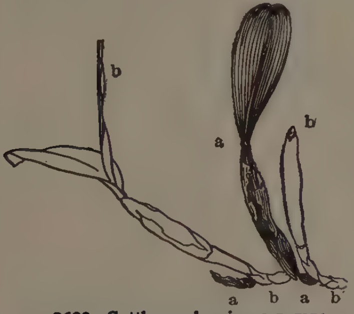
An equally varied display is presented by the sympodial orchids having a lateral inflorescence. Nearly stemless forms, or forms in which the stem is developed as a subterranean structure often of curious configuration, occur in the Phaiinæ (Phaius, Calanthe, Bletia), the Cyrtopodiinæ (Lissochilus, Warrea), and the Corallorhizinæ (Corallorhiza, Aplectrum). In others, the stem is developed as a pseudobulb consisting of several internodes clothed with leaves (Cymbidium, Mormodes, Catasetum, Chysis), or it is elongated and cane-like as in Dendrobium, which, however, may belong to the terminal-flowered forms since some of the near relatives of this genus produce terminal flowers. In species of Grammatophyllum and Cyrtopodium, the tall leafy pseudobulbous stems attain magnificent proportions, reaching a height of 3 to 15 feet. (Fig. 2633.) In the greater number of the lateral-flowered forms, only a single internode of the stem is enlarged to form a pseudobulb. (Fig. 2634.) Such is the case in Odontoglossum, Oncidium, Bulbophyllum, Trichopilia, Zygopetalum, Lycaste, Stanhopea.



2628. Dendrobium, diagrammatic sketch showing growth of sympodial orchid. The dark and light parts, *a a* and *b b*, represent each the growth of one shoot.

The inflorescence of the orchids is throughout of the indeterminate type, that is, truly terminal flowers are not produced. Even in those cases in which the flower is solitary, the presence of a few bracts above it show its axillary position. In the monopodial orchids, the inflorescence is of necessity always axillary since the growth of the vegetative shoot is indeterminate, but in the sympodial orchids it may be either axillary or terminal, as described above. In *Cœlogyne cristata*, and a few others, the inflorescence is terminal on special branches of the sympodium.

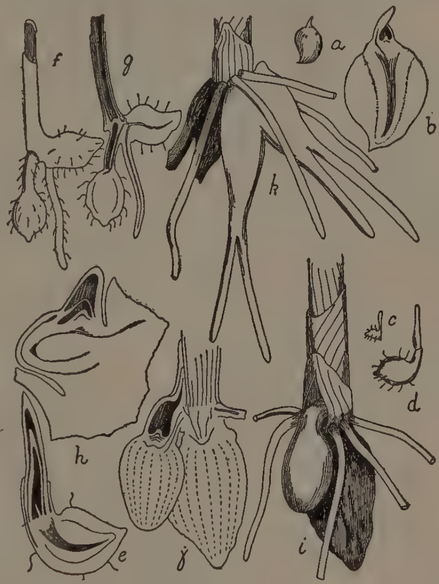
The form of the inflorescence is various. Solitary flowers occur in many genera, as Cypripedium, Lycaste, Anguloa, and others, but more commonly the inflorescence is racemose or paniculate. The raceme may be close and compact as in some of the monopodial orchids (Aĕrides, Saccolabium), or loose with few to many flowers, as in most of our native orchids as well as in most of the commonly cultivated species. In Renanthera, the gigantic racemes attain a length of many feet. Large paniculate inflorescences are characteristic of some species of Oncidium and related genera. The inflorescences are sometimes of a climbing habit and attain a height of several yards. The large perennial panicles of some species of Phalænopsis bear as many as 200 flowers. In Vanilla, large racemes arise from the axils of the upper leaves so that the whole upper part of the plant may be considered as a huge panicle.



2629. Cattleya, showing a sympodial growth. The light and shaded parts, *a a* and *b b*, each represent one year's growth.

Morphology of the floral parts.

No group of plants exhibits so great variety of modifications of the floral structures as the orchid family. Some of the forms are shown in Figs. 2635, 2636, 2637. Fundamentally the flower is of the liliaceous type; but, by the supression of some parts and the modification of others, the structure of the flower has been so changed that in its outward appearance it bears little resemblance to the typical monocotyledonous flower. In flowers of the liliaceous type, there are normally present two outer whorls of floral organs, the sepals and the petals, two whorls of stamens, and an inner whorl representing three carpels. In the orchid flower, the two outer whorls, the sepals, and petals are developed. Of the stamens, only two are fertile in the Diandræ (Cypripedium and related genera), while in all the other orchids (Monandræ) only a single stamen is fertile. The three carpels are always present. The three corresponding stigmas are developed in the Diandræ, while in most of the remaining orchids only two stigmas are receptive (Monandræ). (See Fig. 2638.)



2630. The tuber formation of terrestrial sympodial orchids, *a, b, c, d*, young seedling stages of Orchis militaris; *e*, section through the same; *f* and *g*, plants the following spring with the tubers completed; *h*, section showing beginning of lateral shoot; *i*, tubers of mature plant; *j*, longitudinal section of same; *k*, tubers of Orchis latifolia.

The relation of the parts of the flower to one another is greatly changed by the growth of the floral axis. This is convex in the very young stages of development but it soon becomes cuplike by the cessation of growth of the center and the more rapid growth of the peripheral zone. A hollow or tubular axis is thus produced, within which are formed three longitudinal ridges or placentæ upon which the ovules are borne. The hollow floral axis constitutes the "inferior ovary" of the orchids (Fig. 2639) and at the same time acts as the stalk or pedicel of the individual flowers of the inflorescence. The ovary is structurally 3-celled. (Fig. 2640.) Besides the carpellary cavity, the axis of many orchids contains another cavity which lies toward the labellum or lip and opens at the base of it. This is a nectary. It may be considered in the nature of the cavity of an adnate spur of the labellum. In the embryonic state, the orchid flower is so oriented that the labellum is situated on the side of the flower toward the axis of the inflorescence, as shown in Fig. 2638; that is, it points toward the apex of the inflorescence. In a few forms this condition is permanent, but in the greater number of orchids the ovary or axis is variously bent or twisted so that in the mature flower the labellum is on the side of the flower away from the floral axis or, generally speaking, on the lower side of the flower.

2631. **Cattleya dolosa, a sympodial orchid with terminal inflorescence and pseudobulbs consisting of several internodes.**

Of all the floral organs the sepals are the least modified. These comprise the outside whorl in Fig. 2638. The one originally opposite the axis of the inflorescence, but which by reason of the turning of the flower just described usually occupies a position adjacent to the axis or on the upper side of the flower, is known as the odd sepal. By reason of its actual position with reference to the flower, it is sometimes called the upper sepal. The other two, which were originally adjacent to the axis of the inflorescence, are the paired or lateral sepals. In most orchids, the lateral sepals are asymmetrical, but noteworthy modifications occur only in a few genera. Sometimes the lateral sepals are partly or entirely united (Cypripedium, Oncidium). In Masdevallia, all the sepals are united into a short tube at the base, and expand above into three blades terminating in long tails. Occasionally, the odd sepal is spurred or saccate (Disa) and very commonly differences in size exist between it and the lateral sepals.

2632. **Cœlogyne Cumingii, a sympodial orchid with terminal inflorescence and pseudobulbs of one internode.**

Of the members of the second whorl, the two lateral ones are usually petal-like while the one opposite the odd sepal is specially modified, and is known as the labellum (*l*, in Fig. 2638). In most genera the lateral petals resemble the odd sepal, although minor differences in form, size, and color are of frequent occurrence. This resemblance is most striking when these parts have some unusual form, as in *Oncidium Papilio*, in which they resemble the antennæ of an insect, or in *Phragmopedilum caudatum*, in which they are longcaudate, attaining a length of 3 feet. In some genera, the lateral petals show no resemblance to the odd sepal (Huttonæa, Masdevallia, Achrochæne). Asymmetry of the lateral petals occurs very frequently.

The odd petal, or the labellum, presents the greatest diversity of form of all the floral organs. Sometimes it is small and inconspicuous (Disa), or it is like the lateral petals (Goodyera). As a rule, however, it is much larger than the lateral petals (as in Fig. 2637), and often it is the most conspicuous part of the flower (Oncidium, Cypripedium, *Odontoglossum Londesboroughianum*). In a few genera the labellum is bifid (Vanda, Listera), but in the greater number of orchids it is evidently three-lobed. One of the most common forms which the labellum assumes is that of a trumpet-shaped tube whose sides are formed by the lateral lobes, while the middle lobe is expanded into a variously shaped blade which is often of a deeper shade than the rest of the flower and ornamented by crests and ridges and color-markings of various kinds which are thought to be of service to the flower by attracting insects and guiding them to the nectar and hence to the pollen and stigmas. This form of labellum is characteristic of many of the most beautiful orchids in cultivation (Cattleya, Lælia, Dendrobium, Phaius). Frequently the labellum is more or less concave, and in Cypripedium and related genera it has the form of a sac (Fig. 2636) often compared to a shoe as the name "lady's slipper" indicates. In many species, the labellum is strangely transformed and more or less distinctly segmented into a basal part, the "hypochil," and a terminal petaloid portion which is then designated as the "epichil." Sometimes the differentiation is carried still further and an obscurely defined section, the "mesochil," is recognized between these two. The hypochil is the stalklike, or somewhat concave winged part which joins the column. It is not clearly distinguishable from the foot of the column described below. The mesochil is usually provided with two lateral cirrhous appendages termed "pleuridia," and a central callus known as the "mesidium" (Phalænopsis, Stanhopea, Peristeria, Gongora). (Fig. 2641.) The epichil is the simple or lobed terminal part of the labellum. In color and consistency it usu-

2633. **Grammatophyllum speciosum, a sympodial orchid with lateral inflorescence and pseudobulbous stems consisting of several to many internodes and attaining a height of several feet.**

ally resembles the lateral petals. Often it is movably attached to the mesochil. In some forms of the Pterostylidinæ the labellum is sensitive, and when irritated by an alighting insect closes sharply against the column, entrapping the animal.

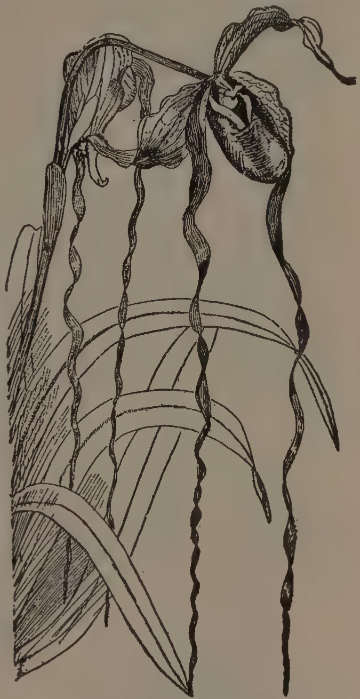
2634. Odontoglossum Œrstedii, a sympodial orchid with lateral inflorescence, and pseudobulbs consisting of a single internode.

2635. An orchid flower (with unexpanded bud above), to show the very long spur. — Macroplectum sesquipedale. (× about ¼)

The morphological center of the flower is occupied by a fleshy elongation of the floral axis known as the column. This is short and inconspicuous in some forms, but in most species it is well developed. It is usually bilaterally symmetrical. The posterior surface is convex while the anterior surface, toward the labellum, is concave. Usually the column is curved toward this face. In a few forms, like Cycnoches, the curvature is very marked, while in Coryanthes the column is asymmetrically bent. Within the column is a canal continuous with the carpellary cavity. (Fig. 2642.) The column is primarily of importance because at its upper end it bears the stamens and the stigmas and auxiliary structures which function in the pollination of the flowers. Besides these organs, it sometimes bears a number of outgrowths and appendages which give it a very complex appearance. Often the labellum does not appear to be attached directly to the column, but is borne upon a special fleshy outgrowth at its base known as the "foot" of the column. Between the forms in which the foot of the column is not developed and those in which it is present, no distinct line can be drawn. In our native orchids it is mostly absent. In Grammatophyllum there is a small cuplike depression upon whose anterior wall the blade of the labellum is attached with a narrow base. It is here a matter of interpretation whether the anterior wall of the cup is regarded as a part of the labellum or as the foot of the column. (Fig. 2643.) In other cases where the foot is more distinctly developed, the labellum is often plainly attached to its lower side, as in Paphinia, Pescatoria, Phaius, Bulbophyllum. (Fig. 2644.) Frequently the lateral sepals are decurrent upon the foot or entirely attached to it (*Bulbophyllum Achrochæne*, Fig. 2645). In some forms the lateral sepals and the labellum are borne near the end of the foot while the lateral petals are decurrent upon it (Batemannia). Sometimes the lateral sepals and the labellum are carried entirely away from the other parts by the elongation of the foot of the column, thus giving the flowers strange and fantastic forms (Drymoda, Gongora, Aërides). When the lateral sepals or the petals are decurrent upon the foot they, together with the labellum attached at the apex, often form a "chin" or "mentum" which is present in many orchids, such as Dendrobium, Pescatoria, Lycaste, Batemannia. (Fig. 2646.) Frequently the base of the mentum is extended below into a sac or spur of various forms and length. More often the spur arises from the labellum itself (Phaius, Platanthera). Within the cavity of these spurs or sacs, honey is secreted, and often the walls themselves contain juices which are sought by insects.

The upper part of the column bears the stigmas and the stamens. In the Diandræ, the three pistils are fertile, as indicated by the more or less evidently three-lobed stigma (Figs. 2647 and 2648), but in the Monandræ only two stigmas are receptive. The place of the third is occupied by the curious "rostellum," which separates the anther-bed from the stigmas and prevents the pollen from falling directly upon them (Fig. 2642). The stigmas are usually flat surfaces sunk in a depression in the column below the rostellum. In a few genera they are elevated on stalks (Habenaria), and in Sophronitis they extend partly along two wing-like projections of the column. The essential organs, in other forms, are shown in Figs. 2647–2652.

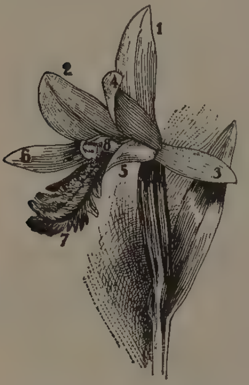
The stamens in the Diandræ are situated laterally on the column under a shield-like staminodium which is developed in place of the odd stamen of the outer whorl. In the Monandræ, the stamen is situated at the dorsal margin of the column. Its position is sometimes erect, but more frequently it is bent downward with the anther either pendent (Cœlogyne, Fig. 2650), or lying in a depression, the "clinandrum" or "anther-bed," in the top of the column. From the dorsal part of the column a petaloid appendage often arises and extends above the anther. The sides of the anther-bed are formed by outgrowths of the column. They are often developed as crests, ears, or winglike structures ornamenting the column and enfolding the anther. The floor of the anther-bed is formed by the rostellum.



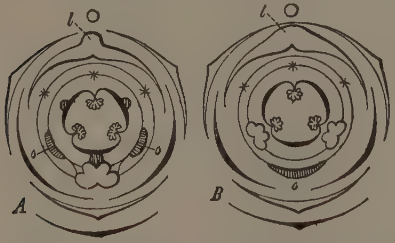
2636. The appendaged flower of Phragmopedilum caudatum.

The anther sometimes remains two-celled, but more frequently the cells are further divided, by longitudinal partitions or cross-walls, into four or eight cells. In a few cases, six cells are formed, probably by the abortion of some of the cells.

The pollen is powdery in some cases, but usually the grains are united by means of a viscid substance into waxy masses termed "pollinia." The number of pollinia corresponds to the number of anther-cells. In many genera, the viscid substance uniting the pollen-grains is prolonged beyond the pollen-mass and hardens into a stalk or "caudicle" within the anther-cell (Fig. 2651). One or two pollen-masses are attached to each caudicle. When the anther dehisces, the caudicles come into contact with masses of sticky matter formed by the disorganization of cells on the upper surface of the rostellum. In many orchids, this substance itself forms the adhesive disk by means of which the pollinia become attached to insects. In others a strip of tissue is separated from the rostellum by the disorganization of the underlying cells, and forms a stalk which in this case is known as the "stipe." When a stipe is formed by the rostellum, the caudicle of the pollen-masses is not produced. In that case, the pollinia become directly attached to the stipe when the anther dehisces. The other end of the stipe forms the adhesive disk. (Fig. 2652.) Whatever its origin, the stalk with its adhesive disk is one of the most important parts of the mechanism by which the transport of the pollen-masses from flower to flower is brought about and by means of which cross-pollination is insured. The details of the process by which this is accomplished have been beautifully explained by Darwin in his classical work, "The Various Contrivances by Which Orchids are Fertilized by Insects."



2637. Flower of Pogonia, a pretty native orchid.—Beneath the expanded part is the long ribbed ovary; *1, 2, 3,* sepals; *4, 5, 6,* petals, one of them *(5)* enlarged into a lip at *7*; *8*, column covered by the anther. (Nearly natural size.)

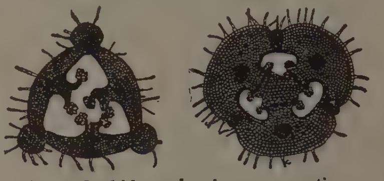


2638. Diagrams of orchid flowers in cross-section.—*A*, Monandræ (one-anther) and *B*, Diandræ (two-anthers); *l*, represents the labellum, and *oo* (in the inside of the diagram) the staminodia.

2639. Orchid flower, showing the long stem-like ovary between the two bracts and the other floral parts above.

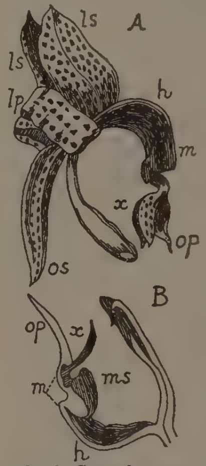
Dimorphic and trimorphic flowers occur in a few orchids. In the inflorescences of a small group of Oncidiums (Heterantha), only few normal flowers are produced together with many smaller sterile ones which lack the column. In *Renanthera Lowii* the upper flowers of the long inflorescence differ in form and color from the others. The most unusual condition exists in Catasetum, in which there are three very different types of flowers. In some years the same plant produces only one type and in other years all types on a single inflorescence.

The flowers of orchids are commonly noted for their longevity. When not pollinated, the flowers of most genera remain fresh for thirty to forty days, and in some genera even for much longer periods. Only a small number of genera have flowers that wither in a few days (Sobralia, Cirrhopetalum). The persistence of the flowers greatly increases the chances for pollination, which, since it is dependent on particular agencies, is more or less uncertain. After pollination has been effected, the flowers soon wither.



2640. Orchid ovaries in cross-section.—Paphiopedilum Charlesworthii at left; P. Schlimii at right.

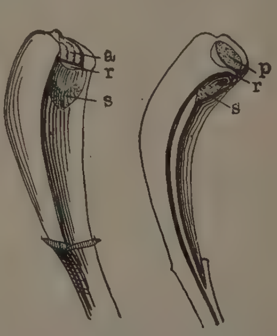
The fruit of orchids is usually a dry capsule, requiring a long time to ripen, so that if an orchid flower is fertilized in one rainy season its seeds are not disseminated until the next wet period. Very few have fleshy fruits which dehisce imperfectly or not at all. In them the seeds are liberated only by the decay of the pericarp (Vanilla). The seeds of orchids are minute and extremely numerous, the number in a single capsule having been estimated for different species from several thousands to over a million. The seeds consist of a dry loose large-celled testa inclosing a rudimentary embryo, which in most genera is entirely undifferentiated. (Fig. 2653.)



2641. Stanhopea platyceras. A. complete flower. B. section, *ls*. lateral sepals; *os*, odd sepal; *lp*, lateral petal; *h* to *op*, odd petal or labellum of which *h* is the hypochil, *m* the mesochil, and *op* the epichil, *ms*, mesidium, and *x*, pleuridia.

Symbiosis.

So far as known, the roots of all orchids, with the exception of occasional individuals, are inhabited by fungi which live within the tissues either symbiotically or at least without causing any apparent injury to the plant. The fungus hyphæ are primarily found in the cortical tissues, but usually two or three of the outer layers of cells of the cortex are not infected. In the epidermis the fungus is found only in the cells bearing root-hairs, through which long hyphæ pass out into the substratum. The central cylinder and the growing apex of the root are not infected. The extent to which the fungus passes upward in the plant varies with different species and with the condition of the roots. In Neottia, Goodyera, and Corallorhiza the lower part of the stem is invaded sometimes up to the first node. In Epipactis, Cypripedium, and Listera, the roots and rhizomes contain much woody tissue. In such forms, many of the roots are free from fungi, and in the remaining roots, as well as in the rhizomes, the distribution of the fungus is irregular. The basal parts of the roots, which are more or



2642. Column of a cattleya, with a longitudinal section at the right.—*a*, anther; *r*, rostellum; *s*, stigma; *p*, pollinium.

less woody, are not infected; and occasionally individual plants are found which appear to be free from the fungus. In the roots of epiphytic orchids, also, the distribution of the fungi is irregular, only scattered islands of cortical tissue being as a rule infected. Only the parts of the roots which are in contact with the substratum contain fungi. In forms like Vanda and Vanilla, with superficial roots, only the side of the root adjacent to the substratum is infected, while the other chlorophyl-bearing side is free.

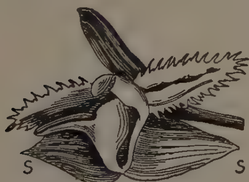
2643. Flower of Grammatophyllum speciosum, showing at the base of a column a cuplike depression to the anterior wall of which is attached the labellum, with a narrow claw.

Within the cells, the fungus has the form of closely coiled and interwoven masses of hyphæ, except in the root-hairs and in the velamen,—the spongy outside covering of the roots of epiphytic orchids,—where long hyphæ occur. The endophytic mycelium is, as a rule, connected with external mycelium in the substratum by means of hyphæ passing through the root-hairs, or, where these are absent, as in *Neottia Nidus-avis*, through the epidermal cells of the rhizome and the roots. In some forms, like Neottia and the epiphytic orchids, such communications have been only sparingly observed, while Corallorhiza and most of the terrestrial orchids have abundant connections with the mycelium in the substratum.

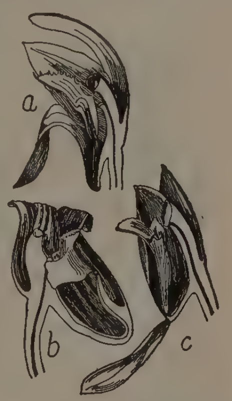
The plants are sometimes permanently infected through the seedling in the way described farther on. Infection also takes place through the root-hairs. When the rhizome and the upper part of the roots are free from fungi, infection must of necessity take place in this way. In epiphytic orchids, and probably in terrestrial orchids also, repeated infections thus occur. In some terrestrial orchids, in which the fungus invades the rhizome, the hyphæ grow out directly from this into the new roots, and also into the bud for the following year. In such forms only a single infection is necessary to establish a permanent symbiosis.

2644. Paphinia cristata, showing at *f* the foot of the column with labellum attached on lower side.

It is generally held that the mycorrhiza fungi supply their hosts with nutrients. That the non-green forms like corallorhiza are supplied with organic carbon compounds in this way can scarcely be doubted, for these plants, lacking chlorophyl, cannot elaborate their own carbohydrates from the carbon dioxide of the air. It is certain, also, as will be described later, that the germination of orchid seeds and the early stages of development of the seedling do not take place without the intervention of the mycorrhiza fungi, but the function of the fungi in these processes remains still to be investigated. To what extent the mycorrhiza fungi function in supplying the plants with water, salts, and organic nitrogenous compounds, is not known. For the greater number of orchids that are equipped with chlorophyl and which can, therefore, utilize the carbon dioxide of the air for the production of carbohydrates, it is not likely that the root-fungi are necessary for supplying them with carbon compounds. There is some evidence, however, that the fungi have a part in supplying the plants with nitrogenous compounds and possibly with phosphorus and potassium also. The fact that the hyphal coils are finally digested in the cells and that the substances which they contain thus become available to the plant, throws no light on this problem for the substances in the hyphæ may have been derived from the plant itself. Investigations up to the present time have shown that orchids do not assimilate free nitrogen from air by the aid of their endophytic symbionts, nor do the fungi themselves in pure cultures fix free atmospheric nitrogen.



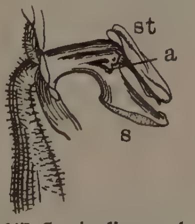
2645. Bulbophyllum Achrochæne, showing (*s, s*) lateral sepals decurrent on foot of column.



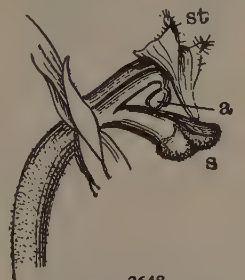
2646. The mentum.—*a*, spur-like mentum of Lycaste Cobbiana; *b*, sack-like mentum of Acanthophippium javanicum; *c*, chin-like mentum of Batemannia Colleyi.

Seedlings.

The growing of orchid seedlings has always been surrounded with much mystery and secrecy. In the large orchid establishments, the secret methods which the expert growers were supposed to possess were carefully protected by locked doors and painted glass, and visitors were seldom admitted to the houses. Yet it was evident that in spite of the carefully guarded practices, chance seemed to play an important part in the culture of orchid seedlings. Rarely were the expert growers uniformly successful. Of the vast number of genera imported, only cattleyas, odontoglossums, cypripediums and a few others could be grown with even a fair assurance of regular success. Some growers were unusually successful with one group and some with another, but generally all were not equally successful with all kinds. The key to this situation was furnished by Noel Bernard who, in 1903, attempted to grow seedlings of a hybrid between *Cattleya Mossiæ* and *Lælia purpurata* under aseptic conditions and found that the embryos swelled and formed green spherules, but that they failed to develop further even after weeks, and finally died. If, however, the seeds were sown on pure cultures of the endophytic fungus isolated from the roots of these plants, the embryo developed normally, forming a spheriod body which soon produced a cotyledon and papillæ with long root-hairs. Further investigations, chiefly by Bernard and by Burgeff, showed that the germination of orchid seeds does not occur except in the presence of the root fungi. Even seedlings of such little mycotrophic forms as Cypripedium and Epipactis, will not develop unless infected, although the mature plants of these species are often found without fungi and do not require their presence

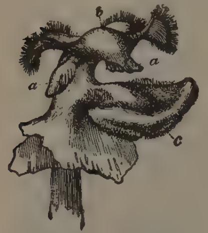


2647. Cypripedium.—*st*, staminodium; *a*, anther; *s*, stigma.



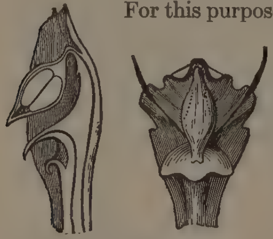
2648. Phragmopedilum caudatum. —*st*, staminodium; *a*, anther; *s*, three-lobed stigma.

The infection of the orchid embryo takes place through the suspensor by means of which the embryo was attached to the nutrient tissue of the ovule (Fig. 2654). From the suspensor the fungus invades the cells in the lower region of the embryo, except the epidermis. The cells become filled with dense interwoven gnarles of hyphæ like those in the roots. The coils in the inner cells undergo a process of digestion, but those in the outer cells remain intact and send hyphæ through the root-hairs of the papillæ into the soil. New papillæ with long absorbing hairs are soon developed and the cotyledon and leaves begin to be differentiated. After three to four months, roots are produced and the young embryo begins to assume the characteristic form of an orchid seedling (Fig. 2655).



2649. Structure of the column of Paphiopedilum Dormanianum.—*a*, *a*, anthers; *b*, body representing the third stamen; *c*, stigma. Underneath are the remains of the floral envelopes, which have been torn away.

From these facts it is apparent that for the growing of orchid seedlings it is absolutely essential that an association of the seed with the proper root-fungus be brought about. In practice, this has often been accomplished by the sowing of the seeds on pots containing the parent plants. This method, however, has many disadvantages. The plants cannot be repotted while the seedlings are growing, and the seeds are likely to be washed away in watering, since they cannot be readily protected by a proper covering. Better success can be secured by the use of straight-walled glass jars with loose glass covers. These are filled with finely chopped sphagnum, which is well pressed into the jar. The whole is then sterilized in a steam-box for one hour on three successive days in order to kill bacteria and spores of molds which are likely to overrun the seedlings. After sterilization, the jars should be allowed to stand for a few days. Those in which molds develop should be discarded. The sterile jars may then be inoculated with the root-fungus from the species of orchid to which the seed-plant belongs. For this purpose, portions of infected roots should be cut into small pieces with a sterile knife and scattered over the sphagnum seed-bed. Great care should be observed at all times to avoid the introduction of foreign spores from the air. It should also be borne in mind that only the covered roots contain the fungus, and that generally only the soft tissues from ½ to 1 inch back from the root-tip are most abundantly infected. As soon as the root-fungus has grown through the sphagnum, the seeds should be sown in the jars. In the collection and handling of the seeds, all possible precaution should be taken to prevent contamination.

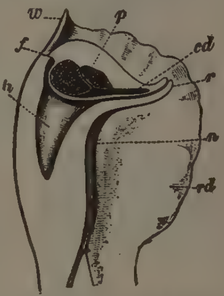


2650. The pendent anther in Cœlogyne speciosa.

While the difficulties involved in these manipulations are considerable, they are not insurmountable, and it is not unlikely that in time means will be found to remove many of the uncertainties which at present attach to the growing of orchid seedlings. With the increasing demand for orchids for cut-flowers and for general florists' use, and the depletion of the sources of supply of imported orchids,—especially of the rarer endemic varieties,—the growing of seedlings will become more and more a matter of necessity. The production of new and improved varieties, and the preservation and multiplication of rare sorts will be greatly facilitated when the growing of seedlings is freed from its many uncertainties. The seed-grown plants have many advantages over the imported ones. They are from the start better adapted to greenhouse conditions. They are hardier and more resistant and can be grown into plants of better form. They also flower more freely and often can be made to bloom twice a year.

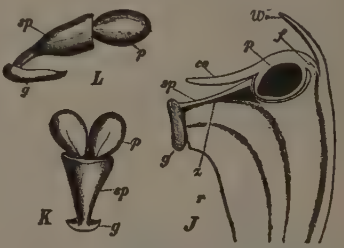
Hybrids.

One of the most fascinating phases of orchid-culture is the production of hybrids. By the crossing of different genera and species, numerous new orchids have been produced, many of which are superior to the native species. The first orchid hybrid to be produced in cultivation was *Calanthe Dominii*, a cross between *C. masuca* and *C. furcata*. It was raised by Mr. Dominy in the nursery of James Veitch & Son, and flowered in 1856. Other hybrids, including the beautiful *Calanthe Veitchii*, appeared in the following years, and in 1861 the same grower produced the first bigeneric hybrid, *Goodyera Dominii*, which was a cross between *Hæmaria* (*Goodyera*) *discolor* and *Dossinia marmorata*. Since that time the interest in orchid hybridization has grown greatly. The number of orchid hybrids now is between 3,000 and 4,000. Rolfe and Hurst record twenty-three genera which have entered into bigeneric hybrids, and many cases in which three genera have entered into the hybrid. In some hybrid genera, like Læliocattleya, the forms far outnumber the species of the parent genera.



2651. Column of Phaius cupreus.—*h*, cavity below the anther; *f*, filament; *p*, pollinia; *cd*, caudicle; *r*, rostellum; *n*, stigma; *w*, petaloid extension of the dorsal part of the column continuous with the lateral wings, *rd*.

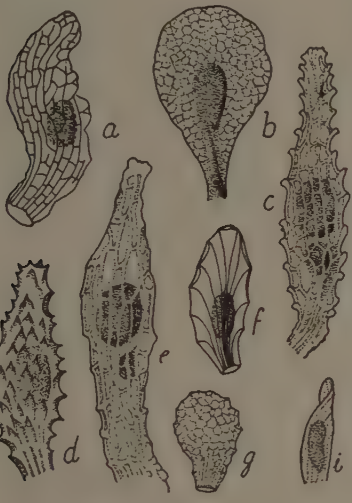
The pollination of orchid flowers requires a little skill and patience and a knowledge of the parts of the flowers described earlier in this article, but otherwise offers no great difficulties. Only strong and vigorous plants should be chosen for seed-bearing, since the process greatly exhausts the plant and sometimes even causes its death. The pollinia are mature and the stigmas are receptive when the flower is fully open. When it is the purpose to produce hybrids, it is well to remove the pollinia of the plant that is to bear the seed since the possibility of accidental interference by the plant's own pollen is thus prevented. Even when it is intended merely to grow non-hybrid seed, this course is to be recommended, since, in nature, the orchids are habitually cross-pollinated. The pollination is easily accomplished. To this end, the pollen-masses are removed from the anther by means of a sharp lead-pencil or a pointed stick and placed on the stigmatic surface. In the Cypripediums and related genera, the pollen-masses are exposed, but in most of the other orchids the pollen is covered by the anther, which can be readily removed. The pollinia can be picked up by



2652. J, column of Cochlioda sanguinea; *w*, dorsal extension of column; *f*, filament; *p*, pollinium; *co*, extension of filament; *sp*, stipe; *g*, adhesive disc; *z*, disorganizing tissue by means of which the stipe and adhesive disc are separated from the rostellum. *K*, two pollinia with stipe and adhesive disc; *L*, lateral view of same.

touching the adhesive disk with the stick or lead-pencil. Usually several pollen-masses will be thus withdrawn, but as a rule it is best to place only a single one upon each stigma. Fewer seeds are thus ripened but these are better nourished and produce more vigorous seedlings than seeds from full capsules. The methods of sowing the seed are the same as already described.

The nomenclature that has been most frequently adopted (aside from treating them as direct species names) for simple orchid hybrids between two species of the same genus consists in the application to the hybrid of a Latin name of specific rank but preceded by a ×. Thus *Calanthe × Veitchii* signifies that the plant so named is a hybrid between two species of Calanthe. Sometimes non-latinized names are used, as Cattleya × "Nymph." In the case of bigeneric or trigeneric hybrids, the name of the hybrid is usually formed by the combination of parts of the names of the parents or of the whole name of one parent and part of that of the other, as Epiphronitis (Epidendrum and Sophronitis), Læliocattleya (Lælia and Cattleya), Brassocattlælia (Brassavola, Cattleya, and Lælia). These are written as one word without hyphens or capitals at the beginning of the second or third parts. For further details concerning orchid hybrids and lists of all known forms, see G. Hansen, "The Orchid Hybrids," London, 1895; E. Bohnhof, "Dictionnaire des Orchidées Hybrides," Paris, 1895; R. A. Rolfe and C. C. Hurst, "The Orchid Stud-book," Kew, 1909, and Sander & Sons, "Orchid Hybrids," St. Albans, 1912 (?). For other suggestions on the nomenclature of orchid hybrids, see the entries *Adamara*, *Linneara*, *Lowiara*.



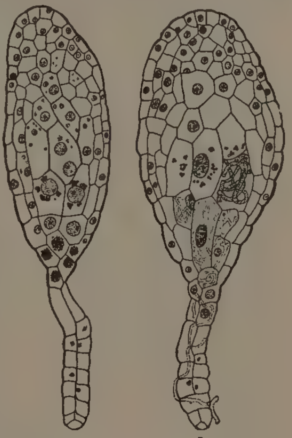
2653. Seeds of orchids.—*a*, Listera ovata; *b*, Stanhopea Warscewiczii; *c*, Mormodes Buccinator; *d*, M. viridiflora; *e*, M. pardina var. unicolor; *f*, Orchis secundiflora; *g*, Sturnia Lœselii; *i*, Octomeria lancifolia.

Foliage plants.

The Physureæ, a small group of orchids distributed in tropical Asia and the Malay Islands, with a few species in Africa and North America, are remarkable for their beautifully variegated leaves (Physurus, Anœctochilus). The plants themselves are usually small, with the habit of Goodyera, a North American representative of the group. Variegated or mottled leaves occur also in some other groups (Cypripedium, Goodyera, Phalænopsis, and Oncidium).

Historical sketch.

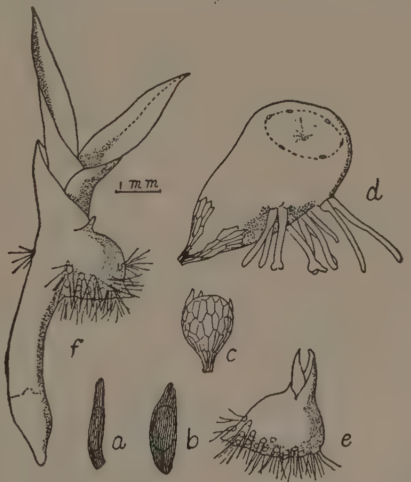
While the native orchids of Europe excited the interest of the herbalists of the sixteenth century, the epiphytic forms of the tropics did not become known to botanists until a much later period. By the end of the seventeenth century, a few species had been described and figured by Rheede tot Draakenstein, Sloane, Plumier, and others. In the second edition of Linnæus' "Species Plantarum" (1763), thirty species of epiphytic orchids are described under Epidendrum, which, at that time, was made to include all epiphytic orchids from the tropics. In 1805, Willdenow, in his edition of the "Species Plantarum," listed 391 orchids, including 140 epiphytic species. In the nineteenth century, through the exertions of many collectors, the number of known tropical orchids rose rapidly. For the descriptions of the numerous forms coming in during that time we are chiefly indebted to efforts of Lindley and of Reichenbach.



2654. Embryos of a Læliocattleya. *a*, not infected; *b*, infected.

Attempts at the cultivation of tropical orchids apparently did not begin until early in the eighteenth century. The first edition of Miller's "Gardener's Dictionary," in 1731, describes twenty native European species under Orchis, but no tropical form is mentioned. About this time, however, plants began to be introduced into English conservatories by missionaries and officers who visited the tropics. In 1731, *Bletia verecunda* was received from the West Indies. The vanilla was cultivated by Miller in 1759, and was at that time fairly well known in English conservatories. In 1789, Commodore Gardner sent plants of *Epidendrum fragrans* from the woods of Jamaica. One of these flowered two years later and was the first orchid figured in Curtis' "Botanical Magazine," plate 152 (as *E. cochleatum*). In Martyn's edition (1807) of Miller's "Gardener's Dictionary," 124 orchids, including the vanilla, were listed under Epidendrum.

The middle part of the nineteenth century is remarkable for the great number of new and rare forms introduced, and for the large sums often paid for striking novelties. As early as 1855, a plant of *Aërides Schroederi* brought something over $430 (G.C. 1855, page 775). In 1875, a plant of *Dendrobium Wardianum* was sold at Stevens' auction rooms for over $500 (G.C. 1875,



2655. Seedling of Odontoglossum.—*a*, seed; *b*, same somewhat swollen; *c*, same bursting testa; *d*, young spherule with root-hairs; *e*, more advanced stage showing cotyledon and first leaves; *f*, seedling with root and leaves developed.

I, page 502), and in the same year at the sale of the collection of John Russell at Mayfield a plant of *Saccolabium guttatum* sold for $313, one of *Saccolabium Russellianum* for $141, and an *Oncidium splendidum* for about $150 (G.C. 1875, II, page 467). In 1879, a fine plant of *Vanda cærulea* sold among other orchids of a large collection for about $460 (G.C. 1879, I, page 27). These are only instances with which the records of that period are replete. Although such prices were realized only for exceptional plants, there was always a large demand for good plants of all types, for which considerable sums were paid. The prospects of great reward caused collectors to scour every part of the tropics, risking their lives in the mountains, jungles, and fever-haunted swamps. Vast numbers of plants were imported and many died on the voyages, or subsequently, for want of rational treatment; but the large importations served to popularize the plants and to increase the demand for them. In time the climatic conditions under which they grew in their native regions became better known, and the plants were treated more in accordance with their requirements. Fewer orchids are imported at the present time, for the rewards are not so great as formerly, and other means for multiplying the stock are supplanting importation to a great extent. Yet the interest in orchids is not abating, but is steadily becoming more widespread. Although the large collections of fanciers are not so distinctive of orchid-culture as formerly in this country, the use of the plants is becoming far more general. The flowers have become a regular part of the florist's stock and thousands are annually sold in the markets. The ease with which they are grown, their great range of fine colors, and the wonderful keeping qualities of the flowers insures them an ever-increasing popularity.

Literature.

A large and special literature on orchids has grown up. Many magnificent folios and smaller works have been devoted to the illustration and description of these plants. Notable among these are "Sertum Orchidaceum," by J. Lindley, London, 1838, a large folio containing forty-nine colored plates of East Indian orchids; "The Orchidaceæ of Mexico and Guatemala," by J. Bateman, London, 1837–1843, an even more sumptuous work, with forty plates, of which only 125 copies were published; "A Monograph of Odontoglossum," London, 1864–1870, by the same author; "Pescatorea," Brussels, 1860, by J. J. Linden; "Reichenbachia," St. Albans and New York, 1888–1890, second series 1892–1894, by F. Sander, folio, two volumes, with ninety-six colored plates; "A Century of Orchidaceous Plants," London, 1849, by W. J. Hooker, a quarto volume containing 100 plates selected from Curtis' "Botanical Magazine," "A Second Century of Orchidaceous Plants," London, 1867, by J. Bateman, contains 100 plates of reproductions from the same work; "Xenia Orchidacea," Leipzig, 1858–1900, by H. G. Reichenbach, three quarto volumes containing 300 partly colored plates; "The Orchid Album," London, 1882–1897, by Robert Warner and B. S. Williams, eleven quarto volumes, containing 528 plates; "Illustrations of Orchidaceous Plants," London, 1857, by T. Moore, contains 100 plates selected from the "Botanical Register" and Sweet's "British Flower Garden;" "Dictionnaire Iconographique des Orchidées," Brussels, 1897–1907, by A. Cogniaux and A. Goosens, eight volumes of colored plates of flowers; and "Orchids, the Royal Family of Plants," Boston, 1885, by Harriet S. Miner, contains twenty-four plates with a popular account. Two periodicals, "L. Orchidophile," Paris, 1881–1892, and "Lindenia," Ghent, 1885–1906, were almost wholly devoted to the illustration of orchids, while "The Orchid Review," London, 1893, and continuing, is a more popular journal devoted to the interests of orchid-culture in general. Many plates and descriptions of orchids have appeared in other serials like Curtis' "Botanical Magazine" and Lindley's "Botanical Register." Many of Reichenbach's species were described in the "Gardeners' Chronicle." A great many large manuals and handbooks have been published. Among them may be mentioned "A Manual of Orchidaceous Plants Cultivated under Glass in Great Britain," by James Veitch & Sons (A. H. Kent), London, 1887–1894, a very comprehensive manual of two volumes, containing many engravings; "Orchids: Their Culture and Management," by W. Watson, London, 1890, new edition, New York, 1903, with twenty colored plates and numerous engravings; "Les Orchidées Exotiques et Leur Culture en Europe," by L. Linden, A. Cogniaux and G. Grignan, Brussels, 1894; "The Orchid-Grower's Manual," by B. S. Williams, seventh edition, London, 1894, a large manual with numerous illustrations; and "Die Orchideen," by R. Schlechter, Berlin, 1914, 1915, a comprehensive handbook and manual giving the most recent taxonomic treatment of the cultivated orchids. Besides these larger works suited to the technical needs of the cultivator, a large number of popular works have appeared. Among these are: "Orchids for Everyone," by C. H. Curtis, London and New York, 1910, a beautifully illustrated popular handbook; "Woodlands Orchids," by F. Boyle, London, 1901, a popular account of orchids with stories of their collecting; "The Book of Orchids," by W. White, London and New York, 1902; "Culture of Greenhouse Orchids," by F. Boyle, London, 1902; and "Orchids," by J. O'Brien, New York, 1911; "Our Native Orchids," by W. H. Gibson, New York, 1905, a popular account, with illustrations; and "Lilies and Orchids," by Rosina C. Boardman, New York, 1906, contains color-sketches of seventeen native species. Among the works of a more technical and monographic character containing plates of orchids should be mentioned "The Orchids of the Sikkim-Himalaya," by Sir George King, Calcutta, 1898, 448 engraved plates (in "Annals of the Royal Botanic Garden," Calcutta, Volume VIII); "Icones orchidearum austro-africanarum extra-tropicarum," by H. Bolus, London 1893–1911, 250 partly colored plates with descriptions; "Orchidaceæ," by O. Ames, Boston and New York, 1905, five fascicles giving illustrations and descriptions of new or recently described species which had been inadequately figured up to the time of the appearance of the work; and "Die Orchideen von Java," by J. J. Smith, Leiden, 1905–1914, one volume, text and one volume plates. Finally may be mentioned the work of F. A. Bauer, "Illustrations of Orchidaceous plants," London, 1830–1838, an account with thirty-five colored plates showing the structure and morphology of the various genera.

The illustrations accompanying the present article are in part borrowed or adapted from German sources, as follows: Figs. 2631, 2638, 2650, 2651, 2652, from Pfitzer in Engler & Prantl's "Die Natürlichen Pflanzenfamilien," II. 6; Figs. 2625, 2626, 2627, 2630, 2632, 2633, 2634, 2641, 2643, 2644, 2645, 2646, from Pfitzer in Grundz. einer Vergl. Morph. d. Orch., and Morph. Studien ü. d. Orchideenbl.; Fig. 2653 from J. G. Beer, Betr. Morph. u. Biolog. d. Orch.; Figs. 2654, 2655, from Burgreff, Anz. Tropisch. Orch. Samen.

Heinrich Hasselbring.

The general culture of orchids.

In the early days of orchid-culture, the treatment of the plants under glass was imperfectly understood, and with the meager knowledge of the natural conditions surrounding them in their native habitats, little successful progress was made for many years. The few cultural directions to be found were in works of foreign publication, scarcely applicable to plants grown in houses in America, where the winters are severe and changeable and the heat of summers more intense and less humid, necessitating a different mode of treatment. With a more satisfactory understanding of their requirements, orchid-culture here has made rapid advance in recent years, and most of the best collections have come into existence, many of which offer a very favorable comparison in fine well-grown specimens with those of the Old World.

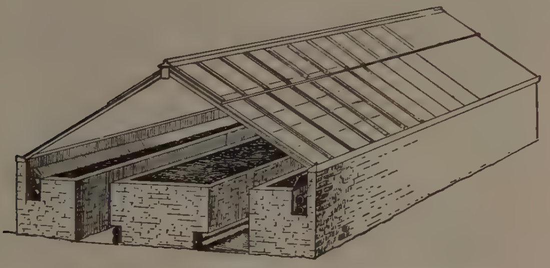
Orchid houses and their construction.

Various are the opinions of cultivators regarding the proper construction of orchid houses to secure the best results. Forty or more years ago many fine specimens of orchids were grown without a special house, along with general stove and greenhouse plants, and many good plants are still found cultivated in this way, but where a general collection of orchids is grown, four separate houses or divisions will be found necessary to obtain the best results. These are known as the "East Indian," "Brazilian," "Mexican" and "New Granadan," or odontoglossum departments. This is the older terminology, but it represents a good cultural classification.

The East Indian department requires a winter temperature of 65° to 70° F. by night and 70° to 75° F. by day; a few degrees' rise with sun heat will do no harm. The temperature should be gradually increased 10° toward midsummer and gradually decreased toward late fall. This is the warmest house and is used for the cultivation of aërides, angræcums, the warmer tropical cypripediums, phalænopsis, calanthes, dendrobiums and thunias while growing.

The Brazilian department should range in winter from 60° to 65° F. at night and about 70° F. in the day, allowing a few degrees more with solar heat, and a rise of 10° toward midsummer. This department is for bulbophyllums, cattleyas, warm epidendrums, Brazilian lælias, miltonias of the cuneata and spectabilis sections, *Odontoglossum citrosmum*, stanhopeas, and various genera and species requiring a like temperature.

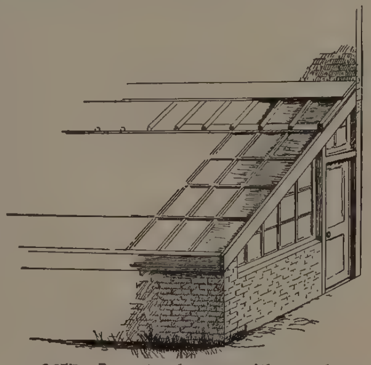
The Mexican department is used chiefly for the cultivation of *Cœlogyne cristata*, Mexican lælias, growing lycastes, anguloas and acinetas, many species of Maxillaria, a large part of the oncidiums and warm odontoglossums, phaius and allied species which require a few degrees lower night temperature and usually a little more sunlight to ripen their tissue for flowering than is afforded in the Brazilian department. It is also invaluable for resting dendrobiums and many other deciduous and terrestrial orchids.



2656. Section of a small, well-constructed orchid house heated by hot water.

The New Granadan (it might now be called the Colombian) or odontoglossum department must be kept as cool as possible in summer, and in winter should range from 50° to 55° by night and to 60° F. by day; it is used principally for masdevallias, odontoglossums, more especially *O. crispum*, and allied genera, disas, cool oncidiums, such as *O. ornithorhynchum* and *O. varicosum*, lycastes in warm weather, and many other individual species from high altitudes which require a cool house at all seasons for they suffer from the heat of our summer.

Styles of construction change, but the fundamental principle in building an orchid house is to secure a structure that can be easily heated and which has a naturally moist atmosphere without excavating deeply, for houses built much below ground lack circulation and almost always prove detrimental to orchid-culture. The houses (excepting the New Granadan house) should preferably be built to run north and south with an east and west exposure, in order that they may receive the benefit of the early morning and late afternoon sun, with the least possible heating effects from it at noonday, thus making little ventilation necessary; atmospheric moisture will be more easily retained in such a structure. The houses may be as long as required (with the potting-shed at the north end to avoid unnecessary shade and protect the houses in winter against severe north wind), and about 16 feet wide, which will allow side beds of 2½ feet each, two walks of the same width, and a center pit 6 feet wide. From floor to ridge should be 10 feet and to the eaves 4½ to 5 feet. Top ventilators should extend along both sides at ridge, thus affording protection from direct cold winter drafts in airing by using the sheltered side. Side ventilation is unnecessary and often injurious, the direct drafts causing plants which are out of condition to shrivel.



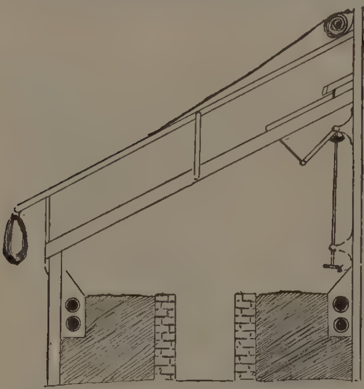
2657. Lean-to house with northern aspect for Odontoglossum crispum and other New Granadan orchids.

In glazing orchid houses, the glass should not be less than 12 by 14 inches, and larger if possible. It is also important that only the best quality procurable be used, free from lenses which burn the leaves when shading is removed. Plate glass is much to be preferred when it can be had, as it contains no lenses and gives a pure even light. If this is used a size about 16 by 24 inches will be found very serviceable. Poor glass should not be employed in any case, as it necessitates shading long before this is beneficial to the plants.

The outside walls should be built of brick or stone when possible, and the beds and pits within should be of the same material, 8 inches thick and about 3 feet in height, filled solid to the top, using stone or rubble for drainage in the bottom, following it up with finer material and finishing with an inch or two of fine gravel. Wooden benches may be used if desired, often with first-class results, by covering them 2 or 3 inches deep with ashes, sand or gravel, but the solid benches are more sure to give better satifaction. They give off moisture more gradually and offer a cool footing for the plant both winter and summer, which is essential and natural.

Good results will follow from either steam or hot-water heating when properly conducted. Unless the range of glass is large and a night fireman is kept, the old-fashioned method of hot water under natural circulation will be useful for orchid collections, using the regulation 3½-inch pipe, running the flows along the back beneath the eaves and returning along the floors beneath. (See Fig. 2656, which fairly illustrates an acceptably constructed house.) The quantity of pipe required for heating a house depends upon the location and degree of heat desired. A slab or board should be placed along the back of the side beds to throw the heat against the eaves and protect the plants from direct heat before it has assimilated the moisture of the house.

The New Granadan house should be a lean-to structure of northern aspect, with a wall of stone or brick along the south side to protect it from solar influence as much as possible (see Fig. 2657). The glass should be protected by canvas roller shades raised 15 or 20 inches above the glass on framework. One side of the canvas should be tacked along the top of the house, and the other to a round wooden roller 3 or 4 inches in diameter and as long as convenient to draw up; the two ropes should be fastened to the ridge, carried down beneath the shade around the roller, and up over the top to a single pulley near the ends; thence through a double pulley in the center and down over the top of the shade to the ground. By these ropes the shade can be raised and lowered in cloudy and bright weather at will. (See Fig. 2658.) Solid beds and piping similar to the other orchid houses can be used, or as in Fig. 2658; viz., a flow and return down each side connected with valves so that either or both sides may be used as desired.


2658. Cross-section of New Granadan orchid house to show solid beds and methods of heating and shading.

Shading of some sort on the glass is necessary for all orchid houses from early February until November, and in some cases also in the winter months, to protect the plants from the sun. It may be of canvas, as in Fig. 2659, or consist of whitewash or paint applied directly to the glass. Whitewash made from fresh lime is perhaps the best to use, as it is easily removed in autumn. The first application in February should be light, following it with a second coat a month later, and, if necessary, a third in July. This will wear off gradually and in most cases should be entirely removed in December. It is easily removed with a stiff brush. There are also patented shadings.

The two great horticultural groups.

Orchids are horticulturally divided into two large sections: terrestrial and epiphytal, the former embracing those that grow on the ground and derive their nutriment more or less directly from it; and the latter those that usually attach themselves to rocks and trees, and derive a greater portion of their nutriment from the atmospheric gases and accidental deposit of decaying leaves, or grow among the various ferns and vines, which grow in abundance on the rocks and trees of the moist, wooded tropics, absorbing the various elements of their slowly decomposing humus.

Terrestrial orchids grow at various altitudes, and are widely distributed throughout both hemispheres, the polar regions and arid deserts excepted. Many are deciduous and tuberous-rooted; some grow from underground rhizomes; others are pseudobulbous and deciduous, while not a few have reed-like stems. Examples of terrestrial orchids are catasetum, calanthe, cyrtopodium, most cymbidiums, some of the cypripediums, disa, goodyera, govenia, habenaria, lissochilus, many masdevallias, microstylis, neottia, orchis, pogonia, peristeria, phaius, sobralia, spathoglottis, all of which should be sought under their special genus headings in other portions of this work for cultural directions. They differ very essentially in structure, and in many cases require a special method of treatment for individual plants of the same genus, as Habenaria for example, where some are found growing in rich, turfy loam exposed to sun, while others inhabit wooded, swampy locations.

Many species of terrestrial orchids nearly or quite defy successful treatment under cultivation from lack of knowledge regarding the mineralogy of their native habitats, or from the plants being practically saprophytic on certain species of decaying vegetation, or growing only in connection with the mycelium of special fungi, which may assist them in making proper growth.

The hardy species, when a general collection is grown, should be cultivated in pots in coldframes, as many need protection during winter and others require shade which can be supplied by painting the glass. Our native hardy species, however, do best planted out in a properly constructed rockery, laid out in pockets so that each may receive its proper compost.

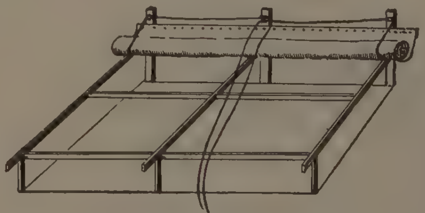
The more tropical species—cymbidiums, cypripediums such as *C. insigne*, *Phaius grandifolius*, *P. maculatus* and *P. Wallichii*, sobralias and some other evergreen species—thrive best in the Mexican or cool end of the Brazilian house.

Anæctochilus, tropical goodyeras and cypripediums, spathoglottis, and several genera of like nature, require the same general treatment as epiphytal orchids, with temperature of the East Indian department at all seasons.

Bletias, catasetums, cyrtopodiums, calanthes, many lycastes, tropical liparis and microstylis, *Phaius Humblotii* and *P. tuberosus*, thunias and many other deciduous and semi-deciduous species, should be grown in the East Indian, or warm end of the Brazilian department, and during the resting period should be placed in the Mexican department, allowing them only sufficient water to keep the plants in sound condition.

Epiphytal orchids are found chiefly in the humid forests of tropical countries, often along streams where they receive their moisture in the dry season. A few grow in open grassy situations or among brush. These consist chiefly of climbing epidendrums of the *E. evectum* section, a few oncidiums of the caulescent type (the distance between the pseudobulbs often denoting a year's growth), and some of the terete vandas, and others.

Aërides, phalænopsis, vanda and the epiphytal cypripediums are distributed throughout India, Malay Peninsula, Cochin-China, Celebes, Borneo, Philippine Islands, Java and some of the Oceanic islands, usually following the moist forests of mountain ranges, occasionally at high elevations. With one or two exceptions, as *Vanda cærulea*, all do satisfactorily in the East Indian department, reserving the warmest part for phalænopsis, which, as a rule, grows nearest the sea-level.


2659. Method of shading orchid houses.

Angræcums are natives of Madagascar and tropical Africa, with one isolated species, *A. falcatum*, which is from Japan. They grow in humid, shady locations, where they can receive a copious supply of water at all seasons, and are closely allied to vanda, requiring the same general temperature and treatment.

Dendrobiums are most common throughout India, Moulmein being a central district, but they are also plentiful and widely distributed throughout eastern Australia, New Guinea, the islands of the west Pacific and Oceanica under various climatic conditions. The larger part of them, especially the deciduous species, are subjected to long droughts and long resting periods, but as they lose their foliage at that time their evaporating surface is reduced to a minimum, and the effect of the dry heat through the day is more than counteracted by heavy dews and the condensing vapors which arise in the early mornings in those countries.

Bulbophyllums and cœlogynes have their homes principally in the mountainous forests of East India and Borneo, where they are copiously supplied by frequent rains. Nearly all grow best in the Brazilian department.

Cattleyas and lælias inhabit the humid forests of the various mountain ranges of tropical America, from Mexico south through Colombia to Peru, the North Amazon Valley, through Venezuela and Guiana, and the mountain belt of eastern and southern Brazil, usually at an altitude of 2,000 to 5,000 feet, excepting the Mexican species, *L. albida*, *L. anceps*, *L. autumnalis* and *L. majalis*, which grow at 5,000 to 8,000 feet, commonly among polypodium fern.

Cattleyas and lælias grow on rocks and trees often devoid of other vegetation along the margins of rivers and ravines, usually in shade, where they receive a copious supply of water from heavy dews and condensation of morning fogs which saturate the forests during the dry season, and often excessive rains while growing. They should be grown in the Brazilian department, excepting *Cattleya citrina*, the Mexican lælias and *L. Jongheana*, which thrive best in the Mexican department or warm end of the New Granadan house.

Stanhopeas are found from southern Mexico south to Peru, Venezuela, Guiana and Brazil at rather low elevations, often in dense forests, the individual species having a very wide range. The Brazilian house affords them the best temperature, but they may be grown in any of the departments with success.

Epidendrum is a large and varied genus, widely distributed throughout tropical America and in the United States from South Carolina southward, and one of the few epiphytal genera inhabiting the United States. They are found at all elevations from sea-level to 10,000 feet or more. The writer found *E. ibaguense* growing in quantity on the margin of perpendicular clay ridges fully exposed to the sun at this altitude in the United States of Colombia in a robust, healthy state, and the same species below 5,000 feet in the same condition. Many of the individual species cover a wide range of distribution. They require the same general treatment as lælias and cattleyas. Few species are worthy of cultivation except for botanical purposes.

Maxillarias cover much the same range as the last genus, but are not quite so widely distributed. They grow equally well in either the Brazilian or Mexican departments.

Oncidiums are distributed along the mountain ranges from southern Mexico to Peru, in the southern and norther portions of Brazil, chiefly along the coast, the Spanish Main and islands of the Caribbean sea. The *O. carthaginense* and *O. Papilio* sections are found at sea-level and seldom above 500 feet elevation. These grow best in the Brazilian house. Nearly all of the other species may be grown in the Mexican department, except a few, such as *O. cucullatum*, *O. Phalænopsis* and the *O. macranthum* section, which are found at high altitudes; these should be grown in the New Granadan department.

Odontoglossums follow the higher wooded mountain ranges from southern Mexico, Cental America and the Central Andes of Colombia south to Peru and the northwestern portion of Venezuela, all at high altitudes. They usually grow in the moist shady forests, where the rainy season is long continued or condensing fogs and dews are very heavy, keeping many of the species in an almost perpetual state of saturation, their only relief of excessive moisture appearing to be from the frequent heavy winds that prevail in these regions. The Mexican species grow well in the cool end of the Mexican department, while those of the *O. luteo-purpureum* and *O. crispum* type require the New Granadan house.

Lycastes are distributed from southern Mexico to Peru along the mountain ranges, usually at an altitude of 4,000 feet in rather shaded locations; they are most common from southern Colombia to their northern limit. *L. tetragona* is from southern Brazil and far removed from the general area of distribution, with little resemblance to any other species. Its 4-angled monophyllus pseudobulbs produce semi-pendent scapes carrying often as many as eight flowers, not unlike a cymbidium in general appearance. Lycastes grow well in either the Mexican or New Granadan department.

Selenipediums are the South American representatives of cypripedium. They are distributed from Costa Rica south to Bolivia, through Venezuela, Guiana and eastern Brazil, from 3,000 to 8,000 feet elevation, in wet marshes and on the branches of trees in shaded forests, in all cases where they get a bounteous supply of water at all seasons. The Brazilian or Mexican department suits them equally well.

Masdevallias, restrepias, and pleurothallis grow at high elevations in Venezuela, Mexico and south to Peru, with a few in the Organ Mountains of Brazil, their principal center being Colombia near the odontoglossum district. They always follow the mountain ranges, growing on trees, rocks and on wet, marshy slopes, in extremely wet locations. The chimæra section is found at the lowest elevation. They all grow best in the New Granadan department.

Newly imported orchids.

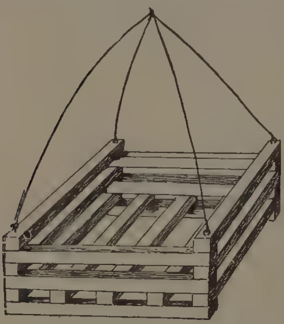
On arrival of cases of orchids from their natural habitats, they should be carefully unpacked as speedily as possible, in an isolated room where insect pests that often arrive in the cases may be destroyed, and laid carefully and loosely against one another, on the bench of a shady well-ventilated house or packing-shed. Should they all be found in good condition, the pseudobulbous species, such as cattleyas and lælias, should be hosed over thoroughly and allowed to remain for about a week, at the end of which time they should be examined for any signs of decay and bruises. All such parts should be removed with a sharp knife. The plants should be cleaned and sponged to remove dust, potted or basketed, as the case requires, and placed in a shady portion of their respective departments, allowing them sufficient water gradually to start them into action, after which time they will require the same treatment afforded established plants of their kind.

Cypripediums, masdevallias, phalænopsis, vandas, the batemannia and bollea sections of zygopetalum and other non-pseudobulbous genera should be placed on damp sphagnum in a well-shaded airy department for a week or ten days, without syringing, until it is ascertained what amount of damage they have received in transit. After sponging the leaves carefully and removing any decayed and bruised parts, they may be potted and basketed, and removed to their proper quarters, watering sparingly until they start new action.

It is customary in some establishments to hang newly imported orchids by the roots, tops down, from the roof of the house or beneath the benches until they show signs of new action, but they invariably suffer more or less from this practice and are better treated as above.

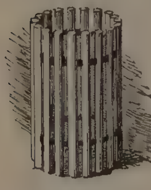
Pots, baskets, and supports.

Many orchids are best cultivated in the ordinary earthen pots and pans, more especially terrestrial species and a few of the epiphytal kinds, which grow on rocks in marshes, and among quantities of humus and fern roots. Most of the epiphytal species, however, need special structures that will admit air to circulate freely to the roots; otherwise, these are liable to decay through excess of water if confined in close pots when inactive in winter, which must eventually weaken the constitution of the plants.


2660. Commonest and best style of basket for general culture of orchids with pendulous scapes.

The best and most practicable pots and baskets are shown in Figs. 2660 to 2661. Fig. 2660 shows the orchid basket most commonly used; it is the best adapted for the general culture of cattleyas, coryanthes, dendrobiums, epidendrums, lælias, masdevallias of the chimæra section, oncidiums, and most orchids with pendulous flower-scapes. They may be made of cedar, teak-wood, cypress, or any durable wood. The wood is cut into square (or round) sticks of any length desirable and in proportionate thickness from ½ to 1 inch, and carefully perforated at each end. Through the holes is inserted a strong wire, which is looped at the upper end when finished in order to receive the wire hanger. These baskets may be as deep as desired, but three sticks on each of the four sides are usually enough for most orchids, with two or three placed crosswise through the bottom, to hold the compost. The hanger is made by twisting together and bending down in the middle two pieces of galvanized or copper wire, thereby forming four ends to insert in the basket-loops and a loop or hook at the top by which to suspend it.

The orchid cylinder (Fig. 2661) is very useful for standing on the bench or pit, and is used for renantheras, aërides, vandas, angræcums, epidendrums, and many other tall plants that are too tall or difficult to suspend. Cylinders are made in all sizes and any diameter desired, with either square or round sticks. They are bored a short distance from the ends and a wire inserted through them, with a small block between each stick, to make an opening for air. When large enough the sides are brought together and fastened. The depth is adjusted by movable cross-pieces.


2661. An orchid cylinder, used for very tall species.

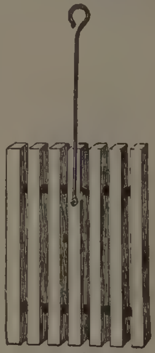
The orchid raft (Fig. 2662) is made in much the same way as the cylinder, but is left flat with the openings between closer together. Oblong-square blocks of hard, rough wood, an inch or less thick, answer much the same purpose. The orchid raft or block is very useful for many species, such as *Cattleya citrina*, barkerias, *Epidendrum falcatum*, *Dendrobium Jenkinsii*, *Oncidium Limminghii* and *O. Papilio*, scuticarias and the like.

The earthen basket (Fig. 2663) is useful when the compost is fine and when the roots do not require much atmospheric action; also properly to mature tissue in a few terrestrial species, thereby inducing them to flower more freely. The earthen basket is especially useful for acinetas, peristerias with pendulous scapes, stanhopeas and others; it is made with ovate openings around the sides and a round one in the center to admit pendulous scapes.

The perforated pan (Fig. 2664) is usually made only in small sizes and used for bulbophyllums, the concolor type of cypripedium, dendrobiums, and many other small-growing species that do well suspended from the roof.

The perforated orchid pot (Fig. 2665) is for bench use and is useful for many epiphytal orchids that are not to be suspended, the perforations or holes supplying abundant air to the roots, a safeguard against losing them through overwatering in winter.

Figs. 2666 and 2667 show the standard earthen pot and pan for terrestrial species. They should have the drainage holes made on the side at the base, instead of directly underneath, as a preventive against earthworms entering from the benches.

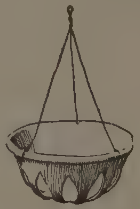

2662. An orchid raft, used for much the same purpose as the cylinder.

Potting of terrestrial orchids.

Terrestrial orchids as a rule grow best under pot culture. Potting material for the following genera—acanthephippium, bletia, calanthe, cymbidium, *Cypripedium insigne* and most of the hardy species, cyrtopodium, habenaria, liparis, microstylis, peristeria, phaius, pleione, sobralia, thunia, and some others—should consist of about one-third each of chopped sod with some of the fine soil removed, chopped live sphagnum and leaf-mold, adding a little ground bone for some of the strong-growing kinds. One-third of the pot space should be devoted to clean drainage, covered with sphagnum or rough material to keep it open. After removing all decayed parts, the roots should be carefully distributed and the compost worked in gently but firmly around them, leaving the surface a little convex and slightly below the rim of the pot as in Fig. 2666 (the dotted lines denote drainage required). The convex surface gives the rhizome an opportunity to dry out frequently, thus avoiding fungi, which are troublesome to some species.

In repotting terrestrial orchids, sufficient pot room should be given to last a year or two if possible, as they dislike to have their roots disturbed oftener than is necessary. The best time to repot is just before the rooting period, or when they are starting their new growths in spring. The deciduous species of calanthe can be easily increased at this time, if desired, by removing the old bulbs and placing a number together in a pan or shallow box, covering them partly with compost and placing them in a warm house until they start action, after which time they should be potted as desired, two or three together.

Anœctochilus, arpophyllums, cypripediums, disas, goodyeras, spathoglottis, and many allied genera, grow best under pot culture, but otherwise require compost and treatment similar to the epiphytal kinds.


2663. Earthen basket, for stanhopeas and other orchids, whose pendulous scapes issue through the holes in the bottom.

Potting, basketing, and compost for epiphytal orchids.

The roots of epiphytal orchids are usually very porous, and many are covered with a corky substance (velamen), capable of absorbing and retaining water for considerable time. In their native homes a great many of the roots are aërial or grow in loose, fibrous material, such as moss and the fine roots of polypodiums and other ferns, where they have free access of air at all times. It is important that they receive similar treatment under cultivation so far as is consistent with the difference of their environment taken into consideration. Thus it is apparent that one of the special features in the culture of epiphytal orchids lies in the proper selection of compost and the method of potting and basketing for the best results in after-cultivation.

Peat fiber, sphagnum moss and leaf-mold constitute the principal materials of good compost, usually lasting one or two years without renewal, which is important, as the roots suffer more or less in being disturbed. By peat fiber is meant the fibrous roots of various wild ferns, with the fine soil removed by first chopping it into small pieces, then rubbing it across a coarse sieve. The several species of osmunda furnish us with the best orchid peat. (See *Osmundine*, page 2414.) The sphagnum moss used for orchids should consist of *Sphagnum squarrosum*, *S. macrophyllum* and the coarse-leaved species only; *S. acutifolium* and other weak-growing species should never be used, as they soon decay and are detrimental to the roots.

2664. Perforated pan, adapted to small orchids that do well when suspended from the roof.

Leaf-mold is made from decomposed leaves. The leaves of almost any tree will do, but those of hardwood trees are most desirable, especially oak. When collected in the fall the leaves should be heaped up to decay for a year or more, and turned over at least twice within that time.

Charcoal is the best material to use for drainage and for mixing or interspersing with the compost. It is best made from hardwood and should not be overburned. Broken potsherds are often used, but they are not so good; being porous, they either absorb too much water at times or become over-dry too often and are liable to prove injurious. Charcoal is lighter in weight, and contains more useful properties.

Where closed pots are used, nearly one-half of the space should be devoted to drainage and the remainder to compost, consisting of about equal parts of peat fiber, chopped sphagnum and leaf-mold for most genera, adding a few pieces of charcoal in potting, and a piece beneath the rhizome of the tender ones. Care must be exercised in potting to distribute the roots properly and make the compost moderately firm about them, leaving the finished surface convex, to throw off surplus water and protect the rhizome from an overabundance of wet. Top-dressing with live sphagnum is beneficial to many orchids, such as *Odontoglossum crispum* and allies, and gives the surface a neat appearance. Fig. 2668 illustrates a finished pot, the dotted line in Fig. 2666 indicating the amount of drainage required.

When perforated or open-work pots or baskets are employed, no direct drainage is necessary. Rough, broken pieces of charcoal should be freely used in the compost while potting, as it helps to keep the mass firm and the roots of nearly all species attach to it freely; also it lessens the quantity of compost and so modifies its texture as to allow it to dry out more readily than when packed in a solid body.

2665. Perforated orchid pot, adapted to epiphytes which need plenty of air at the roots and are in danger of over-watering.

Cattleyas of the *C. intermedia* type, coryanthes, cypripediums of the *C. Lowei* and *C. Stonei* sections, some dendrobiums, *Oncidium carthaginense*, *O. crispum*, *O. macranthum*, *O. Papilio* and their allies should have the leaf-mold omitted, while aërides, phalænopsis, saccolabiums, vandas and kindred genera require only chopped live sphagnum and charcoal as a compost.

Watering, humidity.

It is impossible to lay down any hard and fast rules for watering orchids. Watering is a very important operation and requires more or less practical experience, connected with a knowledge of the general conditions surrounding the plants in their native homes. As a rule, most orchids need a liberal supply while growing, but the condition of the plant and compost and the manner in which it is potted or basketed have much to do with this.

The evergreen terrestrial species, which grow chiefly in loam fiber, as cymbidium, *Cypripedium insigne*, phaius, sobralias, and others, require water whenever the surface of the compost is becoming dry, with occasional light overhead syringing in fine weather, which will assist in keeping down red-spider, thrips and other pests. An occasional application of weak liquid cow- or sheep-manure is of great benefit while the plants are growing.

The deciduous species have a decided period of rest, at which time they are practically inactive and need very little water, enough only to keep the stems and pseudobulbs in sound condition. When growing, however, they require a good supply and should have a thorough watering to the bottom whenever the soil is becoming dry, but should not be kept in a wet condition at all times, or the soil soon becomes sour and infested with worms, under which condition no orchid can do well.

2666. Standard earthen pot for terrestrial orchids, with drainage holes at the side instead of at the bottom.

Epiphytal orchids, or a greater part of them, in their native habitats grow in locations where heavy rains are frequent or of almost daily occurrence in their growing season, and where condensing vapors settle on them like dripping rain, while the early morning fogs rise among the forests, charging the atmosphere almost to saturation in the early part of the day in the resting season. Such species as are subjected to a severe dry resting season are often deciduous (see *Dendrobium*, and also, page 2393). Many of the extremely alpine species, such as the masdevallias and *Odontoglossum crispum*, are subjected to two annual rainy seasons, and where these seasons are much prolonged it has been observed that the last-mentioned species in its native habitat mature as many as three pseudobulbs in the year. Thus the pseudobulb is no indication of annual growth, but a reservoir of supply in case the plant is overtaken by severe or sudden droughts, each pseudobulb being supplied with a mature secondary bud for further reproduction should the proper lead be destroyed.

2667. Standard earthen pan for terrestrial orchids, showing side drainage holes.

Such genera as aërides, cypripediums, masdevallia, vanda, and the like, which have no pseudobulbs, rely more or less directly on a daily supply at all seasons. These, with many of the extreme alpine species, should have a liberal supply of water at all times.

Many of the pseudobulbous kinds, including cattleyas and lælias, are also constantly in action perfecting new roots or maturing their flower-buds, after the pseudobulbs are completed and they are apparently at rest. For this reason careful observation of each species is necessary to make their cultivation successful.

Under basket culture, there is least liability of injury through overwatering, and excepting kinds like the oncidiums and dendrobiums (which need a dry and cool resting period to induce them to flower), and deciduous species at rest, nearly all should receive a good supply of water, weather permitting, whenever the compost is becoming dry, with frequent syringing overhead in fine weather, when the temperature is normal and ventilation can be given. A stimulant of weak sheep- or cow-manure applied occasionally to plants in action will benefit them.

2668. Method of potting an epiphytal orchid, showing the raised and round top of sphagnum.

On cold, cheerless days, when the temperature is below normal and the atmosphere is overcharged with moisture, very little watering or damping is needed, and unless it be some particular species which cannot endure drying, or tiny seedlings, it is safest to withhold water, as at these times the stomata cease action and the plants become overcharged with water; thus those with weak constitutions and immature growths are liable to attacks of wet-spot and rot. The best means of counteraction in such cases is to apply fire heat and ventilation. A close stagnant atmosphere is always to be avoided.

2669. Newly germinated seedling (Phaius hybridus).

As a safeguard against excessive changes in humidity, a hygrometer should be kept in each department to ascertain and regulate the degrees of moisture, especially during fall and winter. When overabundant, moisture can be reduced by applying fire heat and ventilation, and if insufficient by wetting down the paths and shelves, or pits, and reducing the ventilation. Well regulated departments should be kept as near as possible to 70° or 75° through the day or 80° to 85° with free ventilation, and about 80° at night. Just after damping and watering, it will often rise to 85°, but this is of no consequence, as it soon recedes. Orchids at rest, such as calanthes and dendrobiums, should be held at 65° to 75°. In no case, where it can be avoided, should it go below 60° nor rise above 90° for any length of time, as serious results are very liable to follow.

2670. Three months from seed, and ready to transfer to a pot. (Paphiopedilum insigne var. Sanderæ.)

Ventilation.

The ventilators should extend the entire length on both sides of the ridge, and be supplied with the best modern lifting apparatus. Extending them continuously along the roof necessitates raising them but a small height to afford proper circulation to the plants and egress of overheated air, without losing too much moisture. Having them on both sides assists in avoiding direct drafts, by using the side protected from the direct wind.

Air must be given at all times, when possible, to keep the atmosphere active, as well as to lower temperature, also to reduce the density of moisture when excessive in close, inclement weather and during the night. In bright weather ventilate enough to allow egress of the heated air.

It is customary with some cultivators to close down ventilators in wet weather and during the night to help retain heat. This is a serious mistake. It may show no visible injury in bright weather, when the density of moisture in the atmosphere is at a minimum, but this bad practice surely accounts for the decaying of many young growths, which are lost during wet, close and cloudy nights.

Propagation.

Many species of orchids can be propagated by division and by cuttings. This is usually resorted to when it is desired to increase the stock of rare and unique species and varieties. With the more common species, however, it is cheaper and better to buy freshly imported stock, if it can be had, as it often requires two, three or more years to bring the young plants up to the flowering stage.

2671. Eight months from seed. (Phaius Wallichii.)

The pseudobulbous species, such as cattleyas, odontoglossums, cœlogynes, are propagated by cutting part way through the rhizome three or more pseudobulbs behind the lead with a sharp knife. This will usually retard the sap and force the dormant eye behind the cut to grow. The back portion may then be removed and potted or basketed separately, or left on the plant to mature the new growth, and be removed when it starts action the following season.

With the deciduous calanthes, the old bulbs should be removed when potting them in spring and put, several together, in pans or flats and partly covered with sphagnum or potting compost until they start to grow, when they should be potted in the regular way. Thunias are easily propagated after the young growths are well advanced, by cutting the last year's stems into pieces 4 or 5 inches long and inserting the ends in chopped sphagnum and sand, placing them in the propagating-house until they grow, when they may have their normal heat. Dendrobiums are managed in much the same way, or the old canes can be laid on wet sphagnum, when many will produce new growths from the side eyes on the nodes. Aërides and vandas are increased by removing the upper portion with a sharp knife, leaving a few roots and at least a foot of stem to each top. The old bases of the stems usually break new growths freely, often producing several new shoots from each. Cypripediums should be divided between the older growths, leaving at least one old growth with each lead, and potted separately, allowing them a little extra moisture until they start to grow. Masdevallias and allied genera can be separated in the same manner, leaving several leaves and one or more new growths or leads to each piece. All species should be propagated at the commencement of the growing season.

Reproduction of orchids from seed.

The reproduction of orchids from seed through crossing and hybridizing has been conducted for many years successfully by a limited number of hybridists, principally abroad, and it is only within about twenty-five years that it has received much attention in America, but in that time very many beautiful hybrids have come into cultivation. Many of our establishments, both private and commercial, are now paying much attention to this branch of orchid culture, with varying degrees of success.

2672. A year from the seed. (Cattleya intermedia × C. labiata.)

The seeds germinate best when sown soon after maturity, and many lose their vitality in a few months if kept too dry and warm. When sowing the seeds, the best results are often obtained when they are dusted on the surface of pots or baskets containing a plant of the same genus as the seed and carefully watered with a very fine rose until they become attached, watching carefully for snails, slugs, and depredators in general that infest the compost. The pots or baskets should have a favorable-looking surface, with the compost in good condition, firm and free from fungi. Use pots or baskets that will not have to be disturbed for a year or more, as it often takes that length of time for the seedlings to come through. Seed sown in early spring seems to germinate soonest. The writer has had selenipedium seedlings up in three months from sowing, and again has waited for cypripedium twenty-three months before the seedlings appeared.

After the seedlings have perfected two or three leaves it is quite safe to remove them to small pots, singly, or several to a small pan, using compost of the same material as that for the parent, but cut a trifle finer. Many tiny seedlings are lost shortly after germinating, through the soil becoming sour or through fungi. When thus attacked they should be transferred to other pots or baskets not infested.

A newly germinated seedling of *Phaius hybridus* is shown in Fig. 2669. Fig. 2670 is of a three-months-old seedling of *Cypripedium insigne* var. *Sanderæ*, in proper condition to be transferred to a pot; Fig. 2671, eight-months-old plant of *Phaius Wallichii;* Fig. 2672 a twelve-months-old hybrid cattleya (*C. intermedia* × *C. labiata*); Fig. 2673 a cypripedium thirteen months old; Fig. 2674 a two-year-old hybrid between a cattleya and lælia (*C. intermedia* × *L. præstans*).

2673. Thirteen months from seed. (Cypripedium.)

The raising of orchids from seed shoud be encouraged, and should enlist the energy of every orchid-culturist, not necessarily for the production of hybrids, but also for the reproduction of rare species and varieties, and to save a number of species that are fast decreasing or becoming extinct in their native homes. Aside from the financial inducement offered the commercial grower, it will prove instructive to the botanist and afford pleasure and pastime for the amateur.

Diseases.

Orchids are subject to many diseases. Those having importance from a cultural standpoint and most troublesome to the grower are known as wet-rot, dry-rot and spot. Wet-rot is brought on by an overmoist or stagnant atmosphere, and is usually first detected by a semi-transparent appearance of the parts affected, which soon become dark brown. It spreads slowly along the tissue. If noticed at the commencement, it can be readily checked by slitting the epidermis with a sharp knife and removing the plant to a more airy position in the house for a few days.

Dry-rot is caused by a fungus which attacks the rhizome of the plant. It is often produced through burying the rhizome or base of the plant with compost. Cypripediums are subject to it. Large, healthy growths when attacked quickly show a sickly pale color in the foliage, which, on examination of the base, will be found discolored, and with a light brown appearance. If the portion attacked is quickly removed with a sharp knife it will usually give no further trouble; otherwise it will travel through the entire rhizome and destroy the plant in a very short time.

Spot comes from various causes: the appearance of small dark brown spots on the succulent leaves and pseudobulbs is usually an indication of cold and overwatering. Spot also arises through weak tissue, especially in phalænopsis, saccolabiums and angræcums during winter, which have been grown too warm, shady and moist. The affected parts should be slit with a sharp knife and a little flowers of sulfur should be rubbed over the wound. When they make new growth the plants should be placed in a brighter and more airy position to induce a better growth. The brown dots which make their appearance on the leaves, especially at the apices and on new growths of deciduous and plicate-leaved species, indicate either lack of sufficient water at the roots or an over-dry atmosphere, both of which conditions can be easily changed.

Snails and insects.

Orchids are attacked by many forms of snails. Insect pests are a great annoyance to the cultivator. They can be kept in subjection only by constant attention. Slugs and shell snails are very destructive. If allowed to increase they devour young shoots, roots and flower-buds. The best means of capturing them is to place saucers of dry bran on the shelves among the pots, and look them over morning and evening. By this means many will be destroyed. Various species of scale insects attach themselves to the leaves, pseudobulbs and rhizomes of nearly all species of orchids, and can be eradicated only by the use of a soft brush and washing with a sponge and water. A little whale-oil soap added to the water is of great assistance, and also useful in destroying red-spider, green-fly and yellow-fly. Black and red thrips attack the young growths of many species and often become very troublesome. Fumigating the houses with tobacco stems lightly about three times during the week will soon cause them to disappear. Fumigation is also a sure remedy for green-fly.

The cattleya fly is very injurious to young growths of cattleyas, lælias and some epidendrums. The flies lay their eggs in the very young growth at the base, causing an enlargement which is easily distinguished. The only remedy is to remove the growth and burn it. The mature fly can be eradicated by fumigating the house with tobacco stems about three times each week during early spring.

The dendrobium beetle larva burrows in the stems of various species of the genus, and is detected by a small discolored spot. There is no remedy, except to cut away and destroy the parts attacked. A pest much more to be dreaded is the dendrobium mite, which perforates the canes and rhizomes of dendrobiums and many other orchids, laying a number of eggs in each perforation. On hatching, these eat away a part of the plant around them, causing that portion to decay. They can be found only by careful and close observation, and this often after the plant is beyond redemption. There is no remedy but cutting them out, and unless the plant attacked is valuable it is best to burn it and keep the pest from spreading.

Mealy-bug is usually not very troublesome to orchids. It is readily seen and destroyed without much injury to the plant.

Roaches are usually very troublesome, and hard to eradicate, as they feed at night and remain hidden through the daytime. They destroy roots, growing shoots and young flower-buds and scapes. Bran, powdered sugar and paris green, mixed together and placed around the houses in saucers, will usually keep them in subjection, and they should be hunted down at night by the aid of a lantern. Many can be caught in this manner.

2674. Two-year-old hybrid between a cattleya and lælia.

Sow-bugs or wood-lice are usually common in every part of orchid houses, pots and baskets. They do a great deal of damage to young leaves, roots and the tender portions of flower-scapes. The paris green mixture used for roaches is very effectual in reducing their number, but it is impossible to be entirely freed from them.

Robert M. Grey.

Hardy orchids.

Many of our native species of orchids are very beautiful, and some are easy of culture, given suitable situations as to soil, moisture, and, in some instances, shade. It seems almost impossible to tame these wildlings, in the sense of making them border plants; the desirable situations are shady moist places in the woods for the habenarias, *Galeorchis* (*Orchis*) *spectabilis*, listera, and goodyera. Moisture, however, does not mean a stagnant condition of the soil, but slight depressions that are preferably above the level of surrounding soil, so that drainage is secure.

The two-leaved habenarias, such as *H. Hookeriana*, *H. orbiculata*, *H. blephariglottis*, and *H. dilatata* all occur in shady woods. One seldom finds more than an isolated specimen or two, but these may be easily transplanted after their flowering period, taking care to keep the fleshy tuber-like main root intact. *H. psycodes* is a bogplant and is often found in colonies, and this species is widely distributed. *H. ciliaris* grows in bogs in great numbers, and, when in bloom, the bright orange-colored flowers make a beautiful display in late summer. *H. fimbriata* is also a very showy bog-plant, enjoying the full sun. The arethusa often colors New England wet pastures a bright rose-purple in early summer where it is found in quantities very unusual in orchids; it requires very careful handling in digging when transplanting. Some of the soil should be dug with the plant to ensure its growing, and the same is true of the calopogon and pogonia, which also have pretty pink or purple flowers. Good success has been had in establishing colonies of goodyeras on shady banks; the three species, *G. repens*, *G. pubescens*, and *G. Menziesii*, which are very common in the North woods, have beautifully variegated leaves prostrate on the ground, and when in bloom are as pretty as the spiranthes, and a colony can readily be established.

The species of spiranthes are also easy to naturalize. It is found, however, that these plants appear to bloom biennially; one season the dry fields will be dotted with the pretty white flower-scapes, and the next year not one is visible. They have been dug in large numbers, but do not bloom the next year; it seems they require a year in which to recuperate. The common species are *Spiranthes gracilis* and *S. cernua*, both very easily naturalized, as the roots can be dug with a little soil attached. *Aplectrum hyemale*, found but rarely, is easy of culture and transplanting, owing to its having bulbs like many exotic species. The bare flower-scape arises in early summer, and afterward a single broad evergreen leaf appears to mark the place. *Liparis liliifolia* also has fleshy bulbs above the ground, is easy of cultivation and when the purplish lipped flowers are open, a little colony is very pretty and interesting.

The cypripediums are the best known and most sought of native orchids, *C. spectabile* is becoming rare and more difficult to get, but there are plenty of places in the remote North woods where it is still found in quantity. This plant is usually regarded as a bog habitant, but it occurs also on the slopes of shady ravines. *C. pubescens* is found in the same situations, and *C. parviflorum*, the smaller yellow species, is a bog-plant. All these are easy of cultivation if moisture is secure. They are found at times where it seems to be very dry at the roots, but an examination proves that there is seepage from above that provides the necessary moisture, and gives a clue to their culture. In the ravines on the shady slopes, cypripediums reproduce themselves from seeds to a greater extent than is supposed under cultivation, and the pretty yellow and pink flowers are much admired and sought. *C. parviflorum* is exceedingly fragrant when in bloom. *C. acaule*, the common red-and-brown species, is not so tractable, but on sloping banks in partial shade they have flowered for two years and seem to be established. Two other species, *C. arietinum* and *C. candidum*, are hard to obtain, and more difficult to grow than the others, but with care and study of their natural conditions, it is probable that success may be attained with them. There are several Pacific coast cypripediums that have not proved tractable. Possibly they are hardy in the East under proper conditions; this is the case with *Epipactis Royleana*, and *C. californicum* and *C. montanum* are valued in gardens abroad. There are also some fine new species from China and Thibet that give promise and have flowered in Massachusetts gardens from roots brought home by Wilson. We may yet see these widely distributed. There seems to be no recorded example of hybridization among our native cypripedes; it has been attempted many times, and it is strange, in the light of the numberless crosses made among the exotic species, that ours remain true even to themselves, and cannot be mixed.

There are many small gardens in which the study and culture of hardy orchids might well be taken up, together with that of the ferns. The same conditions might be made ideal for both in a very limited area. It is essentially an occupation for the amateur, for the idiosyncrasies of the plants are many. One must have the liking for exploration of the woods and bogs where the plants grow, and preferably gather the roots oneself. In no other way can the special requirements of each species or even each individual be studied and met.

E. O. Orpet.

The culture of epiphytal orchids in Florida.

The greatest trouble in the cultivation of epiphytal orchids on trees in southern Florida is in getting them completely established in their positions on the branches or trunks. In a natural state, the seeds of orchids, which are exceedingly fine, are carried largely by the wind and scattered over the trunks and branches. Those that alight in suitable places germinate and send their roots over the surface of the bark and in time become flowering plants. In artificial culture the plants already grown are placed on the trees, and unless this is done right and they have proper care for awhile, until they become established, but few will live and do well. Indigenous orchids are very abundant on the trees in the hammocks of south Florida, both species and individuals, there being known at present not less than twenty native species in this region. One of these, *Epidendrum conopseum*, ranges throughout the northern half of the state and into South Carolina, Georgia, and Alabama. Another species, *E. tampense*, is distributed over most of the peninsula, and these are endemic. The others are confined to the lower part of the state and are found in the American tropics.

Strong, healthy plants should be chosen and the potting material cleaned out from the roots as much as possible. The roots should be spread out, and a little sphagnum placed over them; then drive a small nail through a strip of mosquito-wire netting and into a tree where it is desired to place the orchid. Then place the roots of the plant against the tree close to the nail, adjust the strip tightly over them and nail through it into the tree on the other side. It may be best to put a second strip across, as it is absolutely necessary that the plant be firmly fastened, for if it is at all loose it never will do well. It should be watered at the time of planting and at intervals of a day or two, if the weather is dry, until it is established.

Orchids should be put on trees that have firm bark which does not scale off. Live oaks are ideal trees and red bay (*Persea carolinensis*) is good. They may be placed on smooth-barked trees but the rough-barked are preferable. Wild rats are often abundant and when orchids are placed on sloping or horizontal surfaces they destroy the plants; therefore, fasten the plants to vertical stems. They may be grown in high or low hammock or on cultivated trees; in fact, in any location where the air is not too dry or the plants are not too much exposed. They may be kept in pots of leaf-mold under a slat-house.

Sometimes orchids are attacked by what is apparently a fungous disease, which operates suddenly and fatally. The sheaths, pseudobubs or leaves at first become almost semi-transparent, looking as if they had been frozen; then they turn brown and the plants die. So far, dendrobiums have not been attacked but cattleyas and the thick-leaved oncidiums have suffered greatly. If noticed before the disease has progressed far, the sheaths of the leaves should be stripped off, the plant sprinkled with water and well dusted with sulfur, and if this is washed off by rain, applied again.

The coolhouse orchids have totally failed after repeated trials. But most of the cattleyas, the dendrobiums, oncidiums, epidendrums, lycastes, maxillarias, brassias and brassivolas, gongora, lælia, miltonia, vanda, cyrtopodium and others have succeeded excellently. *Phalænopsis amabilis* and *P. Schilleriana* are succeeding excellently on trees in low hammock and bloom beautifully every winter. With cypripediums, cymbidiums, phaius and some other terrestrial orchids in the hammock, the success has been only moderate.

Epidendrum tampense is an attractive native orchid and well worthy of cultivation; *E. nocturnum* and *E. cucullatum* are interesting; *Cyrtopodium punctatum* forms great masses on the trees and sometimes a single plant may bear 300 or more flowers. These are of considerable size and, with the scapes, are yellowish green variegated with red brown, a most striking and beautiful plant. *Oncidium luridum* and its var. *guttatum* are very fine, having immense heavy leaves and long branching spikes of brown-red and yellow flowers. These spikes or panicles curve gracefully and are sometimes 10 feet long. *Oncidium sphacelatum* is an epiphytal orchid that has become terrestrial or subepiphytic in its habit, growing wild on decaying logs, the bases of trees, or even in the soil of pine woods. It has tall panicles of bright yellow and brown-green flowers. The last seven species are natives of Florida, and all of them are doing well in cultivation.

There is apparently no reason why anyone may not have a few of these strange and beautiful plants anywhere in Florida. In the northern half of the state, the hardy Florida species and others of similar character from northern Mexico, Japan, north India or the cooler parts of South America can be successfully cultivated, while in the warmer part of the state a large proportion of the tropical species can be grown. They do well on trees in hammocks, in artificial groves and even on isolated trees where they are not too much exposed. Nothing is more entrancing than the cultivation of these strange, often weirdly beautiful forms. If one once becomes interested in orchids he is sure to be a confirmed lover of them ever afterward.

Chas. T. Simpson.

Cultivation of the various kinds of orchids.

At this point are brought together, in alphabetic order, the leading orchid genera for instruction as to methods of cultivation. The list is prefaced with remarks on orchids in general and their cultivation, even though they cover some of the ground already gone over in the article by Robert M. Grey, which was contributed to the Cyclopedia of American Horticulture. The orchids are so special in their requirements that another experience will be valuable.

Orchid-culture has ever been that of the few who are students of plant life and who can give time and care to their plants. This statement has been exemplified by many professional men who have used this means as an alternative to their other cares, and find it all-sufficing since so many species require special treatment and some are never understood. If evidence were needed, it is proved by the fact that so many fine collections are dispersed after the decease of their owners, and that decadence is the usual result with plants that thrived well before passing into other hands. There was also the added interest that when buying imported plants, the flowering of many rare and valuable kinds resulted, which at times paid a liberal interest on the original investment. It is safe to assume now that we shall secure relatively few more new species of value from the native wilds, these having been searched to such an extent that few are the expeditions now made up in search of them.

The greatest impetus in orchid-cultivation today is in the raising of plants by crossing and hybridization under conditions of cultivation, and the time is with us when we do not need to import either new species or plants of well-known forms. It is worthy of remark that the variation among orchids as we know them is such that no two plants are alike in the coloring or marking of the flowers. In the well-known *Cattleya Trianæ*, or any other of the forms of the *C. labiata* group, each plant is different. Doubtless this is due to the fact that most orchids require insect agency for pollination. Usually each flower has a highly colored lip or labellum, to attract the insect, with radiating lines or tracks leading to the nectar and, when this is secured, it is impossible for the agent to withdraw from the flower without taking toll in the shape of pollen which, of necessity, is deposited on the next individual visited. In some orchids there are distinct keels on the lip, the track thus being emphasized and the bee compelled to take the narrow path that his mission shall be fulfilled.

It is often said that orchids need a well-marked period of rest. This is not always possible with specimens newly received from the wilds, as the flowering period has to be changed to accord with our winter or summer which in time governs their well-being. We will assume that the flowers have been pollinated by insect agency, and the seeds have matured. This maturation usually requires about a year. No one knows the number of seeds that will be contained in a healthy capsule. There must be tens of thousands, a very small proportion of which ever reach maturity when sown under glass; but here is apparently a reason for the time taken to ripen the capsule, that it may take place about the period for the plants to bloom again, which is presumably the most favorable or rainy season, and the seeds are distributed by the breeze to suitable media, and a proportion germinates and grows. We learn by sowing under glass that very few, even under the most careful treatment, ever live through the vicissitudes of initial stages, the tiny green globes or thalli having no true roots for months. It is perhaps a year after sowing the seeds before true roots are visible, but in the meantime, a hot drying day, if no gentle spraying of moisture is given, will blast all the hopes of many months' waiting; but we have the compensation of knowing that each plant we raise will be eminently fitted to survive under greenhouse conditions. The recent careful laboratory investigations have suggested rational methods of procedure in the growing of seedlings, and the subject will probably gradually pass out of the region of accident and doubt. (See page 2387.)

Variation that obtains among wild orchids is also present in various degrees among crosses and hybrids raised under cultivation. This was proved by the raising of over eighty plants of *Cattleya Thayeriana*, no two of which were alike, and some could not have been attributed to the same origin were it not for the connecting-links that rounded out the series.

In Europe, a great liking is shown for the coolhouse odontoglossums, especially since the raising of plants from seed has proved or illustrated the origin of many supposed species, the type flowers of which were sealed up for twenty-five years in Vienna in the herbarium of the late Professor Reichenbach who, in his day, was the dean of the orchid botanists, and whose collection was but this year uncovered. Following is a clause in Reichenbach's will: "My herbarium and my botanical library, my instruments, collection of seeds, etc., accrue to the Imperial Hof Museum in Vienna, under the condition that the preserved orchids and drawings of orchids shall not be exhibited before twenty-five years from the date of my death have elapsed. Until this time my collection shall be preserved in sealed cases. In the event of the Vienna Institution declining to observe these conditions, the collection falls under the same conditions to the Botanical Garden at Upsala.

Should the last-mentioned institution decline the legacy, then to the Grayean Herbarium in Harvard University, Cambridge, Mass. If declined by that institution, then to the Jardin des Plantes, at Paris, but always under the same conditions, viz., of being sealed up for twenty-five years, in order that the inevitable destruction of the costly collection, resulting from the present craze for orchids, may be avoided." See Bailey, "Annals of Horticulture," 1889, with portrait, of Reichenbach, from "Gardeners' Chronicle." In the meantime, after the first lamentations, and the gathering of the available living types, cultivators began work with such authentic material as they had until now we have plants with three to four genera in their parentage, and the end is not yet. It will readily be understood that the recording and taking care of the nomenclature of these results as they occur week by week, is no simple matter, but it is being undertaken in such a way that for the present we know the origin of the many plants that have been raised. There is no other record in plant hybridization to compare with that of the orchids. In most cases, drawings have been made of the originals for filing in the archives. The Mendelian theory will surely find much material in the work of the orchid-cultivators, because of their painstaking in the matter of pedigree. It was early decreed that a plant without a pedigree could not be considered for recognition with a name. This seemed hard at times, because of special merit, but the cultivator had to be content with the result rather than with the honor. It is a curious circumstance that in the raising of orchids from seeds, many appear where they were not sown and in the most unexpected places. These are later placeable where they belong if there are other forms with which to connect them, but failing this there is no admitted reason for giving a name.

In past years, large prices were paid for forms of orchids that were unique, as for albinos, specially marked, or highly colored variations, all being imported forms. It was thought that these could be reproduced from seeds; this has not been true in most cases, even albinos having reverted to the normal and in most cases very poor forms. It is now a recognized principle that none but the very best varieties should be used as parents, and from these there are always a number of degenerates.

Orchid-hybridization is not prosecuted in America to the extent that it was at one time. It requires years to secure results that are obtained at far less cost in Europe, where the plants are more easily obtainable. We may mention a case in which nineteen years was required to flower a plant, the only one that survived from a certain cross, and when it bloomed it was of no value although true to its parents, one of which was of poor constitution.

General cultural requirements.

Most tropical orchids of cultivation are epiphytal, very few growing on the soil, and the requisite conditions are largely a matter of atmosphere,—not necessarily temperature. Heat is necessary, but only to be taken seriously in winter when it is generated artificially, sometimes from superheated pipes, which is always detrimental to the well-being of the plants. It is better to have a number of pipes heated to a moderate degree. In summer the heat is not a factor except with the cool Andean plants like the odontoglossums. If plenty of ventilation is given from the time frosts cease at night, one cannot imitate easily the night atmosphere outdoors, and the more the plants get of it when genial, the better they thrive.

Another factor under glass is shade from the sun. This must be governed by the amount of direct light admitted. It must be understood that a house running north and south will not get so much heat from the sun's rays as one built east and west. In a house having full exposure to the sun in winter, orchids will need shading to some extent most of the winter, while one running north and south will not have to be shaded from the month of October until March. The plants are injured by the loss of green in the foliage due to exposure. Part of this will return when shade is given, but some of the older leaves will turn yellow and drop off. It is the medium course that conserves vitality, while ripening the growths perfectly, that the cultivator needs to bring about. The successful grower gives intensive study to each individual plant. We have had the experience of miltonias that thrived perfectly at the end partition of one structure, but never prospered when they were removed to other similar conditions. It was a question of exposure. So it is that cultivators often place a plant in a particular position in a house, seemingly the purest empiricism, but a practice not to be despised by those who want to succeed. It is not surprising that plants collected from the odd corners of the tropics, placed together in a small house where the temperature is to be maintained largely by artificial heat, require careful and individual study. With many difficult orchids, one cannot imitate the atmosphere of the Andes when the dog-days come, or when zero temperatures obtain outdoors and the wholesome atmosphere disappears by the exhaustion from superheated pipes.

Orchid-culture in America will be largely confined to a few genera, the "cool" kinds will rarely succeed, but those from Mexico to Brazil and most of the East Indian and Philippine kinds can be made to thrive better here than in Europe.

A number of American terrestrial orchids are amenable to cultivation. Cypripediums lend themselves kindly; and most of the others, as the calopogons, spiranthes, pogonias and habenarias, are plants essentially of the swamps or woods where moisture is secure all summer, but are not easily tamed in the usual way as are other plants, and yet their essential conditions may be met by the careful and thoughtful gardener.

The main cultural groups.

The orchid family is usually classified by growers into at least three divisions, for providing suitable temperatures and other conditions, especially atmospheric, although a closer analysis would make at least four cultural groups.

1. The warmest division should be kept at a minimum of 65° in winter, to take care of the vandas, aërides, saccolabiums, phalænopsis, angræcum, anœctochilus, habenaria, a few of the strictly tropical dendrobes and other less known genera. Most of these may be termed extra- (or supra-) epiphytal for the reason that they secure most of their needed moisture through their large aërial roots, the material that they are planted in being secondary in importance as a source of nourishment. There are many cypripedes that need this warm treatment, such as the Malayan, Bornean and some of the East Indian species, for they speedily resent being chilled. The higher temperature makes the cultural details in winter more difficult to regulate since moisture must be kept up to counteract the dry heat from the pipes; therefore it is always best to have a number of pipes moderately warm rather than a few superheated. Insect pests are also more persistent under superheated conditions. Thrips and red-spider are harder to fight, and must be kept down by frequent light sprayings with approved insecticides containing nicotine, applied with an atomizer once a week in case of an invasion. Troughs on the heating-pipes for the evaporation of water are essential, and sometimes, in large structures, open tanks are used under the stages on which the plants stand filled with water which is heated by coils. Too much emphasis cannot be placed on the keeping of a proper atmosphere as well as heat for these tropical plants. This can be brought about

by proper ventilation and shading from the hot sun, to prevent the escape of the atmosphere when it has been secured. Most of the foregoing orchids are natives of the tropical jungles where shade is ever present, and exposure suddenly after a few dull weeks to the hot rays of the sun under glass in early spring will do harm.

2. The temperate division is the home of by far the largest number of the cultivated orchids. A night heat of 50° in winter as a minimum on extreme cold nights will be better for the plants than a higher temperature. It is well known that, after a period of severe cold, many of the older leaves of cattleyas turn yellow and fall off, a sign of the stress to which they have been subjected. In moderate weather, 55° will be better, especially if plants are in bloom. In addition to the cattleyas, the lælias, cymbidiums, sobralias, oncidiums, stanhopeas, epidendrums, brassias, miltonias, catasetum, phaius, the Mexican odontoglots, and East Indian dendrobes, and many cypripedes, will thrive best in the temperate house. If but one house or division is to be devoted to orchids, this should be an intermediate one for the reason that, with the exception of the purely tropical species and the coolest Andean, the greatest number can be cultivated therein by the careful utilization of the various parts of the house for individuals that need the warmer or cooler end or a little more shade, conditions that are soon discovered by the observant cultivator. The admission of fresh air when weather permits is of the utmost importance. In summer the house should have free air day and night from the first of May until late September. It is the greatest factor in building up the plants after the exhaustion of flowering. At this time, watering should always be performed in the late afternoon; and if watering is not necessary, spray the plants overhead after each very hot day. In winter, water is best given in the morning that the surplus will dry off before night.

3. A coolhouse is necessary for the Andean odontoglots, cochliodas and their now numerous hybrids, the sophronitis, disas, masdevallias, *Cœlogyne cristata*, *Epidendrum vitellinum*, lycastes, and a few other plants. These are among the most charming of all orchids, the odontoglots especially. Difficult as the odontoglots are to manage, much success has been attained by care and suitable structures, preferably with a north slope with the shade of some other building to the south. Roller shades on the coolhouse should be kept about 12 inches above the glass roof to admit of a free circulation of air beneath in hot weather, with ventilators at the top and bottom near the pipes. Cool orchids require to be kept moist all the time. There is no very marked period of rest, as they are subject to heavy night dews where they grow; but in the dull winter months, all the sunlight must be admitted, as most of the active growth is made in winter and early spring. These plants are a real test of the skill of the grower. A few cool summers build up the plants so they flower well and it has been noticed that the best results are obtained in the cooler parts of the country, or near the seashore.

Further suggestions; propagation.

Many genera in cultivation are seldom seen in collections here, but a knowledge of their native habitat, and especially the elevations at which they grow, must be the clue to their needs in cultivation, together with a study of their root-system. The roots that are white, are aërial, and those that have root-hairs are terrestrial, and being of the earth will best be treated as pot-plants.

Many species are easy of propagation by division, and it is often advisable to divide plants rather than grow them on into large specimens. The plants should be kept in reasonable size. Propagation by means of seeds is a slow process, and in many cases one cannot be sure what will come true from seed. Even from well-marked types there is always the possibility of reversion. Especially is this the case with albino forms, so many of which occur among imported specimens.

Cultivation of leading genera of orchids.

Acanthophippium. For culture, see Acanthophippium.

Acineta. For culture, see Acineta.

Ada. A small genus of few species with bright orange-colored flowers that add color to the coolhouse among the odontoglots, and require similar treatment.

Aërides. True epiphytes that revel in a moist atmosphere in a warmhouse with a winter minimum of 65°. Very little potting material is desirable, just enough to anchor the plants in the pots. The roots made from the stems as the plants grow seem to gather the needed nourishment, and care must be taken not to injure these or check them, as they are very active, even in winter. Some of the species are very fragrant, all are beautiful and last a long time in bloom. A surfacing of moss should be added to a thin layer of osmundine, and the drainage made up of large pieces of charcoal and crocks. Basket-culture is often adopted, but it is hard to re-basket without injuring the roots, but the old material may be removed, the roots washed and new added each year until new baskets are necessary by reason of decay.

Aganisia. Warmhouse plants, needing little material about the roots, and to be suspended near the roof glass with a maximum of light but no direct sun in summer.

Angræcum. Culture as for Aërides.

Anguloa. Culture as for Lycaste.

Anæctochilus. Terrestrial tropical orchids with creeping root-stems, foliage beautifully marked, the Malaccan name being "written flower" owing to the marking resembling hieroglyphs, done in many colors. These plants are best grown in the warmest part of the structure, in a small frame or under bell-glasses to keep the leaves unspotted and ensure uniform heat and moisture, but some air must be given to guard against condensed moisture and consequent drip. Difficult to import and not often seen in collections.

Ansellia. A tropical African genus of a few species growing on trees, where there is a climate of abundant moisture during the growing period, with a dry season of about half the year. Culture in the warmhouse, witholding water to ripen the growths well after they are completed.

Arachnanthe. Culture as for Aërides.

Arpophyllum. A temperate house genus seldom seen in cultivation, coming from high altitudes in Mexico and Guatemala, best grown in baskets, in shade and plenty of moisture. Culture same as for Lycaste.

Aspasia. Once considered as odontoglossums. There are about eight known species, seldom cultivated, requiring treatment as for odontoglots.

Batemannia. Plants that are never at rest, needing a moist tropical atmosphere, with no appreciable resting as water is needed all the time. Very little material is needed at the roots, and this kept in a sweet healthy condition by adding new material and the removal of old portions. Red-spider must be kept away by frequent washing of the foliage.

Bifrenaria. Brazilian plants requiring treatment same as cattleyas from that region, and a trifle warmer position than for those from Colombia.

Bletia and *Bletilla.* Cool terrestrial plants, but not hardy. Can be grown in an ordinary greenhouse and kept dry in winter when at rest, repotting in fresh material when growth begins in spring.

Bollea. Culture as for Batemannia.

Brassavola. Best known by reason of *B. Digbyana*, which is so much used by the hybridist to put the fringed lip on cattleyas and lælias, with which it can be combined readily. Of culture the same as for cattleyas, slow to increase by division, but otherwise easy of culture.

Brassia. These are seldom seen in modern collections, but were old-time favorites, growing and flowering freely in an ordinary structure with no special care, and may well be associated with the warm oncidiums as to potting and subsequent routine.

Broughtonia. The only species known in cultivation here, *B. sanguinea*, is hard to cultivate for any long period. It is best attempted on a portion of osmunda rhizome, with a little moss at the roots, hung near the glass in the warmhouse.

Bulbophyllum. Among these are the giants among orchids. Some species attain huge size, require tropical treatment in a steaming atmosphere during growth and the flowers when produced are remarkable, though very seldom seen except in botanic gardens. Some species are small and require to be grown on blocks of wood; increased by division.

Calanthe. Deciduous bulbs that need rest after the flowers are cut in midwinter, until there are signs of growth in spring, then shaken out to be potted in turfy loam, a little well-decayed manure, in pots or pans with good drainage. The warmest position or shelf with shade will best suit calanthes. It might be said they will enjoy a little fire heat every day in the year, with proper shade and plenty of moisture. The long flower-scapes begin to develop in late summer, and when these appear liquid nourishment must be given frequently to grow large bulbs. The flower-scapes are long, last a long time in perfection when cut, and as the flowers open, cooler and drier treatment may be given. Increase is readily made by means of the old bulbs that will often grow again, and these often double in number each year. A valuable florists' orchid when its culture is understood, and profitable to grow.

Calopogon. For culture, see Calopogon.

Camarotis. Culture as for Aërides and Vanda.

Catasetum. Curious and beautiful orchids from Central America, that often have the two sexes in different individual plants, a fact that was long a puzzle to botanists, and the peculiar structure of the flowers makes the plants very interesting. The culture is not easy in gardens; plants usually dwindle after a few years, but plenty of heat and light when in growth, with a long resting-period between, is necessary, and growth is best when the plants are suspended from the roof.

Cattleya. The most popular and best known of the orchids grown for cut-flowers, with few exceptions. Best grown in the intermediate house. For culture, see Cattleya.

Chysis. Culture as for Vanda.

Cirrhopetalum. For culture, see Cirrhopetalum.

Cleisostoma. Culture as for Aërides.

Cochlioda. A genus much prized by hybridizers of late for the color it imparts to the odontoglossums, the hybrids of which are now known as Odontioda and form a pretty rose-colored series of cool orchids, very popular where they thrive. Treatment same as for odontoglossums.

Cœlia. Culture as for Epidendrum.

Cœlogyne. Terrestrial orchids, both temperate, as *C. cristata*, and tropical, as *C. Massangeana* and *C. pandurata*. Species like the last two need basket culture suspended, as their flower-spikes are dependent. The well-known *C. cristata* will do well in a coolhouse when at rest before flowering, soil containing a portion of earth, and liquid manure during growth is necessary to produce strong flowering growth, increased by division directly after flowering period.

Colax. Culture as for Lycaste and Zygopetalum, in an intermediate house.

Comparettia. Culture as for Broughtonia, but in an intermediate house.

Coryanthes. Culture as for Stanhopea.

Cycnoches. Curious Central American plants, often called the "swan's-neck orchid," requiring treatment identical with that of dendrobium, and well-marked resting-period after growth is completed.

Cymbidium. Decorative evergreen tall-growing plants that have many flowers of long duration. All are from the East Indies, but do well in an intermediate and even a cool house in winter. They also do well when planted out among rockwork in large structures, and the hybridist has added very many fine plants that go to make up the collection in gardens. A soil with loam added and manure-water added frequently when the plants are growing or rootbound will induce strong growth. The plants are impatient of disturbance at the roots, but if carefully done they may be increased by division. Seeds germinate freely. For further cultivation see Cymbidium.

Cynorchis. Terrestrial plants from Madagascar and Natal. Culture same as for Bletia, repotting in fresh material in spring.

Cyperorchis. Culture as for Cymbidium, to which genus they are sometimes referred botanically.

Cypripedium. Terrestrial orchids, although sometimes growing on rocks with little humus about the roots, including tropical or warmhouse plants (now referred to Paphiopedilum), these being often with mottled foliage; intermediate house plants as *Paphiopedilum insigne* and its many hybrids, and the hardy species, always deciduous and widely distributed. Cypripediums are herbaceous, having no pseudobulbs, and should never lack for moisture or be overpotted. Propagation by division or seeds, which germinate freely. Albino forms have been reproduced by seeds, to a large degree true to the parent plant; also specially fine varieties.

Cyrtopodium. Culture same as for Cycnoches, repotting in spring; carefully shade the young foliage until mature. Flowers are produced with the commencement of young growth in spring. Avoid spraying over young growths, as water lodging often induces decay unless the house is well ventilated and the day bright.

Dendrobium. For culture, see Dendrobium.

Diacrium. Culture as for Epidendrum and Cattleya.

Disa grandiflora. An orchid from Table Mountain, is now protected by the state, owing to its scarcity due to collectors, is a very beautiful plant when in bloom, but it is doubtful whether it has ever been cultivated here with success, though not difficult to handle in European gardens, where it is easily raised from seeds and by division. It is strictly terrestrial, but seems unable to bear heat. There are several other species and many hybrids from these, but none seems amenable here.

Epidendrum. A genus of very much varied plants, some being stem-rooting and without bulbs, and these require all the sun to flower freely; others have pseudobulbs, are easy of culture and do well in the intermediate house, with treatment same as for cattleya. For further culture, see Epidendrum.

Eriopsis. Culture as for Lycaste, in shallow baskets suspended in an intermediate or cattleya house. Repot when growth commences, with great care, as the plants are impatient of root-disturbance. *E. rutidobulbon* is the best known species, but it is very rare even in its native Antioquia.

Eulophia. Culture as for Calanthe.

Galeandra. Culture as for Calanthe.

Gomesa. Culture same as for Broughtonia. A Brazilian genus, species of which are rarely seen in cultivation, being largely of interest in a botanical way.

Gongora. Requires to be grown in baskets suspended, as the flower-spikes are produced from the base of the plant downward. No obstruction by way of drainage should be allowed to hinder these. An intermediate treatment, with less water when resting will suit the plants. They are seldom seen, as the flowers have no bright coloring to attract, though some are very fragrant.

Grammangis. For culture, see Grammangis.

Grammatophyllum. For culture, see Grammatophyllum.

Habenaria. Both tropical and temperate species are included. The plants are always deciduous and the warm species need resting until new growth commences, then careful repotting in new material. A warm shady corner suits their needs best. The hardy species are found in both the Old World and New, growing in moist rich soil with partial shade, but sometimes in full sun in marshy land.

Hæmaria. For culture, see Hæmaria.

Hartwegia. Rarely seen. Culture as for Gomesa.

Houlettia. Culture same as for Stanhopea, in intermediate house, kept rather dry in winter, using baskets.

Huntleya. Culture as for Batemannia.

Ionopsis. For culture, see Ionopsis.

Isotria. Culture as for Pogonia.

Lacæna. For culture, see Lacæna.

Lælia. For culture, see Lælia.

Læliocattleya. For culture, see Cattleya and Lælia.

Leptotes. Culture as for Lælia.

Limatodes. For culture, see Limatodes.

Liparis. For culture, see Liparis.

Lissochilus. A tropical African group, requiring soil similar to phaius, made up of part good loam, with a little old manure, sand, and plenty of drainage. In Africa the plants are sub-aquatic, and have been cultivated with water-lilies. This is not generally practised, however. The flower-spikes sometimes attain 12 feet in height in *L. giganteus*. The warmest house is necessary, with frequent applications of liquid manure during growth with somewhat drier treatment in winter until new growth begins. Shade in summer is necessary as the foliage is thin when new.

Listrostachys. Culture same as for Angræcum or Phalænopsis, in very shallow pans as the plants are small.

Luisia. For culture, see Luisia.

Lycaste. Semi-terrestrial orchids requiring intermediate treatment with shade from direct sunlight at all times as the foliage is thin and easily injured. *L. Skinneri* is often grown in baskets suspended, but should be kept moist at all times as flowers are produced at various seasons, and growth is often being made during the whole year. A portion of loam in the soil, or the heavier grade of osmundine is best suited to the roots of orchids of this nature. Propagation by division.

Macodes. Culture as for Anœctochilus.

Masdevallia. Of all Andean orchids these do the best in an ordinary coolhouse when shaded from sun, and watered frequently, for, having no pseudobulbs, there is no reservoir to draw upon. The colors of most masdevallias are wonderful, and the plants easy of culture in the usual orchid material. Increase is readily made by division of the stems just after flowering, being careful to save the roots intact. For further cultivation, see Masdevallia.

Maxillaria. Once a very well-known genus of free-flowering orchids of easy culture, some species being fragrant, but of late, owing to the small flowers and dull coloring, the plants have disappeared from collections with the possible exception of *M. Sanderiana*, which is an exception as to coloring, it being attractive and the flowers large. Treatment as for Lycaste, and propagation by division.

Mesospinidium. Culture as for Cochlioda, to which it is closely allied.

Microstylis. For culture, see Microstylis.

Miltonia. These were long known as odontoglossums, and *M. vexillaria* is one of the prized orchids today. It is a little particular as to position in the house, needing plenty of sun during the winter, which is the period of growth. After flowering, in May or June, there is a short time of rest, when the plants are much weakened and need careful nursing with shade to enable them to recuperate and make strong growth again. *M. Roezlii* is very similar, but is a warmhouse plant requiring 10° more heat, and flowers in winter. These are the two best known species, but, with the exception of *M. Roezlii*, all need the intermediate house. Propagation is by division when growth is starting, at potting time.

Mormodes. For culture, see Mormodes.

Mysticidium. Culture as for Angræcum.

Odontoglossum. A very popular genus in Europe, but difficult to grow well here owing to the extremes of temperature. Natives of the Andes, where the temperature does not vary 10° winter or summer. Some success has been attained here, especially during cool summers. For culture, see Odontoglossum.

Oncidium. There are a large number of species, ranging from the alpine Andean small-growing ones to large tropical plants. No genus of orchids presents such wide variation and study. Their culture is easy when the needs of the individuals are studied, and these are governed by the elevation at which the plants are found growing and imitating as well as can be the temperatures. Some of the cool species need moisture all the time, while the Mexican and Central American ones do best with a defined period of rest, meaning less moisture and heat, generally in the winter, sometimes before flowering and often after. The intermediate house will suit all except the cool ones. The flower-spikes are often very long, as in *O. macranthum*, and need careful training to keep away from the glass. *O. Rogersii* is perhaps the best known and is a popular florists' winter-flowering orchid imported annually in quantity. The usual potting material is suitable, but oncidiums seem to do best when restricted as to root-room.

Ophrys. Culture as for Habenaria.

Palumbina. Closely allied to oncidium, and sometimes included. Culture as for the intermediate house oncidiums.

Paphinia. For culture, see Paphinia.

Paphiopedalum. For culture, see Paphiopedalum and Cypripedium.

Peristeria. A tropical orchid requiring much the same treatment as calanthe when growing, but the peristeria does not need such a marked period of rest, as it is evergreen. It is terrestrial, requiring a loam mixed with old manure, and liberial supplies of moisture. If black-spot disease appears, it must be cut out at once and the cavity filled with lime and sulfur. This disease seems to be common. The tall spikes of sweet-scented flowers, the center of which resembles a dove, are much admired and last long in perfection.

Pescatoria. Culture as for Zygopetalum.

Phaius. Eastern tropical plants of great beauty, one of which has become naturalized in the West Indies. Terrestrial in habit, needing a soil composed largely of loam rich with humus, and liberal feeding when in full growth. Propagated by division, after flowering.

Phalænopsis. Tropical epiphytes needing the warmest temperature admitted in orchid-culture, which is a minimum of 65° in winter and this in the coldest weather, and an atmosphere never allowed to become arid or stagnant. At some seasons drip from above easily proves fatal. Very little material is needed at the roots, as they love to escape the receptacles when doing well and hang pendent. Osmundine is the most suitable material to use as it is lasting, but where sphagnum will live and keep green it is well to use it as an index to the need of moisture. Many growers never spray phalænopsis overhead, water in the center of the plants often causing decay, but in very hot weather this will evaporate by the addition of air. Having no pseudobulbs, but a pair or more of large leaves to support, the plants must never lack moisture. The flowering period is mostly in winter or early spring and the beautiful sprays of bloom are now a large item among growers for market since the plants can be so readily obtained from the Philippines. There is a tradition that phalænopsis do best near the coast. Certain it is, that California growers are having great success with them.

Pholidota. For culture, see Pholidota.

Phragmipedilum. For culture, see Phragmipedilum.

Physurus. From Colombia, but with foliage similar to the anœctochilus from the Malay Archipelago. Physurus grows at an elevation of 5,000 to 6,000 feet and will thus be best treated in the same house with the odontoglots. One species occurs in Peru.

Platyclinis. Warmhouse plants, all of which have fragrant flowers, and are easy of culture. The best known is *P. glumacea*, but *P. filiformis* is sometimes seen. Easily grown in osmundine and propagated by division.

Pleione. A pretty genus of East Indian plants known there as the crocus. Flowers mostly pink, and produced after the foliage has died down. Best grown in shallow soil in pans, with treatment as for calanthe.

Pleurothallis. Small-growing plants of great interest botanically but many have flowers that require the aid of a microscope to see their beauty. Best grown in the cattleya house in shallow pans suspended near the glass. They need moisture at all times but very little material at the roots. In summer the plants may be placed with the masdevallias, at the warm end of the odontoglossum house.

Pogonia. Hardy orchids found in wet soil with very showy flowers, but difficult to transplant unless plenty of earth is taken with the roots.

Polystachya. A tropical African genus, rare in cultivation.

Promenæa. Culture as for Zygopetalum.

Renanthera. Culture as for Vanilla.

Restrepia. For culture, see Restrepia.

Rhynchostylis. Culture as for Saccolabium.

Rodriguezia. For culture, see Rodriguezia.

Saccolabium. Culture as for Aërides. See also under Saccolabium.

Sarcanthus. For culture, see Sarcanthus.

Sarcopodium. A genus separated from Dendrobium and Bulbophyllum, and requiring treatment similar to that of Dendrobium.

Scaphosepalum. For culture, see Scaphosepalum.

Schomburgkia. Culture same as cattleya, but requires to be well ripened by exposure to more sun, especially in winter, to induce flowering. The plants are seldom seen, as they are large, and the flowers inconspicuous by comparison with other orchids, borne on stems sometimes several feet long.

Scuticaria. For culture, see Scuticaria.

Serapias. For culture, see Serapias.

Sobralia. A group of reed-like plants, flowering at the end of new shoots, several large cattleya-like flowers coming in succession, but, these being short-lived, are of no value commercially, but are interesting plants in a collection. Specimens may be grown to a large size and the plants do not deteriorate. Many hybrids have been raised, but are seldom seen in gardens. Propagation by division usually, and a soil as named for cœlogyne.

Sophronitis. A brilliant-colored little orchid, an alpine plant. Easy of culture in shallow pans suspended near the roof. *S. grandiflora* is the best known, and has been much prized for imparting its color to the larger cattleyas and lælias. At least one hybrid has been raised here, and many more in Europe and Britain. The color is usually equally brilliant in secondary crosses. Does best in the cattleya house and should never become dry at the roots or the plants will suffer.

Spathoglottis. For culture, see Spathoglottis.

Spiranthes. Hardy native orchids popularly known as "ladies' tresses." Easily transplanted, but seem to flower biennially, late in summer and early autumn.

Stanhopea. Treatment similar to gongora with similar pendent flower-spikes through the bottom of basket. Flowers very striking in color and odor, but do not last long.

Stenorynchus. Tropical plants allied to spiranthes, with variegated leaves and colored flower-stems. Treatment same as for Paphiopedilum.

Thunia. Tall-growing bamboo-like stems with clusters of flowers at the top. Very attractive but not often seen owing to the attacks of red-spider on the thin foliage. After flowering, the plants need resting, being kept dry but in a warm house, until growth starts again. Propagation is by cutting the stems in pieces with several joints, laying on damp moss in a propagating-case in strong heat until roots are visible, then potting and treatment as with older plants. Loam should be added and weak liquid manure-water when rapid growth is produced.

Trichocentrum. For culture, see Trichocentrum.

Trichosma. Only one species seems to be in cultivation, *T. suavis*, a very pretty fragrant-flowered orchid, needing intermediate house treatment, with culture same as for cypripediums, repotting to be done in winter after flowering season has past.

Tricopilia. Beautiful and fragrant orchids, free-flowering, needing same culture as lycaste.

Vanda. Culture as for Aërides. See also under Vanda.

Vandopsis. Culture as for Vanda.

Vanilla. Tropical epiphytes producing a valuable bean-like capsule and the only orchids known that have a commercial value apart from the flowers. They are true epiphytes, requiring support such as a wall at the end of an orchid house where moisture is assured for the creeping roots. Pollination must be done by hand to be sure of pods being formed. The culture of vanilla is carried on on a large scale in the tropics, but it is impracticable under glass. Easily propagated by cutting up the rooted stems into pieces.

Warrea. Culture as for Phaius.

Warscewiczella. Culture as for Zygopetalum.

Zygopetalum. Very decorative winter-flowering plants, *Z. Mackayi* being of easy culture, and perhaps the only species well known. It is very free-flowering, fragrant, will seed freely and produce plants true even though hybridized by other pollen, even unto the fourth generation. It is one of the oldest known orchids, requiring soil similar to phaius and an intermediate treatment.

E. O. Orpet.

ÓRCHIS (Greek word, referring to the shape of the tuberous roots of certain species). *Orchidàceæ*. The typical genus of the great family of orchids.

Plants perennial by means of simple or palmate tubers: st. simple, erect, terminating in a raceme or spike, with few to many rather small fls., and bearing several lvs., with long sheaths: bracts often foliaceous: sepals all similar, connivent or spreading; petals often smaller, entire; labellum 3-lobed, middle lobe entire or parted, base spurred; column very short or none; stigma plane, not produced (Habenaria).—About 70 species, all terrestrial and natives of the northern hemisphere, chiefly in Eu. and Asia, with 2 species in N. Amer. For *Orchis spectabilis*, Linn., see *Galeorchis*.

Orchises are not showy, and they have no horticultural standing, but lovers of hardy orchids collect them and try to cultivate them, usually with little success. They will probably thrive under the treatment given Galeorchis, of which F. W. Barclay writes: "The American species of Orchis are woodland plants, requiring rich leaf soil, with rather heavy shade, and that even condition of moisture characteristic of deep woods. Where these conditions cannot be supplied, the plants invariably prove short-lived." See also discussion on terrestrial orchids, page 2392.

hircìna, Crantz (*Himantoglóssum hircìnum*, Spreng.). Fl.-sts. 1–2 ft. high, bearing a loose raceme 4–8 in. long: fls. greenish white, exhaling a disagreeable odor; middle lobe of the labellum long, strap-like and twisted, lateral lobes much smaller: lvs. few near the bottom of the scape, oblong-lanceolate. May, June. Eu. and N. Afr. G.W. 2, p. 351.—Advertised by Dutch bulb-growers.

The following species are advertised in Amer. by European dealers, but are not known to be cult. in Amer. Most of them are hardy European plants. The synonomy of the group is somewhat confused. *O. Brancifórtii*, fls. purple.—*O. foliòsa*, large, leafy spikes of purple fls. G. 13:183; 26:296; 35:465. G.M. 50:709.—*O. fúsca*, purple- and rose-colored fls.—*O. latifòlia*, spotted lvs. and purple fls. G. 6:229. Gn.W. 20:599.—*O. longicórnis*, fls. rich purple. N. Afr.—*O. maculàta*, fls. lilac-purple.—*O. máscula*, fls.

purple, in long spikes.—*O. militàris*, fls. purple.—*O. Mòrio*, fls. purple and green.—*O. pállens*, pale sulfur-yellow.—*O. papilionàcea*, fls. purple and white.—*O. provinciàlis*, long spikes of pale lemon-yellow fls.—*O. Robertiàna*, fls. purple, brown and white, in large spikes.—*O. sambucìna*, fls. yellow.—*O. undulatifòlia*, fls. white- and rose-colored.

Heinrich Hasselbring.

OREOCÀRYA (Greek, *mountain nut*, referring to habitat and the nutlets comprising the fr.). *Boraginàceæ.* About 20 species of mostly biennial rough or hispid herbs separated in recent years from Eritrichium and Krynitzkia. They are natives of W. N. Amer. and Mex. They are scarcely known as horticultural subjects, as only now and then are some of them transferred to gardens. They are white- or yellow-fld., the blossoms being on the order of myosotis: lvs. alternate, narrow: roots woody: fls. in crowded thyrse-like or paniculate clusters, the calyx 5-parted; corolla salver-form, crested in the throat, 5-lobed; stamens 5, not exserted, often dimorphic; ovary deeply 4-lobed, becoming 4 nutlets. Many species are native in the Wyo.-Colo.-Utah region. L. H. B.

OREOCÈREUS (the mountain Cereus). *Pilocèreus* in part of authors. *Cactàceæ.* Usually large columnar plants with strong armaments and producing long white hairs or wool like Cephalocereus, but with very different fls.: ovary and fl.-tube covered by numerous imbricating bracts with their axils filled with long woolly hairs; stamens numerous, as long or longer than the petals; style long exserted.—Two species are in cult. and are described below. They are cult. the same as Pilocereus.

Celsiànus, Riccob. (*Pilocèreus Celsiànus*, Lem. *P. fossulàtus*, Lab.). Columnar, in the gardens simple, hardly more than 4 ft. high, 3 in. diam.: ribs 10–17, bright green: areoles bearing long (2 in.) white hair; radial spines usually 9, the lower one, the longest, less than 1 in. long; central usually 1, sometimes 4, the longest sometimes 3 in. long, all yellow: fls. not known. Andes of Bolivia.

Var. **Bruénnowii,** Brit. & Rose (*Pilocèreus Bruénnowii*, Haage, f. *P. Celsiànus Bruénnowii*, Schum.). St. stouter: wool brownish, more copious; spines stronger and darker.

lanàtus, Brit. & Rose (*Cáctus lanàtus*, HBK. *Pilocèreus Daùtwitzii*, Haage. *P. Haàgei*, Poselg.). Columnar, reaching 5 ft. in height, 4 in. diam.: ribs 25–30, low, obtuse: areoles close together, bearing over 20 needle-like, spreading and interlocking spines, and also copious long, white, curled hairs which cover the whole upper part of the plant, like a spider's web.: cephalium and fl. not certainly known. N. Peru. Ecuador. G.C. 1873:7. F.S. 21:2163.

J. N. Rose.

OREÓCOME: *Selinum.*

OREODÓXA (Greek, *mountain glory*). *Palmàceæ.* The royal palm, cabbage palm, and a very few others, from Florida to northern South America, comprising the finest species of palms in cultivation; pinnate-leaved, with tall columnar boles.

The genus Oreodoxa, as formerly understood, has recently been divided, and the Florida and West Indian royal and cabbage palms have been separated as Roystonea and the name Oreodoxa has been reserved for South American species. This separation proceeds on the basis of the botanical distinctness of the two groups and also for nomenclatorial reasons. Oreodoxa was established by Willdenow in 1804 for 2 Venezuelan species, neither of which is congeneric with the W. Indian royal palms. The type species, *O. acuminata*, Willd., is associated by some authors with Euterpe, by others with Œnocarpus. (See O. F. Cook, Science II. 12:479 (1900); Bull. Torr. Bot. Club, 28:549 (1901), and 31:349 (1904); also Cook & Collins, Ec. Pl. Porto Rico). Nevertheless, this disposition has not been accepted by other palm students, as Beccari, and Dammer & Urban; and until something like an agreement is reached (and without expressing any opinion on the merits of the case), it is better for a cylcopedia of horticulture to hold to a conservative practice. For Beccari's recent treatment, see Pomona College Journ. Econ. Botany, May, 1912.

2675. Royal palm.—Oreodoxa regia.

As usually defined, and as understood by Martius (not Willdenow), Oreodoxa comprises spineless palms, the solitary erect robust trunk cylindrical or swollen at the middle: lvs. terminal, equally pinnatisect; segms. narrowly linear-lanceolate, narrowed at the apex, unequally bifid; midnerve rather thick, scaly beneath; margins not thickened, recurved at the base; rachis convex on the back, sulcate toward the base, and acute toward the apex above; petiole half-cylindrical, sulcate above; sheath long: spadix rather large, with long, slender, pendent branches; spathes 2, the lower broad, laterally carinate, shorter than the spadix, the upper complete semi-cylindrical, ventrally fissured: bracts and bractlets scaly: fls. small, white, in scattered glomerules: fr. obovoid or oblong-ovoid, small, violet; seed small, rounded, depressed, or obovate and somewhat curved, with sub-basal embryo and uniform albumen.

The two well-known Oreodoxas are the royal palm (*O. regia*) and the cabbage palm (*O. oleracea*). Both are stately trees. While it is often difficult to distinguish immature specimens of the royal and cabbage palms, in age they are distinct. *O. regia* has staminate flowers which, in bud, entirely inclose the stamens, while in *O. oleracea* the stamens protrude before the flower opens. In the latter species, also, the fruit is nearly twice as long as wide, while in *O. regia* it is not more than a third longer than wide. The character of trunk swelling, usually applied as a distinguishing mark, is likely to break down in some wild plants. The royal palm is one of the grandest of pinnate palms, growing to a height of over 100 feet with immense plumy feathery leaves and a straight white trunk. It is a magnificent tree for extreme southern Florida for avenue planting, and is valuable in all sizes, but especially when 4 feet or over in height. The form of it native in Florida is by some regarded as a distinct species. The cabbage palm is cut down when three years old for the central leaves, which are tender and edible. In southern California, the royal palm lives for years but without attaining any size, and is therefore not accounted a success there. Because of the original error in assigning the West Indian royal palms to Oreodoxa of Martius, which itself is untenable, the names of these plants and their relatives are badly mixed.

A. *Staminate fls. bearing columnar pistillodes that are 3-parted at the apex (Oreodoxa).*

Sancòna, HBK. St. 120–150 ft., smooth, glabrous, grayish black: lvs. pinnate; lfts. membranaceous: wood very hard, used in building houses. Colombia.—Apparently cult. only in S. Calif. within the U. S. Franceschi says it has brownish lf.-stalks and is more tender than *O. regia* or *O. oleracea.*

AA. *Staminate fls. bearing spherical or ovoid pistillodes with sessile stigmas (Roystonea).*

B. *Trunk usually swollen at or above the middle.*

règia, HBK. (*Roystònea règia,* O. F. Cook). ROYAL PALM. Fig. 2675. Caudex 40–60 ft. high.: lvs. 8–10 ft. long; lf.-segms. 2½ ft. long, 1 in. or less wide, linear, acuminate: fr. ovoid, ½in. Cuba, Antigua. G.F. 9:155. S.S. 10:505. G.C. III. 17:239; 27:297. A.F. 12:311. G.M. suppl. Oct. 1, 1892.—Commonly planted in the W. Indies; also elsewhere. The form in Fla. (separated as *Roystonea floridana,* O. F. Cook) is said to lack the characteristic bulge in the trunk and to grow in reach of tide-water rather than on the hills or elevated lands. In the Everglades this native palm sometimes reaches 125 ft. in height, with lvs. 15 ft. long. It is tall and slender when young.

Borinquèna, Reasoner (*Roystònea Borinquèna,* O. F. Cook). The ROYAL PALM of Porto Rico. Trunk usually with a prominent bulge, but sometimes slender, about 30–35 ft. tall; otherwise much as in *B. regia* but differing in having more densely branched infl., which is covered with a dark brown pubescence: seeds about ½in. long, distinctly narrower than those of *O. regia* and somewhat flattened or concave on the back. Porto Rico, on limestone hills.—According to Reasoner it does well in extreme S. Fla. outdoors.

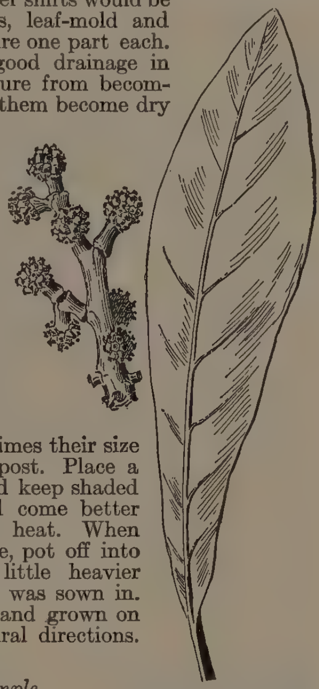
BB. *Trunk not swollen at the middle, usually perfectly cylindric.*

oleràcea, Mart. (*Arèca oleràcea,* Jacq. *Eutérpe caribæa,* Spreng. *Roystònea oleràcea,* O. F. Cook). CABBAGE PALM. Caudex 100–120 ft. high: lvs. 10–14 ft. long; lf.-segms. lanceolate-linear, acuminate, 3 ft. long, 1½ in. wide: fr. obovoid-oblong, ¾in. W. Indies.—Cult. in S. Fla. L. H. B.†

OREÓPANAX (i. e., *mountain Panax*). *Araliàceæ.* Tropical American shrubs and trees grown in the greenhouse.

Leaves simple or compound, entire or toothed, thick: fls. in dense heads which are arranged in racemes or panicles; calyx with minute or obsolete limb; petals 4–7, usually 5, the stamens of the same number and with ovate or oblong anthers; ovary 3–7-loculed, the styles rather long and bearing a flat, not thick, stigma: fr. globose and berrylike.—Some ninety species-names have been referred to this genus, but the number of species is probably much less than this number. In the trade, the species of Oreopanax are usually known as aralias, but in the Aralia tribe the petals are imbricate in the bud, whereas in Oreopanax they are valvate. Few species of Oreopanax are known in cult. Harms (Engler & Prantl, Pflanzenfamilien) divides the species into 3 groups,—lvs. digitate, lvs. lobed, lvs. not lobed. The species described below are those which are now most often mentioned in gardening literature, but only the first seems to be much known here.

Propagation is by cuttings and seeds, any time during January, February and March, the earlier the better. Half-ripened growth of the extreme tops should be placed in a warm propagating-bed with a bottom heat of about 80°. Keep them covered with glass and give sufficient moisture and plenty of shade. When the roots are about ½ inch long, they may be lifted carefully and potted off into 2- or 2½-inch pots, using a mixture of loam, leaf-mold and peat in equal parts, adding enough sand to make it friable. Keep them shaded close and moist until well established, when they may be brought out into full sun. Increase their pot room until they are in 6- or 7-inch pots. They can be kept in fair condition for some time if fed with liquid manure once or twice a week during the spring and summer. During the summer, they will need syringing on all bright days. Always give enough ventilation to keep the growth from becoming too soft, or the atmosphere from becoming too humid. They thrive in an intermediate temperature, in winter from 55° to 60° with a 15° rise during bright days; in spring and summer 60° to 68° for night, with 75° to 80° with sun. They will require some shade when the sun becomes powerful, but not so much as to make them soft. A good compost to use for bigger shifts would be fibrous soil four parts, leaf-mold and well-decayed cow-manure one part each. Give them plenty of good drainage in order to keep the mixture from becoming sour. Do not let them become dry at the roots. In the winter they will need less water and syringing. Keep thrips down by syringing and fumigations.—Oreopanax can also be increased from seed. This seed can be secured through some of the European firms in the spring. It may be sown in pans, using a mixture of loam, peat and sand in equal parts. Cover the seeds about three times their size with finely sifted compost. Place a glass over each pan and keep shaded and moist. They will come better if placed over bottom heat. When large enough to handle, pot off into small pots, using a little heavier mixture than the seed was sown in. They may be shifted and grown on under the above cultural directions. (J. J. M. Farrell.)



2676. Oreopanax reticulatum. Properly Meryta Denhamii. (×¾)

A. *Lvs. all simple.*

reticulàtum, Decne. & Planch. (*Aràlia reticulàta,* Willd.). Fig. 2676. Small tree, with alternate, thick, entire, oblanceolate lvs. 12–18 in. long, somewhat revolute on the margin, strongly alternate-veined and reticulated with shades of green: fl.-heads spherical, nearly or quite an inch diam. S. Amer.?—A handsome plant for foliage.

AA. *Some of the lvs. strongly digitately lobed or angled.*

Sanderiànum, Hemsl. Shrub or small tree, with habit of *Fatsia papyrifera:* lvs. glabrous, thick and glossy, long-stalked, triangular-ovate in outline, on young shoots deeply 3-lobed but on flowering plants cordate and entire: fls. minute, in small, globose heads, which are arranged in racemose panicles. Guatemala. G.C. III. 13:451. A.F. 8:1283.

AAA. *Some or all of the lvs. digitate.*

Epremesniliànum, André. Shrub of striking habit: lvs. large, long-stalked, digitate, the lfts. 7–9, oblong or lanceolate and usually tapering at either end, the middle ones deep-lobed: fl.-heads in a spike. Origin unknown; perhaps a garden form of *O. dactylifolium,* Hort., in which each of the 7 lobes is usually lobed. R.H. 1884, pp. 320, 321. Gn. 29, pp. 354, 355; 30, p. 447.—Named for Count Eprémesnil, Dieppe, France. Well-grown plants resemble *Fatsia japonica* (*Aralia Sieboldii*).

Andreànum, Marchal. Shrub, with variable foliage: lvs. elliptic to roundish, stalked, the lower surface and petioles red-tomentose, varying from angled to deeply digitate and the divisions pinnatifid: fl.-heads globular, in a terminal raceme. Ecuador. R.H. 1882, pp. 524, 525.

Thibaûtii, Hook. Small tree, stellate-pubescent on the young parts: lvs. long-stalked, 5–7-foliolate, the lfts. lanceolate or oblanceolate, entire, 6 in. or less long, dark green: fl.-heads ⅓in. diam., in a terminal raceme 1 ft. long. Mex. B.M. 6340.

O. pedunculàtum was once listed in Calif., with following description: "lvs. palmate, tinged with red; makes a fine foliage plant. Guatemala." It turns out to be Kœlreuteria paniculata.—*O. trílobum*, Hort., a plant offered abroad, may belong here.

L. H. B.

ORÍGANUM (ancient Greek name said to mean *delight of mountains*). *Labiàtæ.* Marjoram. Sweet herbs; and a few species grown in rock-gardens and borders for the ornamental foliage and flowers.

Perennial herbs or undershrubs, with fls. in 2-fld. whorls, rarely 6–10-fld., crowded into globose or oblong spikelets which are disposed in terminal corymbs or panicles: bracts colored and larger than the calyx, or green and smaller; calyx various, 5-toothed or 2-lipped; corolla 2-lipped, the upper or posterior lip 2-lobed or emarginate, the lower 3-lobed; stamens 4, included or exserted; style 2-lobed: nutlets ovoid or oblong, smooth.—About 30 species, largely in the Medit. region, but also in extra-Trop. Asia. Botanically these plants are closely allied to the thyme, but the fls. of marjoram are borne in bracted heads, while those of thyme are borne in few-fld. whorls which are axillary or spicate above. By some authors, the genus is divided into Origanum, with 5-toothed and more or less 13-nerved calyx, and Majorana with oblique calyx-mouth, the upper lip entire and the lower one small or wanting.

The sweet marjoram is *O. Majorana* (or *Majorana hortensis*), not uncommon in gardens. The pot marjoram appears to be very little known in this country. It is commonly referred to *O. vulgare*, although sometimes to *O. Onites*. The former is probably the species concerned, although it is not impossible that both species are confused in this horticultural name, pot marjoram.

Cultivation.—Sweet or annual marjoram (*Origanum Majorana*) is a native of the countries bordering the Mediterranean sea. It is an erect branching perennial, bearing grayish green rounded or oval leaves, small whitish flowers in terminal clusters which appear in midsummer, and little oval dark brown seeds. The plant has a pleasing odor and warm aromatic bitterish taste, due to a volatile oil which is soluble in water, is officinally credited with tonic and gently excitant properties, and, as an infusion, is employed in domestic medicine to "bring out the rash" in such diseases as measles. More frequently than in medicine, however, its green parts are used as a condiment, being highly esteemed as a seasoning for soups, stews, meat-pies and dressings. In the garden this plant is treated as an annual, hence the name "annual marjoram." This practice became necessary since the plants are prone to winter-kill unless carefully protected. Its propagation is also somewhat precarious, owing to the small size of the seeds and the tenderness of the seedlings when exposed to the sun. Shade, therefore, until the plants are well rooted is usually necessary. Successional plantings may be made throughout the spring; sometimes transplanting from hotbeds or coldframes in May or June is practised. The plants should stand 6 inches asunder in rows 12 inches apart, in light and dry but good soil, be kept clean throughout the season, and harvested for winter use just before flowering, the plant being cut close to the ground and hung in a cool, airy place to dry. If planted early, leaves may be gathered in late spring. According to Dreer, American-grown seed is better than imported seed for winter use, as it makes more bulk, while imported seed is better when the plants are to be cut green for summer use.—Pot marjoram (*Origanum vulgare*), a branching hardy perennial, about 2 feet tall, bearing in midsummer pink or purple flowers, and small brown oval seeds, grows wild on the borders of European woods. The highly aromatic leaves and the young shoots gathered just before blossoming are used like those of sweet marjoram. The plant is of easy culture, succeeding in all warm garden soils. It may be propagated by seed, but, where established, division in spring or early autumn is generally practised. The plants should be set 10 inches asunder in rows 15 inches apart, and kept well cultivated. Dwarf pot marjoram, a variety that comes true from seed, bears large heads of whitish flowers, and is often used as an edging plant. (M. G. Kains.)

A. *Spikelets erect.*

B. *Calyx of 5 nearly or quite equal teeth: fl.-bracts medium in size, often colored.*

vulgàre, Linn. Rootstocks nearly horizontal: plant more or less hairy: lvs. stalked, broadly ovate, subserrate or entire, broadly rounded at the base or subcordate: fls. purplish (varying to pink or nearly white), in corymbed clusters or short spikes; bracts purplish, about the length of the calyx; corolla longer than calyx; 2 or 4 of the stamens exserted.—Cult. in old gardens; also wild along eastern roadsides and in fields, naturalized from Eu. An erect herb, 1–2½ ft. high, aromatic. It runs into several forms, one of them being var. **aùreum,** Hort., with golden or yellow foliage.

BB. *Calyx oblique or 2-lipped: fl.-bracts medium or small, not prominently colored.*

C. *Lvs. stalked.*

Majoràna, Linn. (*Majoràna horténsis,* Moench). Sweet Marjoram. Annual Marjoram, from the method of cult., although the plant is perennial. Nearly glabrous, 1–2 ft.: lvs. oblong-ovate, entire, obtuse, tomentose: fls. purplish or whitish; spikelets oblong, 3–5 in a cluster. Eu.

CC. *Lvs. not stalked.*

Onìtes, Linn. (*Onìtes tomentòsa,* Raf. *Majoràna Onìtes,* Benth.). Perennial: st. erect, nearly simple, hirsute: lvs. sessile, ovate, subserrate, villous or tomentose, mostly cordate at the base: fls. as in *O. Majorana* but a little larger; spikelets ovoid, very numerous in a dense cluster. S. E. Eu., Asia Minor, Syria.

AA. *Spikelets nodding: fl.-bracts large, often colored, usually concealing the calyx.*

sipylèum, Linn. (*O. hýbridum,* Mill.). Woody and procumbent at base, the upright branches very villous: lvs. short-petioled, entire, the lower ones suborbicular and hairy, the upper ones ovate, glabrous and glaucous; floral lvs. small: spikes oblong, solitary or in 3's, nodding, the bracts ovate and colored; calyx glabrous, the 3 upper teeth longer; corolla pink. Levant; named for Mt. Sipylos.—A useful little plant for rock-work and dry places; 8–16 in. high; fl.-heads rose-color.

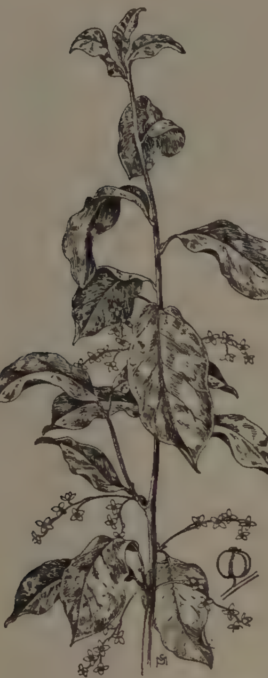
pulchéllum, Boiss. Perennial, grayish pilose, the sts. ascending: lvs. ovate, obtuse, entire, the lower ones short-petioled and the others sessile: spikes nodding, ovate or oblong, the bracts reddish, ovate, glabrous or ciliate; fls. rose-colored; calyx glabrous, the throat bearded, upper lip repand-tridentate, the lower very short and 2-lobed; corolla-tube not gibbous, twice exceeding calyx. S. E. Eu. and eastward.—Said to be a pretty shrub-like little plant with fl.-heads resembling small hops.

O. Dictámnus, Linn., from Crete (Crete Dittany), is a tender species with entire woolly mottled lvs. and purplish or pink fls. in hop-like heads.

L. H. B.

ORÍXA (Japanese name). *Rutàceæ.* Deciduous shrub, with alternate petioled almost entire lvs., and greenish inconspicuous diœcious fls. with 4 sepals and 4 minute petals, the staminate fls. in racemes, the pistillate fls. solitary: fr. consisting of 4 dehiscent pods, each containing 1 black subglobose seed. It has proved hardy in Mass., but has no decorative merit except its bright green foliage, which is not attacked by insects or fungi, and has a strong disagreeable odor like that of ptelea. Orixa seems to grow in almost any soil. Prop. by greenwood cuttings; also by layers and root-cuttings and by seeds. The only species is **O. japónica,** Thunb. (*Celástrus Oríxa,* Sieb. & Zucc. *Ìlex Oríxa,* Spreng. *Othèra Oríxa,* Lam.). Fig. 2677. Shrub, to 8 ft., with spreading branches pubescent when young: lvs. obovate to oblong, obtusely pointed, entire or finely crenulate, bright green above, finely pubescent beneath, translucently glandular-punctate, 2–4 in. long: fls. small, greenish: pods about ⅓in. long, light greenish brown. April, May. Japan. Gt. 35:1232. I.T. 3:101.

Alfred Rehder.


2677. Orixa japonica. (×⅜)

ORMÒSIA (from Greek, for *necklace:* the brilliant seeds of some species used as beads). *Leguminòsæ.* Necklace Tree. Trees, around the world in the tropics, of 40 or more species, bearing large panicles or racemes of white, lilac or black-purple papilionaceous fls., and often handsomely colored seeds, planted sometimes in warm countries: calyx more or less 2-lobed, the 2 upper teeth being somewhat connate; standard very broad, the wings obovate-oblong and oblique; stamens free and unequal; stigma lateral: pod leathery, woody, or fleshy, oblong to linear and compressed, wingless and 2-valved, sometimes septate: lvs. odd-pinnate, with coriaceous lfts.

monospérma, Urban (*Sóphora monospérma,* Swartz. *Ormòsia dasycárpa,* Jacks.). Fig. 2678. Offered abroad: large tree: lfts. 5 pairs, oblong and pointed, 3–4 in. long: fls. blue, ¾in. long in large rusty panicles: pod 1½ in. long, tomentose, 1-seeded; seed somewhat compressed, irregular in shape, ½in. or more longest way, bright scarlet with large angular black patch. W. Indies.

Other species do not appear in accessible lists, but they may be sparingly in cult. *O. coccínea,* Jacks., of S. Amer., is in horticultural literature: lfts. ovate, the margins revolute: fls. blue: pod glabrous and shining; seeds scarlet, with black spot.

L. H. B.

ORNAMENTAL GARDENING, or ornamental horticulture, is that branch of horticulture concerned with cultivating plants of all kinds for show and to satisfy the eye rather than for food. It includes floriculture and also the culture of trees for shade and display. (The culture of trees on a large scale for timber and for other profitable purposes aside from ornament is forestry. The culture of trees in general is arboriculture.) Ornamental gardening includes carpet-bedding and formal gardening in general, while landscape gardening is concerned with making nature-like pictures, or at least with the general plan and setting of the place; it also comprises all that part of floriculture that aims to make grounds and gardens beautiful.

ORNITHÍDIUM (the diminutive for *bird,* from the form of the flower). *Orchidàceæ.* Epiphytic orchids for the warm greenhouse.

Stems leafy, covered with distichously imbricated sheaths, the 1-lvd. pseudobulbs lateral: fls. medium or small, solitary on peduncles which are fascicled in the axils; sepals and petals similar, the sepals free, a little larger than petals; lip 3-lobed, the lateral lobes erect, sometimes inclosing the column; column usually short and footless; pollinia 4, waxy.—About 20 species, in Trop. Amer.

dénsum, Reichb. f. (*Maxillària dénsa,* Lindl.). Pseudobulbs oblong, compressed: peduncles densely fascicled; sepals and petals yellowish, the column and lip marked with rose. Mex. B.R. 1804.

fràgrans, Rolfe. Pseudobulbs ovoid-oblong: fls. few, fragrant, white, faintly flushed with mauve; sepals spreading, oblong-linear, rather acute, the petals somewhat connivent, lanceolate-linear, acute; lip 3-lobed, dull mauve, the lateral lobes small, the middle lobe reflexed, quadrate-oblong, truncate or emarginate.

O. bícolor, Rolfe. Pseudobulbs ovoid, tufted: fls. bright yellow, with a crimson blotch on the front lobe of lip. Colombia.

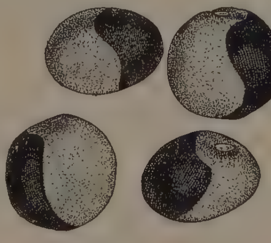
George V. Nash.

ORNITHOCÉPHALUS (Greek, *bird* and *head* in allusion to the aspect of the column). *Orchidàceæ.* Epiphytic orchids, the most striking feature of which is the long slender rostellum.

Cespitose herbs with fleshy lvs.: sepals and petals free, spreading; upper sepal concave; labellum subsessile, 3-lobed, lateral lobes broad and thickened, middle lobe elongated; column short with the rostellum conspicuously elongated; pollinia 4.—About 20 species from Brazil to W. Indies and Mex. The geographical range of the species herein described indicates an intermediate temperature. They may be treated like cattleyas.

grandiflòrus, Lindl. A dwarf compact epiphyte: lvs. distichous, oblong, obtuse, about ⅗in. long: scape from the axil of the lvs.; fls. small, whitish, about ⅘in. across, borne in racemes; sepals and petals similar, blotched at base with emerald-green; labellum 3-lobed, somewhat rounded, saccate, keeled beneath. Brazil.

multiflòrus, Rolfe. Plant densely cespitose: sts. 2⅖ in. high, diphyllous: lvs. lanceolate or oblong, somewhat fleshy, about ⅘in. long: raceme slender, flexuose, 3⅕ in. long; fls. numerous, white; sepals reflexed, ovate, concave; petals spreading; labellum pandurate, obtuse, concave above the middle, 1⅗ in. long, with a suborbicular callus. Brazil.


2678. Seeds of Ormosia monosperma. (×1)

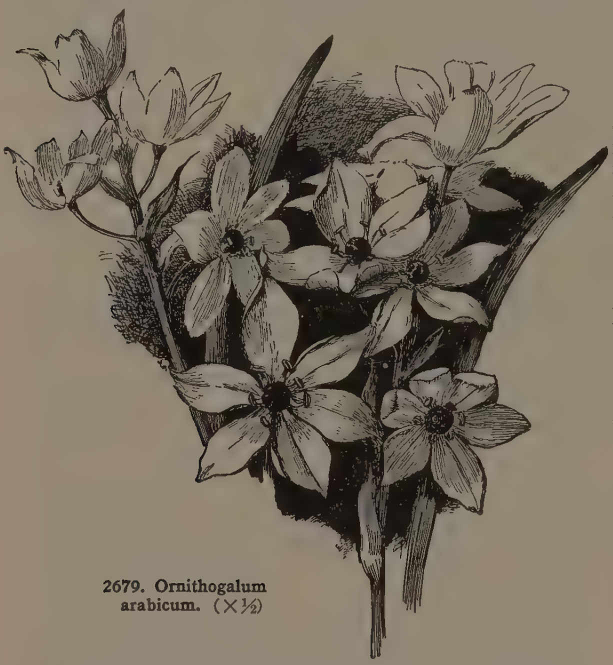
Oakes Ames.

ORNITHOCHÌLUS (Greek, *bird* and *labellum*). *Orchidàceæ.* Epiphytic herbs with leafy sts., similar to Aërides: sepals subequal, spreading, oblong; labellum spurred; infl. longer than the lvs.; fls. yellow with bands of brown; pollinia 2.—A few species from India. **O. fúscus,** Wall. Lvs. subacute, narrowed to the sessile sheathing base, about 6 in. long, about 2 in. wide: infl. longer than the lvs.; fls. small, numerous, in racemes, greenish yellow, with bands of brown and with the pectinate lateral lobes of the labellum purple below; sepals and petals oblong.

Oakes Ames.

ORNITHÓGALUM (Greek, *bird* and *milk;* application not obvious). *Liliàceæ.* This genus includes the star of Bethlehem, a dwarf hardy bulbous plant that bears umbels of green-and-white flowers in May and June; also many other outdoor and indoor bulbs.

Bulb coated, giving rise to linear or very narrow lvs. and a simple leafless scape: fls. white, yellowish or reddish, mostly racemose; perianth persistent; tube none; segms. 6, usually spreading; stamens 6, the filaments more or less flattened and in many species unequal, alternate ones being broader at the base; ovary sessile, 3-celled; ovules many in a cell, superposed; style short or long: caps. membranous, loculicidally 3-valved; seeds globose, usually not crowded nor compressed: often the perianth-segms. are keeled and the green color follows the keel.—Probably more than 100 species, widely spread mostly in the eastern hemisphere. They are particularly numerous in S. Afr. Blue and mauve-purple does not occur in the fls. of this genus, according to Baker.


2679. Ornithogalum arabicum. (×½)

Horticulturally, ornithogalums may be divided into hardy and tender groups, and each of these may be subdivided into dwarf and tall. The hardy kinds are considered by English amateurs amongst the choicest summer-blooming bulbs for wild gardening. With the remarkable increase of wild gardens in America, the popularity of these bulbs is likely to increase with us. The common star of Bethlehem, *O. umbellatum,* a dwarf kind, is the only ornithogalum that is common in American gardens. *O. nutans* has escaped from a few premises; in England "it is a very popular species and one of the most easily managed of all the ornithogalums. In borders amongst other named bulbs, however, it becomes a great nuisance, on account of the freedom with which its innumerable bulbils are formed. In a semi-wild or uncultivated spot it is a capital subject for groundwork; it requires no attention whatever, and flowers freely all through April and May." Of the taller hardy kinds *O. latifolium* and *O. pyramidale* seem to be the most desirable. These may be placed among shrubbery and left undisturbed. A particularly robust clump of *O. latifolium* is recorded as bearing over one hundred spikes of flowers on stalks 3 feet high. *O. pyramidale* sometimes makes a perfect pyramid of starry white flowers, the spike 12 to 18 inches long, the flowers an inch across, and a hundred or more flowers in a spike.

The tender kinds in cultivation are chiefly from the Cape of Good Hope, although *O. arabicum* is found in the Mediterranean region. When well grown, the latter is probably the showiest of the genus. The white of the large broad-petaled flowers is set off by a gleaming black pistil, which makes a striking feature. *O. arabicum* is suitable for pot culture in northern conservatories, but perhaps the best way to grow it is in quantity in a frame. The bulbs have a way of remaining dormant for a season or two, a difficulty possibly to be associated with insufficient ripening. It is suspected that there are two varieties, a shy-blooming and a free-blooming kind. This may explain some of its reputation for capriciousness. *O. thyrsoides* is easier to grow and earlier to bloom. With gentle forcing it may be had for Christmas in a moderately warm house. *O. revolutum* is very distinct in having revolute instead of spreading segments. *O. caudatum* is cultivated in dwelling houses under the erroneous name of sea onion. The sea onion is *Urginea maritima,* a plant of the same general appearance but distinguishable in leaf, flower and fruit as follows: *Urginea maritima* has leaves 2 to 3 inches wide: raceme 1½ to 2 feet long: bracts 3 to 4 lines long: flowers white with a brown keel: seeds crowded, disk-like. *Ornithogalum caudatum* has leaves 1 to 1½ inches wide; raceme ½ to 1 foot long: bracts 6 to 9 lines long: flowers keeled with green: seeds not crowded nor compressed. The ornithogalums are increased naturally by the new bulbs. In general, they are plants of easy culture.

INDEX.

arabicum, 1.
aureum, 3.
biflorum, 11.
caudatum, 13.
exscapum, 8.
flavescens, 3.
kewense, 3.
lacteum, 4.
latifolium, 5.
longebracteatum, 12.
narbonense, 10.
nutans, 9.
pyramidale, 10.
revolutum, 14.
Saundersiæ, 2.
tenuifolium, 6.
thyrsoides, 3.
umbellatum, 7.

A. *Segms. of perianth self-colored on front and back, not keeled with color (No. 2 tinged outside).*

B. *Pistil prominent, shining, greenish black.*

1. **arábicum,** Linn. Fig. 2679. Bulb ovoid, 1–1½ in. thick, proliferous: lvs. 5–8, glaucous green, 1–1½ ft. long, ¾–1 in. wide: scape 1–2 ft. long; raceme 6–12-fld., roundish or deltoid in outline, 3–5 in. long and wide; fls. self-colored, odorous; filaments lanceolate, not cuspidate, alternate ones distinctly broader, but not quadrangular on the base. Medit. region. B.M. 728; 3179 and B.R. 906 (as *O. corymbosum*). G.C. II. 19:665. Gn. 22, p. 249; 32, p. 145; 41, p. 377; 49:308 and p. 309. J.H. III. 61:539. Gn.W. 20:592. G. 10:318; 27:249. C.L.A. 5:48.—The blackish pistil is a beautiful and interesting character. The most popular species for pot culture.

2. **Saûndersiæ,** Baker. Bulb large and globose: lvs. many, flaccid, lorate, more than 1 ft. long: peduncle terete, 2–3 ft., bearing many corymbose fls. on pedicels to 2 in. long with greenish lanceolate bracts; perianth white, ½in. long, the segms. orbicular, tinged outside with green; stamens half as long as perianth; ovary blackish green, with a very short style. S. Afr.

BB. *Pistil not a striking feature, dull, smaller.*

C. *Number of fls. in a cluster less than 50.*

3. **thyrsoìdes,** Jacq. Bulb globose, 1½–2 in. thick: lvs. 5–6, lanceolate, 6–12 in. long, 1–2 in. wide, attenuate above, the margin obscurely ciliate: scape ½–1½ ft. high; raceme 12–30-fld., dense, triangular in outline, 3–4 in. wide; fls. self-colored; segms. ovate and strongly imbricate; filaments alternately longer and lanceolate, alternately shorter, dilated above the base and bicuspidate. S. Afr. B.M. 1164 (fls. white, with a brown eye).—In cult., the perianth may be 1 in. long. Var.

aùreum, Ait. (*O. aùreum,* Curt.), has golden yellow fls. B.M. 190. Var. **flavéscens,** Ker, has pale yellow fls. B.R. 305.—**O. kewénse,** Hort., is a hybrid of *O. thyrsoides* and the var. *aureum:* like *O. thyrsoìdes,* but color is bright buff-yellow.

4. **lácteum,** Jacq. Bulb whitish, subglobose, to 1½ in. diam.: lvs. 9 or 10, somewhat fleshy, rosulate about base of st., lorate, 12 in. or less long, the margins lightly ciliate: peduncle strong and erect, 1–2 ft., bearing a dense 20–50-fld. raceme that becomes 6 in. long and about 2 in. wide, the pedicels erect-spreading and the lowermost as much as 1 in. long; perianth ½–¾in. long, scentless; segms. oblong, about ⅓in. wide, milk-white. S. Afr. R.B. 34:307. G.C. III. 57:193.—An interesting and variable species.

cc. *Number of fls. in a cluster of 50 or more.*

5. **latifòlium,** Linn. Bulb globose, 1½–2 in. diam.: lvs. 5–6, ascending, glabrous, fleshy herbaceous, broadly lorate, 12–15 in. long, 1½–2 in. wide in cult.: scape or peduncle strong and erect, 1–2 ft., bearing a raceme 12–18 in. long and containing 50–100 or more fls.; perianth about ½in. long, the segms. milk-white and oblong-oblanceolate; filaments about equal, lanceolate. Tauria, Caucasus, Kurdistan, Arabia, Egypt. B.M. 876. B.R. 1978.

AA. *Segms. of perianth with a green outer face, the outer segms. narrowly margined white.*

B. *Cluster inversely pyramidal in outline.*

6. **tenuifòlium,** Guss. Bulb ovoid, 1 in. thick, simple: lvs. 5–6, narrowly linear, 5–6 in. long, 1–2 lines wide, unspotted: scape 2–3 in. long; raceme 6–10-fld., corymbose or inversely triangular in outline, 2–3 in. long and wide; pedicels ascending; fls. with outer perianth-segms. margined white. Medit. region.

BB. *Clusters quandrangular in outline.*

c. *Number of fls. 12–20.*

7. **umbellàtum,** Linn. Star of Bethlehem. Bulb subglobose, 1 in. thick, bearing numerous bulbils: lvs. 6–9, narrowly linear, 6–12 in. long, 2–4 lines wide, deeply channeled, distinctly spotted white: scape 4–6 in. long; raceme 12–20-fld., quadrangular in outline, 4–6 in. long, 6–9 in. wide; lower pedicels in fr. spreading; fls. white, with outer perianth-segms. margined white. Medit. region. Escaped from old gardens in U. S. G. 5:72; 27:248.

cc. *Number of fls. 3–12.*

8. **exscàpum,** Ten. Bulb, ovoid, ¾–1 in. thick, not proliferous: lvs. 5–6, narrowly linear, 4–6 in. long, 1–2 lines wide, glabrous, spotted, disappearing after the fls.: scape 1–1½ in. long; raceme 3–12-fld., quadrangular in outline, 1½ in. long, 2½–3 in. wide; lowest pedicels in fr. deflexed; bracts ¾–1 in. long, shorter than the pedicels; fls. with outer perianth-segms. margined white; style very short. S. Eu.

AAA. *Segms. of perianth more or less white-faced but keeled with green on the back.*

B. *Blossoms nodding.*

9. **nùtans,** Linn. Bulb ovoid, 1–1½ in. thick, producing offsets freely: lvs. pale green, 1–1½ ft. long, 3–6 lines wide, disappearing after the fls.: scape 8–12 in. long; raceme 3–12-fld., oblong-cylindrical in outline; pedicels shorter than the bracts; fls. white on upper side, green on the back, margined white, the lower ones nodding. Eu., Asia Minor. B.M. 269. Gn. 32:418 and p. 77; 41, p. 376. Gn.W. 21:871.—Sometimes escaped in U. S.

BB. *Blossoms erect or ascending.*

c. *Width of lvs. 3–6 lines.*

10. **narbonénse,** Linn. Bulb ovoid, 9–15 lines thick: lvs. strap-shaped, 1–1½ ft. long, 3–6 lines wide, glabrous, glaucous green, scarcely disappearing before the end of flowering: scape 1–1½ ft. long; raceme 20–50-fld., oblong-cylindrical, 4–8 in. long, 1½–2 in. wide; lowest pedicels 9–15 lines long; fls. whitish, keeled green on the back; filaments lanceolate at base, not squared. S. Eu. B.M. 2510 (striped green back and front). Var. **pyramidàle,** Hort. (*O. pyramidàle,* Linn.), is considered by Baker to be a robust, large-fld. garden form, but it is said to grow wild in Spain and Portugal and may be a distinct species. Fls. white, with a green stripe on back. Gn. 41:376; 73, p. 603.

11. **biflòrum,** Don. Bulb globose, ¾–1¼ in. diam.: lvs. 4–6, somewhat fleshy, linear, attenuate above, concave, 6–12 in. long and 3–6 lines wide: peduncle or scape 6–12 in. high, with a lax 6–20-fld. raceme that is 3–4 in. long, the pedicels strict and erect-spreading, the lowermost in 2's; perianth about ⅓in. long; segms. ovate-lanceolate and subacute, the back with a narrow green stripe; style short (1 line long). Chile, Peru. G. 26:129. —Said to be a good species for greenhouse decoration.

cc. *Width of lvs. 9–18 lines.*

12. **longebracteàtum,** Jacq. Bulb ovoid, 3–4 in. thick: lvs. 5–6, rather fleshy, glabrous, lanceolate, 1½–2 ft. long, ¾–1½ in. wide, persistent until after flowering: scape 1½–2 ft. long; raceme dense, 30–60-fld., oblong-cylindrical, 6–9 in. long, 15–18 lines wide; lowest pedicels 9–12 lines long; fls. whitish, keeled green on the back; bracts 9–15 lines long; filaments alternately linear and lanceolate at the base. S. Afr.

13. **caudàtum,** Ait. Bulb ovoid, 3–4 in. thick: lvs. 5–6, fleshy-herbaceous, lorate, 1½–2 ft. long, 1–1½ in. wide: scape 1½–3 ft. long; raceme dense, ½–1 ft. long; perianth ⅓in. long, white; banded green on face, and keeled green; stamens three-fourths the length of perianth; bracts 6–9 lines long; filaments alternately lanceolate and quadrate at the base. S. Afr. B.M. 805.—Window plant.

AAAA. *Segms. of perianth white, with a brown or greenish yellow eye, revolute.*

14. **revolùtum,** Jacq. Bulb globose, 1 in. or less diam. lvs. 5–6, lanceolate, 6–9 in. long, 6–9 lines wide: peduncle or scape terete and stiff, 1 ft. high, bearing a dense subcorymbose raceme; fls. not keeled with green, white with yellowish eye; segms. oblong and obtuse, ¼in. broad, reflexing or turning back from near the base; style very short and stout. S. Afr. B.M. 653. B.R. 315.

Wilhelm Miller.
L. H. B.†

ORNÍTHOPUS (*bird's foot,* referring to form of pod). *Leguminòsæ.* A few plants allied to Coronilla and Scorpiurus, from the Canary Isls. through Eu. to W. Asia; and also in Trop. Afr. and S. Brazil. They are little known horticulturally. The fls. are very small, whitish, rose or yellow in umbels, papilionaceous; standard nearly orbicular; wings oblong; keel obtuse and nearly straight; stamens diadelphous: pod much exceeding the calyx, separating into 1-seeded joints or parts. They are slender spreading annuals with pinnate lvs. and axillary peduncles.

The genus is known in cult. in the serradella, a forage plant in Eu., but of very small importance in this country. It is *O. sativus,* Brot., of Spain and Morocco: slender-stemmed and much-branched annual, 1½–2 ft., with strong tap-root: lfts. many, ovate: fls. rose-colored, in few-fld. umbels. It is sown in early spring, 40–60 lbs. of seed to the acre. L. H. B.

OROBÁNCHE (old Greek; said to be given because the species strangle or kill the orobus or vetch). *Orobanchàceæ.* Broom-Rape. Parasitic herbs of purple or brown color, without green foliage, growing on the ground and attached to the roots of other plants. Other genera of the family are Aphyllon and Lathræa, which see. In Orobanche, the calyx is deeply divided into 2 or 4 pointed sepals; corolla broadly tubular or bell-shaped, often curved, more or less 2-lipped; stamens 4, in 2 pairs; ovary 1-celled.—About 100 species, if Aphyllon and some others are included, widely distributed, a number of them in Eu. They are scarcely horticultural subjects, although it is possible to grow them. Writing in The Garden (59, p. 93), Francis D. Horner, says that he was able to grow *O. speciosa* 3 ft. 8 in. high, with many showy fls., and that it began to bloom at 8 in. high. He establishes them on the roots of beans. He grows 3 or 4 beans in a 7-in. pot, and when they are 2 or 3 lvs. high and the roots well around the pot, orobanche seeds are sown over the damp surface. Before the beans are pot-bound, they are planted out with the ball of earth unbroken. The orobanche heads will appear in July. It is essential that the beans do not get into bloom before the seed of the parasite is sown, otherwise it will not get a sufficiently early start to ripen. When fls. of the parasite have turned into shades of brown and the stems have fallen, the plants are stored for seed, which is minute. L. H. B.

ÓROBUS (an old Greek name). *Leguminòsæ.* A genus not now kept separate, and referred mostly to Lathyrus, from which it was distinguished largely by its erect habit and lack of tendrils; some of the species now go to Vicia. Five species-names were found by Beal (Study of Genus Lathyrus, Cornell Bulletins) to be offered by American seedsmen: *O. niger* (=*Lathyrus niger*), *O. vernus* (=*Lathyrus vernus*), *O. lathyroides* (probably=*Vicia oroboides*), and *O. albus* and *O. superbus* which are probably horticultural forms of *Lathyrus vernus.* Abroad there are also listed *O. aurantiacus,* which may be *Vicia aurantia; O. canescens, O. azureus, O. varius, O. Smithii* with "creamy yellow fls., dwarf grower," which probably belong in Lathyrus.

ORÓNTIUM (one of many names arbitrarily applied by Linnæus; he probably had in mind some water plant growing in the Syrian river Orontes). *Aràceæ.* A hardy native aquatic plant, which bears in early spring yellow "clubs" on white stalks. The "club" is a cylindrical spadix 1 to 2 inches long.

Spathe usually soon deciduous; fls. hermaphrodite, covering the whole spadix; sepals scale-like, imbricated upon the ovary, usually 4 in the upper and 6 in the lower fls.; ovary 1-celled; ovule solitary, semi-anatropous: fr. a green utricle.—One species, found in swamps and pools from Mass. to Fla., mostly near the seacoast, but extending as far inland as Cent. Pa. and La.

aquáticum, Linn. Golden Club. Lvs. ascending or floating, according to the depth of the water, oblong-elliptic, no distinct midrib, but numerous parallel veins; blade 5–12 x 2–5 in.; stalk 4–20 in. long: scape ½–2 ft. long. B.B. 1:364. L.B.C. 5:402. R.H. 1888:85. Gn. 27, p. 213. G.M. 54:247.—The foliage is handsome, dark velvety green above, silvery below. The plant is very strong and deeply rooted, growing in water 10–18 in. deep. On account of its firm hold on the soil it may be planted in swifter water than most aquatics. It has the fault of being difficult to eradicate when firmly established. F. W. Barclay.

ORÓXYLUM (Greek, *a mountain tree;* nevertheless it grows anywhere from sea-level to an altitude of 3,000 ft.). Also written *Oroxylon. Bignoniàceæ.* An ornamental tree from S. Asia, with large opposite twice- or thrice-pinnate lvs.: fls. in terminal panicles; calyx leathery, campanulate, truncate or shortly toothed; corolla campanulate, white or purplish with 5 crisped and toothed lobes imbricate in bud; stamens 5, slightly exserted; disk large, fleshy: fr. linear, septicidally dehiscent; seeds broadly elliptic, compressed with a broad transparent wing.—A very striking plant with bold much-divided glossy foliage and ample terminal panicles of large white or purple fls. followed by very long and narrow pendulous caps. It is cult. outdoors in Calif, and in Eu. in greenhouses. Demands rich soil. Prop. by seeds and by cuttings with bottom heat.

índicum, Vent. (*Calosánthes índica,* Blume). Tree, to 40 ft.: lvs. 2–4 ft. across; lfts. ovate, entire, glabrous, about 5 in. long: racemes peduncled, to 10 in. long; fls. 2½ in. long and 2–3½ in. across: caps. 1–3 ft. long and 2–3 in. wide, compressed. India to Cochin-China and Malaya. Wight, Icon. 1337.

O. flàvum, Rehd.=Radermachia pentandra.

Alfred Rehder.

ORPINE, or **STONE CROP:** *Sedum,* particularly *S. Telephium.*

ORRIS-ROOT, or **IRIS-ROOT:** *Iris florentina* and others.

ORTHOCÁRPUS (Greek, *straight fruit,* which distinguishes this genus from Melampyrum). *Scrophulariàceæ.* Annual and perennial herbs, which may be transferred to gardens: lvs. alternate, incised, those in the infl. sometimes colored: fls. mostly white, yellow or cream-colored, sometimes marked, in spikes; corolla tubular, 2-lipped; calyx 4-cleft; stamens 4.—Species about 30, W. N. Amer., and 1 in S. Amer. *O. purpuráscens,* Benth., is something like the painted cup (Castilleja). It is a Californian annual, growing a foot high, with gaudy bracts, and crimson or purple corolla 1–1¼ in. long, the lower lip white-tipped and with yellow or purple markings. It is a common and showy plant growing in the Sierra Nevada foothills, the interior valleys and Coast ranges. This plant was offered in 1891. L. H. B.

ORTHÓSIPHON (name refers to the *straight tube*). *Labiàtæ.* Annual or perennial herbs sometimes sub-shrubs, of more than 100 species in the tropics from Afr. to Austral., little known in cult.: lvs. opposite or whorled, glandular-dotted: infl. terminal, sometimes with colored bracts at top, each whorl 2–6-fld., fls. variable in size; calyx unequally 5-toothed; corolla-tube mostly surpassing the calyx; corolla-limb 2-lipped, the upper lip shortly 3–4-lobed and the lower concave or boat-shaped; stamens 4, exserted; ovary deeply 4-lobed, the style filiform and exserted. *O. stamíneus,* Benth., is probably the species most likely to be found in glasshouses: 1–2 ft., glabrous or pubescent, the st. 4-angled: lvs. ovate, acuminate, coarsely toothed, petioled: fls. white or purplish, about 1 in. long, the corolla-tube thrice longer than calyx; stamens much exserted. India. B.M. 5833. G.Z. 29:145.

L. H. B.

ORTHROSÁNTHUS (Greek, *morning flower;* because the fls. open in the morning and fade before noon). *Iridàceæ.* Small plants for indoor use, listed with dealers among bulbs, bearing bright flowers on a scape arising from the clump of narrow leaves.

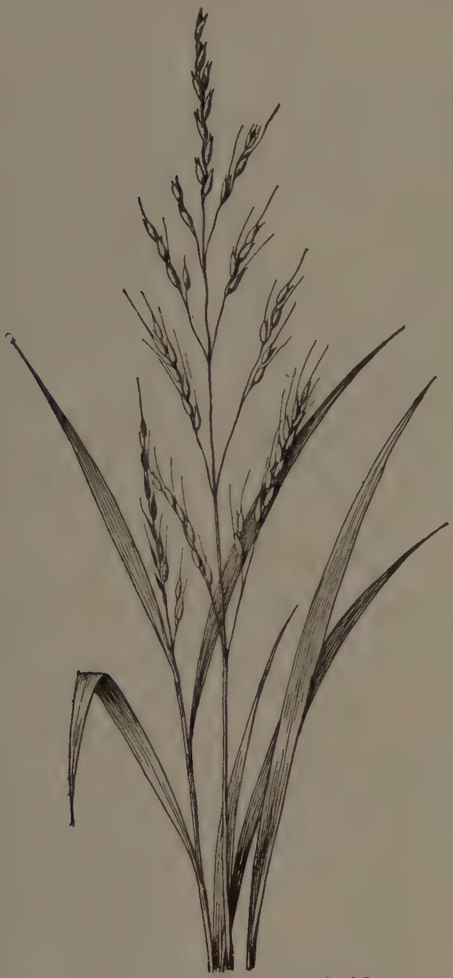
Orthrosanthus is a genus of 9 or 10 species, from Trop. or extra-Trop. Amer. and Austral. Rootstock short: lvs. firm, linear, equitant: clusters many-fld., panicled; fls. pale blue; pedicels so short that the caps. is not protruded from the spathe; perianth-tube very short or none; segms. oblong, nearly equal, spreading; filaments free or connate only at the base; ovary 3-celled; ovules many, superposed; style-branches alternating with the anthers: seeds minute. Very near Sisyrinchium which is a more variable genus, and has longer pedicels.

multiflòrus, Sweet (*Libértia azùrea,* Hort. *Sisyrinchium cyàneum,* Lindl.). Lvs. a dozen or more, 1–1½ ft. long, ⅛–⅙in. wide: panicle 4–6 in. long: caps. obtuse. S. and W. Austral. L.B.C. 15:1474. B.R. 1090.—*O. multiflorus* is a charming plant something like blue-eyed grass or sisyrinchium. It has a tuft of grassy foliage a foot or two high, and sky-blue 6-parted fls. an inch or more across, which open one after another for a week or so. Horticulturally it is classed among tender bulbs, although it has a short thick rhizome.

Wilhelm Miller.

ORỲZA (derived from the Arabic name, *Eruz*). *Gramíneæ.* Marsh plants, with fls. in panicles: spikelets 1-fld., laterally compressed; glumes 2, minute; lemma and palea about equal, keeled, scabrous, the former usually more or less awned.—Six species of the tropics, including *O. sativa*, Linn., the well-known rice of commerce. Dept. Agric., Div. Agrost. 20:49. This is a native of the Old World tropics, and is naturalized in Brazil; cult. extensively in China and India and more recently in the coast region of our southern states. Contrary to the usual supposition, rice paper is not made from rice, but from paper mulberry or bamboo.

A. S. Hitchcock.



2680. Oryzopsis racemosa. (×⅜)

ORYZÓPSIS (Greek, *orusa*, rice, and *opsis*, appearance, from a fancied resemblance to that grain). *Gramíneæ.* Mountain Rice. Mostly tufted perennials, with narrow panicles of rather large greenish one-flowered spikelets.

Glumes thin, nerved, nearly equal; lemma coriaceous, sub-cylindrical, with a short callus at base, and bearing a simple untwisted deciduous awn.—Contains about 24 species of temperate regions. Three of our native species are offered by dealers in wild plants.

racemòsa, Ricker (*O. melanocárpa*, Muhl.). Fig. 2680. Distinguished by its leafy culm, the lvs. broad and flat: panicle simple or compound; lemma blackish; awn about 1 in. long. Rocky woods, New England to Mo.—Blooms late in summer.

asperifòlia, Michx. This and the next have tufted, naked culms, the flat, concave or involute, rough-edged, evergreen lvs. crowded at the base; culms 9–18 in. high, bearing nearly bladeless sheaths; awn ⅓in. long. Northern states to Colo.—Blooms early in spring.

púngens, Hitchcock (*O. canadénsis*, Torr.). Culm 6–15 in.: lowest sheaths leaf-bearing: lvs. involute, filiform; awn very short, deciduous or wanting. Maine to Minn., on rocky hills; rare. Dept. Agric., Div. Agrost. 20:63.

miliàcea, Benth. & Hook. Perennial, 2–3 ft.: blades flat, ⅓in. wide: panicle loose and open, as much as a foot long, with spreading branches; spikelets 1½ lines long, with a deciduous straight awn 2 lines long. Eu.—A form of this (called also *Mílium Thómasii*, Duby, and *Piptathèrum Thómasii*, Kunth) with numerous sterile lower branches of the panicle, is sometimes cult. for ornament.

A. S. Hitchcock.

OSAGE ORANGE: *Maclura.*

OSBÉCKIA (Peter Osbeck, 1723–1805, student of Linnæus, Swedish naturalist). *Melastomàceæ.* About 60 species of herbs, subshrubs and shrubs in the tropical parts of the eastern hemisphere, only seldom cult. for the pink or reddish showy fls. that are borne in heads or panicles or sometimes solitary: usually erect, and scabrous or hispid: lvs. 3–7-nerved, somewhat serrate or entire: calyx-tube urn-shaped or nearly globose, hispid, the limb mostly 5-lobed and the lobes sometimes deciduous; petals commonly 5, obovate; stamens 10 as a rule, the anthers with mostly 2 tubercles at base: caps. small, in the dry calyx-tube. They are grown as warmhouse herbs. Perhaps *O. stellàta*, Wall. is the species most likely to be found in cult.: shrub, 6–7 ft. or less, with 4-angled branchlets: lvs. opposite, ovate-lanceolate, acuminate, 3–6 in. long, ciliate, 5-nerved: fls. lilac-red, in terminal few-fld. clusters; petals 4, nearly or quite orbicular, ciliate, 1½ in. long. India, China. B.M. 8500. J.F. 2:168.

L. H. B.

OSIERS are willows used for baskets and willow-ware in general. Some dogwoods are also sometimes called osiers. The various kinds are described under Salix and Cornus. Osier-culture is generally considered as belonging to general agriculture, rather than to horticulture, and is therefore not treated here.

OSMÁNTHUS (Greek, *fragrant flower*). *Oleàceæ.* Ornamental woody plants grown for their handsome foliage and the white fragrant flowers.

Evergreen shrubs or small trees: lvs. usually opposite, short-petioled, entire or serrate: fls. axillary or terminal, in cymes or short panicles, perfect, polygamous or diœcious; calyx short, 4-toothed; corolla short-tubular, with 4 imbricate lobes; stamens 2, rarely 4; ovary 2-celled: fr. an ovoid drupe with a 1-seeded stone.—About 10 species in E. and S. Asia, and Polynesia, and 1 in N. Amer. Sometimes united with Olea which differs chiefly in its valvate corolla-lobes.

The osmanthuses in cultivation are handsome shrubs with coriaceous rather large leaves and small white very fragrant flowers in axillary clusters followed in the fertile plants by ovoid bluish drupes but rarely produced in cultivation. The hardiest species is *O. Aquifolium* which is hardy in sheltered positions as far north as New York and possibly to Massachusetts. All the others are tenderer and can be grown only in the South and in California. In the North, *O. fragrans* is frequently grown as a greenhouse plant for its very fragrant flowers. It is of the easiest culture in an intermediate temperature. It is almost a continuous bloomer, although ordinarily it should be rested in late winter or summer in order to ripen the wood for fall and winter bloom. Be careful not to overpot, and keep the plant free from mealy-bug. Out-of-doors all the species prefer a place shaded from the mid-day sun. Propagation is usually by cuttings of half-ripened wood in late summer under glass; seeds are rarely obtainable and do not germinate until the second year; grafting on privet, as is sometimes done, is not to be recommended.

Greenhouse treatment of the Olea fragrans of gardens.—This fragrant plant can be grown in a cool house, one that has a night temperature of 45° to 50° in the winter months. The plants should be grown just as cool as possible in the summer months, and allowed to come into flower in their natural way, as they do not take kindly to any kind of forcing. About the first of June, they may be plunged outside in a partially shaded situation where they can be watered and syringed. By September, they may be placed in a cool and airy house where, by receiving care as to watering and ventilation, they will show bloom late in autumn or early winter. When they are through flowering, they may be repotted, using a compost of fibrous soil four parts, well-decayed cow manure one part, leaf-mold one part, and enough of sand to keep it porous.—They will root from ripened points of the young growth placed in sand in a warm propagating-bed. When rooted, they may be potted off into small pots, and grown on in a temperature of 50° to 55°, giving them shade and moisture until they become well established. Give repeated shifts as they fill the pots until they have reached a 7- or 8-inch pot. They may be kept for some time in good vigor by top-dressings and with liquid manure in these pots. When using the compost for these large pots, let the mixture be as lumpy as possible. Do not overlook the importance of giving them plenty of drainage as they will not tolerate anything like a stagnant compost. If the aphis bothers, give light fumigations for two or three nights. When scale shows itself, give a thorough sponging with some good insecticide. (J. J. M. Farrell.)

2681. Osmanthus fragrans. (×½)

A. *Corolla-tube shorter than the lobes or nearly as long: lvs. 1½–5 in. long.*

B. *Lvs. with small teeth or entire, 2½–7 in. long.*

fràgrans, Lour. (*Òlea fràgrans*, Thunb.). Fig. 2681. Small tree, to 30 ft., or shrub: lvs. elliptic to oblong-lanceolate, acute or acuminate, cuneate at the base, finely and sharply toothed or entire, reticulate beneath: fls. very fragrant, in clusters on slender pedicels ½–¾ in. long; corolla divided nearly to the base: drupe ovoid, about ½in. long. Early spring. Himalayas, China, S. Japan. B.M. 1552. L.B.C. 18:1786. Gt. 28, p. 276. G. 3:582. Gn. 19, p. 261.

americànus, Benth. & Hook. (*Òlea americàna*, Linn.). Devil-Wood. Florida Olea. Shrub or small tree, to 40 ft. with whitish bark: lvs. elliptic to lance-oblong, acute, narrowed into the short petiole, entire, lustrous above, 2½–7 in. long: fls. fragrant, in short panicles, on short pedicels or nearly sessile; corolla-lobes spreading, about as long as the tube: drupes ovoid, nearly 1 in. long. Early spring. N. C. to Fla. and Miss. S.S. 6:279, 280.

BB. *Lvs. with few coarse spiny teeth, rarely entire, 1–2 in. long.*

Aquifòlium, Sieb. (*Òlea Aquifòlium*, Sieb. & Zucc. *Òlea ilicifòlia*, Hassk.). Shrub or small tree, to 20 ft.: lvs. oval or ovate to elliptic-oblong, with 2–4 strong spiny teeth on each side, rarely entire, lustrous, 1–2 in. long: fls. fragrant, in axillary clusters, on slender pedicels about ⅓in. long; corolla divided nearly to the base, with reflexed lobes; sepals entire: fr. ovoid, ½–¾in. long. June, July. G.C. II. 7:239 (as *O. ilicifolius*); III. 2:379. S.I.F. 1:82. Var. **myrtifòlius,** Nichols. (*O. myrtifòlia*, Hort.). Lvs. smaller, entire, acute or acuminate. Gn. 50, p. 86. Var. **rotundifòlius,** Nichols. (*O. rotundifòlius*, Hort.). Lvs. about 1 in. long, often obovate, entire or with short obtusish teeth; a dwarf slow-growing form. Var. **atropurpùreus,** Schneid. (*O. Aquifòlium* var. *ilicifòlius purpùreus*, Nichols.). Foliage purplish black while young, later green with purple tinge. Var. **argénteo-marginàtus,** Hort., with white, and var. **aùreo-marginàtus,** Hort., with yellow variegation. —*O. Aquifolium* has often been confused with *O. Fortunei* (see suppl. list) and the true *O. Aquifolium* distinguished as var. *ilicifolia* or *O. ilicifolia*.

AA. *Corolla-tube much longer than the lobes, ⅓–½in. long: lvs. ½–1 in. long.*

Delavàyi, Franch. Shrub, to 6 ft.: young branchlets finely pubescent: lvs. ovate or ovate-elliptic, acute or obtusish, cuneate or rounded at the base, sharply or indistinctly toothed: fls. in terminal, 5–8-fld. cymes, fragrant, white; pedicels short; anthers inclosed in the tube: fr. ovoid, bluish black. Early spring. S. W. China. B.M. 8459. R.H. 1912, p. 173. Gn. 75, p. 178. G. 33:225. V.F. 185. G.C. III. 55:269. G.M. 57:336.

O. armàtus, Diels. Allied to O. fragrans. Shrub: lvs. oblong-lanceolate to lanceolate, remotely spiny-toothed, 3–4 in. long: fls. in axillary clusters, on stout pedicels scarcely ¼in. long. Cent. and W. China.—*O. buxifòlia*, Hort., is probably Olea capensis, Linn., a shrub from S. Afr.—*O. Fórtunei*, Carr. (O. japonicus, Makino). Probably hybrid of O. Aquifolium and O. fragrans. Lvs. elliptic-ovate to oblong-ovate, with few spiny teeth or many small teeth, 3–4 in. long: sepals denticulate. R.H. 1864, p. 70. G.C. II. 6:689; 7:239. Gt. 28, p. 277.—*O. latifòlia* and *O. ligustrifòlia* of the trade are probably phillyreas.

Alfred Rehder.

OSMARÒNIA (derivation doubtful). Syn., *Nuttállia. Rosàceæ*, subfamily *Prùneæ*. Osoberry. Ornamental woody plant grown for its handsome foliage and early-appearing flowers.

Deciduous shrub or small tree: winter-buds stalked, with few imbricate scales: lvs. alternate, short-petioled, entire, with deciduous small stipules: fls. polygamo-diœcious or diœcious, white, in racemes; calyx campanulate; petals spatulate-oblong; stamens 15, 10 inserted with the petals, 5 below, with very short filaments; carpels 5; styles not exceeding the calyx-tube: fr. consisting of 1–5 oblong drupes with thin flesh and smooth stone.—One or possibly more species in W. N. Amer.

The osoberries are usually shrubs with upright clustered stems, bright green generally oblong rather large leaves and with rather small white flowers appearing with the leaves in pendulous racemes followed by bluish black oblong drupes. The flowers resemble somewhat those of *Ribes americanum*. Hardy as far north as Massachusetts in somewhat sheltered positions, but sometimes injured by late frosts, as it leafs and flowers very early. It prefers a humid soil and a partly shaded situation. Propagation is by seeds sown after maturity or stratified, and by suckers.

cerasifórmis, Greene (*Nuttállia cerasifórmis*, Torr. & Gray). Shrub, 6–15 ft., sometimes tree-like: branchlets glabrous: lvs. oblong-lanceolate, acute at both ends, glabrous above, pubescent beneath, 3–4 in. long: racemes short-peduncled, 5–10-fld., glabrous; pedicels with 2 bractlets; fls. about ½in. across; petals about as long as calyx-tube, the triangular sepals half as long: drupe ¼–⅓in. long, bluish black, bloomy. April, May: fr. in July, Aug. Brit. Col. to Calif. G.C. II. 19:309; III. 19:489; 43:266, 267. Gn. 34, p. 78. L.I. 9.—Greene has described 5 more species of which *O. demissa*, Greene, seems the most distinct and is probably occasionally cult. in Calif. It is a low shrub, 2–4 ft. high, with rigid upright sts.: lvs. smaller, mucronate, glabrous, prominently veined: racemes numerous, denser; sepals ciliolate: drupes more rounded, very bloomy. San Francisco Bay region.

Alfred Rehder.

OSMORHÌZA (Greek; referring to the sweet, aromatic, edible roots). *Umbellíferæ*. A small genus of native herbs, 1 to 3 feet high, sometimes called sweet cicely, but the true sweet cicely is *Myrrhis odorata*, a closely allied European plant, the leaves of which have the scent of anise seed and are used in flavoring. Sometimes listed by dealers in native plants.

Perennial, slender, hirsute or glabrous, with thin soft foliage: lvs. ternately compound, the lfts. ovate and toothed: fls. very small, white, in small few-rayed umbels; calyx-teeth obsolete: fr. linear, glabrous or bristly; carpel slightly flattened dorsally or not at all; styles long or short; seed-face from slightly concave to deeply sulcate: root thick, aromatic. By some botanists, the name Washingtonia is used for this genus. The plants thrive in moist more or less shady woodsy places.

A. *Fr. with prominent caudate attenuation (2–4 lines long) at base, very bristly.*

B. *Style a line or more long.*

longístylis, DC. Stout, glabrous or slightly pubescent. Canada to Va. and west to Dakota. B.B. 2:530.—Roots with a stronger smell and taste of anise than *O. Claytonii*. Brotherton says it is a much prettier plant than the next, with larger umbels.

BB. *Style half a line or less long.*

Clàytonii, Clarke (*O. brevistylis*, DC.). Rather stout, villous-pubescent: lvs. 2–3-ternate: rays stout, 1–2 in. long; style and stylopodium half a line long. Canada to N. C. B.B. 2:530.

nùda, Torr. Rather slender, glabrous, 2½ ft.: lvs. somewhat hispid, biternate, the lower ones 5 in. long; lfts. ovate to elliptic, 3-lobed, serrate: rays of umbel, 4 in. or less long, the involucels none: fr. rather more than ½in. long. Calif.

AA. *Fr. without caudate attenuation at base.*

occidentàlis, Torr. (*Mýrrhis occidentàlis*, Benth. & Hook.). Rather stout, puberulent or pubescent: lvs. 2–3-ternate; lfts. 1½–4 in. long: umbel 5–12-rayed; rays 1–5 in. long; stylopodium and style ½–1 line long. Sierras to Wash., east.

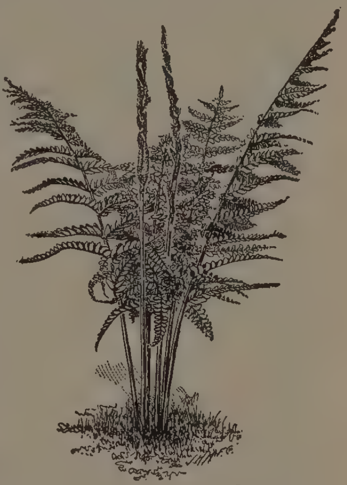
L. H. B.†

OSMÚNDA (from *Osmunder*, a name of a Saxon god). *Osmundàceæ*. A small group of larger ferns, with rather coarse foliage, but highly ornamental from their clustered habit. The sporangia are formed in panicles borne on the veins of reduced lvs., provided with a rudimentary transverse ring and opening vertically.

Osmundas are strong-growing ferns of vigorous constitution, and well adapted for general culture in any fertile soil which is not over-dry. They are deep-rooted ferns and, therefore, require considerable depth of soil. All the species do well in full sunlight, but the most satisfactory position for all the species would be a deeply dug thoroughly enriched border lying north of a wall. *O. regalis* reaches perfection only in rich wet swamps in full sunlight or thin shade, where it may attain a height of 8 feet. *O. Claytoniana* prefers rich peaty soil in moist but not wet, open or partially shaded positions. It may attain a height of 6 feet. *O. cinnamomea* is naturally a fern of the swamp, though not in such wet positions as *O. regalis*. It grows most luxuriantly in partial shade. In a wild state it frequently attains a height of 6 feet. (F. W. Barclay.)

A. *Lvs. fully bipinnate.*

regàlis, Linn. Royal Fern. Growing in clumps 2–10 ft. high, some of the lvs. bearing panicles at their apices; pinnæ 1–2 in. long, rounded at the base and usually blunt. Well adapted for open, moist places. E. N. Amer. and Japan.—Commonly called royal fern, flowering fern or king-fern. *O. japónica*, Thunb., is a form with the sporophylls forming distinct lvs. and soon withering away; various crested forms appear in cult. *O. grácilis*, offered by some dealers, is probably a S. American form of *O. regalis*. *O. palústris* and varieties belong also with *O. regalis*. This is a diminutive form from Brazil, with slender elegant fronds, abundantly produced from a woody rootstock. S. 3:30, and p. 42. G. 37:423. Var. *Màyi*, G.C. III. 40:161, and var. *crispàto-congésta*, a dwarf form, are both forms of *O. palustris*.



2682. Cinnamon fern.—Osmunda cinnamomea.

AA. *Lvs. bipinnatifid only.*

cinnamòmea, Linn. Cinnamon Fern. Fig. 2682. Growing in clusters 2–6 ft. high or even more, the fertile lvs. appearing earliest, entirely covered with sporangia, at first green, but becoming pale, tall, and slender, cinnamon-colored at maturity of the spores, the sterile lvs. growing about a crown from a large creeping rootstock. N. Amer.—Very handsome for decorative purposes, especially for low grounds. The creeping sts. of this species and of the other two osmundas are always covered with a very dense tangled growth of blackish fibrous roots. These are dug up and shaken free of soil, and are then largely used as the matrix upon which to grow orchids and other epiphytes. (See *Osmundine*.)

Claytoniàna, Linn. Interrupted Fern. Lvs. growing in crowns, with the sporangia confined to a few (4–10) of the median pinnæ of the lf., and of a dark brown color. Similar to the preceding, but lacking the tuft of wool in the axils of the pinnæ which characterizes the cinnamon fern. N. Amer., Japan; said also to grow in India.

R. C. Benedict.†

OSMUNDINE. The material now so largely used in this country, and also exported to Europe in quantities for the rooting medium in which to grow epiphytal orchids. Not long ago it was considered necessary to send to England for peat for this purpose, and the word peat used in this connection meant the roots of the bracken, *Pteris aquilina,* when growing in bog-mold. The supply of this became exhausted, owing to the enormous growth of the orchid cultivation, and it was necessary to find a substitute. The first thing tried was the mats of root-fibers of the common *Polypodium vulgare* as found growing on trees in large masses in the moist climate of Ireland. This was composed of a clear light brown fiber with a little humus, and could be torn off the branches in large mats 2 or 3 inches in thickness, and when cut up in suitable pieces made excellent material. However, the supply was soon exhausted and Belgium furnished a quantity which is still being used to some extent. In the meantime the roots of the two species of Osmunda so common and so widespread in this country, *O. cinnamomea* and *O. Claytoniana,* have been found to give very excellent results. These two ferns make huge masses of roots above the level of the soil, sometimes several feet square, and when these are grubbed up, or rather off the ground, sawed in slabs with a cross-cut saw, the fern rhizomes taken out, two grades of material are obtained in which any orchid will grow. The fiber at the base is coarse, black, and contains some earthy matter, and is very suitable for the culture of cypripediums, cœlogynes, and other orchids like the lycastes that are more or less terrestrial. For orchids with the characteristic white aërial roots, the brown upper part of the osmundine is most suitable, as it is sponge-like in color and texture, and will not decay or become unsuitable for at least three years. Care must always be taken in potting orchids to make all firm, or too much moisture will be held in suspension by the osmundine for the roots to ramify and do well.

In cattleyas imported from their native habitats, mats of polypodium are often seen which, together with the orchid roots, enable the plants to anchor securely to the trees. The nature of these fern-masses is identical with that of osmundine except that they are living, whereas the osmundine is not. It is well to use the osmundine as soon as possible after being cut up from the original piece. The pieces are best gathered in autumn, stored in a dry place for the winter's work, and cut up as needed, and if any are not used, place the clumps outdoors for the summer in a shady place where they will grow on indefinitely until wanted for use.

The collection, manufacture, and export of osmundine is now quite a large industry, and the United States is supplying practically all the orchid-growing world with an admirable material, often in thousand-barrel lots, at a price below that of any other kind, with the additional advantage of being more durable than any other. The osmundas named are indigenous to all the eastern states, but the osmundine industry is confined at present to New York because of easy shipment. *Osmunda regalis* is not used, as it is more often found in swamps, and the root-fiber is likely to be sour. Moreover this species does not make the large clumps that the others do, making it unprofitable to gather them.

E. O. Orpet.

OSOBERRY: *Osmaronia.*

OSTEOMÈLES (Greek, *stone apple* or *stone fruit*). *Rosàceæ,* subfamily *Pòmeæ.* Ornamental shrubs, sometimes grown for their graceful foliage and white flowers.

Evergreen: lvs. alternate, pinnate, with linear stipules; lfts. small, entire: fls. in terminal corymbs; calyx-teeth small, acute; petals 5, ovate-oblong; stamens 15–20; styles 5, distinct; ovary inferior, 5-celled, each cell with 1 ovule: fr. a small pome with persistent calyx and 5 1-seeded stones.—Three species in E. Asia and Polynesia. Closely related to Pyracantha and Cotoneaster, but easily distinguished by the pinnate lvs. The S. American genus Hesperomeles, with about 10 species, of which none seems to be in cult., is sometimes united with Osteomeles; it has simple lvs. and is apparently more nearly allied to Cratægus.

These plants are slender-branched shrubs with evergreen small pinnate foliage, and white flowers followed by bluish black berry-like fruits. All three species are in cultivation at least in Europe, but can be grown only in subtropical or warmer temperate regions, the hardiest being probably *O. Schwerinæ.* They prefer a sunny position and well-drained soil. Propagation is by seed sown soon after maturity, but it germinates slowly, sometimes not until the second year, or by cuttings of half-ripened wood in July and August under glass; it also may be grafted on cotoneaster.

anthyllidifòlia, Lindl. Shrub, to 6 ft., or more: young branchlets densely villous: lfts. 13–19, obovate-oblong or oblong, mucronate or obtuse, pubescent on both sides while young, later glabrous and lustrous above, silky pubescent beneath, ⅓–½in. long: corymbs 1–1½ in. across, grayish villous; fls. ½in. across; styles villous: fr. subglobose, bluish black, villous at first, finally nearly glabrous, about ¼in. thick, sweet. Spring. Hawaiian Isls. to Pitcairn Isl. Trans. Linn. Soc. 13:8. —In the Hawaiian Isls. known as "uhi-uhi."

O. Schwerìnæ, Schneid. Shrub, to 10 ft.: lfts. 17–23, oblong or narrow-oblong, acute, ⅙–⅓, rarely ½in. long, slightly pubescent or nearly glabrous: corymbs loose, slightly villous: fr. glabrous. S.W. China. B.M. 7354, G. 27:219, and G.C. III. 50:433 (as O. anthyllidifolia).—*O. subrotùnda,* Koch. Low shrub: lfts. 11–17, obovate-oblong, obtuse: corymbs and calyx silky pubescent. S. Japan, S.E. China. H.I. 27:2644.

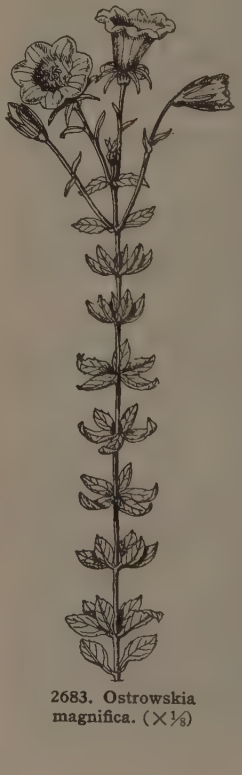
Alfred Rehder.

OSTEOSPÉRMUM (Greek, *bone seed*). *Compósitæ.* A group of South African yellow-flowered shrubs or subshrubs, scarcely in cultivation.

Leaves alternate or rarely opposite: heads many-fld. radiate; pistillate fls. all rays; staminate fls. all disks, with abortive ovules and style; involucre in few rows, the scales free: achenes of the ray drupaceous or nut-like, thick, very hard, glabrous and without pappus.—Thirty-eight species are known, all S. African. In Flora Capensis 3:433–436, the whole group is monographed.

monilíferum, Linn. Shrubby, yellow-fld., grows 2–4 ft. high, and was offered in 1891 in southern Fla. It is a usually unarmed, much-branched, subshrub with leathery lvs. about 1½ in. long. It is known in Austral. as the "bushtick berry." It appears to have dropped out of cult. There are many natural varieties, none of which seems to be known in cult.

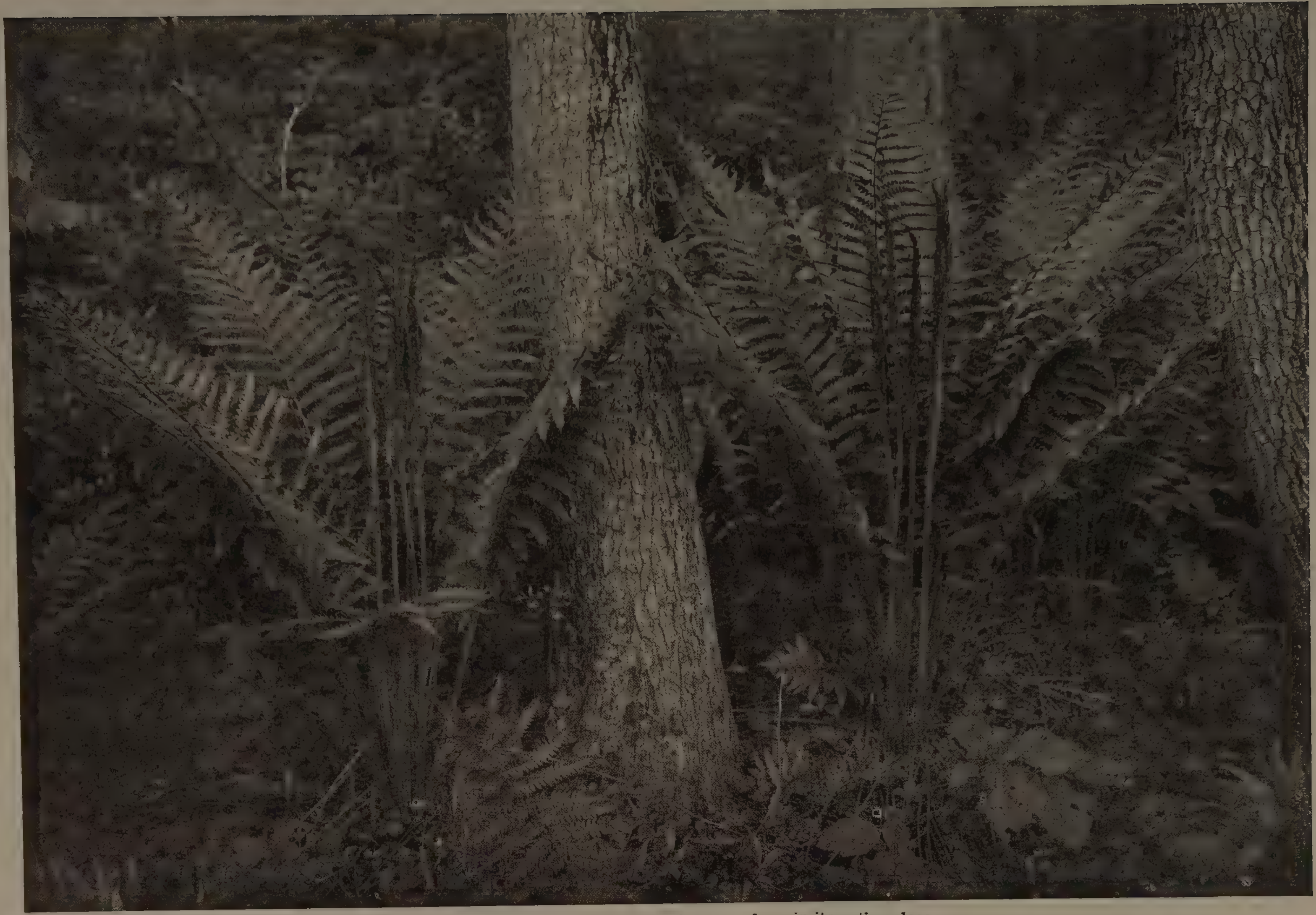
N. Taylor.



2683. Ostrowskia magnifica. (×⅛)

OSTRÒWSKIA (after N. ab Ostrowsky, Russian patron of science). *Campanulàceæ.* GIANT BELL-FLOWER. One species, a very large-flowered perennial herb.

Very closely allied botanically to Campanula but distinguished, according to Hooker, by the whorled lvs., the numerous divisions of the calyx and



LXXX. Osmunda cinnamomea, the cinnamon fern, in its native place.

lobes of the corolla and of the cells of the ovary and stigmas, and by the pores in the caps. double the number of sepals.—The single species is a stately plant of Cent. Asia, first described as recently as 1884, and exhibited in England in 1888. It is a hardy plant, prop. readily by seeds if they are sown as soon as mature, although the plants may not bloom under 3 or 4 years. The long tuberous roots do not bear division well and this is probably one reason why it is not more popular with dealers.

The reason for *O. magnifica* not being catalogued in this country is the difficulty in its successful growing and over-wintering. It requires a light sandy soil, rich in humus and of considerable depth, for the roots of the thick fleshy stock go down deep. A high ground and open sunny exposure are a necessity. After the flowering season, plants like oriental poppies and ostrowskia dry up and should be kept dormant. To prevent growing in autumn, plantations should be protected from excessive moisture. A slopy ground with good drainage is of advantage. For winter cover, dry pine-needles covered with tar-paper are best; leaves will also answer, but by all means avoid manure protection. In early spring, the young growth needs to be protected from late frosts. Treated this way, ostrowskias can be grown in this country and are indeed beautiful border plants.—Propagation is by root- or top-cuttings in spring. Seeds unless sown fresh, require a long time for germination. Seedlings require from three to four years cultivating before reaching a really effective size. (Richard Rothe.)

2684. Ostrya virginiana.—Hop hornbeam. (×¼)

magnífica, Regel. Giant Bell-Flower. Fig. 2683. Tall strict glabrous herb, 4 or 5 ft. or more high, simple, with tuberous roots: lvs. in distant whorls of 4 or 5, ovate, toothed, short-stalked, 4–6 in. long: fls. 4 in. across at the mouth, pale lilac, but varying somewhat in tint; corolla broad-campanulate, the tube 2 in. long and ribbed, the lobes short and broader than long; calyx-lobes 2 in. long, spreading or recurved; floral parts 5–9, usually 7; style large, thick, yellow. E. Bokhara, at 7,000 ft. B.M. 7472. G.C. III. 4:65; 47:400, 401. Gn. 34:604; 52, p. 481; 64, p. 381; 73, p. 375; 75, p. 382; 77, p. 361; 78, p. 374. J.H. III. 60:493. Gt. 50, p. 431. G.W. 4, p. 387. Gn.W. 20:313. G. 30:351; 34:259. G.M. 31:459, 461; 51:765. R.H. 1893:472 and p. 473; 1888, p. 344. I.H. 35:71. S.H. 1:437. G.F. 6:276. A.F. 4:331.

L. H. B.†

ÓSTRYA (ancient name). *Betulàceæ.* Hop Hornbeam. Trees grown for their handsome foliage.

Deciduous: winter-buds conspicuous, pointed: lvs. alternate, doubly serrate, plaited on the straight veins, with oblong or lanceolate stipules: fls. monœcious, in catkins; the staminate catkins slender, pendulous, with 3–14 stamens in the axil of each bract; filaments forked; pistillate upright, slender, with 2 fls. in the axil of each bract; the 2-ovuled ovary crowned by 2 slender stigmas and inclosed in a tubular involucre: fr. a nutlet inclosed by the bladder-like involucre; the inflated involucres loosely imbricated to form a strobile, resembling that of the hop.—Four closely related species in N. Amer., Eu., and E. Asia. From Carpinus distinguished by the bladder-like involucre.

The hop hornbeams are small or medium-sized trees with slender spreading branches forming a round or open head, with handsome bright green foliage, and rather inconspicuous flowers appearing with or before the leaves, followed by the attractive light green strobiles contrasting with the darker foliage. They are hardy and slow-growing, well adapted for planting in dry and exposed localities. The heavy and tough, very close-grained wood is used chiefly for fence-posts, handles of tools and other small articles. Propagation is by seed sown soon after maturity or stratified, otherwise it will usually not germinate until the second year; rarer kinds may be grafted on a common species or on the hornbeam.

virginiàna, Koch (*O. virgínica,* Willd.). Fig. 2684. Tree, to 30, occasionally to 50 ft.: lvs. oblong-ovate, acuminate, glabrous above, pubescent on the veins below, with 11–15 pairs of veins, 3–5 in. long: strobiles slender-stalked, pendulous, 1½–2½ in. long; nutlets spindle-shaped glabrous or nearly so. Dry woods. Cape Breton to Minn., south to Fla. and Texas. S.S. 9:445. Gn. 24, pp. 230, 231.—The lvs. change to clear yellow.

O. carpinifòlia, Scop. (O. vulgaris, Willd. O. italica, Winkl. O. virginiana var. carpinifolia, Schneid.). Tree, to 30 or occasionally 50 ft.: lvs. short-acuminate, pubescent on both sides while young: nutlet ovoid, pubescent at the apex. Eu. R.H. 1905, pp. 188, 189. H.W. 2:18, p. 35. G.C. III. 8:274. Gn. 24, p. 231. G. 7:689.—*O. japónica,* Sarg. (O. virginiana var. japonica, Schneid.). Tree, to 60 ft.: lvs. pubescent beneath: strobiles shorter; nutlets glabrous at the apex. Japan. G.F. 6:384. S.I.F 1:25.—*O. Knòwltonii,* Coville. Tree, to 30 ft.: lvs. ovate or elliptic, obtuse or acute, 1–2 in. long: strobiles 1–1½ in. long; nutlets minutely pubescent. Ariz. G.F. 7:115. S.S. 9:446.

Alfred Rehder.

OSTRYÓPSIS (meaning *Ostrya-like*). *Betulàceæ.* A shrub most nearly related to Ostrya, but frs. tightly inclosed by the 3-parted involucre collected into slender-stalked heads or short racemes: anthers and filaments not divided. In habit and foliage it resembles Corylus. The only species is **O. Davidiàna,** Decne. Low shrub: winter-buds obtuse: lvs. ovate, doubly serrate and slightly lobed, pubescent beneath, 1½–2 in. long: involucre narrowed above the nutlet, ½in. long. N. and W. China, Mongolia. L.I. 3.—Has proved hardy at the Arnold Arboretum. Cult. and prop. like ostrya or corylus.

Alfred Rehder.

OTAHEITE. Tahiti or Tahitian, for an island in the South Pacific, under French rule, as the Otaheite orange and Otaheite mulberry.

OTHÈRA JAPÓNICA: *Ilex integra.*

OTHÒNNA (ancient Greek name, of no particular application here). *Compósitæ.* Herbs and shrubs, of which one is in cultivation as a window-garden plant.

Heads usually yellow, with fertile rays and sterile tubular disk-florets; torus convex or somewhat conical, usually honeycombed; scales of involucre in one series, more or less united to the base, valvate; style of disk-fls. not divided: achenes oval, with bristle-like pappus in many rows or series.—About 80 S. African species, of which only one appears to be in general cult., and this has no established vernacular name in this country, although it is sometimes dubbed "little pickles" because of its cylindrical pulpy lvs.

The plant shown in Fig. 2685 is commonly known as *Othonna crassifolia,* but thereby arises a puzzle in nomenclature. By Linnæus a certain flat-leaved plant was called *Othonna crassifolia.* Subsequently some of the species of Othonna were separated by Jaubert & Spach into a distinct genus, Othonnopsis, distinguished by involucral scales distinct and style of the disk-florets two-parted. One of the plants relegated to this new genus was *Othonna cheirifolia,* Linn., which then became *Othonnopsis cheirifolia,* Jaubert & Spach. Bentham & Hooker consider Linnæus' *Othonna crassifolia* to be a horticultural form of *Othonnopsis cheirifolia.* It was therefore a natural sequence to say that the *Othonna crassifolia* of horticulturists is properly *Othonnopsis cheirifolia*, a statement which the writer made in the revision of Gray's "Field, Forest and Garden Botany."

2685. Othonna crassifolia. A yellow-flowered trailing plant with succulent leaves.

It turns out, however, that the *Othonna crassifolia* of horticulturists is not the *Othonna crassifolia* of Linnæus (if he has been correctly reported). The former plant is a true Othonna. It is the *Othonna crassifolia* of Harvey; but since this name *crassifolia* was used by Linnæus, it leads to confusion to use it again in the same genus, and Harvey's plant might take some other name. In fact, before Harvey's time, the name *Othonna crassifolia* was used by Meyer for still another species. The *O. crassifolia* of Harvey was once described as *O. filicaulis*, but this name also has been previously used in the genus. It seemed to the writer, therefore, as if a new name must be given to the *O. crassifolia* of Harvey and of the horticulturists, and this was done in the Cyclopedia of American Horticulture (*O. capensis*); but under the International Rules, Harvey's name may hold since the other crassifolias are clearly synonyms. What, now, is Linnæus' *Othonna crassifolia?* As early as 1771, this plant was figured in color by Philip Miller as the "*Othonna foliis lanceolatis integerrimis*" of Linnæus' "Hortus Cliffortianus." It was figured again by Edwards in 1818 (B.R. 266). It is an upright or ascending undershrub, with flat leaves reminding one of leaves of the stock. It is described in the European books, but is probably not in commercial cultivation. It is native to the north of Africa. A reproduction of part of Philip Miller's picture of the plant, reduced in size, is shown in Fig. 2686.

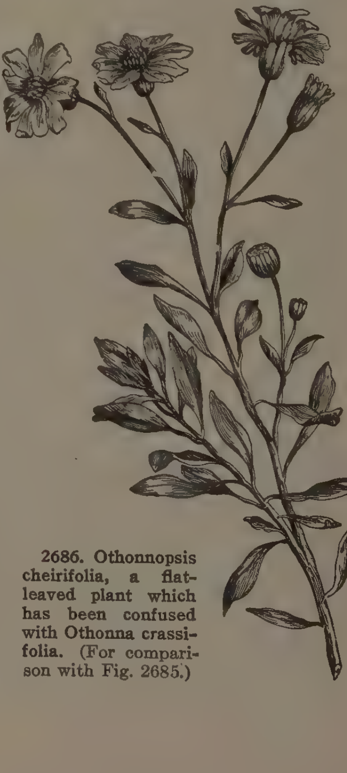
crassifòlia, Harv., not Linn. nor Mey. (*Othónna capénsis*, Bailey). Fig. 2685. Perennial, becoming shrubby at base in its native country, glabrous, with slender trailing or drooping sts.: lvs. 1 in. or less long, fleshy and cylindrical-obovoid, sharp-pointed, either scattered or in clusters: pedicels 2–6 in. long, ascending, slender; heads nearly or quite ½in. across when well grown, the narrow, bright yellow rays wide-spreading. S. Afr. V. 3:117; 10:138.—An excellent plant for hanging-baskets, for it withstands extremes of moisture and temperature. It is readily prop. by planting pieces of the sts. It blooms in nearly all seasons. Fls. open only in sun. L. H. B.

OTTÈLIA (from a name in Malabar). *Hydrocharitàceæ.* Perhaps two dozen fresh-water herbs of the tropics and subtropics of both hemispheres, some of which may be useful as aquatics: lvs. both submerged and floating; the latter with long petioles, the blades lanceolate, ovate or cordate: scape elongated, bearing a fl. in a winged spathe; calyx 3-lobed; petals 3, yellow or white, much longer than calyx-lobes; stamens 6–10 or more, bearing erect anthers: fr. 6-valved, inclosed in the spathe. *O. alismoìdes*, Pers. (*Stratiòtes alismoìdes*, Linn.) is of wide distribution. Afr. to Austral.: perennial, the lvs. arising from the base on long 3-angled petioles; blades broadly cordate, or rounded, obtuse, 2–6 in. or even more long or broad, 7–11-nerved: fls. white, the petals broadly ovate and 1 in. long. B.M. 1201 (as *Damasonium indicum*). G.W. 14, p. 658.—The plants are said to be eaten as pot-herbs by natives. L. H. B.

OURÀTEA (vernacular name in Guiana). Syn. *Gómphia. Ochnàceæ.* Tropical American shrubs and trees of minor importance horticulturally but sometimes grown for the yellow mostly paniculate fls. and evergreen foliage; glabrous: lvs. shining, stiff, alternate, serrate or toothed: sepals and petals 5; receptacle or torus prolonged into a gynophore; stamens 10, attached on base of torus, erect and connivent, the filaments very short; ovary deeply 5- or 6-parted: fr. 5 or less drupes, sessile on the enlarged torus or disk. *O. cuspidàta*, Engler (*Gómphia cuspidàta*, St. Hil.), from Brazil, is mentioned in horticultural literature abroad: shrub 3–6 ft.: lvs. alternate, elliptic, to 6 in. long, minutely toothed: fls. yellow, about ½in. across, in a terminal simple or branched panicle; petals obovate, more or less crisped. *O. olivæfórmis*, Engler (*O. décorans*, Baill. *Gómphia olivæfórmis*, St. Hil. *G. décorans*, Lem.). Tall shrub from Brazil: lvs. broad-lanceolate, shining, finely serrulate: fls. bright yellow, in a large dense terminal raceme; petals obovate and broad. B.M. 5262. G 27:325. Gn. 62, p. 339 (note). J.F. 4:415. L. H. B.

OURÍSIA (Governor Ouris, of the Falkland Islands). *Scrophulariàceæ.* Small herbs, used in alpine gardening and for borders.

Perennial, rarely somewhat woody at the base, usually dwarf, decumbent or creeping a short distance, glabrous or sparsely hairy: lvs. opposite, nearly all radical, crenate or entire: fls. either axillary and solitary, or in a raceme at the apex of a scape, usually scarlet or rose-colored; corolla-tube cylindrical or slightly bell-shaped at the throat, mostly somewhat curved, lobes nearly equal; stamens 4, didynamous; style entire: caps. 2-celled.—About 20 species in Tasmania, New Zeal., S. Amer.



2686. Othonnopsis cheirifolia, a flat-leaved plant which has been confused with Othonna crassifolia. (For comparison with Fig. 2685.)

coccínea, Pers. Hardy herbaceous perennial, sparsely hairy: lvs. mostly radical, long-stalked, heart-shaped, unequally lobed and crenate: scape furnished with 1- or 2-stalked lvs. at the base, and pairs of toothed bracts, from which the pedicels arise; calyx-lobes 5, short, spreading. Chile. B.M. 5335. G.M. 50:633.

macrophýlla, Hook. (*O. robústa,* Col.). To 2 ft. high, from a short decumbent rhizome, mostly somewhat hairy: radical lvs. long-petioled, the blade 1–5 in. long and ovate to orbicular-oblong, crenate, thinnish; st.-lvs. only 1 or 2 pairs, sessile: fls. large (to ¾in. diam.), white or with purplish streaks, in whorls or sometimes in a few-fld. umbel; corolla villous within. the lobes obovate and retuse. New Zeal. B.M. 8295. G.C. III. 45:390. J.H. III. 66:583. Gn. 73, p. 435. G. 34:641.—A good plant for blooming under glass in spring.

O. Cockaynidna, Petrie. A New Zeal. species forming large matted patches, reported in England: sts. 3–6 in. or more long, creeping and rooting: lvs. ovate or ovate-spatulate, obtuse, crenate, with sheathing petioles: peduncles few-fld. and 3–6 in. high, bearing large white fls.

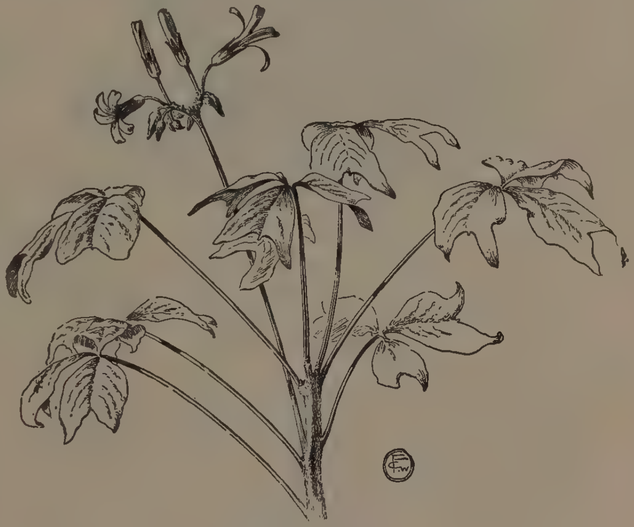
L. H. B.†

OUVIRÁNDRA (Madagascar name meaning *water yam,* referring to the edible tubers). *Aponogetonàceæ.* The lace-leaf or lattice-leaf plant, *O. fenestralis,* is one of the most distinct and interesting plants in cultivation It grows in Madagascar, its skeletonized leaves floating just under the surface of the water. The genus is now included with *Aponogeton,* which see.

ÓXALIS (Greek, *sharp,* referring to the usual acidity of the foliage, which also gives the common name of sorrel). *Oxalidàceæ,* formerly treated as a division of *Geraniàceæ.* Mostly bulbous or tuberous herbs with clover-like leaves, usually cultivated as hanging-basket or window plants for their flowers; a few are used in salads and several South American species like *O. Deppei* (Gn. 8, p. 43) furnish edible roots or tubers.

Annual, or with a bulbous, tuberous or creeping, perennial rootstock: lvs. alternate, mostly digitately compound (3-foliolate in the native species): peduncles axillary, 1- to several-fld.; sepals and petals 5; stamens 10, monadelphous at base, 5 longer and 5 shorter; ovary 5-celled; several ovules in each cell; styles 5: caps. loculicidally dehiscent.—Over 400 species mostly of S. Afr. and the warmer parts of Amer. The fls. usually close at night and in cloudy weather, and the lvs. "sleep" at night (Fig. 2690). Trimorphic heterogone fls. occur in many species; our native *O. violacea,* sometimes grown as a hardy perennial, presents long- and short-styled fls.; and our common native yellow-fld. species offer puzzling transitions between heterogone and homogone types. The small seeds are interestingly discharged from the fr. by the pressure of a fleshy outer envelope. The classical works on the genus are Jacquin's Oxalis Monographia (1794) and Zuccarini's Monographie der Amerikanischen Oxalis-Arten, and its Nachtrag (1825–31). Many of the earlier species, characterized by the relative length of stamens and styles, prove to be long-, short-, and mid-styled forms of identical species. The principal groups are sometimes segregated as distinct genera.

Generally speaking, the genus Oxalis is not highly esteemed by the florists. However, several species and varieties are used in masses for floral displays in botanical collections. The noteworthy species occasionally seen are *O. Bowiei, O. lasiandra* and its varieties *alba, cærulescens* and *lilacina, O. variabilis* and its varieties *alba* and *rubra, O. Simsii,* and *O. rosea.* When used for display during February or March, the bulbs or tubers should be cleaned and divided into convenient sizes during August or September. Excellent results may be accomplished by potting three bulbs, forming a triangle in each 4-inch spot, placing them just below the surface of the soil. The soil ingredients should consist of loam, leaf-soil and sand, in proportion to give a good porous medium. As root-action and growth increase, repot into 5- or 6-inch pots, which will carry them throughout the flowering period. Occasionally the crowns have a tendency to rise above the level of the soil; these may be lowered during repotting. When the plants are well rooted, periodical watering with organic fertilizer will help the development of good substantial flowers. During growth place the plants on the side stages near the glass in a temperature of 60° F. After the flowering period gradually reduce the water-supply and finally place in a cool cellar for the resting-period, or under the greenhouse bench, laying the pots side down. Specimen clumps are an acquisition planted below the benches in the floral display house; under these conditions they will practically naturalize themselves. Plants are also conveniently grown as common house plants, either in hanging-baskets or as pot-plants for the window during the summer months. When dormant they are easily stored in the cellar. A disappointing feature is the partial closing of the flowers during dull weather. (G. H. Pring.)



2687. Oxalis Ortgiesii.

INDEX.

Acetosella, 9.
adenophylla, 12.
alba, 16, 19.
albiflora, 19.
atropurpurea, 5.
bipunctata, 13.
Bowieana, 17.
Bowiei, 17.
Bustillosii, 12.
cernua, 18.
cærulescens, 16.
corniculata, 5.
delicata, 6.
Deppei, 15.
dispar, 7.
elongata, 20.
enneaphylla, 11.
floribunda, 13, 16.
fulgida, 21.
grandiflora, 19.
hirta, 21.
hirtella, 21.
lasiandra, 16.
laxula, 19.
lilacina, 16.
Martiana, 13.
multiflora, 21.
oregana, 8.
Ortgiesii, 3.
plena, 18.
purpurea, 17, 19.
repens, 5.
rigidula, 19.
rosacea, 21.
rosea, 1, 11.
rubella, 21.
rubra, 10, 19.
Simsii, 2.
speciosa, 19.
stricta, 5.
suggilata, 19.
tetraphylla, 14.
tropæoloides, 5.
urbica, 13.
valdiviana, 4.
valdiviensis, 4.
variabilis, 19.
venusta, 19.
versicolor, 20.

A. *Producing neither tubers nor bulbs.*

B. *Leafy-stemmed.*

C. *Lfts. notched at end.*

D. *Fls. red or rosy.*

1. **ròsea,** Feuill. Tall, erect: petioles scarcely 1 in. long: fls. long-stalked, in open irregularly forked cymes on long axillary peduncles, rather large, rosy with deeper veins. Chile. B.M. 2830. B.R. 1123 (as *O. floribunda*).

2. **Símsii,** Sweet. Resembling the preceding but more delicate: fls. deep red. Chile. B.M. 2415.

DD. *Fls. yellow.*

E. *Sts. erect.*

3. **Ortgièsii,** Regel. Fig. 2687. Red-tinged: st. tall, rather succulent: petioles long; lfts. deeply notched, with acute tips: fls. in close forked cymes on long axillary peduncles, small, yellow with deeper veins. Peru. Gt. 1875:817.

2688. Oxalis corniculata.

4. **valdiviénsis,** Barn. (*O. valdiviàna,* Hort.). St. short: lvs. clustered; petioles long: fls. in close umbels on long axillary peduncles, small, yellow with reddish veins. Chile.

EE. *Sts. low or creeping.*

5. **corniculàta,** Linn. (*O. stricta.* Linn.). Fig. 2688. Slender, prostrate, often rooting, loosely hairy: lfts. obcordate. Var. **atropurpùrea,** Planch. (*O. tropæoloìdes,* Schlecht.). Spreading, red-purple: fls. few, in umbels on rather short axillary peduncles, small, yellow. Eu. F.S. 12:1205; 19:1968 (a form with variegated lvs.). R.H. 1897, p. 499.—A closely related smaller plant common everywhere as a greenhouse weed, especially in agave and cactus tubs, is the tropical *O. rèpens,* Thunb.

CC. *Lfts. entire, separated.*

6. **delicàta,** Pohl. St. slender, erect, branching: lfts. ovate or lance-ovate: fls. in forked cymes on long axillary peduncles, small, pale rosy. Brazil.

7. **díspar,** N. E. Br. St. rather stout, tall, erect, branching: lfts. lanceolate, subacuminate, heavy-veined: fls. nearly sessile, in compact cymes on long axillary peduncles, rather small, golden. Guiana. B.M. 7794.

BB. *Lvs. and scapes from scaly ends of the rootstocks.*

8. **oregàna,** Nutt. Low: lfts. broadly obcordate, 1–2 in. wide: fls. white or rosy, yellowish at base, deeper veined. N. W. coast.

9. **Acetosélla,** Linn. Scarcely half as large in its various dimensions, otherwise very similar. E. U. S. and Eu. Fl. Dan. 980.—Often taken for the shamrock. Like the preceding, used sparingly in rockeries.

AA. *Producing tubers: not leafy-stemmed.*

10. **rùbra,** St. Hil. Lvs. spreading, long-petioled, thin, somewhat hairy, obcordate: fls. in usually compound umbels, rosy with deeper veins. Brazil. Gn. 50, p. 511 (as *O. floribunda*).—Forms occur also with lilac or white fls.

11. **enneáphylla,** Cav. Fig. 2689. Lvs. crowded; lfts. 9–20, glaucous, ½in. long, obcordate-cuneate, nearly sessile: fls. large, solitary, white, with lavender veins. Falkland Isls. Gn. 52:202; 73, p. 339. G.C. III. 49:414. G.M. 50:565. G. 34:717; 36:719.—A rosy-fld. form is var. *ròsea,* Hort.

12. **adenóphylla,** Gillies. (*O. Bustillòsii,* Phil.). Lvs. crowded; lfts. 12–22, glaucous, ½in. long, obcordate-cuneate with short gland-like base: fls. large, solitary or in few-fld. umbels, rosy-tinged with deeper veins and base. Chile. B.M. 8054. G.C. III. 46:164; 55. 400. Gn. 75, p. 358. G. 35:237.

AAA. *Producing bulbs.*

B. *Bulbs loosely scaly: not leafy-stemmed.*

C. *The bulbs compound, of numerous small ones: lfts. 3.*

13. **Martiàna,** Zucc. (*O. úrbica,* St. Hil. *O. bipunctàta,* Graham. *O. floribúnda,* Lehm. *Ionóxalis Martiàna,* Small). Somewhat long-hairy: lvs. long-petioled, thin, obcordate, orange-warty beneath, at least around the margin: fls. in loose usually compound umbels, rosy. Trop. Amer. B.M. 2781, 3938.

CC. *The bulbs simple.*

14. **tetraphýlla,** Cav. (*Ionóxalis tetraphýlla,* Rose). Lfts. mostly 4, 1 in. long, inversely deltoid, retuse, each crossed by a purple band: fls. rather few in simple umbels, lilac or rosy. Mex. Cav. Icon. 237. G.M. 39, p. 403 (as *O. Deppei*). L.B.C. 8: 790.

15. **Déppei,** Lodd. (*Ionóxalis Déppei,* Small). Differs chiefly in the lfts. being truncate instead of notched at apex. Mex. L.B.C. 15:1500.

16. **lasiándra,** Zucc. (*Ionóxalis lasiándra,* Rose). Lfts. 5–10, several inches long, oblong, spatulate, entire at end, glabrous: fls. in crowded umbels, rosy crimson. Mex. B.M. 3896.—Under the variously used name "*floribunda*" said to occur in the color varieties *álba, cæruléscens* and *lilácina.*

BB. *Bulbs firm, usually fusiform: lfts. 3.*

C. *Fls. umbelled, large: acaulescent.*

17. **Bòwiei,** Herb. (*O. Bowieàna,* Hort. *O. purpùrea,* Hort.). Fig. 2690. Lvs. spreading and large, fleshy, deep green; lfts. obovate, more or less notched: fls. bright rose-red. Cape. B.R. 1585. B. 1:25. R.H. 1858, p. 120. Gn. 10, p. 159; 37:508.

18. **cérnua,** Thunb. (*Bolbóxalis cérnua,* Small). BERMUDA BUTTERCUP. Fig. 2691. Lvs. ascending, not very large or fleshy, often purplish or mottled; lfts. obcordate: fls. bright yellow. Cape. L.B.C. 12:1154. B.M. 237.—A form with double fls. is var. *plèna,* F.S. 19:1964.

CC. *Fls. solitary on bractless or 2-bracted peduncles.*

D. *Lfts. broad, notched: nearly acaulescent.*

19. **variábilis,** Jacq. (*O. grandiflòra,* Jacq. *O. láxula,* Jacq. *O. purpùrea láxula,* Hort. *O. rigídula,* Jacq. *O. suggilàta,* Jacq. *O. variábilis albiflòra,* Lindl.). Hairy: lvs. petioled, rather fleshy, often purplish: fls. large, white or shaded with rose, yellow at base. Cape. B.M. 1683. B.R. 1505.—A form with deep rosy fls. is var. *rùbra,* Jacq. (*O. purpùrea,* Jacq. *O. speciòsa,* Jacq. *O. venústa,* Lowe). B.M. 1712. A white form, var. *álba,* Hort., is grown.

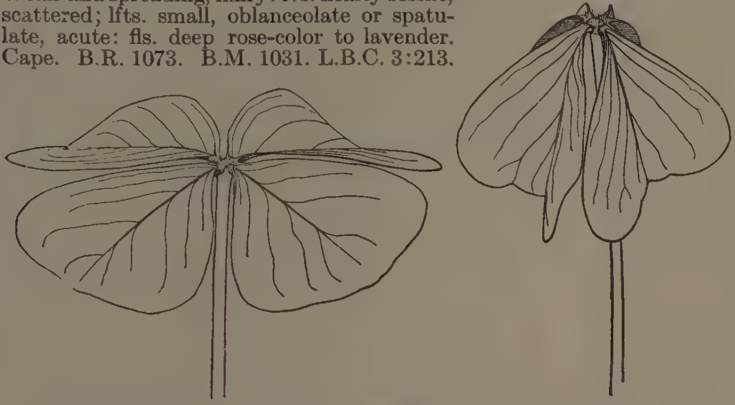
2689. Oxalis enneaphylla. (×½)

DD. *Lfts. narrow or small: leafy-stemmed.*

20. **versícolor,** Linn. (*O. elongàta,* Jacq.). Glandular: lvs. petioled, clustered at top of the st.: lfts. linear-

wedge-shaped, notched: fls. white, margined with red, yellow below. Cape. B.M. 155. F.S. 8:834.

21. **hírta,** Linn. (*O. fúlgida,* Lindl. *O. hirtélla,* Jacq. *O. multiflòra,* Jacq. *O. rosàcea,* Jacq. *O. rubélla,* Jacq.). Weak and spreading, hairy: lvs. nearly sessile, scattered; lfts. small, oblanceolate or spatulate, acute: fls. deep rose-color to lavender. Cape. B.R. 1073. B.M. 1031. L.B.C. 3:213.



2690. Leaves of Oxalis Bowiei, showing day and night positions.

O. japónica, Franch. & Sav. Lfts. broadly triangular, scarcely notched, and truncate. Otherwise similar to O. Acetosella. Japan.—*O. violàcea,* Linn. Lvs. rather fleshy, glabrous: fls. in simple umbels, rose-violet. E. U. S. B.M. 2215. Mn. 5:121.—Scarcely useful, except for hardy borders or rockeries.

William Trelease.

OXÈRA (meaning dubious, probably referring to sourness). *Verbenàceæ.* Shrubby often climbing plants, useful for growing under glass for the showy flowers, but little known horticulturally.

Leaves opposite, entire, leathery: fls. whitish or yellowish, in twice- or thrice-forked cymes, varying greatly in form of calyx and corolla, but the latter always 4-lobed, and wide-throated: drupes 4-parted or by abortion reduced to a single segm.—Species about two dozen, New Caledonia.

pulchélla, Labill. Lvs. 2–5 in. long, stalked, the lower ones oblong-lanceolate: calyx conspicuous, loose, composed of 4 more or less united greenish yellow sepals, each ½–¾in. long. B.M. 6938. Gn. 33:510; 45, p. 333. I.H. 36:76. J.H. III. 30:33; 42:39; 55:521. G.C. III. 3:209. R.H. 1890, p. 274.—Once offered by John Saul, Washington, D. C. Also cult. outdoors in S. Calif. It needs but a glance at any of the colored portraits of *O. pulchella* to see that it is one of the most interesting climbers cult. in hothouses. It has ivory-white trumpet-shaped sweet-scented fls. 2 in. long and 1 in. across, borne profusely in clusters of a dozen or more. A plant 2 years old from cuttings will clothe the rafters and bloom freely, the weight of the clusters causing the fls. to droop gracefully. The prominent calyx suggests *Clerodendron Thompsonæ,* a near relative. As the corolla-tube leaves the calyx, it makes a bend and then broadens into a funnel-shaped fl., with the 4 lobes scarcely spreading. The appearance of the fls. is enhanced by the long style and the 2 stamens, which are thrust out and strongly curved. It is reported as thriving in a winter temperature of 55–60°; it requires a warmer place than the ordinary greenhouse. It blooms well in the winter months. It prop. readily by cuttings placed around the side of a pot; also from seeds, which it matures in considerable numbers.

Wilhelm Miller.
L. H. B.†

OX-EYE: in America, *Heliopsis;* in Europe, *Buphthalmum.* Ox-eye daisy: *Chrysanthemum Leucanthemum* and *Rudbeckia hirta.*

OXLIP: *Primula elatior.*

OXYÁNTHUS (Greek, *sharp flower;* referring to the acute lobes of the corolla and calyx). *Rubiàceæ.* African trees and shrubs, allied to the cape jasmine (Gardenia). They are remarkable for their extremely long and slender corolla-tubes, which are topped by a five-pointed star of spreading narrow lobes.

Leaves opposite: fls. usually white, in axillary racemes or panicles; calyx-tube truncate, or with 5 short teeth; corolla salver-shaped, throat glabrous; stamens 5, inserted at the mouth of the tube; ovary 2-celled, except in 1 species; style usually exserted; stigma usually spindle-shaped or club-shaped, 2-cut at the top; ovules numerous, not immersed in the 2 fleshy placentæ: fr. a sort of berry.—Species 30–40, mostly in Trop. Afr., some in S. Afr.

natalénsis, Sond. Branches, lvs. and calyx glabrous: lvs. elliptic-oblong or ovate-lanceolate, shortly acuminate, entire, 7–8 in. long, 3 in. wide: racemes axillary, loosely 16–20-fld.; fls. white, fragrant; corolla-tube about half the length of the lvs. Wet places in woods, Natal.—Cult. outdoors in S. Fla., and in Eu. under glass.

ísthmia, Hort. Described as a splendid flowering shrub in S. Fla., similar to the above but with larger calyces and possibly more fragrance. Probably S. American, and requiring further study. The name is not identified botanically.

O. tubiflòrus, DC. (Gardenia tubiflora, Andr.). Hispidulous-puberulous: lvs. obtusely rounded or somewhat eared at the base: fls. 6–7 in. long, at first creamy white, then tawny or ochrous: fr. terete, not grooved. Trop. Afr. F.S. 7:737. B.M. 1992 (as *O. speciosus*) 4636. J.F. 3:245.

Wilhelm Miller.
L. H. B.†

OXYDÉNDRUM (Greek, *sour tree;* from the acid taste of the foliage). Also written *Oxydéndron. Ericàceæ.* Sour-Wood or Sorrel-Tree. Ornamental tree grown for its white flowers appearing in summer and the handsome foliage turning scarlet in autumn.

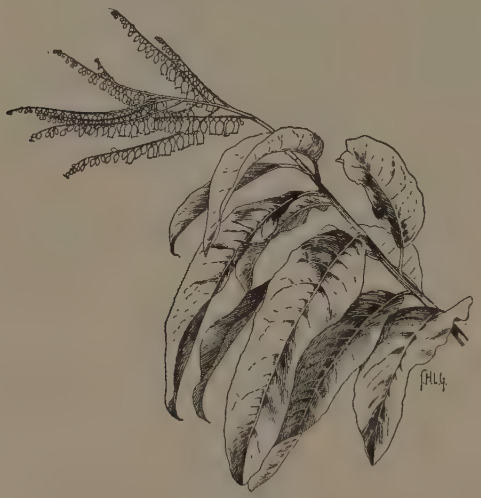
2691. Oxalis cernua.

Deciduous: lvs. alternate, petioled, serrulate: fls. whitish in terminal panicles composed of 6 or more

1-sided racemes; calyx divided nearly to the base into 5 sepals valvate in bud; corolla cylindric-ovoid, puberulous, with 5 minute lobes; stamens 10; anthers linear-oblong, opening from the apex to the middle; style slightly exserted: caps. ovoid-pyramidal, 5-valved, loculicidally dehiscent, many-seeded; seeds slender, the reticulate loose seed-coat produced at the ends into slender points.—One species in E. N. Amer.

A handsome medium-sized tree with slender spreading branches, rather large, generally oblong bright green leaves turning scarlet in fall and with small white flowers, followed by small grayish capsules nearly as conspicuous as the flowers. It is hardy North and of easy culture in any moderately good soil, but rather slow in becoming established and of rather slow growth. It is useful in shrubberies, along the borders of woods, or even within the woodland, since it endures shade fairly well. Propagation is by seeds treated like those of Andromeda.

arbòreum, DC. (*Andrómeda arbòrea,* Linn.). Fig. 2692. Tree with deeply fissured bark, occasionally to 60 ft. high: branchlets glabrous: lvs. slender-stalked, oblong-lanceolate, acuminate, broadly narrowed at the base, serrulate, glabrous except a few hairs on the midrib, 4–7 in. long: panicle 6–10 in. long; fls. ⅓in. long: caps. ⅓–½in. long. June–Aug.; fr. in Sept., Oct. Pa. to Ind. and along the mountains to Fla. and La. S.S. 5:235. B.M. 905. L.B.C. 13:1210. G. 27:415. F.E. 24:131. M.D.G. 1904:253. ALFRED REHDER.†



2692. Oxydendroum arboreum. Sour-wood or sorrel-tree. (×⅓)

OXYLÒBIUM (Greek, *sharp pod*). Including *Callístachys. Leguminòsæ.* One of many genera of Australian shrubs with pea-like flowers which are little known in cultivation.

Undershrubs or shrubs: lvs. very short-stalked, opposite or more or less whorled, rarely scattered or alternate: fls. in terminal or axillary racemes; petals clawed; stamens free; ovary villous, sessile or stalked, 4–30-ovuled. Nearest to Chorizema, but the keel is about as long as the wings, while in Chorizema the keel is much shorter. The following species was considered the type of another genus; it is distinguished from all other species of Oxylobium by the incomplete dehiscence of the pod.—Species nearly 30, of which perhaps a dozen have been cult. in Europe. Their fls. are yellow, or more or less flushed with red on the keel or the base of the standard. *O. Callistachys* is perhaps the best for conservatories. In America it is cult. only in S. Calif.

Callístachys, Benth. Tall shrub: lvs. mostly in irregular whorls of 3, varying from ovate-oblong and 1½–2 in. long to lanceolate and 4–5 in. long, leathery, silky-pubescent beneath when young: racemes oblong or pyramidal, 2–6 in. long. B.R. 216 (as *Callistachys lanceolata*). B.M. 1925 (as *C. ovata*). P.M. 8:31 (as *C. longifolia*). L.B.C. 20:1983 (as *C. retusa*). J.H. III. 35:35. WILHELM MILLER.

OXYPÉTALUM (Greek, *sharp petal*). Incl. *Tweèdiea. Asclepiadàceæ.* S. American and largely Brazilian herbs or subshrubs, twining or not: lvs. opposite: calyx 5-parted; corolla deeply 5-cut, short-tubed; scales of the corona 5, fastened at the base of the corolla and staminal tube.—Species about 100, not widely known in cult.

cærùleum, Decne. Herbaceous, but more or less woody below, downy: lvs. short-petioled, oblong, but cordate-hastate at the base: peduncles axillary from one of each pair of the upper lvs., 3–4-fld.: corolla-lobes spreading: scales of the corona 5, erect, darker blue, fleshy, exserted, recurved and notched at the apex. B.M. 3630 (as *Tweediea versicolor*).—*O. cæruleum* is a tender twining plant from Argentina with changeable 5-lobed fls. about an inch across. The fls. are said to be pale blue when they first open, then purplish, and when withered lilac. Not cult. in Amer., but apparently desirable for cult. here.

solanoìdes, Hook. & Arn. (*Tweèdiea floribúnda,* Hort.). Erect, little branched, shrubby or somewhat so, 6 ft.: lvs. lanceolate to oblong-cordate, acute, tomentose, the sinus at the base deep: fls. not so large as in *O. cæruleum,* bluish tinged rose (or dull purplish red), in terminal or axillary few-fld. cymes; staminal crown of 5 fleshy parts. Brazil. B.M. 4367. L. H. B.†

OXÝPOLIS (derivation not explained). *Umbellíferæ.* A few erect glabrous wet-ground perennials in N. Amer., seldom used in bog- and swamp-gardening; formerly known as Tiedemannia. The plants have tuberous clustered roots: lvs. pinnate or ternate, sometimes reduced to hollow and jointed phyllodia: fls. small, white, in compound mostly involucrate and involucellate umbels: fr. glabrous, ovate or obovate, dorsally flattened, ribbed or winged. *O. rígidius,* Raf. (*Tiedemánnia rígida,* Coult. & Rose), COWBANE, is a poisonous herb, 2–6 ft. tall, growing in swamps, N. Y. to Minn. and Fla., which was once offered in the trade: lvs. pinnate; lfts. oblong to ovate-lanceolate or nearly linear, entire or sparsely dentate. Probably not now listed.

OXYTENANTHÈRA: *Bamboo.*

OXÝTROPIS (Greek, *sharp keel*). *Leguminòsæ.* Perennial herbs, half-shrubs and shrubs.

The genus is like Astragalus, but is distinguished by a subulate beak at the tip of the keel. The American species are tufted with numerous short sts. from a hard and thick rootstock: lvs. odd-pinnate with 7–16 pairs of lfts., which are woolly and white beneath: calyx tubular or tubular-campanulate: fls. pea-shaped (papilionaceous), with an erect standard, wings elongated, keel occasionally with thorn-like apex, longer or shorter than the wings, in racemes, spikes or heads and range from yellow, white through blue and purple to crimson: pods many-seeded.—About 234 species with the center of their distribution in Asia from Siberia to the Caucasus Mts. and Turkestan. A few species reach the mountains of Cent. Eu. None occurs in Afr. About 18 species found in the Rocky Mts. are referred to Aragallus, a generic name brought into prominence by E. L. Greene (Pittonia 3:208) and reviewed in Erythea 7:57–64 (1899) without definition. *O. Lambertii* is poisonous to stock. It is one of the most characteristic loco-weeds of the W. (see *Poisonous Plants*). Locoed sheep are difficult to herd, as they stray away from the flock; slight locomotor ataxia is manifested with twitching of the eyelids and grinding motion of the jaws. About a dozen kinds of Oxytropis are cult. in Eu., mostly as rock plants. They are hardy, easily prop. by seeds or division, and prefer a dry, sandy loam. These plants are of minor value horticulturally.

A. *Stipules free: pod 1-celled.*

defléxa, DC. (*Arágallus defléxus,* Heller). Leafy-stemmed to nearly stemless, a foot or less tall with crowded lfts. in 12–16 pairs, lanceolate to oblong, 3–6 lines long: fls. rather small, about 3 lines long, pale purple: pods pendant, 1-celled, many times exceeding the calyx. Mountains, Brit. Amer. to Colo. and Utah. Fls. June, July.—Prefers moist open ground throughout the eastern Rockies at lower altitudes. A very distinct species by reason of its stipules almost free, or only slightly adnate to the base of the petioles.

AA. *Stipules decidedly adnate to petioles: pods not pendant, 2-celled.*

B. *Lvs. strictly pinnate; lfts. opposite.*

Lámbertii, Pursh. (*Arágallus Lámbertii,* Greene). Fig. 2693. A tufted perennial with strong taproot and several erect scapes, 4–20 in. tall: spike short-oblong, densely fld.; fls. usually purple or violet: lfts. about 7 pairs: pod broadly or narrowly oblong, silky pubescent, firm-coriaceous, 2-celled. Fls. June, July. Includes *O. campéstris,* Hook. Fl. Bor. Am. in part, also *Arágallus pátens, A. angustàtus* and *A. atropurpùreus* of Rydberg. B.M. 2147 (dark blue). B.R. 1054 (blue). V. 3:138.—Aven Nelson, in Erythea 7:62, says that the specific name should be kept for the purple-violet-fld. forms. D. M. Andrews offers a crimson-fld. form and also var. **spicàta,** which has large spikes of white fls. Common along the Great Plains from Sask. to New Mex. and in the foothills where it is held to be responsible, as a loco-weed, for the poisoning and death of sheep and cattle. A clue as to its cultural requirements may be had from its wild habitat in open ground growing in masses of considerable extent.

BB. *Lfts. verticillate, numerous.*

spléndens, Douglas. A very showy, densely silky, silvery-villous, stemless, tufted plant, 4–18 in. tall: lfts. numerous, fascicled in 3's or 4's, as if verticillate: scape spicately, many-fld.; fls. bright-blue to deep purple, about ½in. long in June: pod ovate, hairy, much longer than the calyx. Native to open ground on the eastern slopes of the Rockies and in dry alpine meadows.

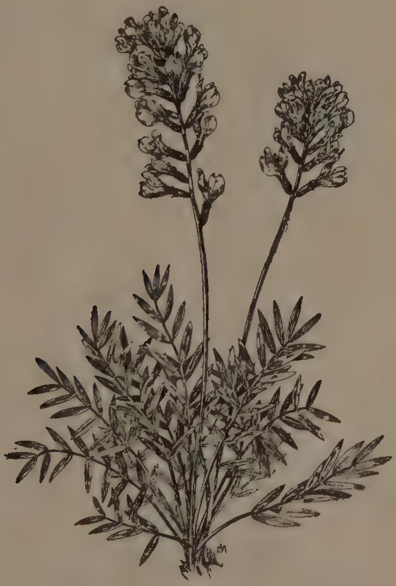
O. hýbrida, Bruegg. Probably a hybrid between O. campestris and O. sericea or O. Hallesi. Perennial, from Switzerland.—*O. ochroleùca,* Bunge. Lvs. pinnate, 3–4 in. long, with oblong-lanceolate lfts.: fls. small, drooping, in short racemes, yellowish white. N. Asia.—*O. villòsa,* Blank (Aragallus villosus, Rydb.). Densely cespitose: foliage silvery white: fls. creamy white, in dense spikes; calyx silky, villous: pod white-silky tipped with hooked beak. Mont.—*O. yunnanénsis,* Franch. Sts. many, woody: lfts. in 8–11 pairs, lanceolate: fls. in dense head of 7–12, deep blue. Yunnan.

JOHN W. HARSHBERGER.

OXYÙRA: *Layia.*

OYSTER PLANT or SALSIFY: *Tragopogon porrifolius.*

OZOTHÁMNUS: *Helichrysum diosmæfolium* (*O. rosmarinifolius*).



2693. Oxytropis Lambertii. (×⅓)

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